Temperature Control Equipment

RoHS

Thermo-chiller Lineup

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

Thermo-chiller/Standard Type
Series ***HRS***

1.1 kW to 5.9 kW With heating function

Temperature stability ±0.1°C

Outstanding performance and multiple functions are now the global standard.

Lightweight/Compact!

- Cooling valve control
- Air-cooled condenser fan
- Heating valve control



CE cMETus* (UL Standards)

* UL Standards: Applicable to 60 Hz only



Thermo-chiller/Standard Type
Series ***HRS100/150***

CE (Only 400 VAC type)

10 kW/15 kW With heating function

Temperature stability ±1.0°C

A model designed for outdoor use in the HRS series



Thermo-chiller/Inverter Type
Series ***HRSH090***

9.5 kW to 11 kW With heating function

Temperature stability ±0.1°C

CE (Only 400 VAC type) ETL (UL Standards)

Only for indoor use in the HRSH series

Lightweight and compact triple inverter model



Thermo-chiller/Inverter Type
Series ***HRSH***

CE cMETus (UL Standards)

10 kW to 28 kW With heating function

Temperature stability ±0.1°C

Globally compatible powerful and intelligent chiller

Outstanding energy saving effect with the triple inverter!



Thermo-chiller/Basic Type
Series ***HRSE***

1.0 kW to 2.2 kW

Temperature stability ±2.0°C

CE (Only 230 VAC type)

Convenient cooling in the required location

Large energy saving by triple control!



Thermo-chiller/High-performance Type
Series ***HRZ/HRZD/HRW***

CE SEMI

1.0 kW to 30 kW With heating function

Temperature stability ±0.1/0.3°C

High-performance type for semiconductor manufacturing equipment, etc.



Peltier-type Thermo-con Lineup

Thermoelectric Bath
Series ***HEB***

CE cMETus (UL Standards)

140 W to 320 W With heating function

Temperature stability ±0.01°C

Accurately controls the temperature of water in the bath.



Chemical Thermo-con
Series ***HED***

CE SEMI

300 W to 750 W With heating function

Temperature stability ±0.1°C

All wetted parts are made of fluororesin. Controls the temperature of chemicals by directly cooling and heating them.







Thermo-con *Series HEC/HECR*

CE cMETus (UL Standards) ETL (Only HEC series)

140 W to 1200 W With heating function

Temperature stability ±0.01 to 0.03°C

High-precision temperature control type for semiconductor manufacturing equipment, medical equipment, etc.

SMC

CAT.E43E

Thermo-chiller Variations

Series	Features	Temperature range setting	Cooling capacity	Cooling method	Temperature stability	Pump capacity
Thermo-chiller Standard type *Series* ***HRS***  P.18 (Only 60 Hz)	● With this chiller, cooling water can be obtained anywhere it is necessary because of easy installation and easy operation. ● For a wide range of applications such as laser machine tool, analytical equipment, LCD manufacturing equipment, mold temperature control, etc. ● Compact: W 377 x H 615 x D 500 mm, 40 kg (HRS012/018/024) ● Timer operation function, Low level in tank, Power failure auto-restart, Anti-freezing operation function, etc. ● Self diagnosis function ● No heater required, circulating fluid is heated using heat exhausted by refrigerating circuit. ● Low-noise design: 70 dB(A) (HRS100/150) ● Outdoor installation: IPX4 (HRS100/150)	5 to 40°C 0 60	1.3 kW 1.9 kW 2.4 kW 3.2 kW 5.1 kW 5.9 kW (60 Hz)	Air-cooled Water-cooled	±0.1°C	42 L/min
Thermo-chiller Standard type *Series* ***HRS100/150***  P.64 (Only 400 VAC type)		5 to 35°C 0 60	9.5 kW 14.5 kW (60 Hz)	Air-cooled Water-cooled	±1.0°C	68 L/min
Thermo-chiller Inverter type *Series* ***HRSH090***  P.96 (Only 400 VAC type)	● Power consumption reduced by 53% Outstanding energy saving effect with the triple inverter! ● Max. ambient temperature: W 377 x H 1080 x D 970 mm ● Low-noise design: Max.66 dB ● Max. ambient temperature: 45°C	5 to 40°C 0 60	9.5 kW	Air-cooled Water-cooled	±0.1°C	60 L/min
Thermo-chiller Inverter type *Series* ***HRSH***  P.124 (400 V as standard, 200 V as an option) (Only 200 V as an option)	● Outstanding energy saving effect with the triple inverter! ● Outdoor installation: IPX4 ● Max. ambient temperature: 45°C ● Space-saving, Lightweight 280 kg (25 kW type)	5 to 35°C 0 60	10 kW 15 kW 20 kW 25 kW 28 kW	Air-cooled Water-cooled	±0.1°C	180 L/min
Thermo-chiller Basic type *Series* ***HRSE***  P.160 (Only 230 VAC type)	● Simple function and performance. Thermo-chiller of the basic type. ● Large energy saving by triple control! Power consumption 33% energy saving ● Compact/Lightweight 32 kg (100 VAC) ● Maintenance free: Magnet pump ● Low-noise design: 55 dB (A)	10 to 30°C 0 60	1.2 kW 1.6 kW 2.2 kW (60 Hz)	Air-cooled	±2.0°C	25 L/min
Thermo-chiller High-performance type *Series* ***HRZ***  P.182 SEMI	● Suitable for semiconductor processing equipment with a wide variety of features such as high temperature stability, wide temperature range, failure diagnosis, external communication, etc. ● Can respond to change of process conditions flexibly, which is suitable for semiconductor equipment with a short innovation cycle. ● Conforming to various safety standards ● Inverter type is selectable. Energy saving is achieved through use of a DC inverter compressor.	–20 to 40°C –30 90 20 to 90°C –30 90 –20 to 90°C –30 90	1 kW 2 kW 4 kW 8 kW	Water-cooled	±0.1°C	40 L/min
Thermo-chiller High-performance type *Series* ***HRZ***  P.182 SEMI		–20 to 90°C –30 90 10 to 60°C –30 90	10 kW	Water-cooled	±0.1°C	40 L/min
Thermo-chiller High-performance inverter type *Series* ***HRZD***  P.216 SEMI	● Temperature for two systems can be controlled separately by one chiller. ● Double inverter: More effective energy-saving is achieved through use of a DC inverter compressor and an inverter pump. ● Space-saving: Footprint 23% reduction ● Reduced wiring, piping and labor: Single power cable, single facility water piping system	–30 to 90°C –30 90	9.5 kW x 2	Water-cooled	±0.1°C	40 L/min
Water-cooled thermo-chiller High-performance type *Series* ***HRW***  P.218 SEMI	● Direct heat exchanger for in-plant circulating fluid ● Can control the temperature over a wide range since a compressor is not required. ● Suitable for semiconductor processing equipment with a wide variety of features such as high temperature stability, wide temperature range, failure diagnosis, external communication, etc. ● Inverter type is selectable.	20 to 90°C –30 90	2 kW 8 kW 15 kW 30 kW	Water-cooled (Without compressor)	±0.3°C	50 L/min
Water-cooled thermo-chiller High-performance inverter type *Series* ***HRW***  P.218 SEMI						

	Pump type	Power supply	Circulating fluid
	Magnet pump (Mechanical seal pump for high pressure pump mounted type)	Single-phase 100 VAC (50/60 Hz) Single-phase 115 VAC (60 Hz) Single-phase 200 to 230 VAC (50/60 Hz)	Tap water Deionized water Ethylene glycol aqueous solution (15%)
	Mechanical seal pump	3-phase 200 VAC (50 Hz) 3-phase 200 to 230 VAC (60 Hz) 3-phase 380 to 415 VAC (50/60 Hz)	Tap water Deionized water Ethylene glycol aqueous solution (15%)
	Mechanical seal pump	3-phase 200 VAC (50 Hz) 3-phase 200 to 230 VAC (60 Hz) 3-phase 380 to 415 VAC (50/60 Hz)	Tap water Deionized water Ethylene glycol aqueous solution (15%)
	Immersion pump	3-phase 200 VAC (50 Hz) 3-phase 200 to 230 VAC (60 Hz) 3-phase 380 to 415 VAC (50/60 Hz)	Tap water Deionized water Ethylene glycol aqueous solution (15%)
	Magnet pump	Single-phase 100 VAC (50/60 Hz) Single-phase 200 VAC (50/60 Hz) Single-phase 230 VAC (50/60 Hz)	Tap water Ethylene glycol aqueous solution (15%)
	Immersion pump	3-phase 200 VAC (50 Hz) 3-phase 200 to 208 VAC (60 Hz)	Fluorinated fluid Tap water Deionized water Ethylene glycol aqueous solution (60%)
	Immersion pump	3-phase 200 VAC (50 Hz) 3-phase 200 to 208 VAC (60 Hz)	Fluorinated fluid Tap water Deionized water Ethylene glycol aqueous solution (60%)
	Immersion pump	3-phase 200 VAC (50 Hz) 3-phase 200 to 208 VAC (60 Hz)	Fluorinated fluid Ethylene glycol aqueous solution (60%)
	Immersion pump	3-phase 200 VAC (50 Hz) 3-phase 200 to 208 VAC (60 Hz)	Fluorinated fluid Tap water Deionized water Ethylene glycol aqueous solution (60%)

Accessories List

●: Standard ◆: Option ★: Optional accessories

	HRS	HRS100/150	HRS090	HRSH	HRSE	HRZ	HRZD	HRW
Heating function	●	●	●	●		●	●	●
Fan inverter			●	●				
Compressor inverter			●	●		●	●	
Pump inverter			●	●		●	●	●
PID control	●	●	●	●		●	●	●
ON/OFF control					●			
Error diagnostic function	●	●	●	●	●	●	●	●
Flow sensor/switch					●	●	●	●
RS-232C	●	●	●	●				
RS-485	●	●	●	●		●	●	●
Analog I/O (Contact input/output)	●/★	●	●	●		●	●	●
Analog communication	★					◆	●	◆
DeviceNet Communication						◆		◆
With earth leakage breaker	◆	◆	◆	◆				
With earth leakage breaker with handle				◆		●	●	●
With heater						●	●	●
With external switch inlet	●	●	●	●				
With water leakage sensor						●	●	●
Drain pan set (With water leakage sensor)	★							
With automatic water fill function	◆	●		●				
With fluid fill port	●	◆	●	◆	●	●	●	●
Applicable to deionized water piping	◆		◆					●
High pressure pump mounted	◆				◆			
High temperature environment specification	◆							
With caster adjuster-foot		◆/★		◆/★		●	●	●
Circulating Fluid Automatic Recovery						◆		◆
DI control kit/Electrical resistance control set	★					◆		◆
Electrical resistance sensor set	★							
Electric conductivity control set		★	★	★				
DI filter set	★					★		★
Insulating material for DI filter						★		★
Anti-quake bracket	★		●	●	★	★		★
Piping conversion fitting (NPT thread or G thread)	◆/★	◆/★	◆/★	◆/★				
NPT fitting						◆		◆
Bypass piping set	★	★	★	★	★	★	★	★
Power supply cable	★							
Particle filter set	★	★	★	★	★			
Contaminant filter								★
Connector cover	★							
Replacement type dustproof filter set	★				★			
Separately installed power transformer	★							
Relief valve set		★						
Snow protection hood		★		★				
4-port manifold						★		★
60% ethylene glycol aqueous solution						★		★
Ethylene glycol aqueous solution concentration meter	★	★	★	★	★	★	★	★
	P.18	P.64	P.96	P.124	P.160	P.182	P.216	P.218

Peltier-type Thermo-con Variations

Series	Features	Temperature range setting	Cooling capacity	Cooling method	Temperature stability	Power supply	Circulating fluid	Option
Thermo-con Rack mount type P.248 ***Series HECR*** 	● Mountable in a 19-inch rack. Saves space by mounting multiple equipment together in a rack. ● Learning control function ● Low vibration, Low noise	10 to 60°C –30 90	200 W	Peltier-type air-cooled	±0.01 to 0.03°C	Single-phase 100 to 240 VAC (50/60 Hz)	Tap water Ethylene glycol aqueous solution (20%)	With feet and No rack mounting brackets With flow switch
			1 kW			Single-phase 200 to 240 VAC (50/60 Hz)		
Thermo-con P.268 ***Series HEC*** 	● For applications requiring high-precision temperature control ● High-precision, refrigerant-free temperature control equipment employing Peltier elements ● Highly-reliable simple construction ● Easy installation in equipment with a compact, low-vibration body	10 to 60°C –30 90	230 W 600 W	Peltier-type air-cooled	±0.01 to 0.03°C	Single-phase 100 to 240 VAC (50/60 Hz)	Tap water Ethylene glycol aqueous solution (20%)	With flow switch NPT thread With level switch
			140 W 320 W	Peltier-type water-cooled				
			600 W 1200 W			Single-phase 200 to 220 VAC (50/60 Hz)	Fluorinated fluid Tap water	
Thermoelectric Bath P.302 ***HEB***  Made to Order 	● High-precision temperature control bath with a Peltier device ● Compact and low noise ● Minimal up-down temperature distribution with a unique agitation method	–15 to 60°C –30 90	140 W	Round type Peltier-type water-cooled	±0.01°C	Single-phase 100 to 240 VAC (50/60 Hz)	Fluorinated fluid Tap water	NPT thread
			280 W			Single-phase 200 to 220 VAC (50/60 Hz)		
			140 W 320 W	Square type Peltier-type water-cooled	±0.03°C	Single-phase 100 to 240 VAC (50/60 Hz)	Tap water Ethylene glycol aqueous solution (50%)	
			220 W	Square type Peltier-type air-cooled				
Chemical Thermo-con P.314 ***Series HED***  SEMI	● Heat exchanger for direct temperature control with a Peltier device ● Compatible with a wide range of chemical liquids by use of a fluororesin heat exchanger	10 to 60°C –30 90	300 W 500 W 750 W	Peltier-type water-cooled	±0.1°C	Single-phase 200 to 220 VAC (50/60 Hz)	Deionized water Fluorinated fluid Ammonia hydrogen peroxide solution, etc.	

SMC's Unique Chiller Control — A Challenge to Downsizing

Temperature stability ±0.1°C/Compact

The precision temperature control method by expansion valve and temperature sensor, realized high temperature stability of ±0.1°C and a small-size tank.

Applicable model



Standard type/ HRS012 to 060
P.18

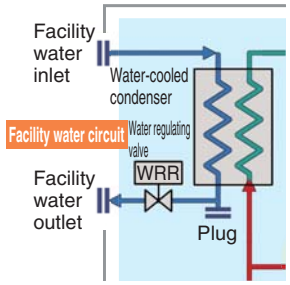


Inverter type/ HRSH090
P.96

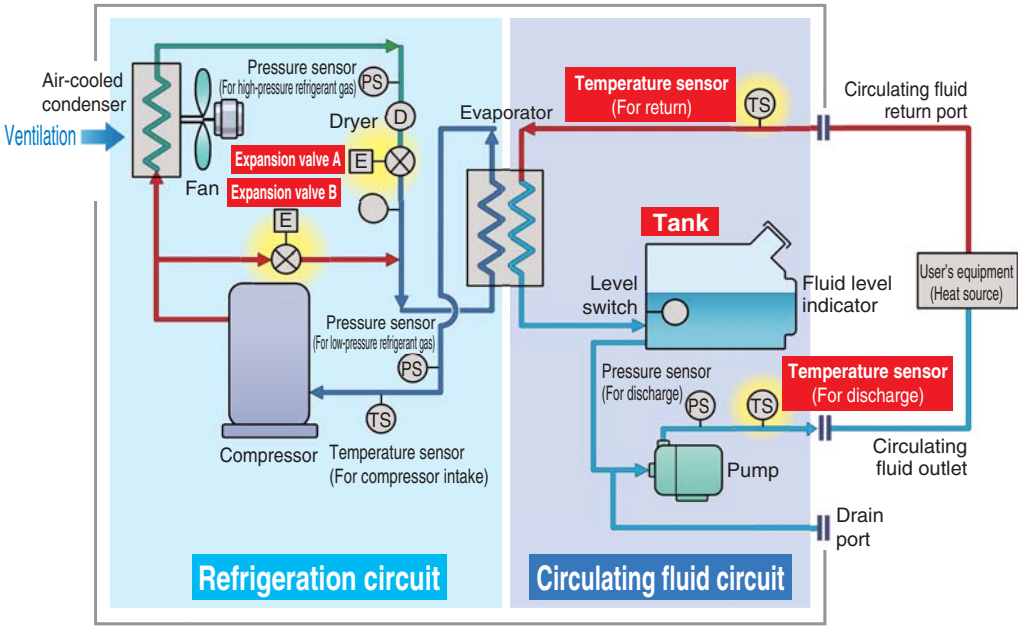


Inverter type/ HRSH100 to 300
P.124

■ Water-cooled HRS□-W-□



■ Air-cooled HRS□-A-□



∗ The flow diagram shown above is for standard type HRS012 to 060.

Refrigeration circuit

- The compressor compresses the refrigerant gas, and discharges the high temperature and high pressure refrigerant gas.
- In the case of air-cooled refrigeration, the high temperature and high pressure refrigerant gas is cooled down by an air-cooled condenser with the ventilation of the fan, and becomes a liquid. In the case of water-cooled refrigeration, the refrigerant gas is cooled by a water-cooled condenser with the facility water in the facility water circuit, and becomes a liquid.
- The liquefied high pressure refrigerant gas expands and its temperature lowers when it passes through expansion valve A and vaporizes by taking heat from the circulating fluid in the evaporator.
- The vaporized refrigerant gas is sucked into the compressor and compressed again.
- When heating the circulating fluid, the high pressure and high temperature refrigerant gas is bypassed into the evaporator by expansion valve B, to heat the circulating fluid.

Point The combination of precise control of **expansion valve A** for cooling, and **expansion valve B** for heating realized high temperature stability.

Circulating fluid circuit

- The circulating fluid discharged from the pump, is heated or cooled by the user's equipment and returns to the thermo-chiller.
- The circulating fluid is controlled to a set temperature by the refrigeration circuit, to be discharged to the user's equipment side again by the thermo-chiller.

Point Since the refrigeration circuit is controlled by the signal from **2 temperature sensors (for return and discharge)**, precise temperature control of the circulating fluid can be performed. Therefore, there is no necessity of absorbing the temperature difference in the circulating fluid with a large tank capacity, and realizes high temperature stability even with a **small-size tank**. Also, contributes to space-saving.

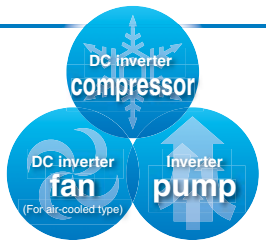
Facility water circuit

For water-cooled refrigeration HRS□-W-□

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

Triple inverter

The inverter respectively controls the number of motor rotations of the compressor, fan and pump depending on the load from the user's equipment.



Applicable model



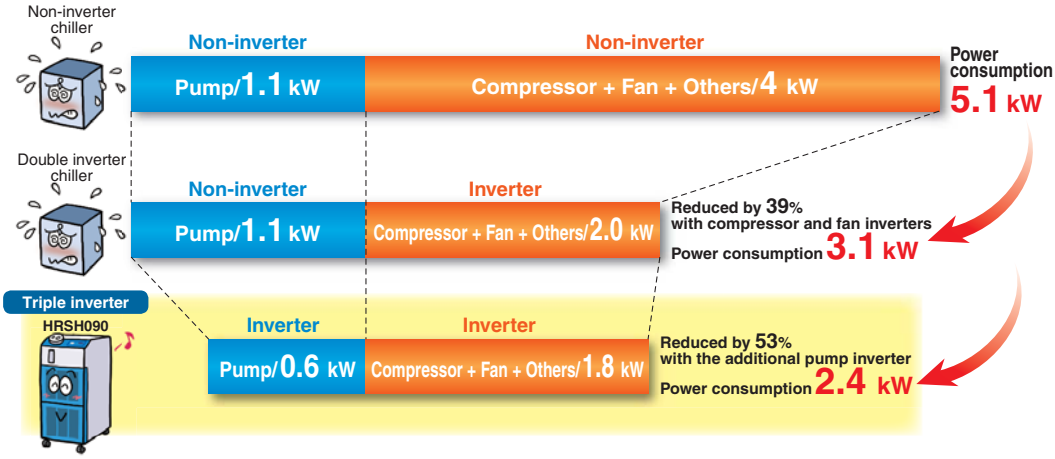
Inverter type/ HRSH090
P.96

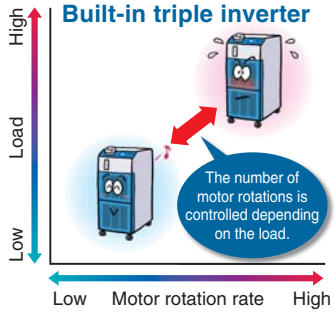


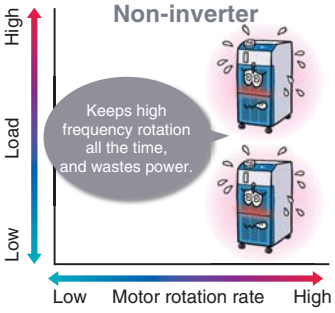
Inverter type/ HRSH100 to 300
P.124

Power consumption reduced by 53% compared with a non-inverter (HRSH090)

With the inverter, it is possible to operate with the same performance even with the power supply of 50 Hz.







Operating ratio: Ratio of 9.5 kW (with heat load) to 0 kW (without heat load) Operating ratio: 50%, with heat load of 9.5 kW all the time

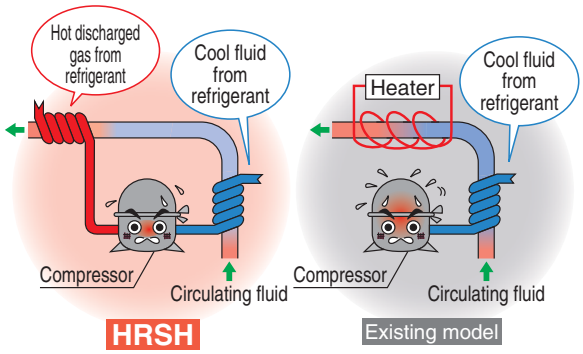
Conditions

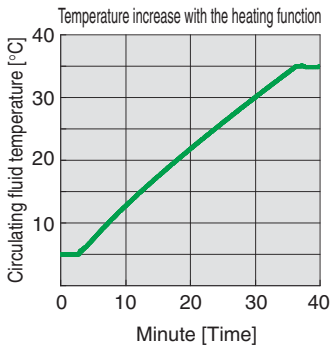
Common conditions for non-inverter and triple inverter:
- Ambient temperature: 32°C
- Circulating fluid temperature: 20°C
- Circulating fluid flow rate: 35 L/min@0.3 MPa (60 Hz)
- Heat load: 9.5 kW

Conditions for non-inverter chiller: Continuous operation of the compressor which can cool down 9.5 kW at 60 Hz. The pump shall be same as that of the HRSH.

Circulating fluid can be heated without a heater.

Heating method using discharged heat makes a heater unnecessary.





∗ This is just an example diagram.

Applicable model



Standard type/ HRS012 to 060
P.18



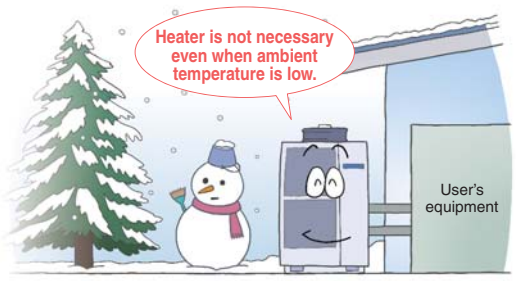
Standard type/ HRS100/150
P.64



Inverter type/ HRSH090
P.96



Inverter type/ HRSH100 to 300
P.124



∗ For HRSH250-A-20

Conditions
- Ambient temperature: 5°C
- Power supply: 200 V 60 Hz
- Circulating fluid flow: 125 L/min@0.5 MPa
- External piping: Bypass piping

Inverter pump

Power reducing effect of the inverter pump

Applicable model



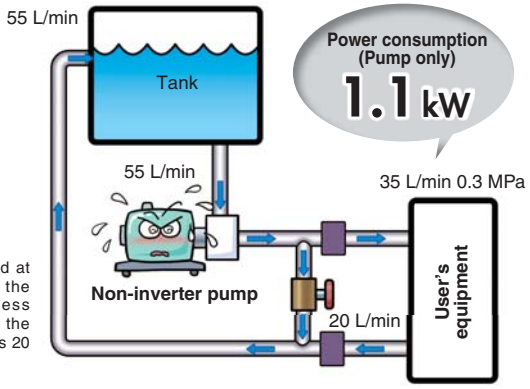
Inverter type/ HRSH090
P.96



Inverter type/ HRSH100 to 300
P.124



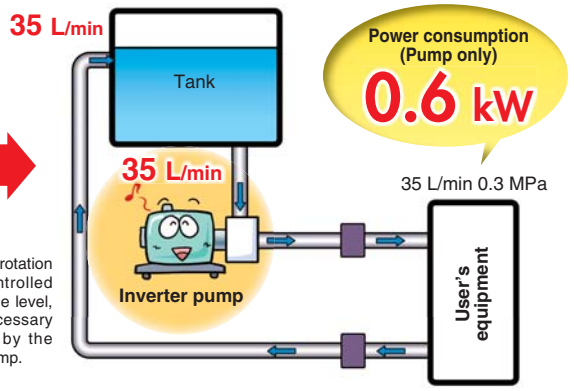
Current model



The pump is operated at the rated output all the time. With the excess power consumption, the circuit needs to bypass 20 L/min.

Inverter pump

HRSH090



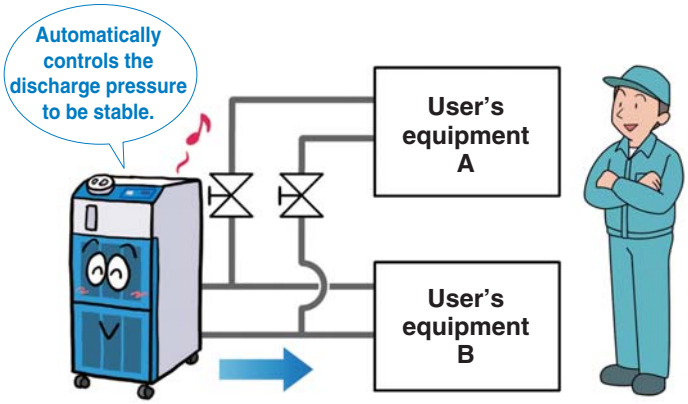
The motor rotation rate is controlled to a suitable level, for the necessary pressure, by the inverter pump.

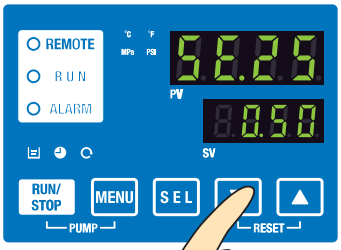
* Immersion pump is used for the inverter type HRSH100 to 300.

Circulating fluid pressure adjustable

Discharge pressure of the circulating fluid can be set with the operation panel. The inverter pump automatically controls the discharge pressure to the set pressure without adjusting the bypass piping under various piping conditions. Power consumption can be reduced by this control. (Operation to the set pump operating frequency is also possible.)

* Bypass piping is required depending on the flow rate.



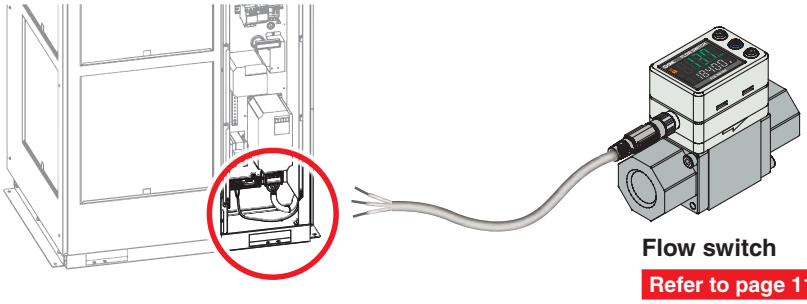


Operation display panel (Circulating fluid discharge pressure setup screen)

When the product is used with the flow path switched for maintenance, the pressure adjusting function controls the discharge pressure to be stable. (Secure the specified minimum flow for each branch circuit.)

Power supply (24 VDC) available

Power can be supplied from the terminal block on the rear side to external switches etc.



Flow switch
Refer to page 11.

Applicable model



Standard type/ HRS012 to 060
P.18



Standard type/ HRS100/150
P.64



Inverter type/ HRSH090
P.96

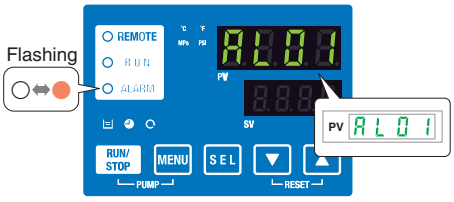


Inverter type/ HRSH100 to 300
P.124

Easy maintenance with the check display of the operation panel

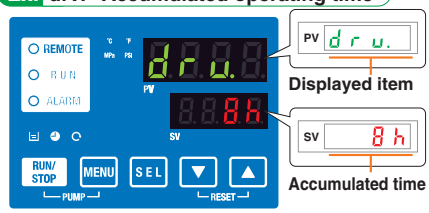
Alarm codes notify of checking times.
Notifies when to check the **pump** and **fan motor**.
Helpful for facility maintenance.

Ex. AL01 "Low level in tank"



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

Ex. drv. "Accumulated operating time"



Displayed item			
Temperature	Circulating fluid outlet temperature	Operating time	Accumulated operating time
	Circulating fluid return temperature		Accumulated operating time of pump
	Compressor gas temperature		Accumulated operating time of fan*2
Flow rate	Circulating fluid flow rate*1		Accumulated operating time of compressor
Pressure	Circulating fluid outlet pressure		Accumulated operation time of dustproof filter*2
	Compressor gas discharge pressure		
	Compressor gas return pressure		

*1 This is not measurement value. Use it for reference. (Except standard type HRS012 to 060)
*2 These are displayed only for air-cooled refrigeration.

Applicable model



Standard type/ HRS012 to 060 P.18

Standard type/ HRS100/150 P.64



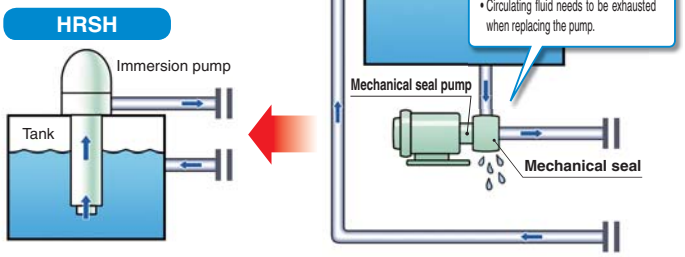
Inverter type/ HRSH090 P.96

Inverter type/ HRSH100 to 300 P.124

Reduces the maintenance hours for the pump.

Mechanical seal-less immersion pump is used.

As the pump has no external leakage of the circulating fluid, a periodic check of the pump leakage and replacement of the mechanical seal are not necessary. There is no need to exhaust the circulating fluid when removing the pump.



Applicable model



Inverter type/ HRSH100 to 300 P.124

IPX4

Applicable model



Standard type/ HRS100/150 P.64

Inverter type/ HRSH100 to 300 P.124

IP (International Protection) is the industrial standard for "Degrees of protection provided by outer defensive enclosures of electric equipment (IP Code)" according to IEC 60529 and JIS C 0920.

IPX4: No harmful influence by water splash is acceptable from every direction.

Can be installed outdoors.



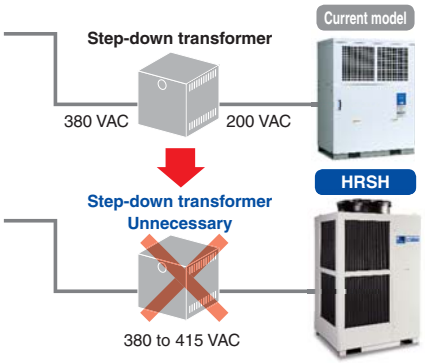
Global compatibility

(Europe, Asia, Oceania, Central and South America)

Transformer unnecessary

Power supply **Applicable to 200 to 230 VAC, or 380 to 415 VAC**

Transformers are unnecessary even when used overseas.



Applicable model



Standard type/ HRS012 to 060 P.18

Standard type/ HRS100/150 P.64



Inverter type/ HRSH090 P.96

Inverter type/ HRSH100 to 300 P.124



Basic type/ HRSE P.160

Conforming to International Standards

SEMI

P.1, 3 Refer to the variations table.

SMC

Thermo-chiller/High-performance Type *Series HRZ/HRZD/HRW*



HRZ



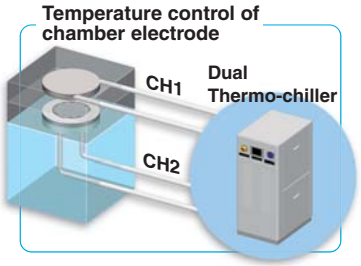
HRW

- Temperature stability ±0.1°C, temperature range from –20°C to +90°C. Full array of features and equipment.
- A double inverter type is also available, saving energy more effectively through use of a DC inverter compressor and an inverter pump.



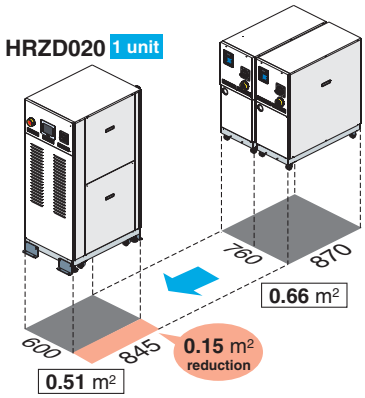
HRZD

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



Space-saving

Footprint reduced by 23%



Peltier-type Thermo-con Lineup

Thermo-con *Series HECR/HEC*

Temperature stability: ±0.01 to 0.03°C



Rack mount type *Series HECR*





Series HEC

Thermoelectric Bath *Series HEB*

Accurately controls the temperature of liquid in the bath.
Temperature stability: ±0.01°C
Temperature distribution in the bath: ±0.02°C



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

INR
Made to Order



Chemical Thermo-con *Series HED*

Fluororesin heat exchanger allows direct temperature control for chemical liquids!!
Industry-leading withstand pressure 0.35 MPa!!



Global Supply Network

SMC has a comprehensive network in the global market.

We now have a presence of more than 400 branch offices and distributors in 78 countries world wide such as Asia, Oceania, North/Central/South America, and Europe. With this global network, we are able to provide a global supply of our substantial range of products with the best service. We also provide full support to local factories, foreign manufacturing companies and Japanese companies in each country.



Applications

Laser beam machine/Laser welding machine
Cooling of the laser oscillation part and power source



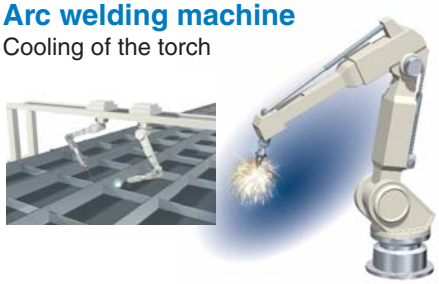
Printing machine
Temperature control of the roller



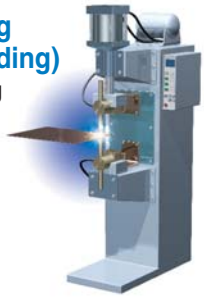
Cleaning machine
Temperature control of cleaning solution



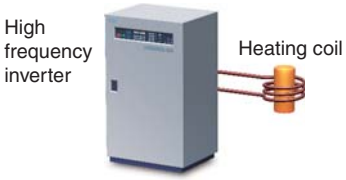
Arc welding machine
Cooling of the torch



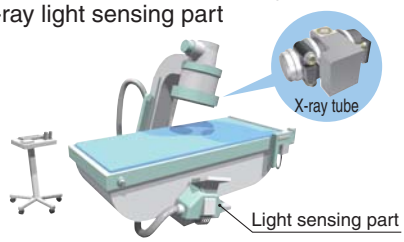
Resistance welding machine (spot welding)
Cooling of the welding head electrodes, transformers and transistors (thyristors)



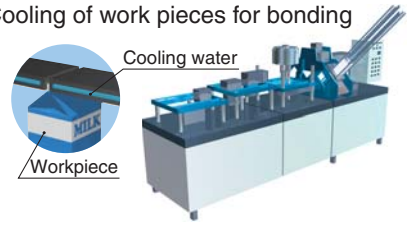
High frequency induction heating equipment
Cooling of the heating coils, high frequency power source and around inverters



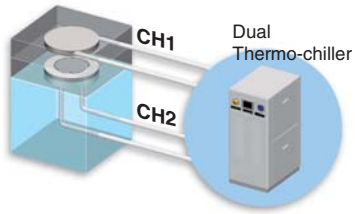
X-ray (digital) instrument
Temperature control of X-ray tube and X-ray light sensing part



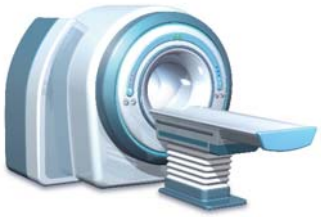
Packaging line (sealing of film and paper package)
Cooling of work pieces for bonding



Temperature control of chamber electrode



MRI



Injection molding



Atomizing device (food and cosmetics)
Temperature control of sample and device



Crushing machine
Cooling of the jacket

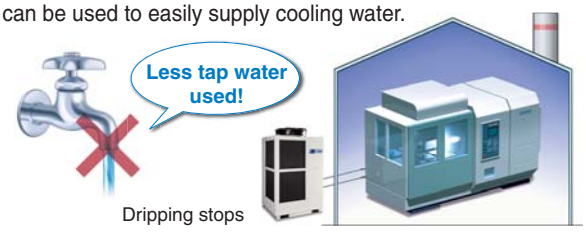


Makes cooling water easily available, anytime, anywhere.

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



Even without a cooling tower, an air-cooled refrigerated chiller can be used to easily supply cooling water.



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

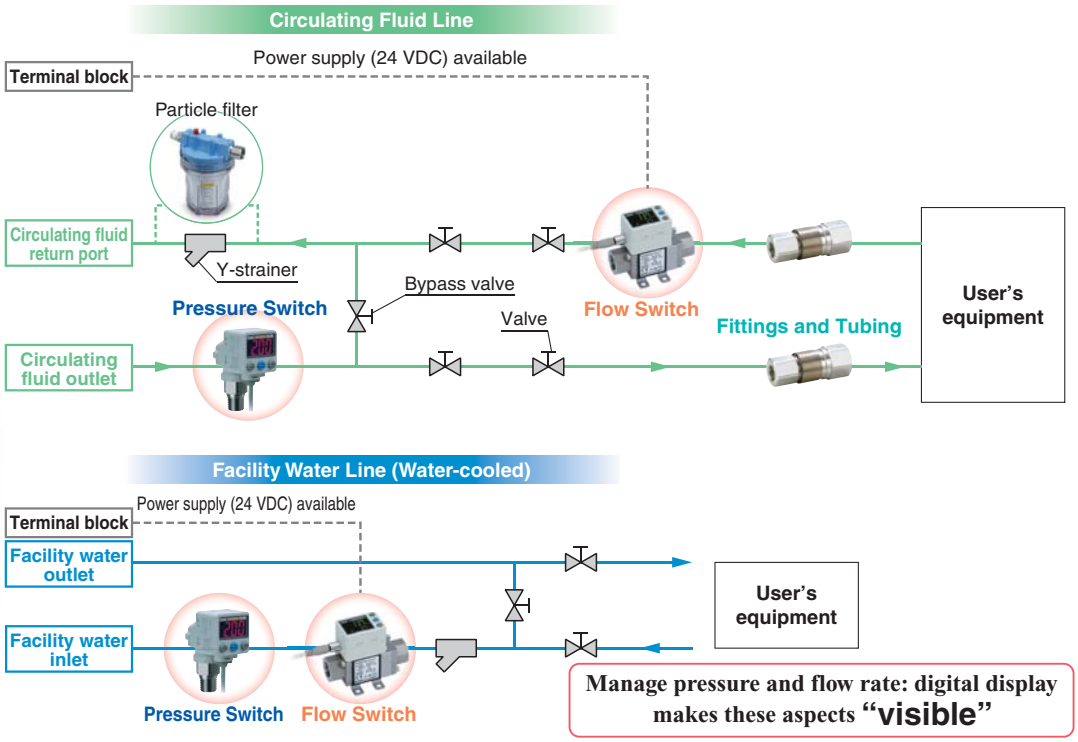


Cooling water at a consistent temperature can be supplied regardless of the season.



Circulating Fluid/Facility Water Line Equipment





Manage pressure and flow rate: digital display makes these aspects "visible"

Flow Switch: Monitors flow rate and temperature of the circulating fluid.

3-Color Display Digital Flow Switch for Water ***PF3W***



Integrated flow adjustment valve and temperature sensor



PVC Piping

3-Color Display Electromagnetic Type Digital Flow Switch ***LFE***



Digital Flow Switch for Deionized Water and Chemical Liquids ***PF2D***

4-Channel Flow Monitor ***PF2□200***



Pressure Switch: Monitors pressure of the circulating fluid.



2-Color Display High-Precision Digital Pressure Switch ***ISE80***



Pressure Sensor for General Fluids ***PSE56□***

Pressure Sensor Controller ***PSE200,300***

Particle Filter



P.53

Fittings and Tubing

S Coupler ***KK***



S Coupler/Stainless Steel (Stainless Steel 304) ***KKA***



Tubing ***T□***



Series	Material
T	Nylon
TU	Polyurethane
TH	FEP (Fluoropolymer)
TD	Modified PTFE (Soft fluoropolymer)
TL	Super PFA
TLM	PFA

Metal One-touch Fittings ***KQB2***



Stainless Steel 316 One-touch Fittings ***KQG2***



Stainless Steel 316 Insert Fittings ***KFG2***



Fluoropolymer Fittings ***LQ***



Refer to the **WEB catalog** or the Best Pneumatics No. 6 for details.

Temperature Control Equipment

Thermo-chiller

Standard Type
Series HRS

P. 18

Basic Type
Series HRSE

P. 160

Standard Type
Series HRS100/150

P. 64

Refrigerated Thermo-chiller
Series HRZ

P. 182

Inverter Type
Series HRSH090

P. 96

Refrigerated Dual Thermo-chiller
Double Inverter Type
Series HRZD

P. 216

Inverter Type
Series HRSH

P. 124

Water-cooled Thermo-chiller
Series HRW

P. 218

Peltier-type Thermo-con

Thermo-con/Rack Mount Type
Series HECR

P. 248

Thermoelectric Bath
Series HEB
Made to Order

P. 302

Thermo-con Air-cooled/ Water-cooled
Series HEC

P. 268

Chemical Thermo-con
Series HED

P. 314

Temperature Control Equipment Contents

Thermo-chiller/Standard Type
Series HRS P.18



How to Order/Specifications
Single-phase 100/115 VAC ····· Page 27
Single-phase 200 to 230 VAC ····· Page 29
Cooling Capacity ····· Page 31
Heating Capacity ····· Page 33
Pump Capacity/Required Facility Water Flow Rate ··· Page 35
Dimensions ····· Page 36
Operation Display Panel ····· Page 39
Alarm ····· Page 39
Communication Function ····· Page 40

◎Options

With Earth Leakage Breaker ····· Page 41
With Automatic Fluid Fill Function ····· Page 41
Applicable to Deionized Water Piping ····· Page 41
High Pressure Pump Mounted ····· Page 41
High Temperature Environment Specification ····· Page 43

◎Optional Accessories

① Anti-quake Bracket ····· Page 47
② Piping Conversion Fitting (For Air-Cooled Refrigeration/Water-Cooled Refrigeration) ··· Pages 47, 48
③ Piping Conversion Fitting (For Option) ····· Page 48
④ Concentration Meter ····· Page 49
⑤ Bypass Piping Set ····· Page 49
⑥ Power Supply Cable ····· Page 50
⑦ DI Filter Set ····· Page 51
⑧ Electrical Resistance Sensor Set ····· Page 52
⑨ Particle Filter Set ····· Page 53
⑩ Drain Pan Set (With Water Leakage Sensor) ····· Page 54
⑪ Connector Cover ····· Page 55
⑫ Analog Gateway Unit ····· Page 55
⑬ Replacement Type Dustproof Filter Set ····· Page 55
⑭ Separately Installed Power Transformer ····· Page 56

◎Cooling Capacity Calculation

Required Cooling Capacity Calculation ····· Page 57
Precautions on Cooling Capacity Calculation ····· Page 58
Circulating Fluid Typical Physical Property Values ··· Page 58

Specific Product Precautions ····· Page 59

Thermo-chiller/Standard Type
Series HRS100/150 P.64



How to Order/Specifications Air-cooled 200 V ····· Page 71
How to Order/Specifications Water-cooled 200 V ····· Page 72
How to Order/Specifications Air-cooled 400 V ····· Page 73
How to Order/Specifications Water-cooled 400 V ····· Page 74
Cooling Capacity ····· Page 75
Pump Capacity ····· Page 76
Dimensions ····· Page 77
Recommended External Piping Flow ····· Page 79
Cable Specifications ····· Page 79
Operation Display Panel ····· Page 80
List of Function ····· Page 80
Alarm ····· Page 80
Communication Function ····· Page 81

◎Options

With Caster Adjuster-foot ····· Page 82
With Earth Leakage Breaker ····· Page 82
With Fluid Fill Port ····· Page 82

◎Optional Accessories

① Piping Conversion Fitting ····· Page 83
② Caster Adjuster-foot Kit ····· Page 83
③ Electric Conductivity Control Set ····· Page 84
④ Bypass Piping Set ····· Page 84
⑤ Relief Valve Set ····· Page 85
⑥ Snow Protection Hood ····· Page 86
⑦ Particle Filter Set ····· Page 87

◎Cooling Capacity Calculation

Required Cooling Capacity Calculation ····· Page 88
Precautions on Cooling Capacity Calculation ····· Page 89
Circulating Fluid Typical Physical Property Values ··· Page 89

Specific Product Precautions ····· Page 90

Thermo-chiller/Inverter Type
Series HRSH090 P.96



How to Order/Specifications
Air-cooled 200 V/400 V ····· Page 107
Water-cooled 200 V/400 V ····· Page 108
Cooling Capacity ····· Page 109
Pump Capacity ····· Page 109
Dimensions ····· Page 110
Recommended External Piping Flow ····· Page 111
Cable Specifications ····· Page 111
Operation Display Panel ····· Page 112
List of Function ····· Page 112
Alarm ····· Page 112
Communication Function ····· Page 113

◎Options

With Earth Leakage Breaker ····· Page 114
With Automatic Fluid Fill Function ····· Page 114
Applicable to Deionized Water Piping ····· Page 114
Conforming to CE/UL Standards ····· Page 114

◎Optional Accessories
①Piping Conversion Fitting……Page 115
②Bypass Piping Set……Page 115
③Electric Conductivity Control Set……Page 116
④Particle Filter Set……Page 116

◎Cooling Capacity Calculation
Required Cooling Capacity Calculation……Page 117
Precautions on Cooling Capacity Calculation……Page 118
Circulating Fluid Typical Physical Property Values…Page 118

Specific Product Precautions……Page 119

Thermo-chiller/Inverter Type
Series HRSH P.124



How to Order/Specifications Air-cooled 200 V……Page 135
How to Order/Specifications Water-cooled 200 V…Page 136
How to Order/Specifications Air-cooled 400 V……Page 137
How to Order/Specifications Water-cooled 400 V…Page 138
Cooling Capacity……Page 139
Pump Capacity……Page 140
Dimensions……Page 141
Recommended External Piping Flow……Page 143
Cable Specifications……Page 143
Operation Display Panel……Page 144
List of Function……Page 144
Alarm……Page 144
Communication Function……Page 145

◎Options
With Caster Adjuster-foot……Page 146
With Earth Leakage Breaker……Page 146
With Earth Leakage Breaker with Handle……Page 147
With Fluid Fill Port……Page 147
Conforming to CE/UL Standards……Page 148

◎Optional Accessories
①Piping Conversion Fitting……Page 149
②Caster Adjuster-foot Kit……Page 149
③Electric Conductivity Control Set……Page 150
④Bypass Piping Set……Page 150
⑤Snow Protection Hood……Page 151
⑥Particle Filter Set……Page 152

◎Cooling Capacity Calculation
Required Cooling Capacity Calculation……Page 153
Precautions on Cooling Capacity Calculation……Page 154
Circulating Fluid Typical Physical Property Values…Page 154

Specific Product Precautions……Page 155

Thermo-chiller/Basic Type
Series HRSE P.160



How to Order/Specifications
Single-phase 100 VAC……Page 167
Single-phase 200 VAC……Page 168
Single-phase 230 VAC……Page 169
Cooling Capacity……Page 170
Pump Capacity……Page 171
Dimensions……Page 172
Operation Display Panel……Page 173
Alarm……Page 173

◎Option
High Pressure Pump Mounted……Page 174

◎Optional Accessories
①Anti-quake Bracket……Page 174
②Bypass Piping Set……Page 174
③Replacement Type Dustproof Filter Set……Page 175
④Particle Filter Set……Page 175

◎Cooling Capacity Calculation
Required Cooling Capacity Calculation……Page 176
Precautions on Cooling Capacity Calculation……Page 177
Circulating Fluid Typical Physical Property Values…Page 177

Specific Product Precautions……Page 178

Refrigerated Thermo-chiller
Series HRZ P.182



◎Model Selection
Guide to Model Selection……Page 189
Required Cooling Capacity Calculation……Page 190
Precautions on Model Selection……Page 191
Circulating Fluid Typical Physical Property Values…Page 192

◎Fluorinated Fluid Type
How to Order/Specifications……Page 193
Cooling Capacity/Heating Capacity……Page 194
Pump Capacity……Page 195

◎Ethylene Glycol Type
How to Order/Specifications……Page 196
Cooling Capacity/Heating Capacity……Page 197
Pump Capacity……Page 198

◎Tap/Deionized Water Type
How to Order/Specifications……Page 199
Cooling Capacity/Heating Capacity/Pump Capacity…Page 200

Temperature Control Equipment Contents

◎**Double Inverter Type**
How to Order/Specifications ····· Page 201
Cooling Capacity/Heating Capacity/Pump Capacity ··· Page 202

◎**Common Specifications**
Dimensions ····· Page 203
Communication Function ····· Page 205
· Contact Input/Output ····· Page 205
· Serial RS-485 ····· Page 206
· Connector Location ····· Page 206
Operation Display Panel ····· Page 207
Alarm ····· Page 207

◎**Optional Accessories**
① Bypass Piping Set ····· Page 208
② Anti-quake Bracket ····· Page 208
③ 4-Port Manifold ····· Page 209
④ DI Filter ····· Page 209
⑤ Insulating Material for DI Filter ····· Page 209
⑥ 60% Ethylene Glycol Aqueous Solution ····· Page 210
⑦ Concentration Meter ····· Page 210

◎**Options**
Analog Communication ····· Page 211
DeviceNet Communication ····· Page 211
NPT Fitting ····· Page 211
DI Control Kit ····· Page 211
Circulating Fluid Automatic Recovery ····· Page 212

Specific Product Precautions ····· Page 213

Refrigerated Dual Thermo-chiller/ Double Inverter Type Series HRZD P.216



Specifications/Dimensions ····· Page 217

Water-cooled Thermo-chiller Series HRW P.218



◎**Model Selection**
Guide to Model Selection ····· Page 225
Required Cooling Capacity Calculation ····· Page 226
Precautions on Model Selection ····· Page 227
Circulating Fluid Typical Physical Property Values ··· Page 228

◎**Fluorinated Fluid Type**
How to Order/Specifications ····· Page 229
Cooling Capacity/Heating Capacity/Pump Capacity ··· Page 230

◎**Ethylene Glycol Type**
How to Order/Specifications ····· Page 231
Cooling Capacity/Heating Capacity/Pump Capacity ··· Page 232

◎**Tap/Deionized Water Type**
How to Order/Specifications ····· Page 233
Cooling Capacity/Heating Capacity/Pump Capacity ··· Page 234

◎**Common Specifications**
Dimensions ····· Page 235
Communication Function ····· Page 236
· Contact Input/Output ····· Page 236
· Serial RS-485 ····· Page 237
· Connector Location ····· Page 237
Operation Display Panel ····· Page 238
Alarm ····· Page 238

◎**Options**
Analog Communication ····· Page 239
DeviceNet Communication ····· Page 239
NPT Fitting ····· Page 239
DI Control Kit ····· Page 239
Circulating Fluid Automatic Recovery ····· Page 240

◎**Optional Accessories**
① Bypass Piping Set ····· Page 241
② Anti-quake Bracket ····· Page 241
③ 4-Port Manifold ····· Page 242
④ DI Filter ····· Page 242
⑤ Insulating Material for DI Filter ····· Page 242
⑥ Contaminant Filter ····· Page 243
⑦ 60% Ethylene Glycol Aqueous Solution ····· Page 243
⑧ Concentration Meter ····· Page 243

Specific Product Precautions ····· Page 244

Thermo-con/Rack Mount Type Series HECR/HECR010 P.248
Series HECR



Model Selection ····· Page 253
How to Order/Specifications Air-cooled ····· Page 255
Cooling Capacity ····· Page 256
Heating Capacity ····· Page 256
Pump Capacity (Thermo-con Outlet) ····· Page 256
Dimensions ····· Page 257
Operation Display Panel ····· Page 258
Alarm ····· Page 258
Maintenance ····· Page 258

◎**Options**
With Feet and No Rack Mounting Brackets ····· Page 259
With Flow Switch ····· Page 259

◎Optional Accessories
Power Supply Cable ····· Page 260

Specific Product Precautions ····· Page 261

Series HECR010



How to Order/Specifications Air-cooled ····· Page 263
Cooling Capacity ····· Page 264
Heating Capacity ····· Page 264
Pump Capacity (Thermo-con Outlet) ····· Page 264
Dimensions ····· Page 265

◎Options
With Feet and No Rack Mounting Brackets ····· Page 266
With Flow Switch ····· Page 266
High-pressure Pump Mounted ····· Page 266

Thermo-con
Air-cooled Water-cooled Series HEC P.268
Model Selection ····· Page 273

Air-cooled Series HEC-A



How to Order/Specifications ····· Page 275
Cooling Capacity/Heating Capacity/
Pump Capacity (Thermo-con Outlet) ····· Page 276
Parts Description ····· Page 277
Dimensions ····· Page 278
Connectors ····· Page 280
Alarm/Maintenance ····· Page 281
Options ····· Page 282

Specific Product Precautions ····· Page 283

Water-cooled Series HEC-W



How to Order/Specifications ····· Page 287
Cooling Capacity/Heating Capacity/Pump Capacity (Thermo-con
Outlet)/Pressure Loss in Facility Water Circuit ····· Page 289
Parts Description ····· Page 292
Dimensions ····· Page 293
Connectors ····· Page 296
Alarm/Maintenance ····· Page 297
Options ····· Page 298

Specific Product Precautions ····· Page 299

Thermoelectric Bath Series HEB P.302



How to Order ····· Page 305
Specifications ····· Page 306
Cooling Capacity ····· Page 307
Heating Capacity ····· Page 307
Pressure Loss in Facility Water Circuit ····· Page 307
Parts Description ····· Page 307
Dimensions ····· Page 308
Connectors ····· Page 309
Maintenance ····· Page 309

Specific Product Precautions ····· Page 310

Made to Order ····· Page 312



Chemical Thermo-con Series HED P.314



Model Selection ····· Page 318
How to Order ····· Page 319
Main Specifications ····· Page 320
· Heat Exchanger Specifications ····· Page 320
· Temperature Controller Specifications ····· Page 320
Cooling Capacity ····· Page 321
Heating Capacity ····· Page 321
Pressure Loss in Circulating Fluid Circuit ····· Page 322
Pressure Loss in Facility Water Circuit ····· Page 322
Dimensions ····· Page 323
Connectors ····· Page 325
Alarm ····· Page 326
Maintenance ····· Page 326

◎Applicable Fluids ····· Page 327

Specific Product Precautions ····· Page 328

Technical Data ····· Page 331
Temperature Control Equipment Warranty ····· Page 340
Safety Instructions ····· Page 341
Precautions ····· Page 342

(UL Standards)

Lightweight/Compact
Temperature stability ±0.1°C

HRS050/HRS060



HRS012/018/024 HRS030

Same width for all models: 377 mm

Model	Size [mm]	Weight	Cooling capacity (60 Hz)	Set temperature range
HRS012	W 377 x H 615 x D 500	40 kg	1300 W	5 to 40°C
HRS018			1900 W	
HRS024			2400 W	
HRS030	W 377 x H 660 x D 500	47 kg	3200 W	
HRS050	W 377 x H 976 x D 592	69 kg	5100 W	
HRS060		73 kg	5900 W	

Compatible power supplies in Europe, Asia, Oceania, North, Central and South America

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

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

Convenient functions Page 21
Timer operation function/Unit conversion function/Power failure auto-restart function/ Anti-freezing operation function

Self diagnosis function and check display Page 22
35 types of alarm codes

Easy maintenance Page 21
Tool-less maintenance of filter

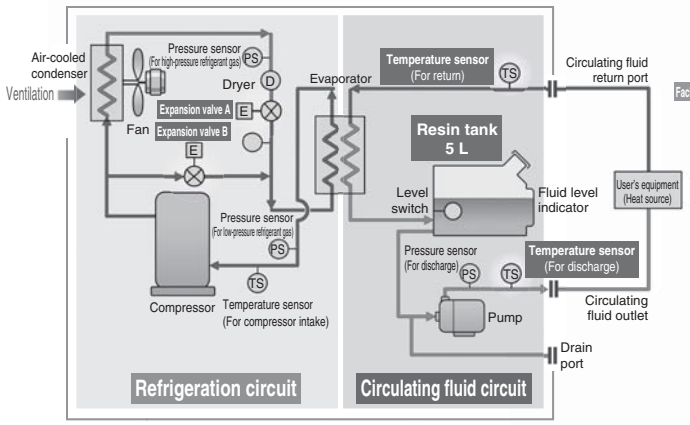
Communication function Page 22
Equipped with serial communication (RS232C/RS485) and contact I/Os (2 inputs and 3 outputs) as standard.

Environmental friendly R407C R410A as refrigerant

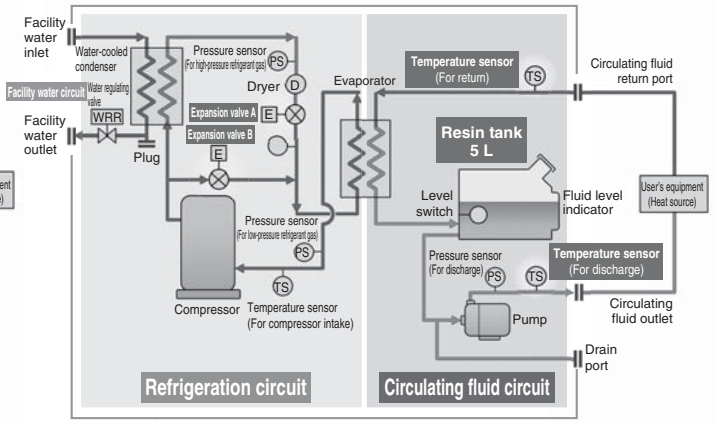
Temperature stability ±0.1°C / Compact

The precision temperature control method by expansion valve and temperature sensor, realized high temperature stability of ±0.1°C and a small-size tank.

■ Air-cooled HRS□-A-□



■ Water-cooled HRS□-W-□



Refrigeration circuit

- The compressor compresses the refrigerant gas, and discharges the high temperature and high pressure refrigerant gas.
- In the case of air-cooled refrigeration, the high temperature and high pressure refrigerant gas is cooled down by an air-cooled condenser with the ventilation of the fan, and becomes a liquid. In the case of water-cooled refrigeration, the refrigerant gas is cooled by a water-cooled condenser with the facility water in the facility water circuit, and becomes a liquid.
- The liquefied high pressure refrigerant gas expands and its temperature lowers when it passes through expansion valve A and vaporizes by taking heat from the circulating fluid in the evaporator.
- The vaporized refrigerant gas is sucked into the compressor and compressed again.
- When heating the circulating fluid, the high pressure and high temperature refrigerant gas is bypassed into the evaporator by expansion valve B, to heat the circulating fluid.

Point The combination of precise control of **expansion valve A** for cooling, and **expansion valve B** for heating realized high temperature stability.

Circulating fluid circuit

- The circulating fluid discharged from the pump, is heated or cooled by the user's equipment and returns to the thermo-chiller.
- The circulating fluid is controlled to a set temperature by the refrigeration circuit, to be discharged to the user's equipment side again by the thermo-chiller.

Point Since the refrigeration circuit is controlled by the signal from **2 temperature sensors (for return and discharge)**, precise temperature control of the circulating fluid can be performed. Therefore, there is no necessity of absorbing the temperature difference in the circulating fluid with a large tank capacity, and realizes high temperature stability even with a **small-size tank**. Also, contributes to space-saving.

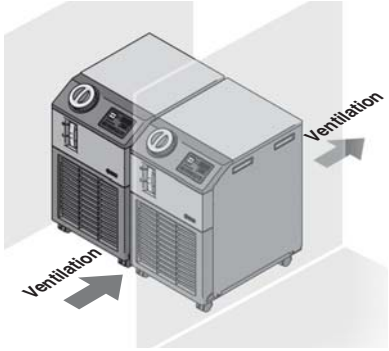
Facility water circuit

For water-cooled refrigeration HRS□-W-□

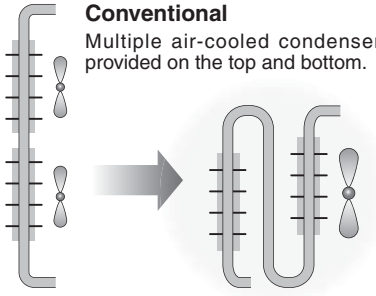
- The water regulating valve opens and closes to keep the refrigerant gas pressure consistent. The facility water flow rate is controlled by the water regulating valve.

Installation close to a wall is possible on both sides.

(HRS012/018/024 ∗ Except option G)

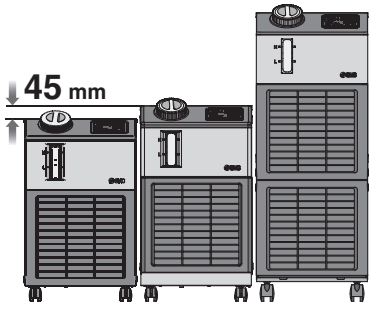


Reduced-height double condenser structure (HRS030/060)



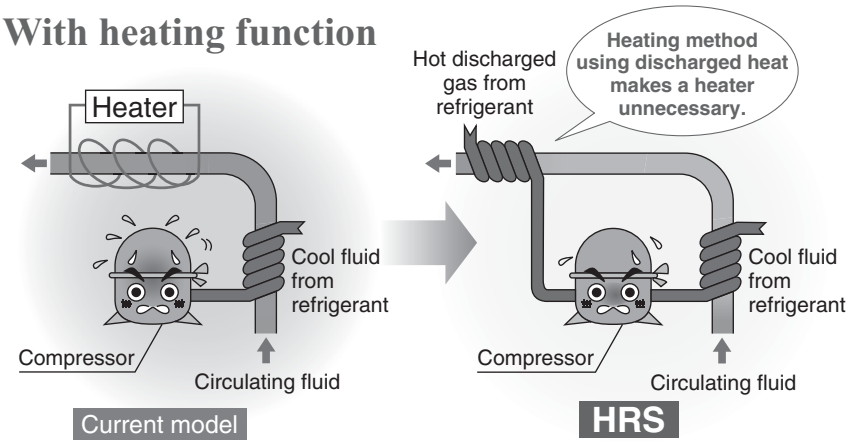
Conventional
Multiple air-cooled condensers are provided on the top and bottom.

HRS030
Achieved a maximum reduction in the height of the product while expanding the cooling capacity, by providing overlapped air-cooled condensers.

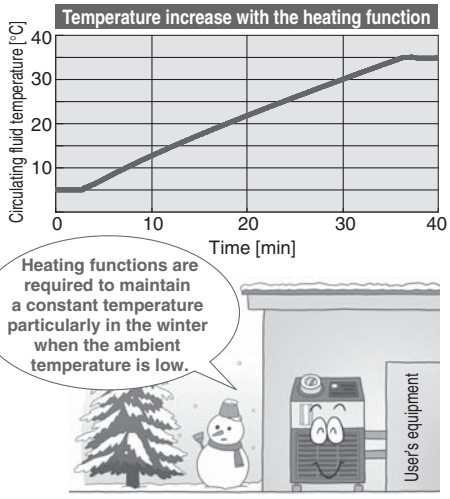


HRS012 018 024 **HRS030** **HRS050 HRS060**

With heating function



∗ This is just an example diagram.



Simple operation

Step ❶ Press the RUN/STOP keys.

Step ❷ Adjust the temperature setting with the ▼ / ▲ keys.

Step ❸ Press the RUN/STOP key to stop.

Easy operation by these steps



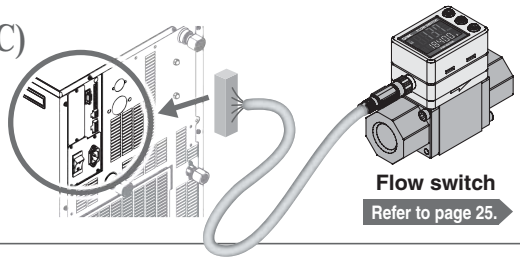


Large digital display

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).

Power supply (24 VDC) available

Power can be supplied from the connector at the rear side of the HRS to external switches etc.



Variations

Model		Cooling method	Cooling capacity [W] (50/60 Hz)	Single-phase 100 VAC (50/60 Hz) 115 VAC (50/60 Hz)	Single-phase 200 to 230 VAC (50/60 Hz)	Option Page 41	Optional accessories Page 45	International standards
	**HRS012**	Air-cooled refrigeration	1100/1300	●	●	· With earth leakage breaker · With automatic fluid fill function · Applicable to deionized water piping · High pressure pump mounted (∗ The HRS050/060 cannot be selected.) · High temperature environment specification (∗ The HRS030/050/060 cannot be selected.)	· Anti-quake bracket · Piping conversion fitting (For air-cooled, water-cooled and option) · Concentration meter · Bypass piping set · Power supply cable · DI filter set · Electrical resistance sensor set · Particle filter set · Drain pan set (With water leakage sensor) · Connector cover · Analog gateway unit · Replacement type dustproof filter set · Separately installed power transformer	CE cMETus ∗ (UL Standards) **Refer to pages 27 to 30 for details on applicable models.**
	HRS018		1500/1700	●	—			
			1700/1900	—	●			
	**HRS024**		2100/2400	—	●			
	HRS030	Water-cooled refrigeration	2600/3200	—	●			
	**HRS050**		4700/5100	—	●			
	HRS060		4900/5900	—	●			

∗ UL Standards: Applicable to only 60 Hz

Reduces the maintenance hours for the pump.

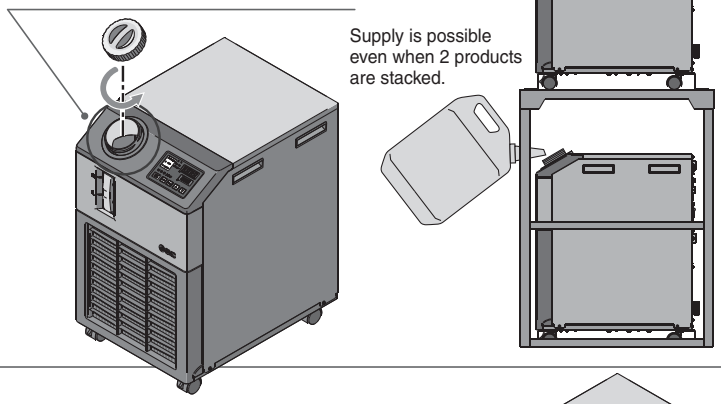
Adoption of the magnet pump*

No external leakage of the circulating fluid because the sealless pump is used, and a periodic check of the pump leakage and replacement of the mechanical seal are not necessary.

* When the option, high pressure pump, is selected and for the HRS050/060, the mechanical seal pump is chosen.

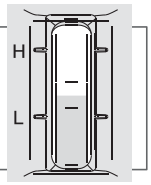
Shaped for easy supply of circulating fluid

The angled supply port facilitates the supply of circulating fluid.



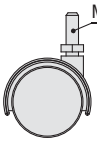
Supply is possible even when 2 products are stacked.

Easy check of the circulating fluid level





With casters (Removable)



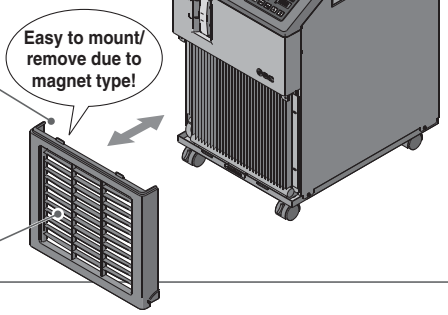
M8 thread

Tool-less inspection and cleaning of air-cooled condenser

Dustproof filter

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

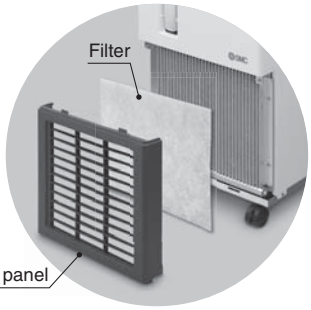
Easy to clean dust and cutting chips etc. stuck to the dustproof net by brush or air blow.



Optional accessories

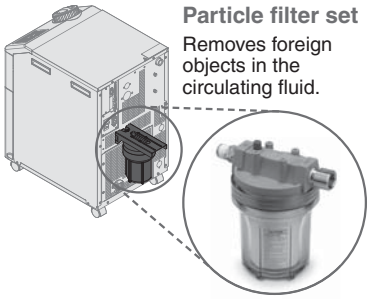
Replacement type dustproof filter set

Suitable for use in excessively dusty atmospheres. The disposable type filter saves time and effort of cleaning.



Particle filter set

Removes foreign objects in the circulating fluid.



Convenient functions (Refer to the Operation Manual for details.)

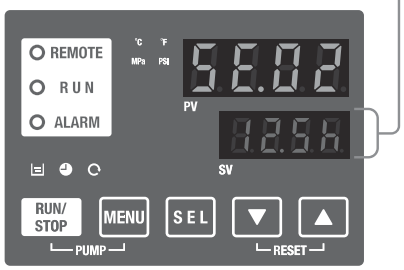
Timer operation function

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"**

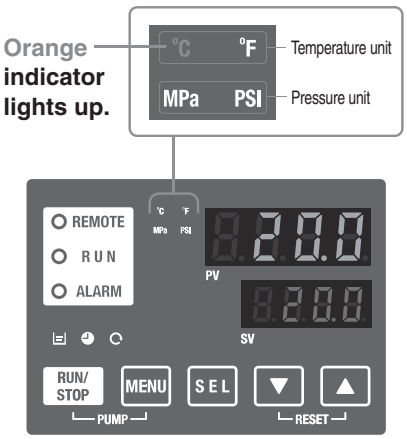
Timer The time remaining can be checked.



Unit conversion function

Temperature and pressure units can be changed.

Orange indicator lights up.



Power failure auto-restart function

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

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.

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.

Independent operation of the pump

The pump can be operated independently while chiller is powered off. You can check piping leak and remove the air.

Self diagnosis function and check display

Display of 35 types of alarm codes For details, refer to page 39.

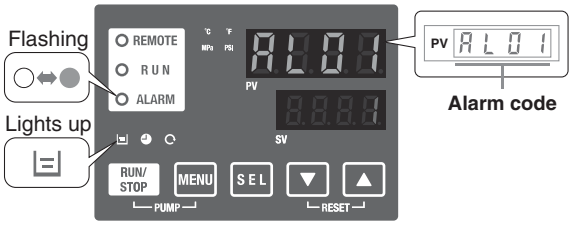
Operation is monitored all the time by the integrated sensor.
Should any error occur, the self diagnosis result is displayed by the applicable alarm code from 35 types.
This makes it easier to identify the cause of the alarm.
Can be used before requesting service.

Changeable alarm set values

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*

* Set values vary depending on the model.

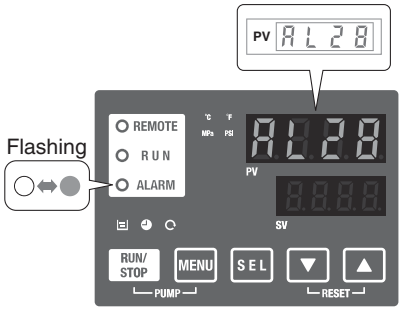
Ex. AL01 "Low level in tank"



Alarm codes notify of checking times.
Notifies when to check the pump and fan motor.
Helpful for facility maintenance.

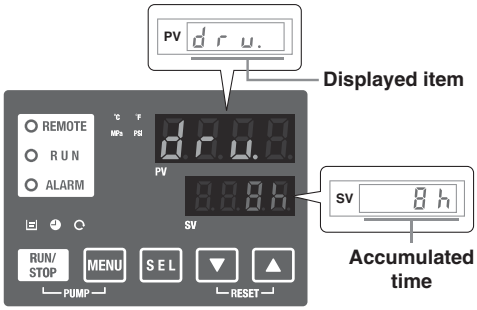
* The fan motor is not used in water-cooled refrigeration.

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 outlet temperature
Circulating fluid return temperature
Compressor gas temperature
Circulating fluid outlet 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

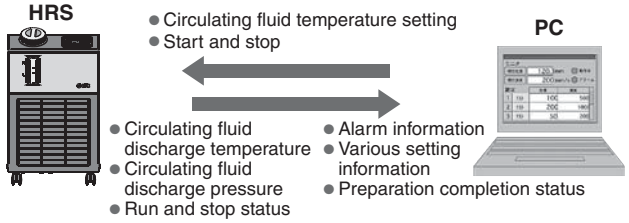
* These are displayed only for air-cooled refrigeration.

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 equipment 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.).

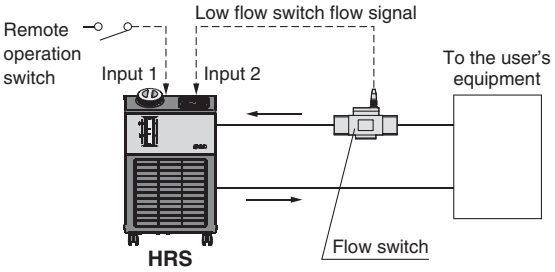
Ex. 1 Remote signal I/O through serial communication

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



Ex. 2 Remote operation signal input

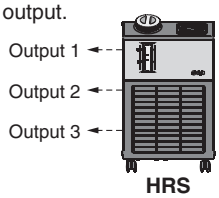
One of the contact inputs is used for remote operation and the other is used for a flow switch to monitor the flow, and their warning outputs are taken in.



Power for flow switch (24 VDC) can be supplied from thermo-chiller.

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

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



• Output setting example
Output 1: Temperature rise
Output 2: Pressure rise
Output 3: Operation status (start, stop, etc.)

Application examples

	Heat source	Automotive	Light electrical appliance	Food	Machinery	Medical	Semiconductor
Arc welding machine	Torch	●			●		
Resistance welding machine	Tip	●	●		●		
Laser welding machine	Oscillator	●	●		●		●
UV curing device	Lamp	●	●	●		●	
X-ray instrument			●			●	●
Electronic microscope	Lens		●			●	●
Laser marker	Oscillator	●	●	●		●	●
Ultra sonic wave inspection machine		●	●		●		
Atomizing device/ Crushing equipment	Blade			●			
Linear motor	Motor	●			●		
Packaging machines (food products)	Dies/ Welded portions			●			
Mold cooling	Mold	●	●	●		●	
Temperature control of adhesive and paint material	Paint material/ Welding materials	●	●	●			
Cooling of vacuum pump	Pump	●					●
Shrink fit machine	Workpiece	●			●		
Gas cylinder cabinet							●
Concentrating equipment	Test liquid			●		●	
Reagent cooling equipment	Reagent			●		●	●
Cleaning machine (hydrocarbon-based)	Cleaning tank	●	●		●		
Printing machine	Roller		●	●	●		
Chamber electrode	Electrode						●
High frequency induction heating equipment	Power supply/ Heating coil	●			●		

Global Supply Network

SMC has a comprehensive network in the global market.

We now have a presence of more than 400 branch offices and distributors in 78 countries world wide such as Asia, Oceania, North/Central/South America, and Europe. With this global network, we are able to provide a global supply of our substantial range of products with the best service. We also provide full support to local factories, foreign manufacturing companies and Japanese companies in each country.





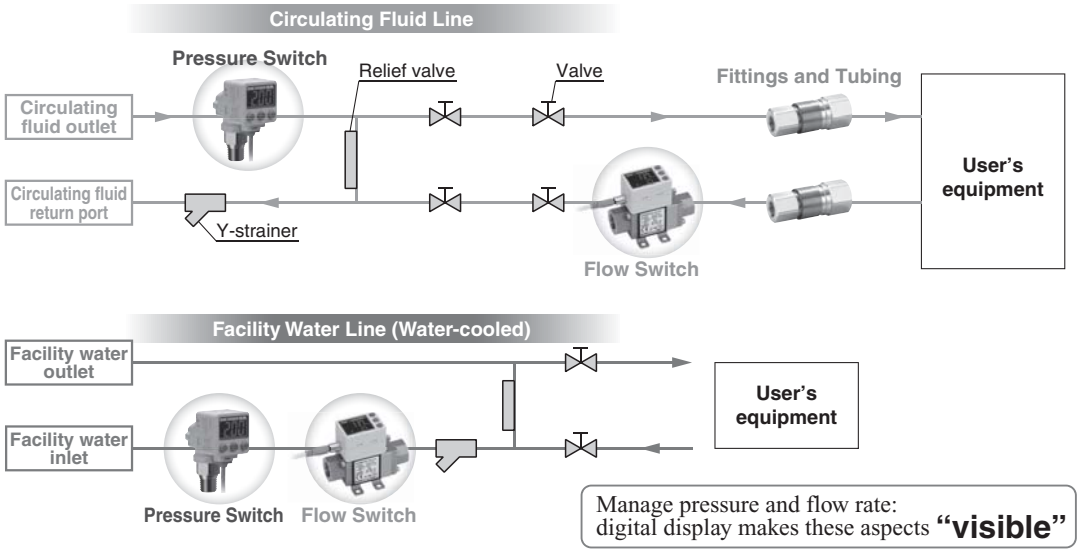
SMC Thermo-chiller Variations

Lots of variations are available in response to the users' requirements.

Series	Temperature stability [°C]	Set temperature range [°C]	Cooling capacity [kW]												Environment	International standards
			1.2	1.8	2.4	3	5	6	9	10	15	20	25	28		
 **HRSE Basic type**	±2.0	10 to 30	●	●	●										Indoor use	CE (Only 230 VAC type)
 **HRS Standard type**	±0.1	5 to 40	●	●	●	●	●	●							Indoor use	CE (MET) (Only 60 Hz)
 **HRS100/150 Standard type**	±1.0	5 to 35								●	●				Outdoor installation IPX4	CE (400 V as standard)
 **HRSH090 Inverter type**	±0.1	5 to 40							●						Indoor use	CE (400 V as standard) (ETL) (Only 200 V as an option)
 **HRSH Inverter type**	±0.1	5 to 35								●	●	●	●	●	Outdoor installation IPX4	CE (400 V as standard, 200 V as an option) (MET) (Only 200 V as an option)

Circulating Fluid/Facility Water Line Equipment



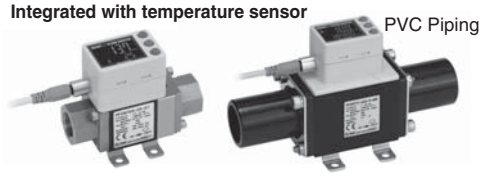


Manage pressure and flow rate:
digital display makes these aspects **"visible"**

Flow Switch: Monitors the flow rate and temperature of the circulating fluid and facility water.

Refer to the Best Pneumatics No. 6 for details.

3-Color Display Digital Flow Switch for Water ***PF3W***
Integrated with temperature sensor



3-Color Display
Electromagnetic Type Digital Flow Switch ***LFE***



Digital Flow Switch for
Deionized Water and Chemical Liquids ***PF2D***
4-Channel Flow Monitor ***PF2□200***



Pressure Switch: Monitors pressure of the circulating fluid and facility water.

Refer to the Best Pneumatics No. 6 for details.



2-Color Display
High-Precision Digital Pressure Switch ***ISE80***



Pressure Sensor for General Fluids ***PSE56□***
Pressure Sensor Controller ***PSE200,300***

Fittings and Tubing

Refer to the Best Pneumatics No. 6 for details.

S Coupler ***KK***



S Coupler/Stainless Steel
(Stainless Steel 304) ***KKA***



Metal One-touch Fittings ***KQB2***



Stainless Steel 316
One-touch Fittings ***KQG2***



Stainless Steel 316 Insert Fittings ***KFG2***



Fluoropolymer Fittings ***LQ***



Tubing ***T□***



Series	Material
T	Nylon
TU	Polyurethane
TH	FEP (Fluoropolymer)
TD	Modified PTFE (Soft fluoropolymer)
TL	Super PFA
TLM	PFA

CONTENTS

Series HRS Standard Type



Thermo-chiller Series HRS

How to Order/Specifications
- Single-phase 100/115 VAC ····· Page 27
- Single-phase 200 to 230 VAC ····· Page 29

Cooling Capacity ····· Page 31
Heating Capacity ····· Page 33
Pump Capacity/Required Facility Water Flow Rate ···· Page 35
Dimensions ····· Page 36
Operation Display Panel ····· Page 39
Alarm ····· Page 39
Communication Function ····· Page 40

Options

With Earth Leakage Breaker ····· Page 41
With Automatic Fluid Fill Function ····· Page 41
Applicable to Deionized Water Piping ····· Page 41
High Pressure Pump Mounted ····· Page 41
High Temperature Environment Specification ···· Page 43

Optional Accessories

① Anti-quake Bracket ····· Page 47
② Piping Conversion Fitting
(For Air-Cooled Refrigeration/Water-Cooled Refrigeration) ···Pages 47, 48
③ Piping Conversion Fitting (For Option) ····· Page 48
④ Concentration Meter ····· Page 49
⑤ Bypass Piping Set ····· Page 49
⑥ Power Supply Cable ····· Page 50
⑦ DI Filter Set ····· Page 51
⑧ Electrical Resistance Sensor Set ····· Page 52
⑨ Particle Filter Set ····· Page 53
⑩ Drain Pan Set (With Water Leakage Sensor) ···· Page 54
⑪ Connector Cover ····· Page 55
⑫ Analog Gateway Unit ····· Page 55
⑬ Replacement Type Dustproof Filter Set ····· Page 55
⑭ Separately Installed Power Transformer ····· Page 56

Cooling Capacity Calculation

Required Cooling Capacity Calculation ····· Page 57
Precautions on Cooling Capacity Calculation ····· Page 58
Circulating Fluid Typical Physical Property Values ····· Page 58

Specific Product Precautions ····· Page 59

Thermo-chiller Standard Type
Single-phase 100/115 VAC
Series HRS

(UL Standards)

RoHS



How to Order

Air-cooled refrigeration **HRS 018 – A □ – 10 – □**

Cooling capacity

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

Note) UL Standards: Applicable to only 60 Hz

Cooling method

A	Air-cooled refrigeration

Pipe thread type

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

Option

Symbol	Option
Nil	None
B	With earth leakage breaker
J	With automatic fluid fill function
M	Applicable to deionized water piping
T	High pressure pump mounted Note)

- When multiple options are combined, indicate symbols in alphabetical order.

Note) ● The cooling capacity will decrease by about 300 W from the value in the catalog.
● Pending for CE marking and UL Standards

Power supply Note)

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

Note) UL Standards: Applicable to only 60 Hz

Specifications

∗ There are different values from standard specifications. Refer to pages 41 to 43 for details.

Model				HRS012-A□-10	HRS018-A□-10
Cooling method				Air-cooled refrigeration	
Refrigerant				R407C (HFC)	
Control method				PID control	
Ambient temperature/humidity Note 1)				Temperature: 5 to 40°C, Humidity: 30 to 70%	
Circulating fluid system	**Circulating fluid** Note 2)			Tap water, 15% ethylene glycol aqueous solution Note 4)	
	Set temperature range Note 1)		°C	5 to 40	
	Cooling capacity (50/60 Hz) Note 3)		W	1100/1300	1500/1700
	Heating capacity (50/60 Hz) Note 3)		W	360/450	
	Temperature stability Note 5)		°C	±0.1	
	Pump	**Rated flow (50/60 Hz)** Note 6) 7)	L/min	7 (0.13 MPa)/7 (0.18 MPa)	
		Maximum flow rate (50/60 Hz)	L/min	27/29	
		Maximum pump head (50/60 Hz)	m	14/19	
		Output	W	200	
	Tank capacity		L	Approx. 5	
	Port size			Rc1/2	
	Fluid contact material			Stainless steel, Copper (Heat exchanger brazing), Bronze, Alumina ceramic, Carbon, PP, PE, POM, FKM, EPDM, PVC	
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 Note 8)		A	15	
	Rated operating current		A	7.5/8.3	7.7/8.4
	Rated power consumption (50/60 Hz) Note 3)		kVA	0.7/0.8	0.8/0.8
Noise level (50/60 Hz) Note 9)			dB	58/55	
Accessories				Fitting (for drain outlet) 1 pc., Input/output signal connector 1 pc., Power supply connector 1 pc., Operation Manual (for installation/operation) 1, Quick Manual (with a clear case) 1, Alarm code list sticker 1, Ferrite core (for communication) 1 pc., Power supply cable: Option (sold separately) to be ordered or prepared by user.	
Weight Note 10)			kg	40	

Note 1) It should have no condensation.
Note 2) If tap water is used, use water that conforms to Water Quality Standards of the Japan Refrigeration and Air Conditioning Industry Association (JRA GL-02-1994 cooling water system - circulating type - make-up water).
Note 3) ① Ambient temperature: 25°C, ② Circulating fluid temperature: 20°C, ③ Circulating fluid rated flow, ④ Circulating fluid: Tap water
Refer to the cooling capacity graph on page 31 for details.
Note 4) Use a 15% ethylene glycol aqueous solution if operating in a place where the circulating fluid temperature is 10°C or less.
Note 5) Outlet temperature when the circulating fluid flow is rated flow, and the circulating fluid outlet and return port are directly connected. Installation environment and the power supply are within specification range and stable.
Note 6) The capacity at the thermo-chiller outlet when the circulating fluid temperature is 20°C.
Note 7) Required minimum flow rate 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. (In such a case, use a bypass piping set (sold separately).)
Note 8) Purchase an earth leakage breaker with current sensitivity of 15 mA or 30 mA separately. (A product with an optional earth leakage breaker (option B) is also available. Refer to page 41.)
Note 9) Front: 1 m, height: 1 m, stable with no load, Other conditions → Note 3)
Note 10) Weight in the dry state without circulating fluids
Note 11) If the product is used at altitude of 1000 m or higher, refer to "Operating Environment/Storage Environment" (page 60) Item 14 "∗ For altitude of 1000 m or higher".



How to Order

Water-cooled refrigeration **HRS 018 – W □ – 10 – □**

Cooling capacity

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

Note) UL Standards: Applicable to only 60 Hz

Cooling method

W	Water-cooled refrigeration

Pipe thread type

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

Power supply Note)

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

Note) UL Standards: Applicable to only 60 Hz

Option

Symbol	Option
Nil	None
B	With earth leakage breaker
J	With automatic fluid fill function
M	Applicable to deionized water piping
T	High pressure pump mounted Note)

- When multiple options are combined, indicate symbols in alphabetical order.

Note)
- The cooling capacity will decrease by about 300 W from the value in the catalog.
- Pending for CE marking and UL Standards

Specifications

∗ There are different values from standard specifications. Refer to pages 41 to 43 for details.

Model				HRS012-W□-10	HRS018-W□-10
Cooling method				Water-cooled refrigeration	
Refrigerant				R407C (HFC)	
Control method				PID control	
Ambient temperature/humidity Note 1)				Temperature: 5 to 40°C, Humidity: 30 to 70%	
Circulating fluid system	Circulating fluid Note 2)			Tap water, 15% ethylene glycol aqueous solution Note 4)	
	Set temperature range Note 1)		°C	5 to 40	
	Cooling capacity (50/60 Hz) Note 3)		W	1100/1300	1500/1700
	Heating capacity (50/60 Hz) Note 3)		W	360/450	
	Temperature stability Note 5)		°C	±0.1	
	Pump	Rated flow (50/60 Hz) Note 6) 7)	L/min	7 (0.13 MPa)/7 (0.18 MPa)	
		Maximum flow rate (50/60 Hz)	L/min	27/29	
		Maximum pump head (50/60 Hz)	m	14/19	
		Output	W	200	
	Tank capacity		L	Approx. 5	
	Port size			Rc1/2	
	Fluid contact material			Stainless steel, Copper (Heat exchanger brazing), Bronze, Alumina ceramic, Carbon, PP, PE, POM, FKM, EPDM, PVC	
Facility water system	Temperature range		°C	5 to 40	
	Pressure range		MPa	0.3 to 0.5	
	Required flow rate (50/60 Hz) Note 11)		L/min	8	12
	Inlet-outlet pressure differential of facility water		MPa	0.3 or more	
	Port size			Rc3/8	
	Fluid contact 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 Note 8)		A	15	
	Rated operating current		A	7.5/8.3	7.7/8.4
	Rated power consumption (50/60 Hz) Note 3)		kVA	0.7/0.8	0.8/0.8
Noise level (50/60 Hz) Note 9)			dB	58/55	
Accessories				Fitting (for drain outlet) 1 pc., Input/output signal connector 1 pc., Power supply connector 1 pc., Operation Manual (for installation/operation) 1, Quick Manual (with a clear case) 1, Alarm code list sticker 1, Ferrite core (for communication) 1 pc., Power supply cable: Option (sold separately) to be ordered or prepared by user.	
Weight Note 10)			kg	40	

Note 1) It should have no condensation.
Note 2) If tap water is used, use water that conforms to Water Quality Standards of the Japan Refrigeration and Air Conditioning Industry Association (JRA GL-02-1994 cooling water system - circulating type - make-up water).
Note 3) ① Ambient temperature: 25°C, ② Circulating fluid temperature: 20°C, ③ Circulating fluid rated flow, ④ Circulating fluid: Tap water, ⑤ Facility water temperature: 25°C Refer to the cooling capacity graph on page 31 for details.
Note 4) Use a 15% ethylene glycol aqueous solution if operating in a place where the circulating fluid temperature is 10°C or less.
Note 5) Outlet temperature when the circulating fluid flow is rated flow, and the circulating fluid outlet and return port are directly connected. Installation environment and the power supply are within specification range and stable.
Note 6) The capacity at the thermo-chiller outlet when the circulating fluid temperature is 20°C.
Note 7) Required minimum flow rate 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. (In such a case, use a bypass piping set (sold separately).)
Note 8) Purchase an earth leakage breaker with current sensitivity of 15 mA or 30 mA separately. (A product with an optional earth leakage breaker (option B) is also available. Refer to page 41.)
Note 9) Front: 1 m, height: 1 m, stable with no load, Other conditions → Note 3)
Note 10) Weight in the dry state without circulating fluids
Note 11) Required flow rate when a load for the cooling capacity is applied at a circulating fluid temperature of 20°C, and circulating fluid rated flow and facility water temperature of 25°C.
Note 12) If the product is used at altitude of 1000 m or higher, refer to "Operating Environment/Storage Environment" (page 60) Item 14 "∗ For altitude of 1000 m or higher".

Thermo-chiller Standard Type
Single-phase 200 to 230 VAC
Series HRS

(UL Standards)

RoHS



How to Order

Air-cooled refrigeration **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)
030	Cooling capacity 2600/3200 W (50/60 Hz)
050	Cooling capacity 4700/5100 W (50/60 Hz)
060	Cooling capacity 4900/5900 W (50/60 Hz)

Note) UL Standards: Applicable to only 60 Hz

Cooling method

A	Air-cooled refrigeration

Pipe thread type

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

Option

Symbol	Option	Applicable model
Nil	None	HRS012/018/024 030/050/060
B	With earth leakage breaker	
J	With automatic fluid fill function	
M	Applicable to deionized water piping	
T	High pressure pump mounted Note)	HRS012/018/024/030
G	High temperature environment specification	HRS012/018/024

- When multiple options are combined, indicate symbols in alphabetical order.

Note) The cooling capacity will decrease by about 300 W from the value in the catalog.

Power supply Note)

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

Note) UL Standards: Applicable to only 60 Hz

Specifications

∗ There are different values from standard specifications. Refer to pages 41 to 43 for details.

Model			HRS012-A□-20	HRS018-A□-20	HRS024-A□-20	HRS030-A□-20	HRS050-A□-20	HRS060-A□-20
Cooling method			Air-cooled refrigeration					
Refrigerant			R407C (HFC)				R410A (HFC)	
Control method			PID control					
Ambient temperature/humidity Note 1)			Temperature: 5 to 40°C, High temperature environment specification (option): 5 to 45°C, Humidity: 30 to 70%					
Circulating fluid system	**Circulating fluid** Note 2)		Tap water, 15% ethylene glycol aqueous solution Note 4)					
	Set temperature range Note 1)	°C	5 to 40					
	Cooling capacity (50/60 Hz) Note 3)	W	1100/1300	1700/1900	2100/2400	2600/3200	4700/5100	4900/5900
	Heating capacity (50/60 Hz) Note 3)	W	530/650			600/640	1100/1400	1000/1300
	Temperature stability Note 5)	°C	±0.1					
	Pump **Rated flow (50/60 Hz)** Note 6) 7)	L/min	7 (0.13 MPa)/7 (0.18 MPa)				23 (0.24 MPa)/28 (0.32 MPa)	23 (0.21 MPa)/28 (0.29 MPa)
	Pump **Maximum flow rate (50/60 Hz)**	L/min	27/29			34/40	31/42	29/38
	Pump **Maximum pump head (50/60 Hz)**	m	14/19				50	
	Pump **Output**	W	200				550	
	Tank capacity	L	Approx. 5					
	Port size		Rc1/2					
	Fluid contact material		Stainless steel, Copper (Heat exchanger brazing), Bronze, Alumina ceramic, Carbon, PP, PE, POM, FKM, EPDM, PVC					
Electrical system	**Power supply**		Single-phase 200 to 230 VAC (50/60 Hz) Allowable voltage range ±10%					
	Circuit protector	A	10				20	30
	Applicable earth leakage breaker capacity Note 8)	A	10				20	30
	Rated operating current	A	4.6/5.1	4.7/5.2	5.1/5.9	5.2/6.0	8/11	8.9/11.5
	Rated power consumption (50/60 Hz) Note 3)	kVA	0.9/1.0	0.9/1.0	1.0/1.2	1.0/1.2	1.7/2.2	1.8/2.3
Noise level (50/60 Hz) Note 9)		dB	60/61			62/65	65/68	66/68
Accessories			Fitting (for drain outlet) 1 pc. Note 11), Input/output signal connector 1 pc., Power supply connector 1 pc. Note 11), Operation Manual (for installation/operation) 1, Quick Manual (with a clear case) 1 Note 11), Alarm code list sticker 1, Ferrite core (for communication) 1 pc., Power supply cable: Option (sold separately) to be ordered or prepared by user.					
Weight Note 10)		kg	43			47	69	73

Note 1) It should have no condensation.
Note 2) If tap water is used, use water that conforms to Water Quality Standards of the Japan Refrigeration and Air Conditioning Industry Association (JRA GL-02-1994 cooling water system - circulating type - make-up water).
Note 3) ① Ambient temperature: 25°C, ② Circulating fluid temperature: 20°C, ③ Circulating fluid rated flow, ④ Circulating fluid: Tap water
Refer to the cooling capacity graph on pages 31 and 32 for details.
Note 4) Use a 15% ethylene glycol aqueous solution if operating in a place where the circulating fluid temperature is 10°C or less.
Note 5) Outlet temperature when the circulating fluid flow is rated flow, and the circulating fluid outlet and return port are directly connected. Installation environment and the power supply are within specification range and stable.
Note 6) The capacity at the thermo-chiller outlet when the circulating fluid temperature is 20°C.
Note 7) Required minimum flow rate 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. (In such a case, use a bypass piping set (sold separately).)
Note 8) Purchase an earth leakage breaker with current sensitivity of 30 mA separately. (A product with an optional earth leakage breaker (option B) is also available.)
Note 9) Front: 1 m, height: 1 m, stable with no load, Other conditions → Note 3)
Note 10) Weight in the dry state without circulating fluids
Note 11) It is not provided for the HRS050/060.
Note 12) If the product is used at altitude of 1000 m or higher, refer to "Operating Environment/Storage Environment" (page 60) Item 14 "∗ For altitude of 1000 m or higher".

SMC



How to Order

Water-cooled refrigeration **HRS 018 – W □ – 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)
030	Cooling capacity 2600/3200 W (50/60 Hz)
050	Cooling capacity 4700/5100 W (50/60 Hz)
060	Cooling capacity 4900/5900 W (50/60 Hz)

Note) UL Standards: Applicable to only 60 Hz

Cooling method

W	Water-cooled refrigeration

Pipe thread type

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

Option

Symbol	Option	Applicable model
Nil	None	HRS012/018/024 030/050/060
B	With earth leakage breaker	
J	With automatic fluid fill function	
M	Applicable to deionized water piping	
T	High pressure pump mounted Note)	HRS012/018/024/030

- When multiple options are combined, indicate symbols in alphabetical order.

Note) The cooling capacity will decrease by about 300 W from the value in the catalog.

Power supply Note)

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

Note) UL Standards: Applicable to only 60 Hz

Specifications

∗ There are different values from standard specifications. Refer to pages 41 to 43 for details.

Model			HRS012-W□-20	HRS018-W□-20	HRS024-W□-20	HRS030-W□-20	HRS050-W□-20	HRS060-W□-20
Cooling method			Water-cooled refrigeration					
Refrigerant			R407C (HFC)				R410A (HFC)	
Control method			PID control					
Ambient temperature/humidity Note 1)			Temperature: 5 to 40°C, High temperature environment specification (option): 5 to 45°C, Humidity: 30 to 70%					
Circulating fluid system	Circulating fluid Note 2)		Tap water, 15% ethylene glycol aqueous solution Note 4)					
	Set temperature range Note 1)		5 to 40					
	Cooling capacity (50/60 Hz) Note 3)	W	1100/1300	1700/1900	2100/2400	2600/3200	4700/5100	4900/5900
	Heating capacity (50/60 Hz) Note 3)	W	530/650			400/600	1000/1300	
	Temperature stability Note 5)	°C	±0.1					
	Pump Rated flow (50/60 Hz) Note 6) 7)	L/min	7 (0.13 MPa)/7 (0.18 MPa)				23 (0.24 MPa)/28 (0.32 MPa)	23 (0.21 MPa)/28 (0.29 MPa)
	Pump Maximum flow rate (50/60 Hz)	L/min	27/29			34/40	31/42	29/38
	Pump Maximum pump head (50/60 Hz)	m	14/19				50	
	Pump Output	W	200				550	
	Tank capacity	L	Approx. 5					
	Port size		Rc1/2					
	Fluid contact material		Stainless steel, Copper (Heat exchanger brazing), Bronze, Alumina ceramic, Carbon, PP, PE, POM, FKM, EPDM, PVC					
Facility water system	Temperature range	°C	5 to 40					
	Pressure range	MPa	0.3 to 0.5					
	Required flow rate (50/60 Hz) Note 11)	L/min	8	12	14	15	16	17
	Inlet-outlet pressure differential of facility water	MPa	0.3 or more					
	Port size		Rc3/8				Rc1/2	
	Fluid contact 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				20	
	Applicable earth leakage breaker capacity Note 8)	A	10				20	
	Rated operating current	A	4.6/5.1	4.7/5.2	5.1/5.9	5.2/6.0	7.6/10	7.6/10.4
	Rated power consumption (50/60 Hz) Note 3)	kVA	0.9/1.0	0.9/1.0	1.0/1.2	1.0/1.2	1.5/2.0	1.5/2.1
Noise level (50/60 Hz) Note 9)		dB	60/61			62/65	65/68	66/68
Accessories			Fitting (for drain outlet) 1 pc. Note 12), Input/output signal connector 1 pc., Power supply connector 1 pc. Note 12), Operation Manual (for installation/operation) 1, Quick Manual (with a clear case) 1 Note 12), Alarm code list sticker 1, Ferrite core (for communication) 1 pc., Power supply cable: Option (sold separately) to be ordered or prepared by user.					
Weight Note 10)		kg	43			46	67	

Note 1) It should have no condensation.

Note 2) If tap water is used, use water that conforms to Water Quality Standards of the Japan Refrigeration and Air Conditioning Industry Association (JRA GL-02-1994 cooling water system - circulating type - make-up water).

Note 3) ① Ambient temperature: 25°C, ② Circulating fluid temperature: 20°C, ③ Circulating fluid rated flow, ④ Circulating fluid: Tap water, ⑤ Facility water temperature: 25°C Refer to the cooling capacity graph on pages 31 and 32 for details.

Note 4) Use a 15% ethylene glycol aqueous solution if operating in a place where the circulating fluid temperature is 10°C or less.

Note 5) Outlet temperature when the circulating fluid flow is rated flow, and the circulating fluid outlet and return port are directly connected. Installation environment and the power supply are within specification range and stable.

Note 6) The capacity at the thermo-chiller outlet when the circulating fluid temperature is 20°C.

Note 7) Required minimum flow rate 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. (In such a case, use a bypass piping set (sold separately).)

Note 8) Purchase an earth leakage breaker with current sensitivity of 30 mA separately. (A product with an optional earth leakage breaker (option B) is also available.)

Note 9) Front: 1 m, height: 1 m, stable with no load, Other conditions → Note 3)

Note 10) Weight in the dry state without circulating fluids

Note 11) Required flow rate when a load for the cooling capacity is applied at a circulating fluid temperature of 20°C, and circulating fluid rated flow and facility water temperature of 25°C.

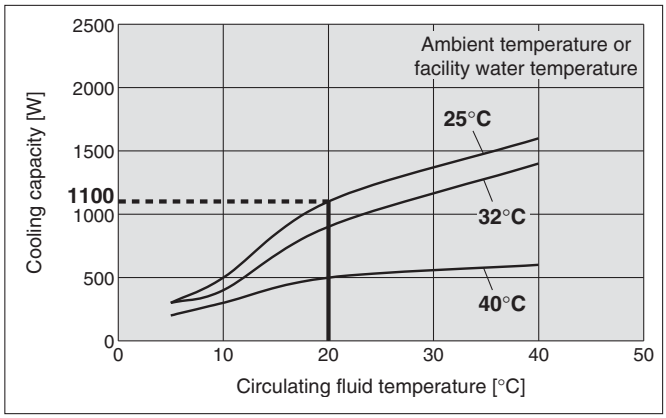
Note 12) It is not provided for the HRS050/060.

Note 13) If the product is used at altitude of 1000 m or higher, refer to "Operating Environment/ Storage Environment" (page 60) Item 14 "∗ For altitude of 1000 m or higher".

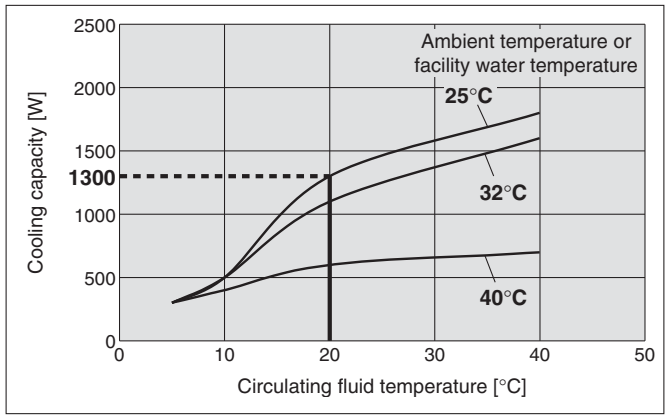
Cooling Capacity

Note 1) If the product is used at altitude of 1000 m or higher, refer to “Operating Environment/Storage Environment” (page 60) Item 14 “∗ For altitude of 1000 m or higher”.
Note 2) For models with high pressure pump mounted (-T), the cooling capacity will decrease by about 300 W from each graph.

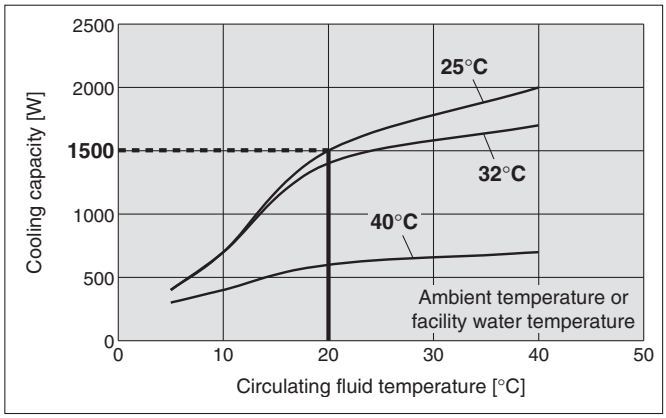
HRS012-A-10, HRS012-W-10 (Single-phase 100/115 VAC) (50 Hz)



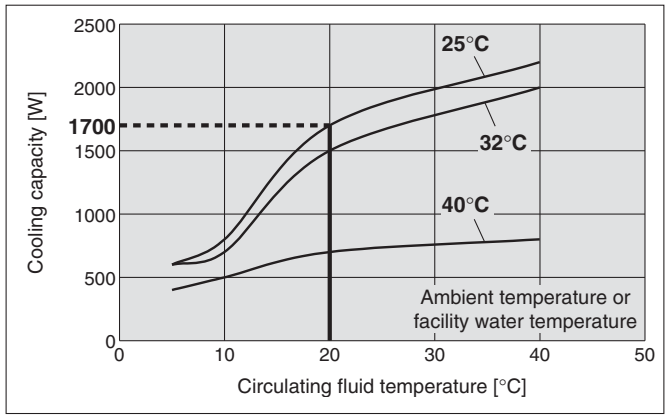
(60 Hz)



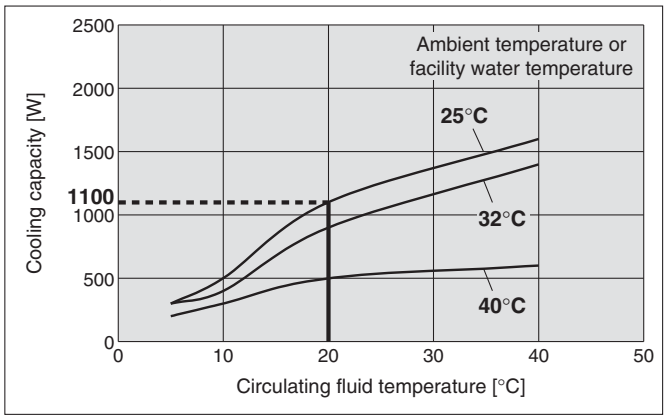
HRS018-A-10, HRS018-W-10 (Single-phase 100/115 VAC) (50 Hz)



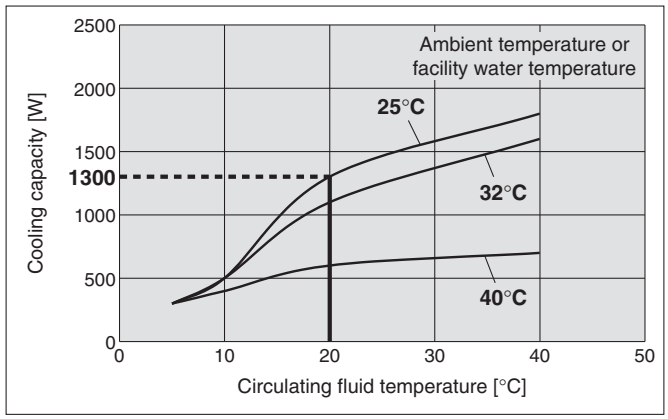
(60 Hz)



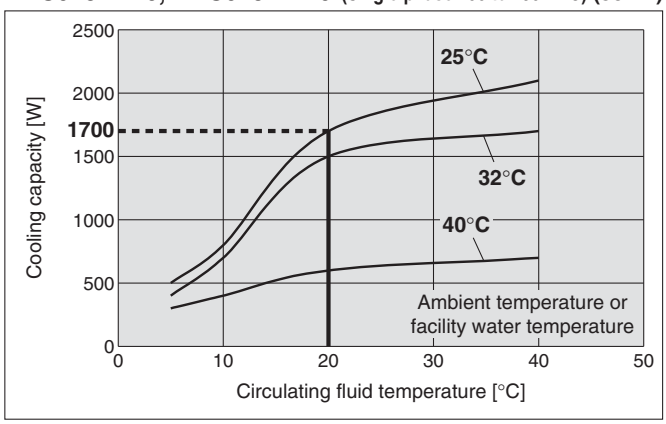
HRS012-A-20, HRS012-W-20 (Single-phase 200 to 230 VAC) (50 Hz)



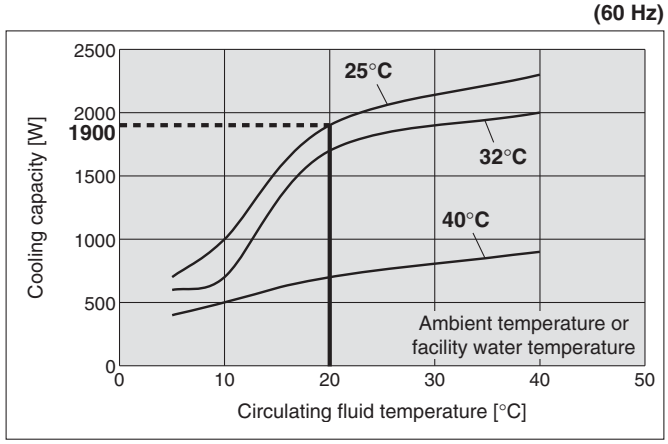
(60 Hz)



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



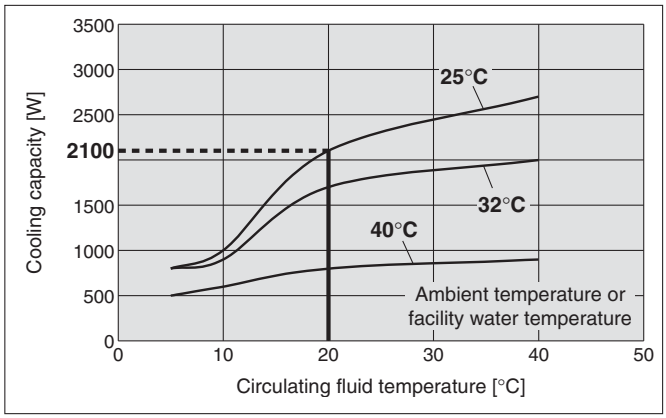
(60 Hz)



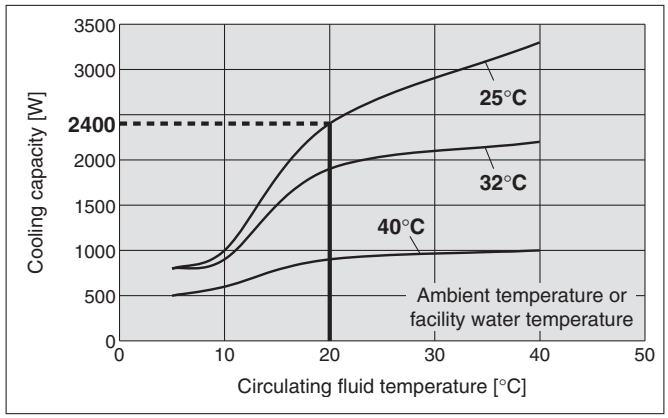
Cooling Capacity

Note 1) If the product is used at altitude of 1000 m or higher, refer to “Operating Environment/Storage Environment” (page 60) Item 14 “∗ For altitude of 1000 m or higher”.
Note 2) For models with high pressure pump mounted (-T), the cooling capacity will decrease by about 300 W from each graph.

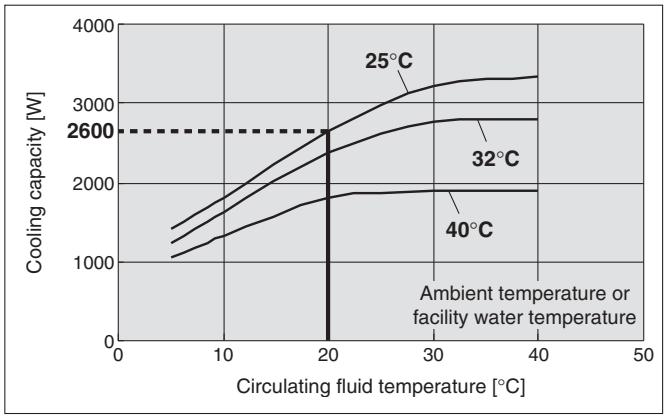
HRS024-A-20, HRS024-W-20 (Single-phase 200 to 230 VAC) (50 Hz)



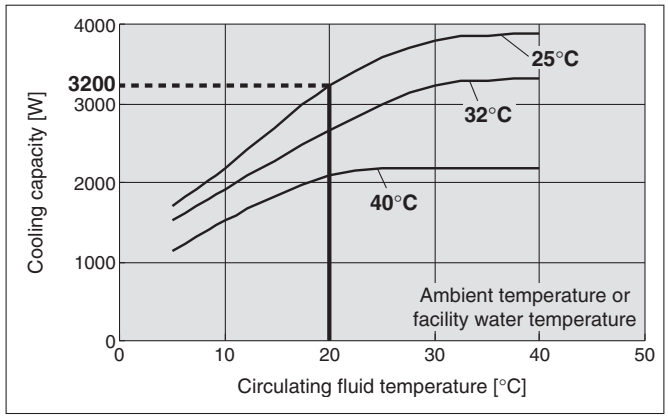
(60 Hz)



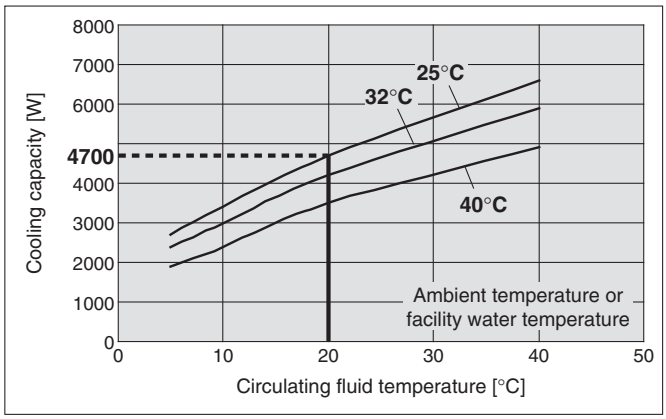
HRS030-A-20, HRS030-W-20 (Single-phase 200 to 230 VAC) (50 Hz)



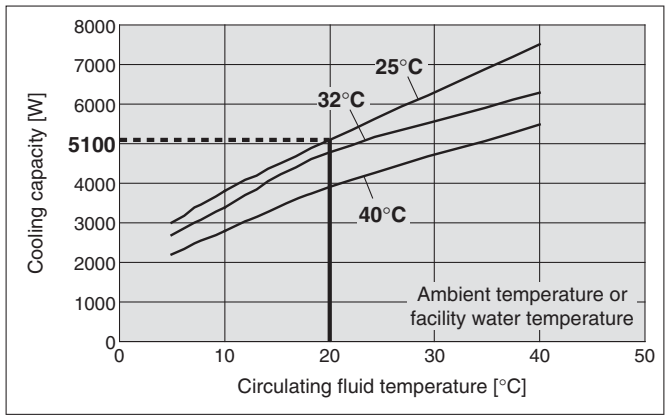
(60 Hz)



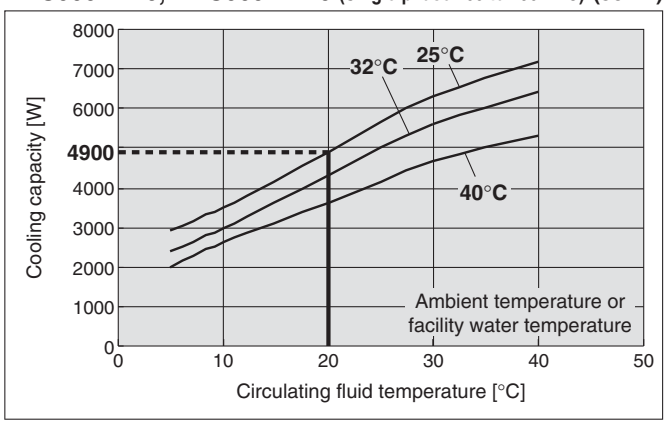
HRS050-A-20, HRS050-W-20 (Single-phase 200 to 230 VAC) (50 Hz)



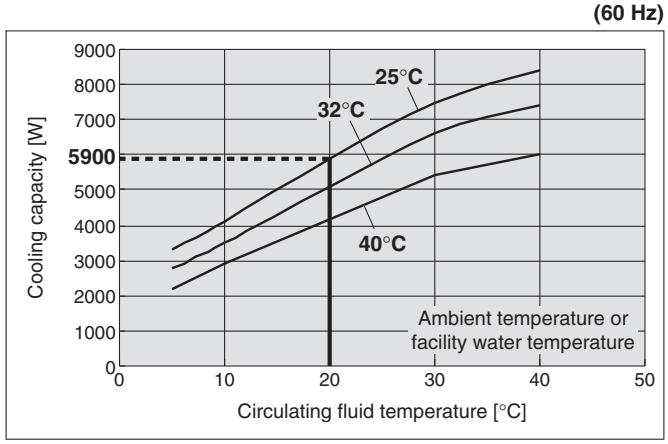
(60 Hz)



HRS060-A-20, HRS060-W-20 (Single-phase 200 to 230 VAC) (50 Hz)



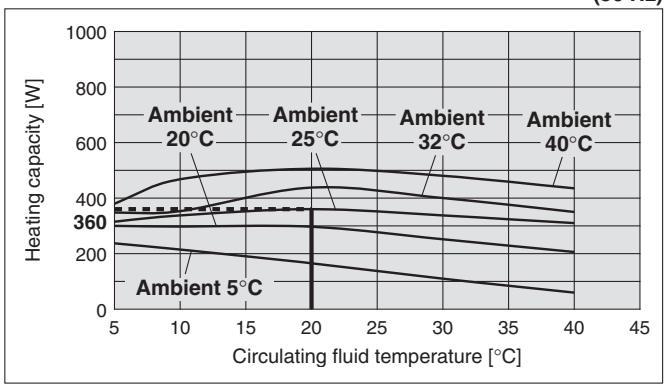
(60 Hz)



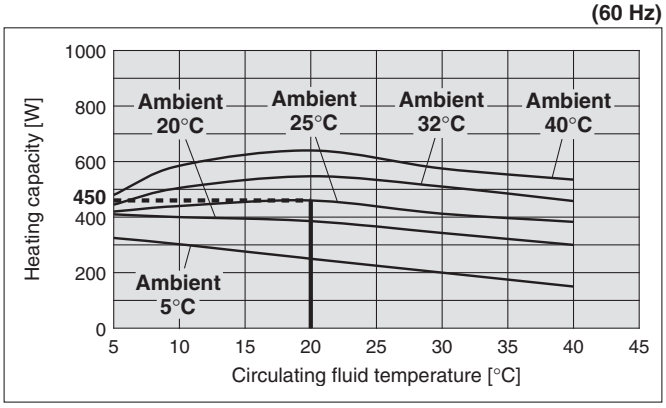
Heating Capacity

HRS$^{012}_{018}$-$^{A}_{W}$-10 (Single-phase 100/115 VAC)

(50 Hz)

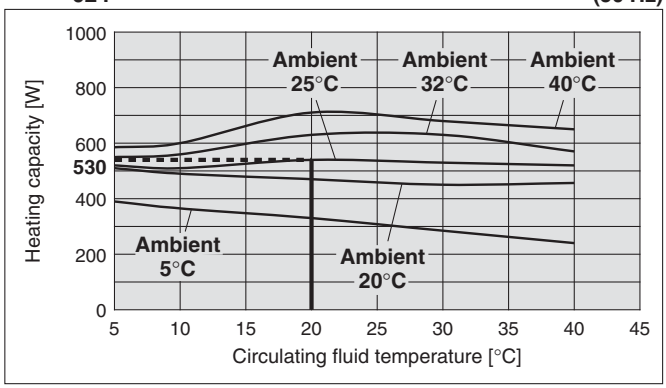


(60 Hz)

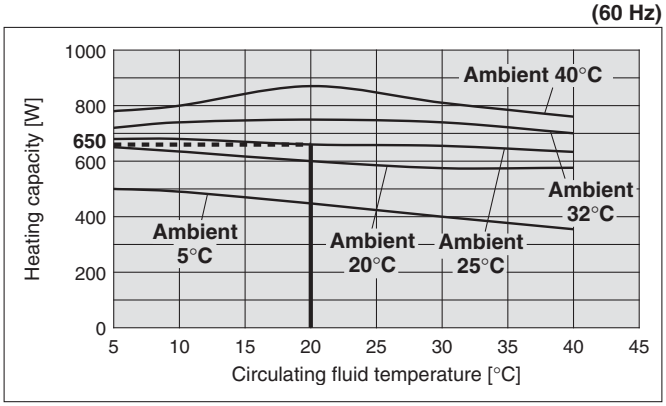


HRS$^{012}_{018}$-$^{A}_{W}$-20 (Single-phase 200 to 230 VAC)

(50 Hz)

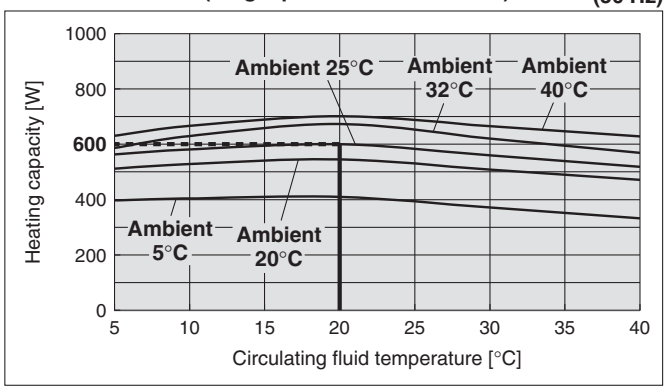


(60 Hz)

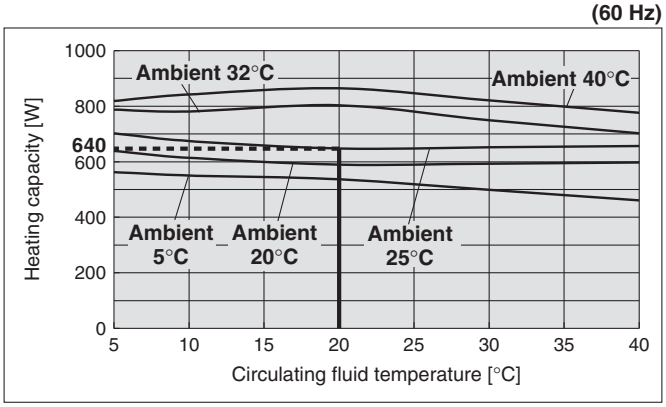


HRS030-A-20 (Single-phase 200 to 230 VAC)

(50 Hz)

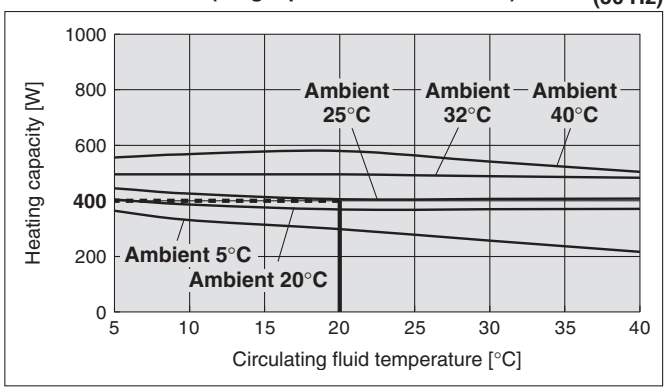


(60 Hz)

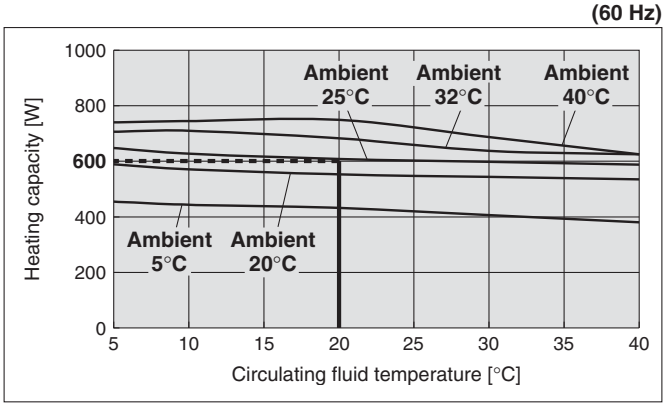


HRS030-W-20 (Single-phase 200 to 230 VAC)

(50 Hz)



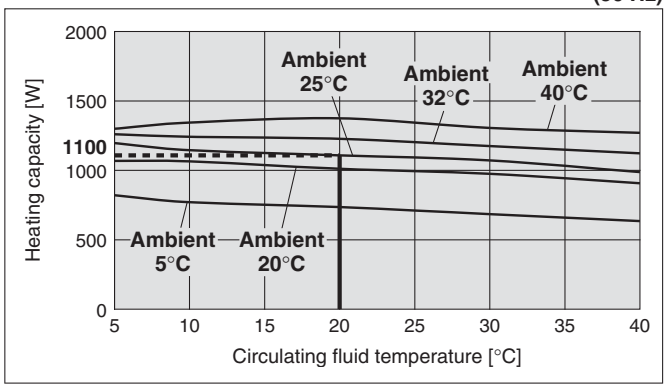
(60 Hz)



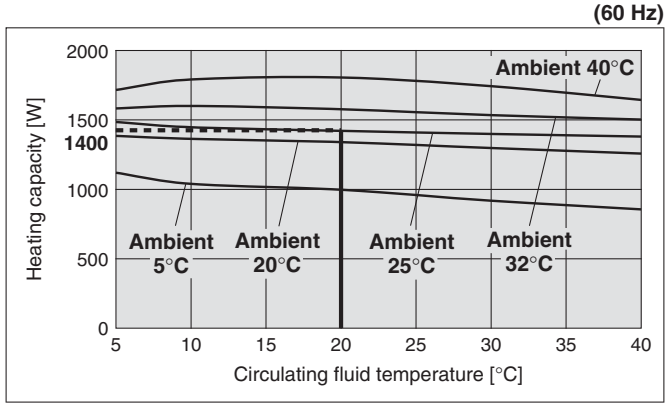
Heating Capacity

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

(50 Hz)

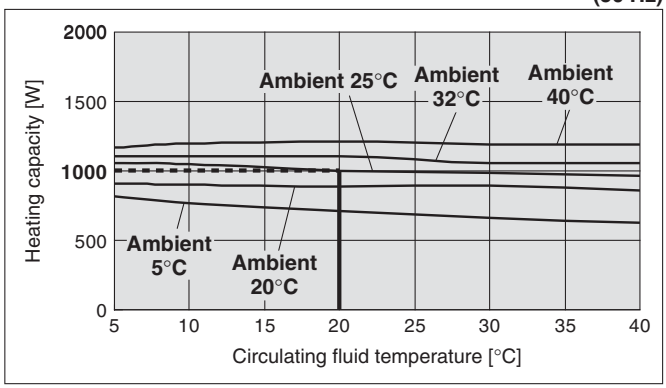


(60 Hz)

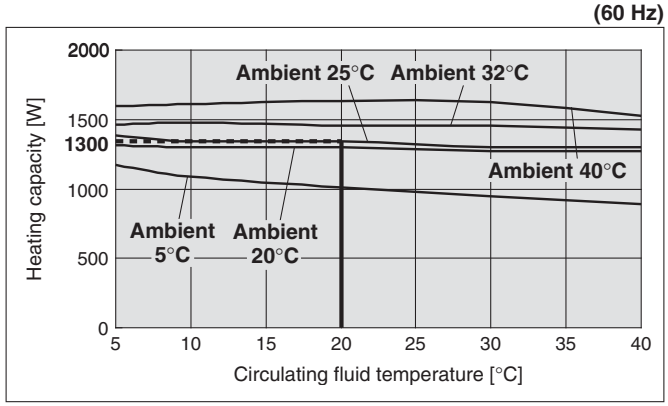


HRS050-W-20 (Single-phase 200 to 230 VAC)

(50 Hz)

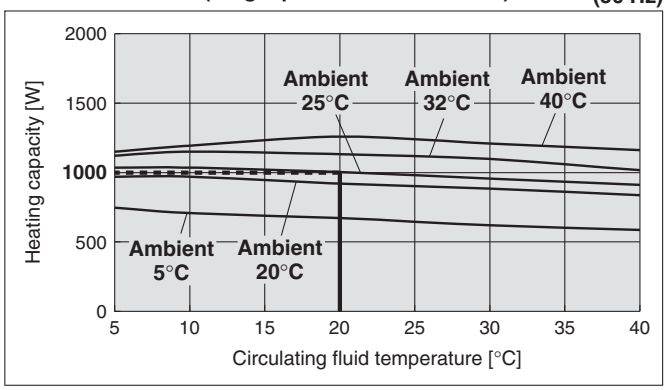


(60 Hz)

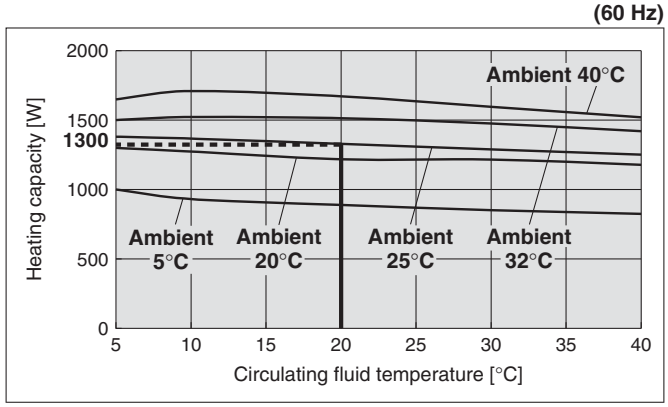


HRS060-A-20 (Single-phase 200 to 230 VAC)

(50 Hz)

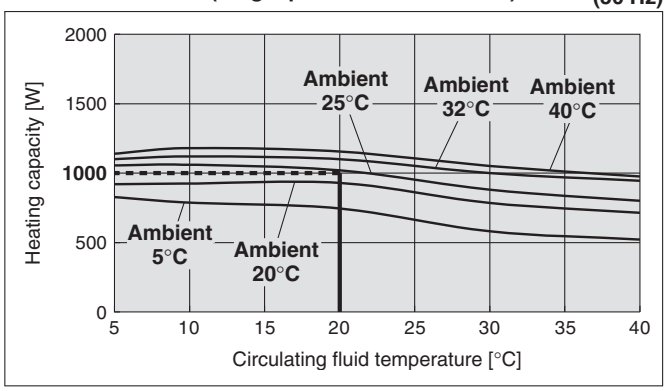


(60 Hz)

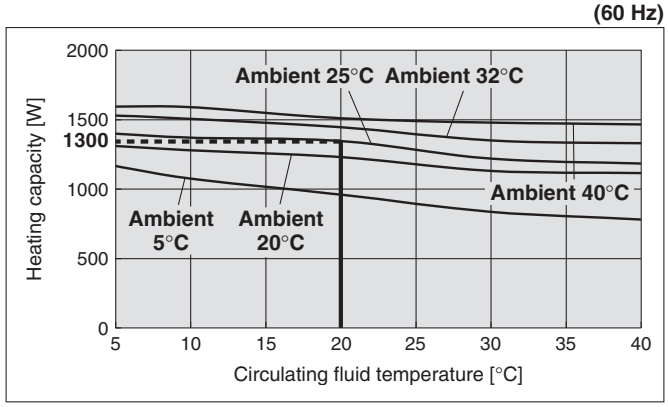


HRS060-W-20 (Single-phase 200 to 230 VAC)

(50 Hz)

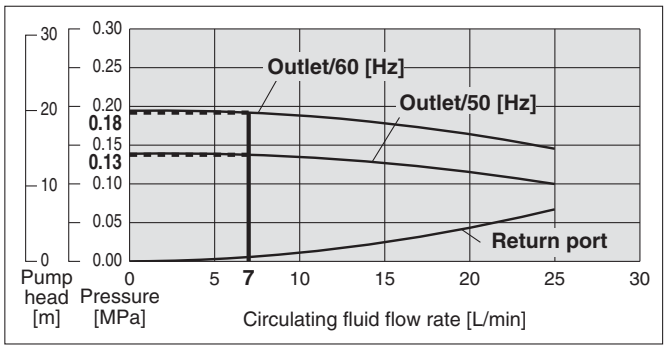


(60 Hz)

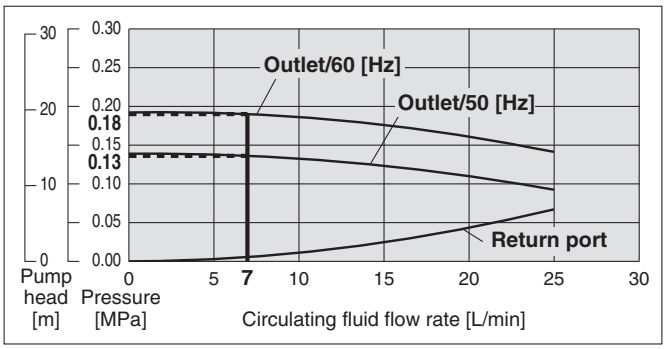


Pump Capacity

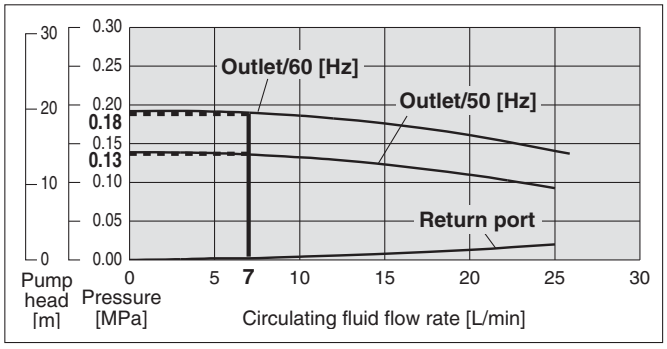
HRS$^{012}_{018}$-$^{A}_{W}$-10 (Single-phase 100/115 VAC)



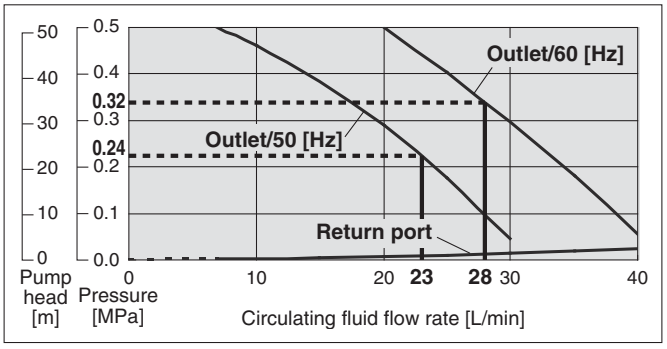
HRS$^{012}_{018}$-$^{A}_{W}$-20 (Single-phase 200 to 230 VAC)



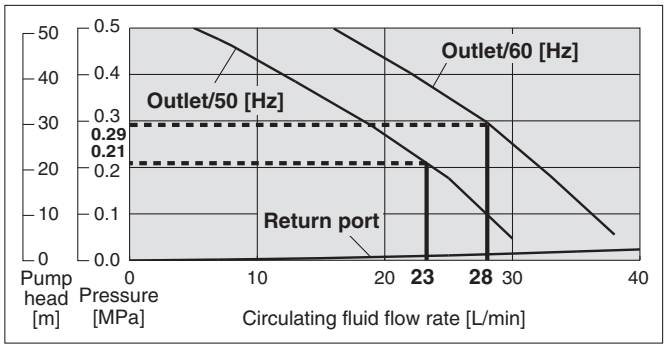
HRS030-$^{A}_{W}$-20 (Single-phase 200 to 230 VAC)



HRS050-$^{A}_{W}$-20 (Single-phase 200 to 230 VAC)

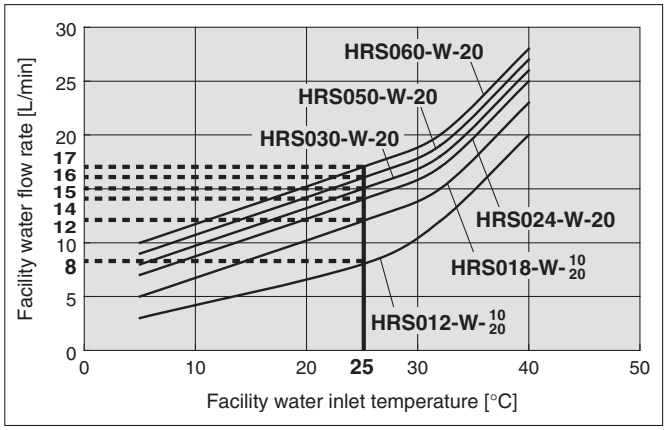


HRS060-$^{A}_{W}$-20 (Single-phase 200 to 230 VAC)



Required Facility Water Flow Rate

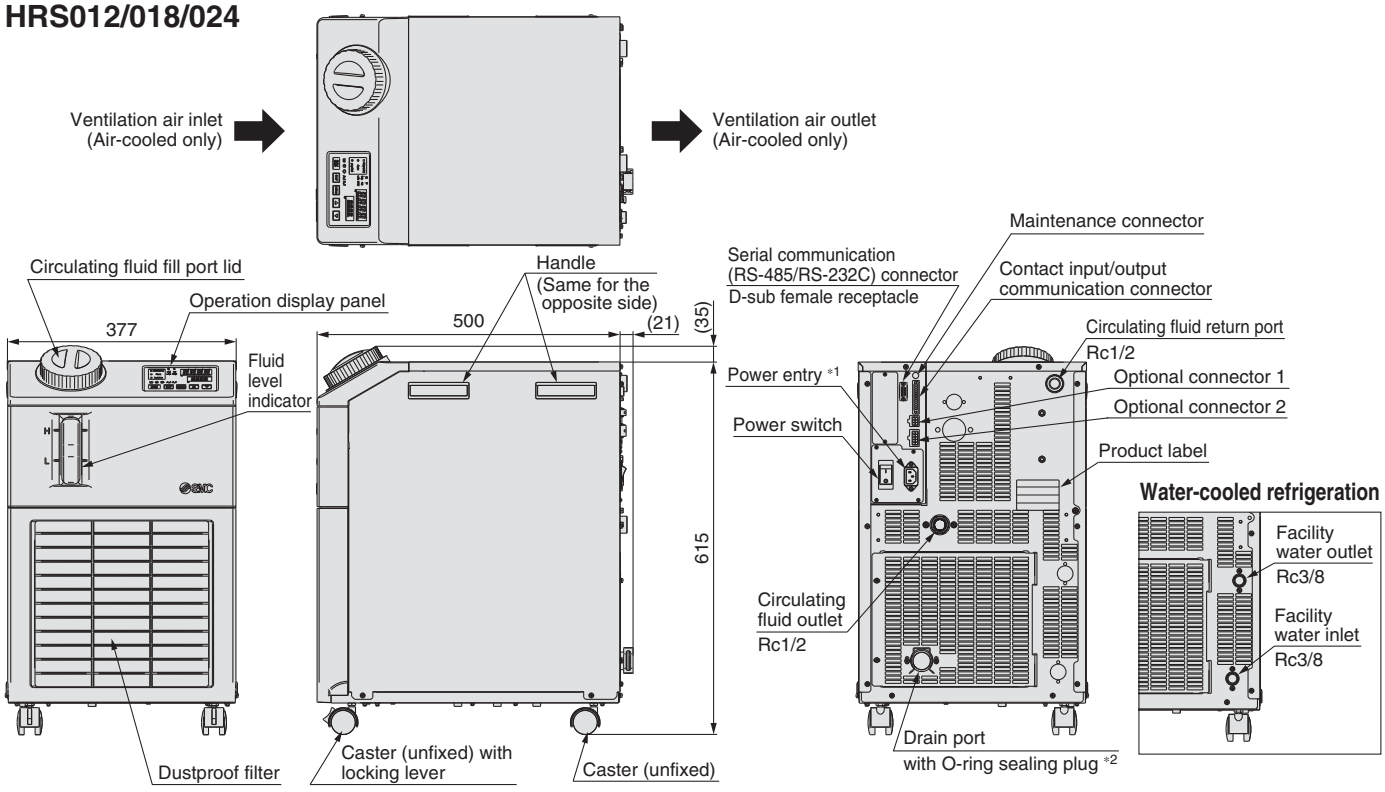
HRS012-W-$^{10}_{20}$, HRS018-W-$^{10}_{20}$, HRS024-W-20
HRS030-W-20, HRS050-W-20, HRS060-W-20



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

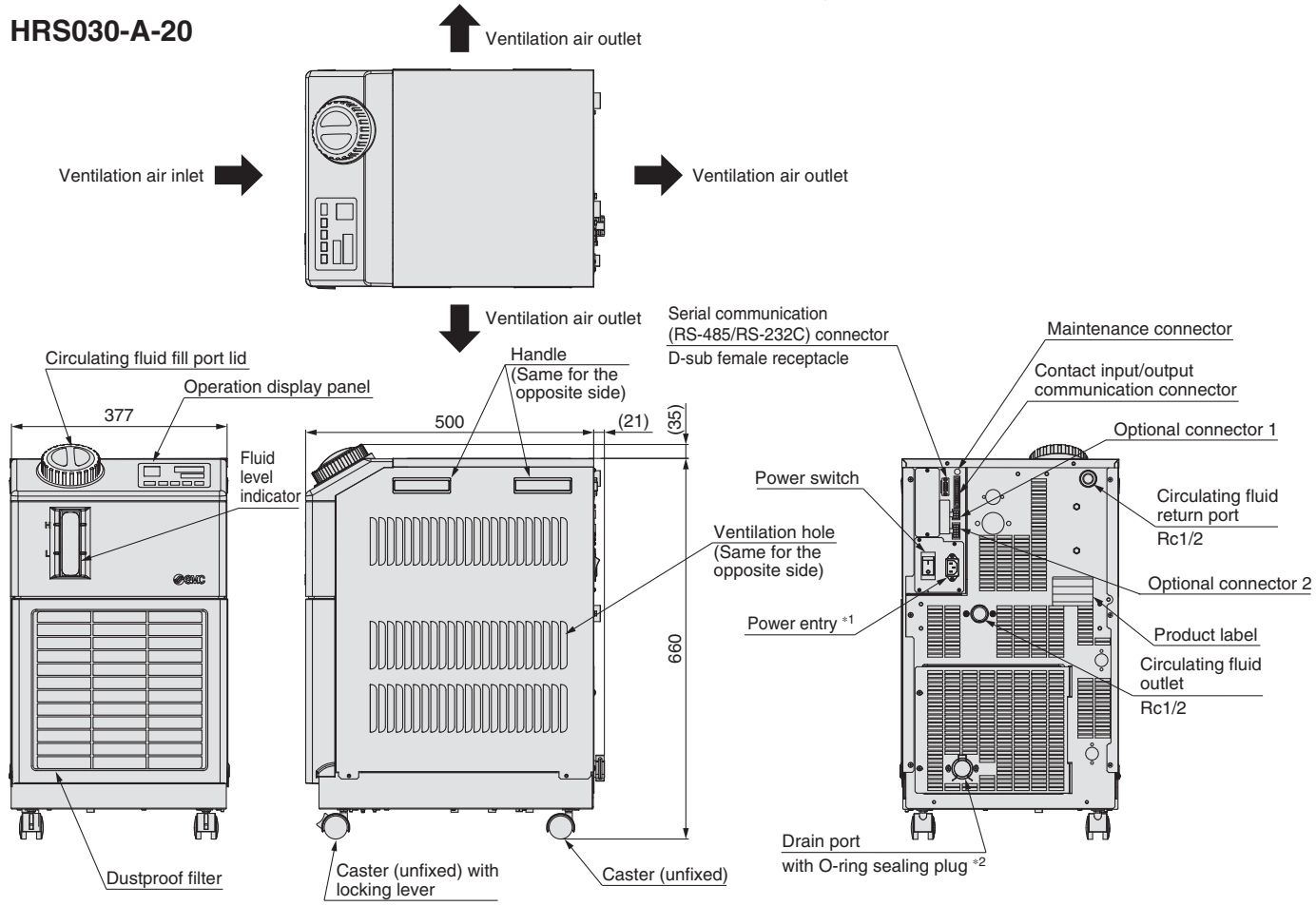
Dimensions

HRS012/018/024



*1 The power supply cable is not provided. (The power supply connector is provided.)
*2 The conversion fitting (R3/8 male thread) is provided.

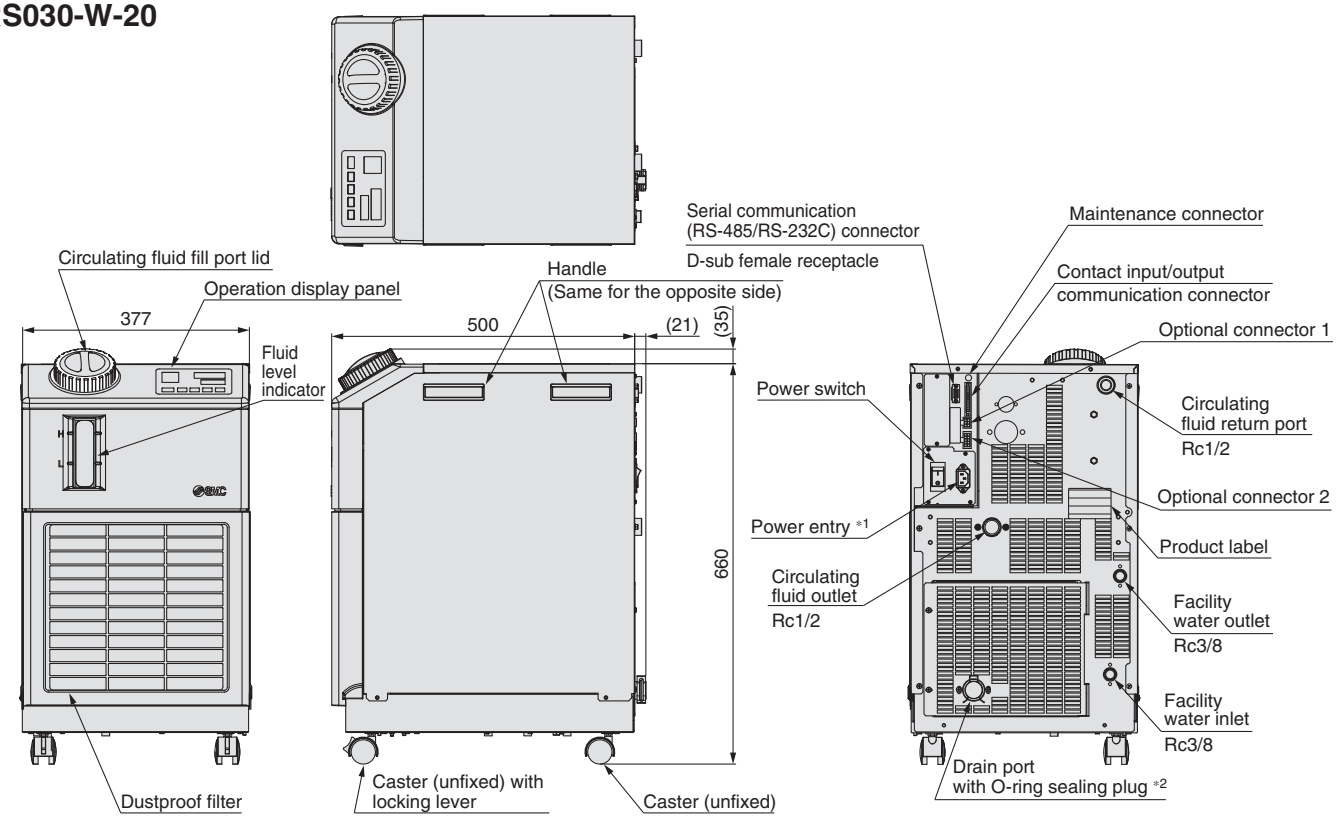
HRS030-A-20



*1 The power supply cable is not provided. (The power supply connector is provided.)
*2 The conversion fitting (R3/8 male thread) is provided.

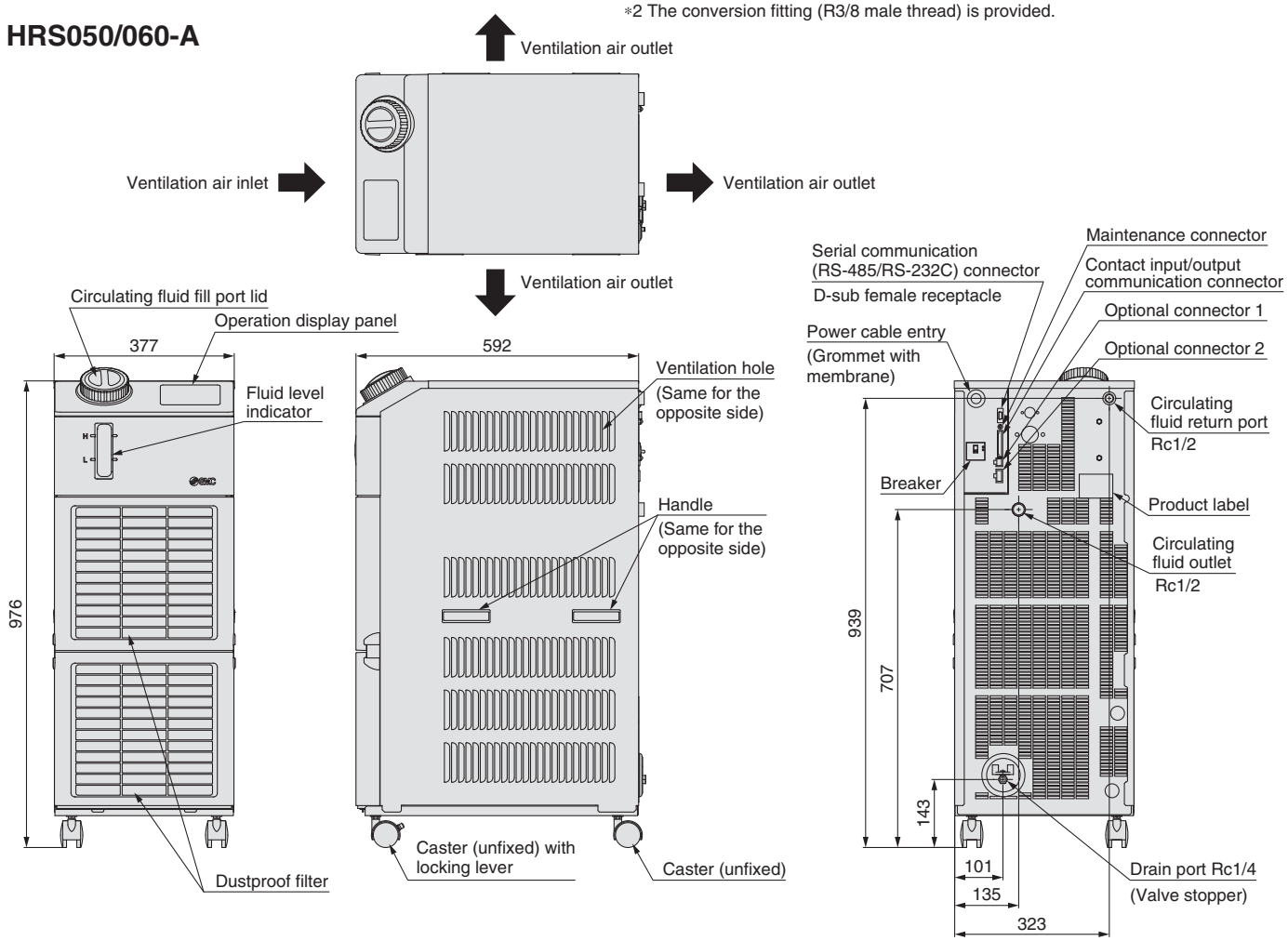
Dimensions

HRS030-W-20



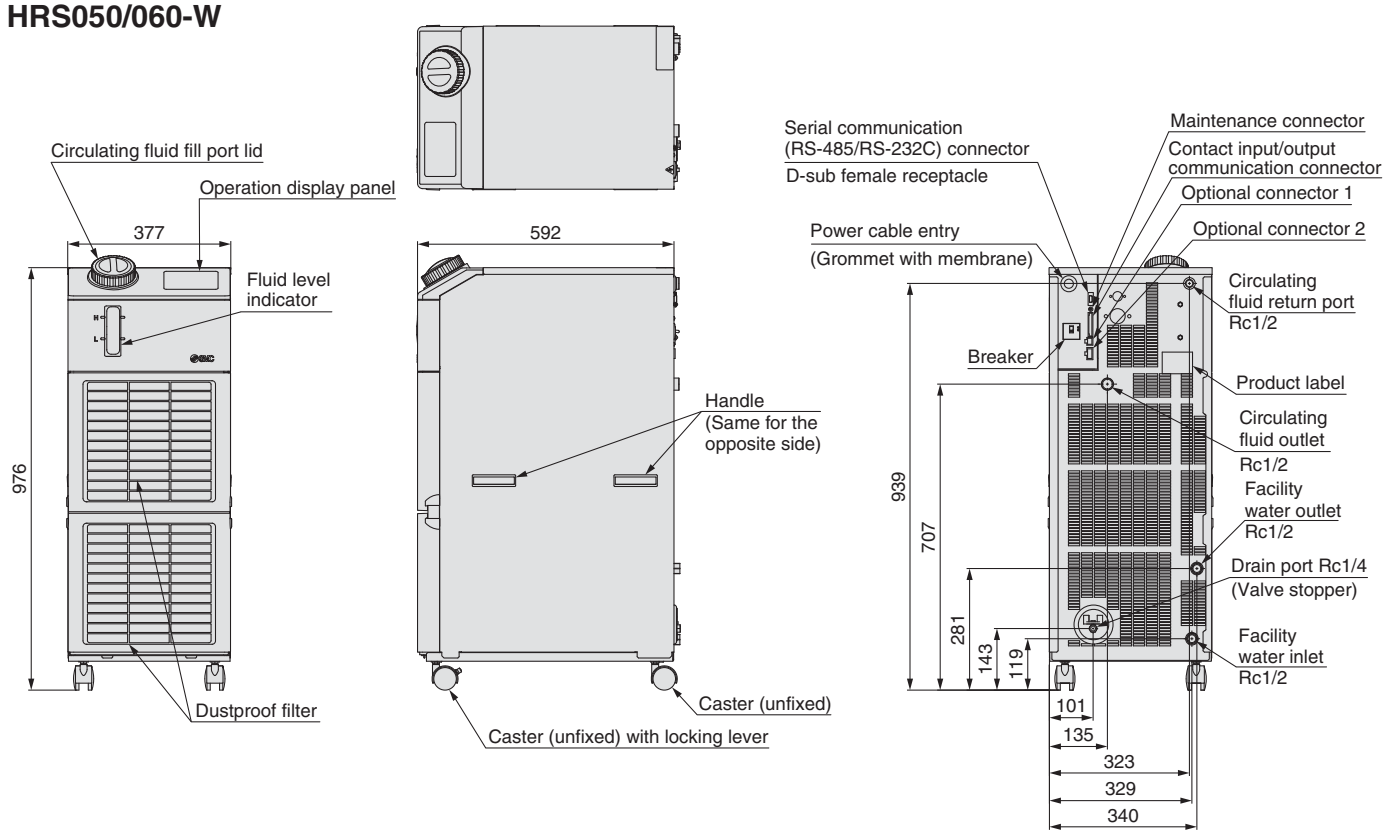
*1 The power supply cable is not provided. (The power supply connector is provided.)
*2 The conversion fitting (R3/8 male thread) is provided.

HRS050/060-A



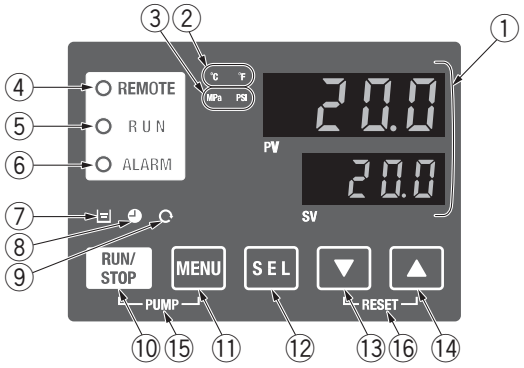
Dimensions

HRS050/060-W



Operation Display Panel

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



No.	Description	Function	
①	**Digital display (7-segment, 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	**[⊨] 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] indicator is reset.	

Alarm

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

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
AL18	Compressor overload	Stop
AL19 *2	Communication error *2	Continue *1

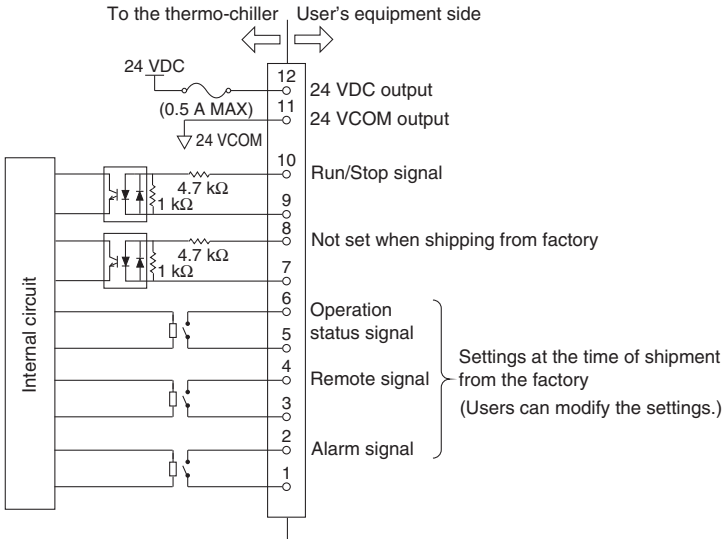
Alarm code	Alarm message	Operation status
AL20	Memory error	Stop
AL21	DC line fuse cut	Stop
AL22	Circulating fluid discharge temperature sensor failure	Stop
AL23	Circulating fluid return temperature sensor failure	Stop
AL24	Compressor intake temperature sensor failure	Stop
AL25	Circulating fluid discharge 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
AL33 *4	Water leakage	Stop *1
AL34 *4	Electrical resistance rise	Continue
AL35 *4	Electrical resistance drop	Continue
AL36 *4	Electrical resistance sensor failure	Continue

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

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

Communication Function

Contact Input/Output

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

∗ The pin numbers and output signals can be set by 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.

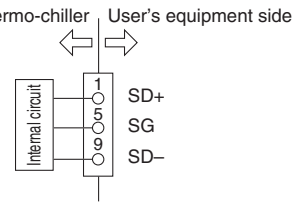
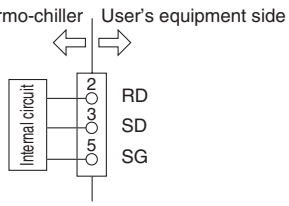
Writing

Run/Stop
Circulating fluid temperature setting (SV)

Readout

Circulating fluid present temperature
Circulating fluid discharge pressure
Electrical resistance ∗1
Status information
Alarm occurrence information

∗1 When the optional accessory, "electrical resistance sensor set" is used.

Item	Specifications	
Connector type	D-sub 9-pin, Female connector	
Protocol	Modicon Modbus compliant/Simple communication protocol	
Standards	EIA standard RS-485	EIA standard RS-232C
Circuit diagram		

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

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

Series HRS
Options

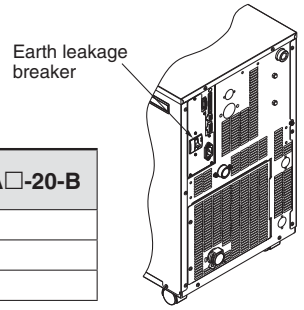
Note) Options have to be selected when ordering the thermo-chiller. It is not possible to add them after purchasing the unit.

Option symbol

B With Earth Leakage Breaker

HRS□□□-□□-□-B

With earth leakage breaker



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

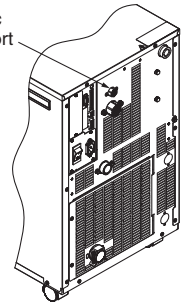
Applicable model	HRS012/018-□□-10-B	HRS012/018/024/030-□□-20-B	HRS050-□□-20-B HRS060-W□-20-B	HRS060-A□-20-B
Rated current sensitivity [mA]	30	30	30	30
Rated shutdown current [A]	15	10	20	30
Short circuit display method	Mechanical button			

Option symbol

J With Automatic Fluid Fill Function

HRS□□□-□□-□-J

With automatic fluid fill function



By installing this at the automatic fluid fill port, the circulating fluid can be automatically supplied to the product using a built-in solenoid valve for a fluid fill while the circulating fluid is decreasing.

Applicable model	HRS012/018/024/030/050/060-□□-□-J
Fluid fill method	Built-in solenoid valve for automatic fluid fill
Fluid fill pressure [MPa]	0.2 to 0.5

∗ When the option, with automatic fluid fill function, is selected, the weight increases by 1 kg.

Option symbol

M Applicable to Deionized Water Piping

HRS□□□-□□-□-M

Applicable to deionized water piping

Contact material of the circulating fluid circuit is made from non-copper materials.

Applicable model	HRS012/018/024/030/050/060-□□-□-M
Contact material for circulating fluid	Stainless steel (including heat exchanger brazing), Alumina ceramic, SiC, Carbon, PP, PE, POM, FKM, NBR, EPDM, PVC

∗ No change in external dimensions

Option symbol

T High Pressure Pump Mounted

HRS□□□-□□-□□-T

High pressure pump mounted

Possible to choose a high pressure pump in accordance with user's piping resistance.
Cooling capacity will decrease by heat generated in the pump.

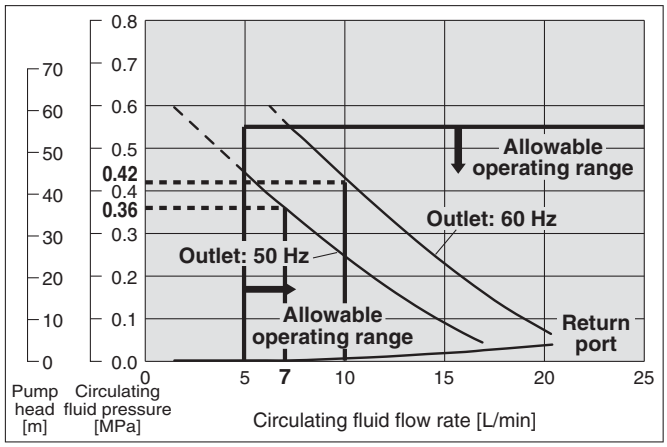
∗ **The HRS050/060 cannot be selected.**

Applicable model			HRS012/018-□□-10-T/MT	HRS012/018/024/030-□□-20-T	HRS012/018/024/030-□□-20-MT Note 1)
Pump	Rated flow (50/60 Hz) Note 2) 3)	L/min	7 (0.36 MPa)/10 (0.42 MPa)	10 (0.44 MPa)/14 (0.40 MPa)	10 (0.32 MPa)/14 (0.32 MPa)
	Maximum flow rate (50/60 Hz)	L/min	18/22		
	Maximum pump head (50/60 Hz)	m	55	70	60
	Output	W	320	550	
Circuit protector		A	15	15 (10 A for standard)	
Recommended earth leakage breaker capacity		A	15		
Cooling capacity Note 4)		W	The cooling capacity reduces about 300 W from the value in the catalog. (due to an increase in the heat generation of the pump)		

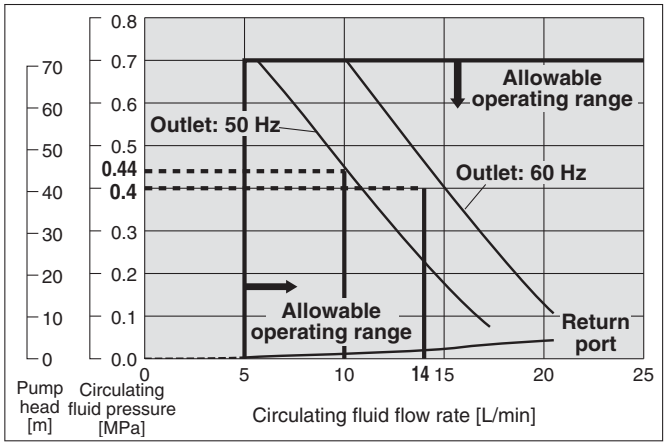
Note 1) -MT: Applicable to deionized water piping + High pressure pump
Note 2) The capacity at the thermo-chiller outlet when the circulating fluid temperature is 20°C.
Note 3) Required minimum flow rate for cooling capacity or maintaining the temperature stability.
Note 4) Cooling capacity will decrease as pump power increases.
Note 5) When the option, high pressure pump mounted, is selected, the weight increases by 4 kg for -10 type and 6 kg for -20 type.
∗ No change in external dimensions

Pump Capacity

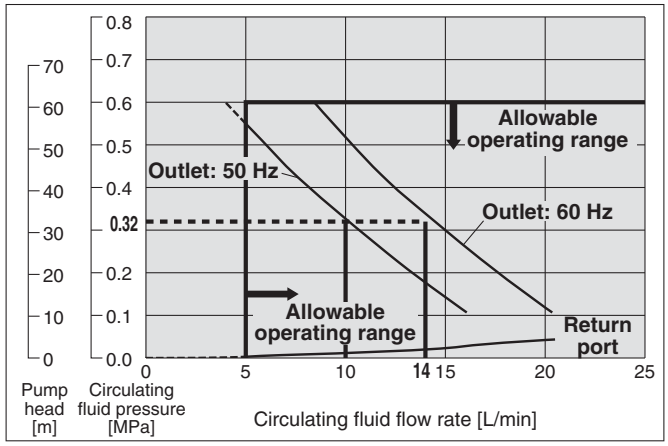
HRS012/018-□□-10-T/MT



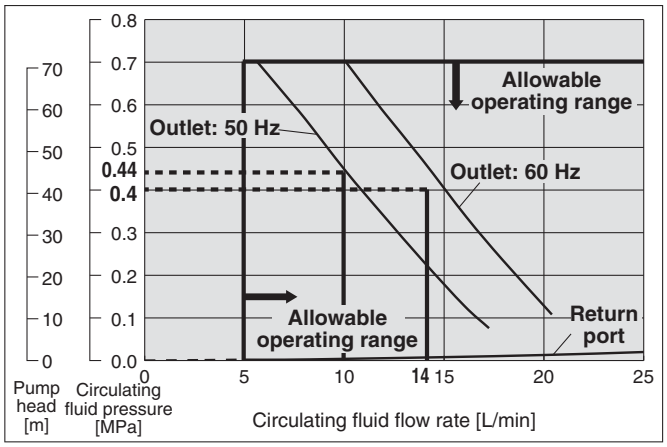
HRS012/018/024-□□-20-T



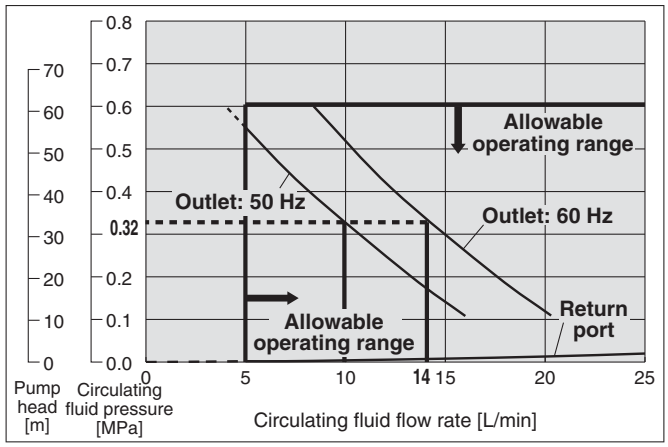
HRS012/018/024-□□-20-MT



HRS030-□□-20-T



HRS030-□□-20-MT



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

G Option symbol

High Temperature Environment Specification

HRS□□□-A□-20-G

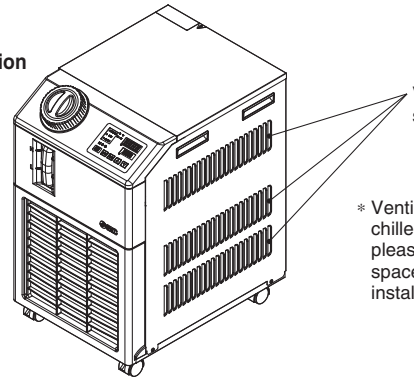
High temperature environment specification

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

Applicable model	HRS012/018/024-A□-20-G
Cooling method	Air-cooled refrigeration
Power supply	Single-phase 200 to 230 VAC (50/60 Hz)

∗ No change in external dimensions

∗ **The HRS030/050/060 cannot be selected.**



Ventilation slots are added to side panels (on both sides).

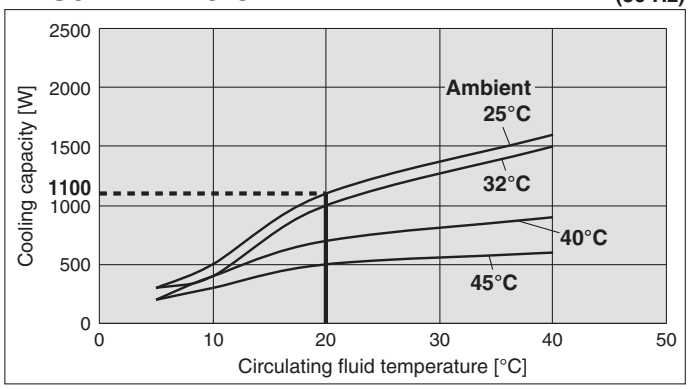
∗ Ventilation slots are added to thermo-chiller side panels. For this reason, please provide 300 mm of ventilation space next to the side panels (do not install with sides touching walls).

Note 1) If the product is used at altitude of 1000 m or higher, refer to "Operating Environment/Storage Environment" (page 60) Item 14 "∗ For altitude of 1000 m or higher".
Note 2) For models with high pressure pump mounted (-T), the cooling capacity will decrease by about 300 W from each graph.

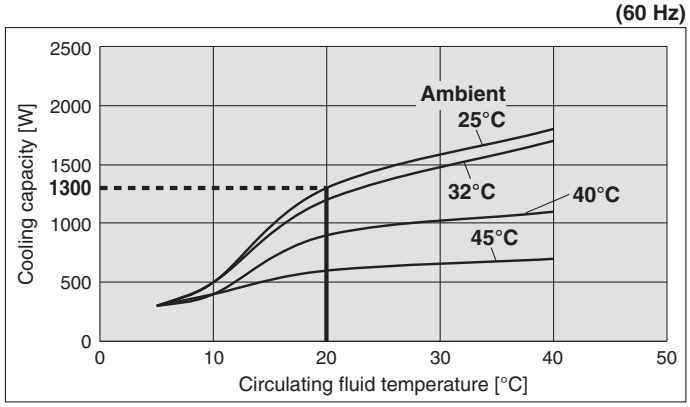
Cooling Capacity

HRS012-A□-20-G

(50 Hz)

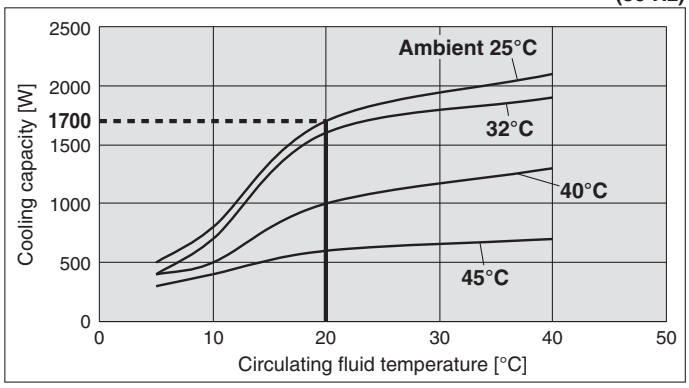


(60 Hz)

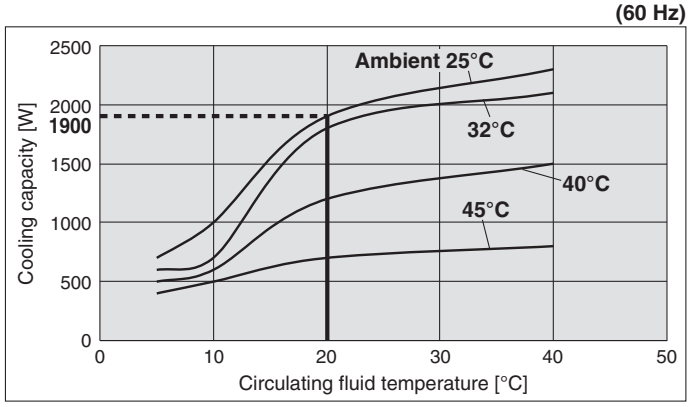


HRS018-A□-20-G

(50 Hz)

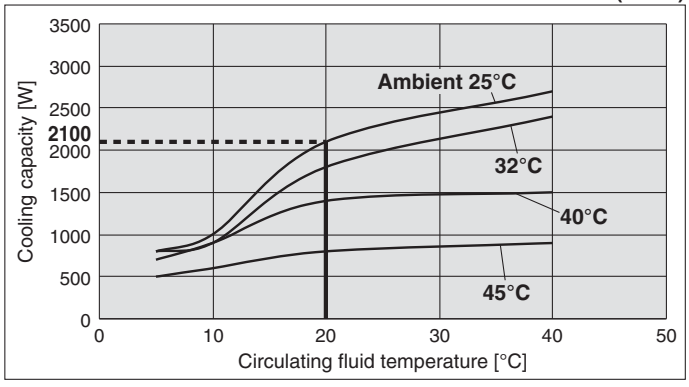


(60 Hz)

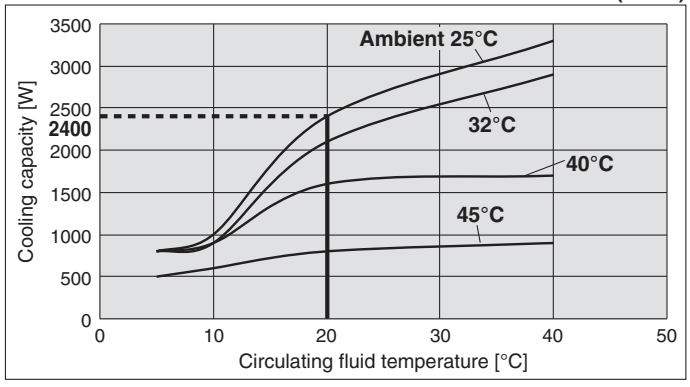


HRS024-A□-20-G

(50 Hz)



(60 Hz)



Optional Accessories

Applicable Model List/Air-Cooled Refrigeration

No.	Description		Part no.	HRS012-A HRS018-A		HRS024-A-20	HRS030-A-20	HRS050-A-20 HRS060-A-20	Option		Page
				-10	-20				(for -J)	(for -T)	
①	Anti-quake bracket		HRS-TK001	●	●	●	●	—	—	—	47
			HRS-TK002	—	—	—	—	●	—	—	
②	Piping conversion fitting (for air-cooled refrigeration)	G thread conversion fitting set	HRS-EP001	●	●	●	●	—	—	—	47
		NPT thread conversion fitting set	HRS-EP002	●	●	●	●	—	—	—	
		G thread conversion fitting set	HRS-EP009	—	—	—	—	●	—	—	
		NPT thread conversion fitting set	HRS-EP010	—	—	—	—	●	—	—	
③	Piping conversion fitting Note 1) (for automatic water fill port)	G thread conversion fitting set	HRS-EP005	—	—	—	—	—	●	—	48
		NPT thread conversion fitting set	HRS-EP006	—	—	—	—	—	●	—	
	Piping conversion fitting Note 2) (for drain outlet)	G thread conversion fitting set	HRS-EP007	—	—	—	—	—	—	●	
		NPT thread conversion fitting set	HRS-EP008	—	—	—	—	—	—	●	
④	Concentration meter		HRZ-BR002	●	●	●	●	●	●	●	49
⑤	Bypass piping set		HRS-BP001	●	●	●	●	—	—	—	49
			HRS-BP004	—	—	—	—	●	—	—	
⑥	Power supply cable	For single-phase 100/115 VAC type	HRS-CA001	●	—	—	—	—	—	—	50
		For single-phase 200 VAC type	HRS-CA002	—	●	●	●	— Note 3)	—	—	
		For single-phase 100/115 VAC type	HRS-CA003	●	—	—	—	—	—	—	
		For single-phase 200 VAC type	HRS-CA004	—	—	—	—	● Note 4)	—	—	
	Retaining clip		HRS-S0074	●	●	●	●	—	—	—	
⑦	DI filter set		HRS-DP001	●	●	●	●	●	—	—	51
			HRS-DP002	●	●	●	●	●	—	—	
⑧	Electrical resistance sensor set		HRS-DI001	●	●	●	●	●	—	—	52
		With control function/bypass	HRS-DI003	●	●	●	●	●	—	—	
		With bypass	HRS-DI004	●	●	●	●	●	—	—	
		With control function	HRS-DI005	●	●	●	●	●	—	—	
⑨	Particle filter set	(#5) OUT side	HRS-PF001	●	●	●	●	●	—	—	53
		(#10) OUT side	HRS-PF002	—	—	—	—	●	—	—	
		(#5) IN side	HRS-PF003	●	●	●	●	●	—	—	
		(#10) IN side	HRS-PF004	—	—	—	—	●	—	—	
⑩	Drain pan set	With water leakage sensor	HRS-WL001	●	●	●	●	—	—	—	54
			HRS-WL002	—	—	—	—	●	—	—	
⑪	Connector cover		HRS-BK001	●	●	●	●	—	—	—	55
			HRS-BK002	—	—	—	—	●	—	—	
⑫	Analog gateway unit		HRS-CV001	●	●	●	●	●	—	—	55
⑬	Replacement type dustproof filter set		HRS-FL001	●	●	●	—	—	—	—	55
	Replacement type dustproof filter		HRS-FL002	●	●	●	—	—	—	—	
⑭	Separately installed power transformer		IDF-TR1000-1	●	—	—	—	— Note 3)	—	—	56
			IDF-TR1000-2	●	—	—	—		—	—	
			IDF-TR1000-3	●	—	—	—		—	—	
			IDF-TR1000-4	●	—	—	—		—	—	
			IDF-TR2000-9	—	●	●	●		—	—	
			IDF-TR2000-10	—	●	●	●		—	—	
			IDF-TR2000-11	—	●	●	●		—	—	

Note 1) When option J is selected.
Note 2) When option T or the HRS050/060 is selected.
Note 3) For the HRS050/060 models: To be prepared by user.
Note 4) Not applicable for the HRS060-A□-20. To be prepared by user.

Applicable Model List/Water-Cooled Refrigeration

No.	Description		Part no.	HRS012-W HRS018-W -10	HRS012-W HRS018-W -20	HRS024-W-20	HRS030-W-20	HRS050-W-20 HRS060-W-20	Option (for -J)	Option (for -T)	Page
①	Anti-quake bracket		HRS-TK001	●	●	●	●	—	—	—	47
			HRS-TK002	—	—	—	—	●	—	—	
②	Piping conversion fitting (for water-cooled refrigeration)	G thread conversion fitting set	HRS-EP003	●	●	●	●	—	—	—	48
		NPT thread conversion fitting set	HRS-EP004	●	●	●	●	—	—	—	
		G thread conversion fitting set	HRS-EP011	—	—	—	—	●	—	—	
		NPT thread conversion fitting set	HRS-EP012	—	—	—	—	●	—	—	
③	Piping conversion fitting Note 1) (for automatic water fill port)	G thread conversion fitting set	HRS-EP005	—	—	—	—	●	●	—	48
		NPT thread conversion fitting set	HRS-EP006	—	—	—	—	●	●	—	
	Piping conversion fitting Note 2) (for drain outlet)	G thread conversion fitting set	HRS-EP007	—	—	—	—	—	—	●	
		NPT thread conversion fitting set	HRS-EP008	—	—	—	—	—	—	●	
④	Concentration meter		HRZ-BR002	●	●	●	●	●	●	●	49
⑤	Bypass piping set		HRS-BP001	●	●	●	●	—	—	—	49
			HRS-BP004	—	—	—	—	●	—	—	
⑥	Power supply cable	For single-phase 100/115 VAC type	HRS-CA001	●	—	—	—	—	—	—	50
		For single-phase 200 VAC type	HRS-CA002	—	●	●	●	— Note 3)	—	—	
		For single-phase 100/115 VAC type	HRS-CA003	●	—	—	—	—	—	—	
		For single-phase 200 VAC type	HRS-CA004	—	—	—	—	● Note 4)	—	—	
	Retaining clip		HRS-S0074	●	●	●	●	●	—	—	
⑦	DI filter set		HRS-DP001	●	●	●	●	●	—	—	51
			HRS-DP002	●	●	●	●	●	—	—	
⑧	Electrical resistance sensor set		HRS-DI001	●	●	●	●	●	—	—	52
		With control function/bypass	HRS-DI003	●	●	●	●	●	—	—	
		With bypass	HRS-DI004	●	●	●	●	●	—	—	
		With control function	HRS-DI005	●	●	●	●	●	—	—	
⑨	Particle filter set	(#5) OUT side	HRS-PF001	●	●	●	●	●	—	—	53
		(#10) OUT side	HRS-PF002	—	—	—	—	●	—	—	
		(#5) IN side	HRS-PF003	●	●	●	●	●	—	—	
		(#10) IN side	HRS-PF004	—	—	—	—	●	—	—	
⑩	Drain pan set	With water leakage sensor	HRS-WL001	●	●	●	●	—	—	—	54
			HRS-WL002	—	—	—	—	●	—	—	
⑪	Connector cover		HRS-BK001	●	●	●	●	—	—	—	55
			HRS-BK002	—	—	—	—	●	—	—	
⑫	Analog gateway unit		HRS-CV001	●	●	●	●	●	—	—	55
⑬	Replacement type dustproof filter set		—	—	—	—	—	—	—	—	—
	Replacement type dustproof filter		—	—	—	—	—	—	—	—	
⑭	Separately installed power transformer		IDF-TR1000-1	●	—	—	—	— Note 3)	—	—	56
			IDF-TR1000-2	●	—	—	—		—	—	
			IDF-TR1000-3	●	—	—	—		—	—	
			IDF-TR1000-4	●	—	—	—		—	—	
			IDF-TR2000-9	—	●	●	●		—	—	
			IDF-TR2000-10	—	●	●	●		—	—	
			IDF-TR2000-11	—	●	●	●		—	—	

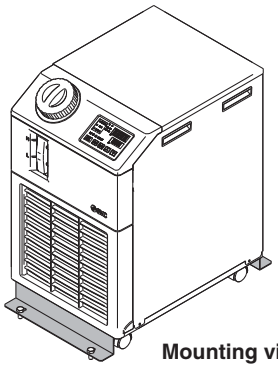
Note 1) When option J is selected.
Note 2) When option T or the HRS050/060 is selected.
Note 3) For the HRS050/060 models: To be prepared by user.
Note 4) Not applicable for the HRS060-A□-20. To be prepared by user.

① Anti-quake Bracket

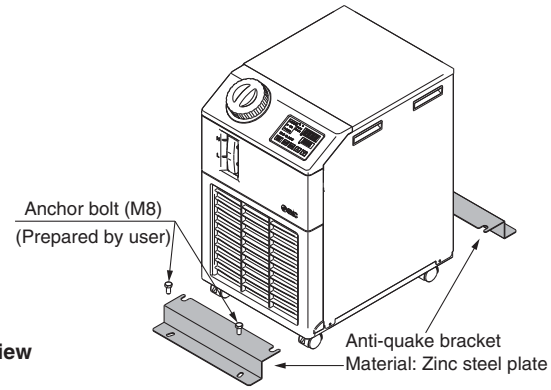
Bracket for earthquakes. Anchor bolt (M8) suitable for the flooring material should be prepared separately by user.
(Anti-quake bracket thickness: 1.6 mm)

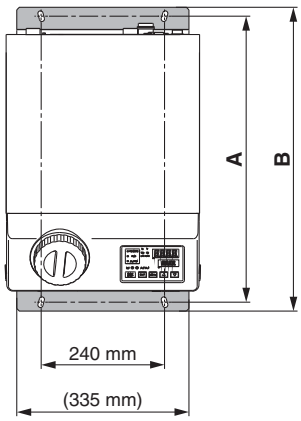
[mm]

Part no. (per unit)	Applicable model	A	B
HRS-TK001	HRS012-□□-□ HRS018-□□-□ HRS024-□□-□	555	(590)
	HRS030-□□-□	546	(581)
HRS-TK002	HRS050-□□-□ HRS060-□□-□	664	(698)



Mounting view





② Piping Conversion Fitting (For Air-Cooled Refrigeration)

■ Conversion fitting for circulating fluid + Conversion fitting for drain outlet
HRS012-A□-□, HRS018-A□-□, HRS024-A□-□, HRS030-A□-□

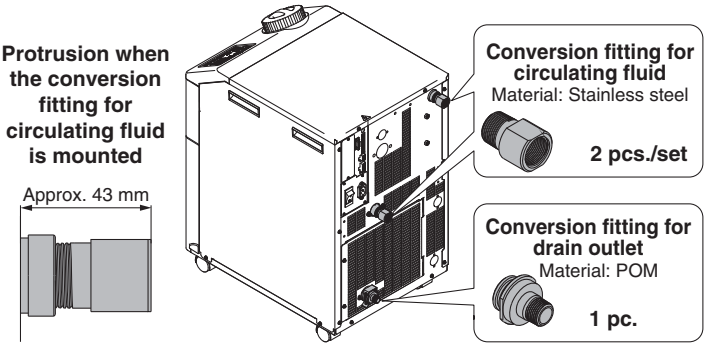
This fitting changes the port size for circulating fluid from Rc1/2 to G1/2 or NPT1/2, and for drain from Rc3/8 to G3/8 or NPT3/8. It is not necessary to purchase this when pipe thread type F or N is selected in "How to Order" since it is included in the product.

Part no.		Applicable model
HRS-EP001	G thread conversion fitting set	HRS012-A-□ HRS018-A-□
HRS-EP002	NPT thread conversion fitting set	HRS024-A-□ HRS030-A-□

When the options, with automatic water fill function "-J", or high pressure pump mounted "-T" are selected, purchase ③ piping conversion fitting (for option), too.

Protrusion when the conversion fitting for circulating fluid is mounted

Approx. 43 mm



HRS050-A□-□, HRS060-A□-□

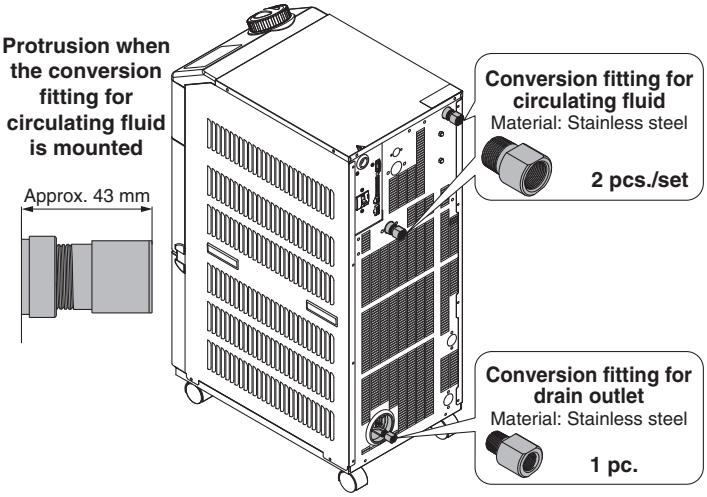
This fitting changes the port size for circulating fluid from Rc1/2 to G1/2 or NPT1/2, and for drain from Rc1/4 to G1/4 or NPT1/4. It is not necessary to purchase this when pipe thread type F or N is selected in "How to Order" since it is included in the product.

Part no.		Applicable model
HRS-EP009	G thread conversion fitting set	HRS050-A-□
HRS-EP010	NPT thread conversion fitting set	HRS060-A-□

When the option, with automatic water fill function "-J", is selected, purchase ③ piping conversion fitting (for option), too.

Protrusion when the conversion fitting for circulating fluid is mounted

Approx. 43 mm



② Piping Conversion Fitting (For Water-cooled Refrigeration)

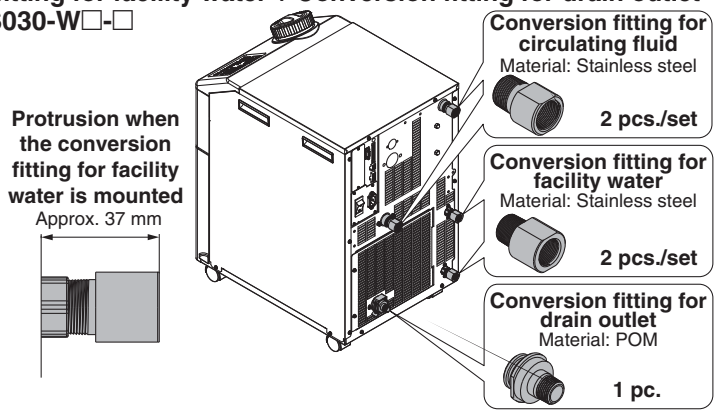
■Conversion fitting for circulating fluid + Conversion fitting for facility water + Conversion fitting for drain outlet

HRS012-W□-□, HRS018-W□-□, HRS024-W□-□, HRS030-W□-□

This fitting changes the port size for circulating fluid from Rc1/2 to G1/2 or NPT1/2, for facility water from Rc3/8 to G3/8 or NPT3/8, and for drain from 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.		Applicable model
HRS-EP003	G thread conversion fitting set	HRS012-W-□ HRS018-W-□ HRS024-W-□ HRS030-W-□
HRS-EP004	NPT thread conversion fitting set	

When the options, with automatic water fill function "-J", or high pressure pump mounted "-T" are selected, purchase ③ piping conversion fitting (for option), too.

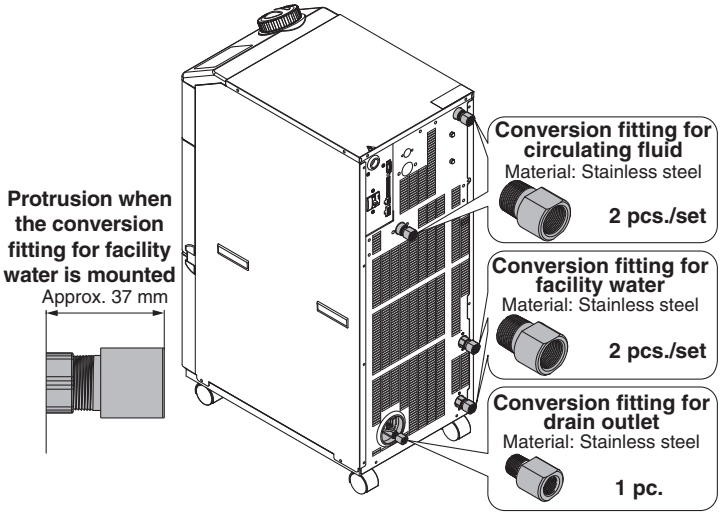


HRS050-W□-□, HRS060-W□-□

This fitting changes the port size for circulating fluid from Rc1/2 to G1/2 or NPT1/2, for facility water from Rc3/8 to G3/8 or NPT3/8, and for drain from Rc1/4 to G1/4 or NPT1/4.
It is not necessary to purchase this when pipe thread type F or N is selected in "How to Order" since it is included in the product.

Part no.		Applicable model
HRS-EP011	G thread conversion fitting set	HRS050-W-□ HRS060-W-□
HRS-EP012	NPT thread conversion fitting set	

When the option, with automatic water fill function "-J", is selected, purchase ③ piping conversion fitting (for option), too.

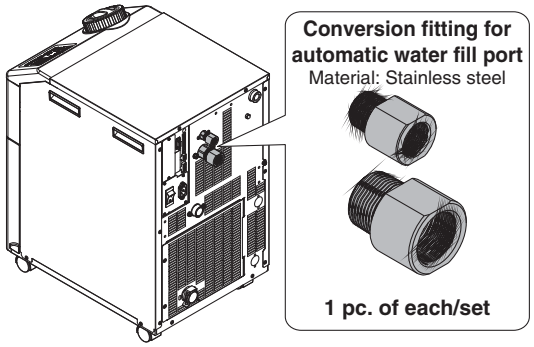


③ Piping Conversion Fitting (For Option)

■Conversion fitting for automatic water fill port

This fitting changes the port size for the option, with automatic water fill function "-J" from Rc3/8, Rc3/4 to G3/8, G3/4 or NPT3/8, NPT3/4.
It is not necessary to purchase this when pipe thread type F or N is selected in "How to Order" since it is included in the product.

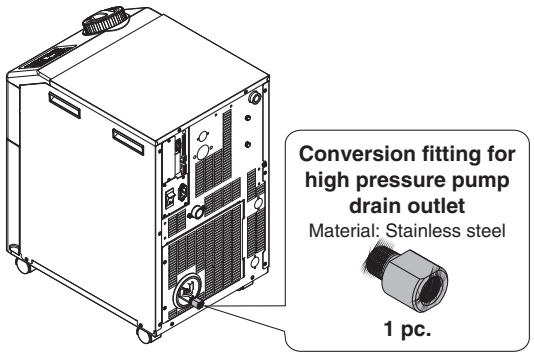
Part no.		Applicable model
HRS-EP005	G thread conversion fitting	HRS012-□-□-J HRS018-□-□-J HRS024-□-□-J
HRS-EP006	NPT thread conversion fitting	HRS030-□-□-J HRS050-□-□-J HRS060-□-□-J



■Conversion fitting for drain outlet

This fitting changes the port size for drain outlet for the option, high pressure pump mounted "-T" from Rc1/4 to G1/4 or NPT1/4.
It is not necessary to purchase this when pipe thread type F or N is selected in "How to Order" since it is included in the product.

Part no.		Applicable model
HRS-EP007	G thread conversion fitting	HRS012-□-□-T HRS018-□-□-T HRS024-□-20-T
HRS-EP008	NPT thread conversion fitting	HRS030-□-20-T HRS050-□-20 Note) HRS060-□-20 Note)

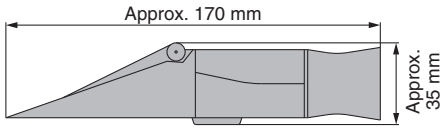


Note) It is not necessary to purchase this when you purchase the HRS-EP009 to 012 since it is included in the product.

④ Concentration Meter

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

Part no.	Applicable model
HRZ-BR002	HRS012-□□-□ HRS018-□□-□ HRS024-□□-□ HRS030-□□-□ HRS050-□□-□ HRS060-□□-□



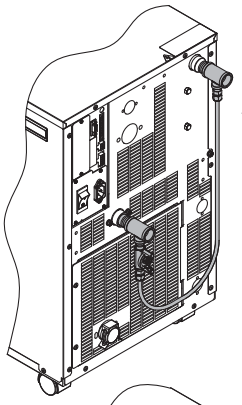
⑤ Bypass Piping Set

When the circulating fluid goes below the rated flow (7 L/min for the HRS012, 018, 024, 030 and 23/28 L/min for the HRS050, 060), cooling capacity will be reduced and the temperature stability will be badly affected. In such a case, use the bypass piping set. A high pressure pump is also available.

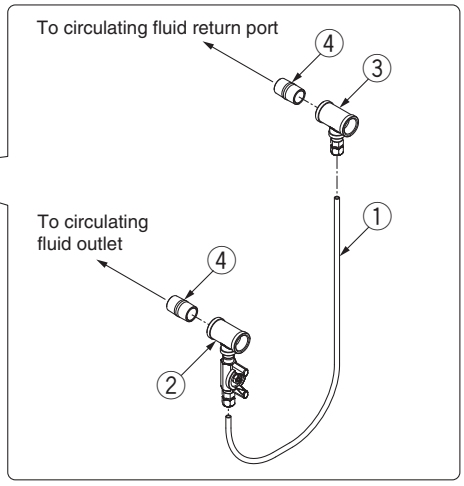
Part no.	Applicable model
HRS-BP001	HRS012-□□-□ HRS018-□□-□ HRS024-□□-□ HRS030-□□-□

Parts List

No.	Description
①	Bypass tube (700 mm) (Part no.: TL0806)
②	Outlet piping (with ball valve)
③	Return port piping
④	Nipple (Size: 1/2) (2 pcs.)



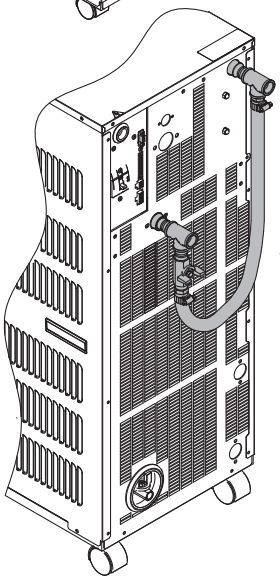
Note) To be mounted by user.



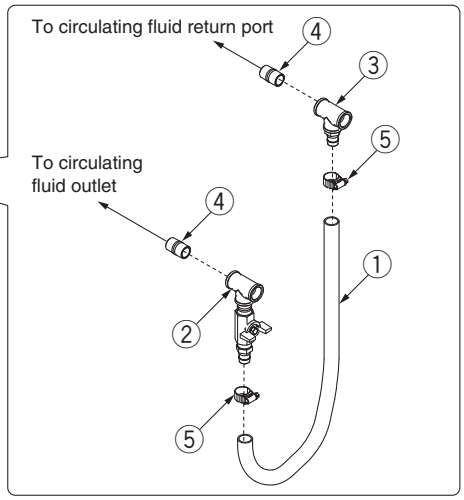
Part no.	Applicable model
HRS-BP004	HRS050-□□-□ HRS060-□□-□

Parts List

No.	Description
①	Hose (Approx. 700 mm)
②	Outlet piping (with ball valve)
③	Return port piping
④	Nipple (Size: 1/2) (2 pcs.)
⑤	Hose band (2 pcs.)



Note) To be mounted by user.



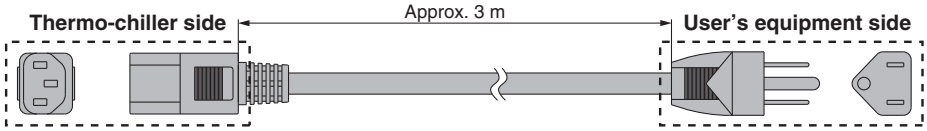
⑥ Power Supply Cable

■ For single-phase 100/115 VAC type

∗ Not applicable for the 200 V type.

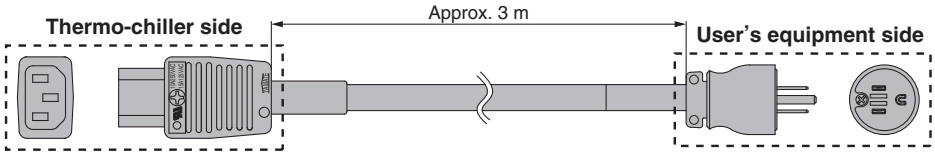
Part no.	Applicable model
HRS-CA001	HRS012-□□-10 HRS018-□□-10

∗ Not applicable to retaining clip.



Part no.	Applicable model
HRS-CA003	HRS012-□□-10 HRS018-□□-10

∗ Applicable to retaining clip.

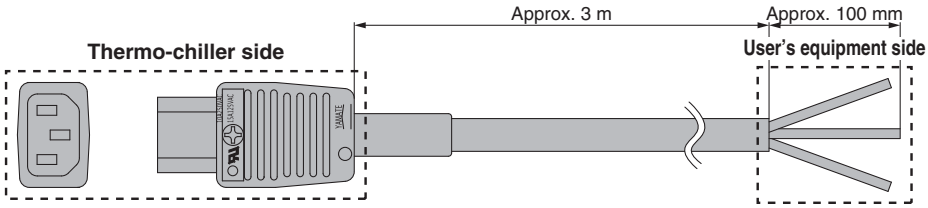


■ For single-phase 200 VAC type

∗ Not applicable for the 100 V type.

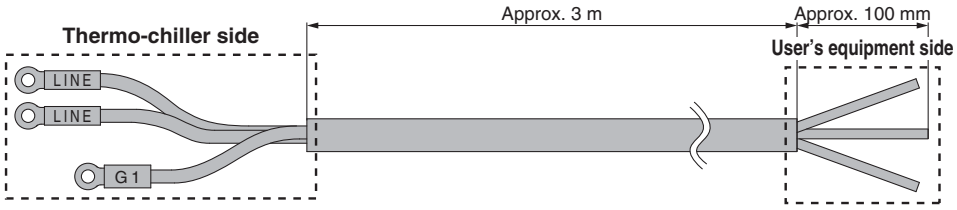
Part no.	Applicable model
HRS-CA002	HRS012-□□-20 HRS018-□□-20 HRS024-□□-20 HRS030-□□-20

∗ Applicable to retaining clip.



Part no.	Applicable model
HRS-CA004	HRS050-□□-20 HRS060-W□-20

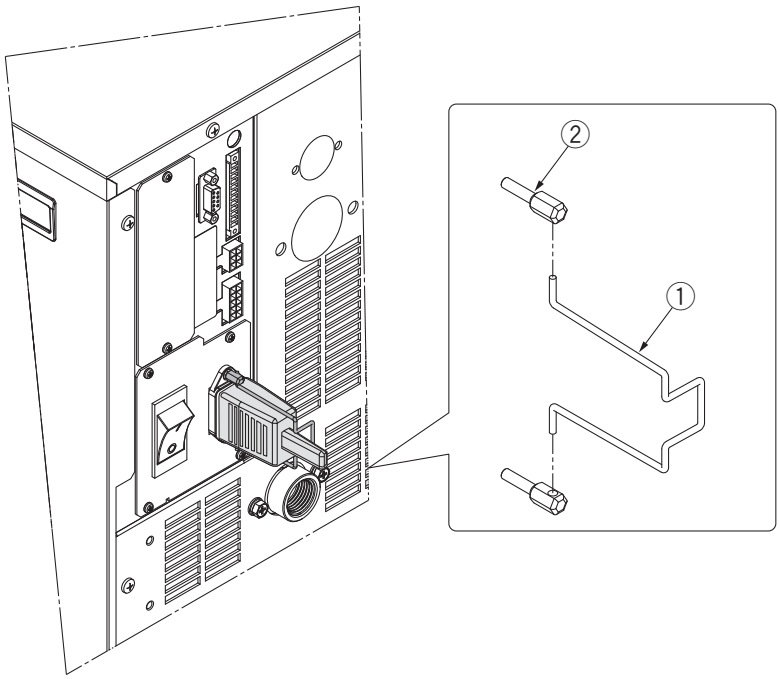
∗ Not available for the HRS060-A□-20.
To be prepared by user.
∗ Not applicable to retaining clip.



■ Retaining clip

Holds the connector on the thermo-chiller side in position.

Part no.	Applicable power supply cable
HRS-S0074	HRS-CA002 HRS-CA003 Power supply connector for accessory



Parts List

No.	Description
①	Retaining clip
②	Holding screw

⑦ DI Filter Set

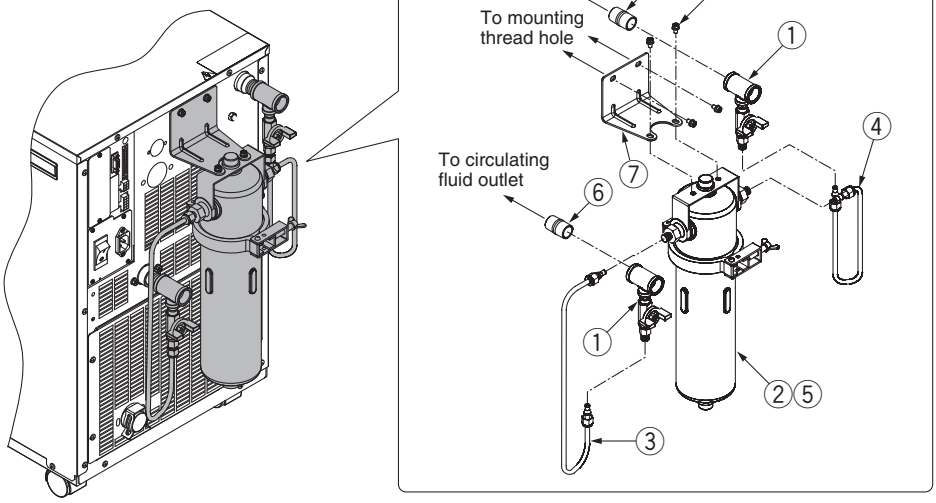
It is possible to keep electrical resistance by flowing the circulating fluid to the ion replacement resin (DI filter).
The set parts are in order to install DI filter to bypass circuit and flow the fixed rate of the circulating fluid to DI filter.
It is not to control the value of electrical resistance.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

■ Stainless steel type

Suitable for locations with dusty atmospheres.

Part no.	Applicable model
HRS-DP001	HRS012-□□-□ HRS018-□□-□ HRS024-□□-□ HRS030-□□-□ HRS050-□□-□ HRS060-□□-□

∗ Cannot be installed in combination with particle filter set (HRS-PF001 to PF004).



Parts List

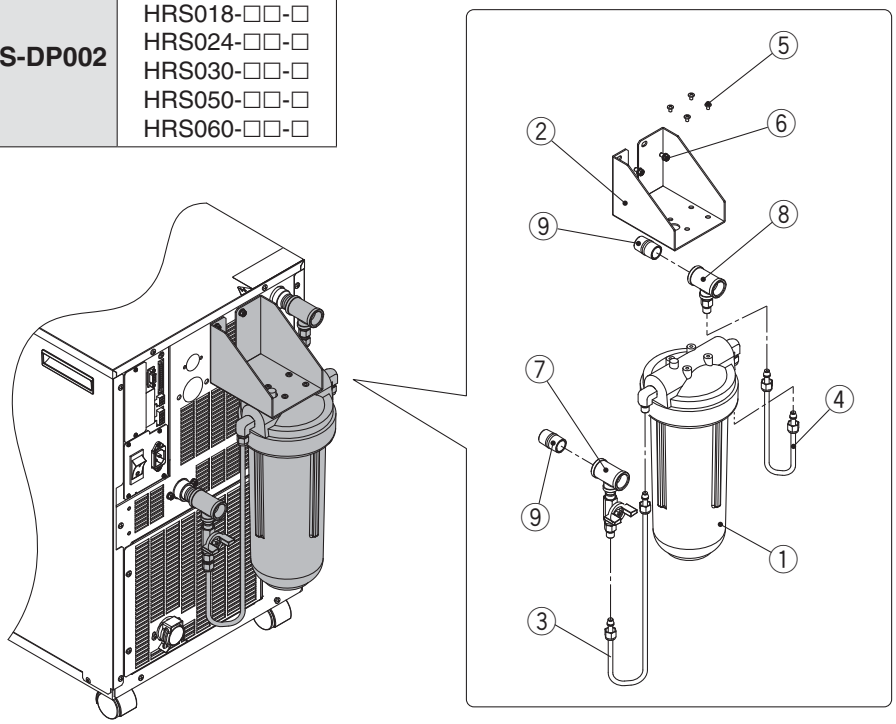
No.	Description
①	Branch line (2 pcs.)
②	DI filter vessel (Stainless steel)
③	DI filter inlet tube
④	DI filter outlet tube
⑤	DI filter cartridge (Part no.; HRS-DF001)
⑥	Nipple (Size: 1/2) (2 pcs.)
⑦	Mounting bracket
⑧	Mounting screw (M6 screw, 2 pcs.) (M5 screw, 2 pcs.)

■ Resin type

Lightweight and compact
Can be installed in combination with the HRS-PF001, PF002.

Part no.	Applicable model
HRS-DP002	HRS012-□□-□ HRS018-□□-□ HRS024-□□-□ HRS030-□□-□ HRS050-□□-□ HRS060-□□-□

∗ Cannot be installed in combination with particle filter set (HRS-PF003, PF004).



Parts List

No.	Description
①	DI filter vessel (Resin)
②	Mounting bracket
③	DI filter inlet tube
④	DI filter outlet tube
⑤	Tapping screw (4 pcs.)
⑥	Mounting screw (M5, 2 pcs.)
⑦	Branch line for inlet
⑧	Branch line for outlet
⑨	Nipple (Size: 1/2) (2 pcs.)

⑧ Electrical Resistance Sensor Set

Maintains, displays and controls electrical resistivity of the circulating fluid, deionized water.
The function differs according to the model (Refer to Table 1). Refer to the Operation Manual for details.

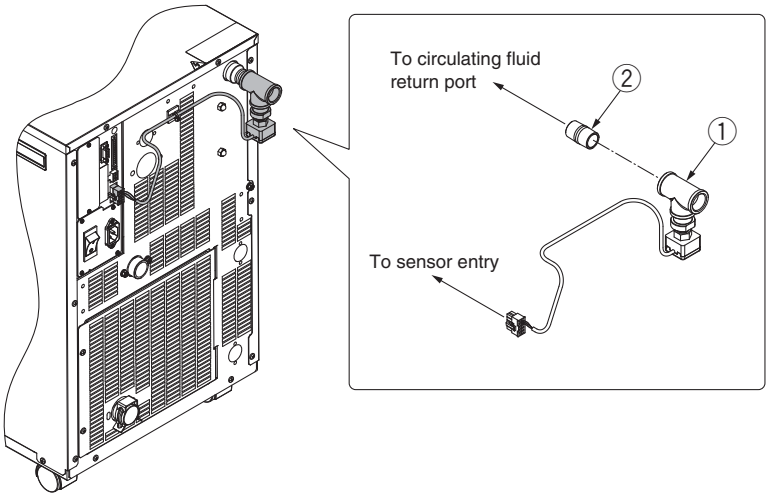
Part no.	Applicable model
HRS-DI001 **HRS-DI003** **HRS-DI004** **HRS-DI005**	HRS012-□□-□ HRS018-□□-□ HRS024-□□-□ HRS030-□□-□ HRS050-□□-□ HRS060-□□-□

Table 1: Combination of Option and Optional Accessories

	HRS model	Option M	Optional accessories	Feed-water *1	Electrical resistivity maintenance	Electrical resistivity display *2, *3	Electrical resistivity control	Bypass
①	Standard	No	—	○	× *4	×	×	×
②	Standard	Yes	—	○	× *5	×	×	×
③	Standard	Yes	HRS-DI001	○	×	○	×	×
④	Standard	Yes	HRS-DP001	○	○	×	×	×
⑤	Standard	Yes	HRS-DP001 + HRS-DI001 (DI filter set)	○	○	○	×	×
⑥	Standard	Yes	HRS-DI003	○	○	○	○	○
⑦	Standard	Yes	HRS-DI004	○	○	○	×	○
⑧	Standard	Yes	HRS-DI005	○	○	○	○	×

*1: When only supplying or feeding deionized water (at the start of use etc.)
*2: Display range is 0 to 4.5 MΩ·cm.
*3: Readout using serial communications (RS-485/RS-232C) can be performed.
*4: The deionized water cannot flow continuously.
*5: The deionized water can flow continuously. (electrical resistance 4.5 MΩ·cm or less)
However, the electrical resistance cannot be kept, displayed or controlled.

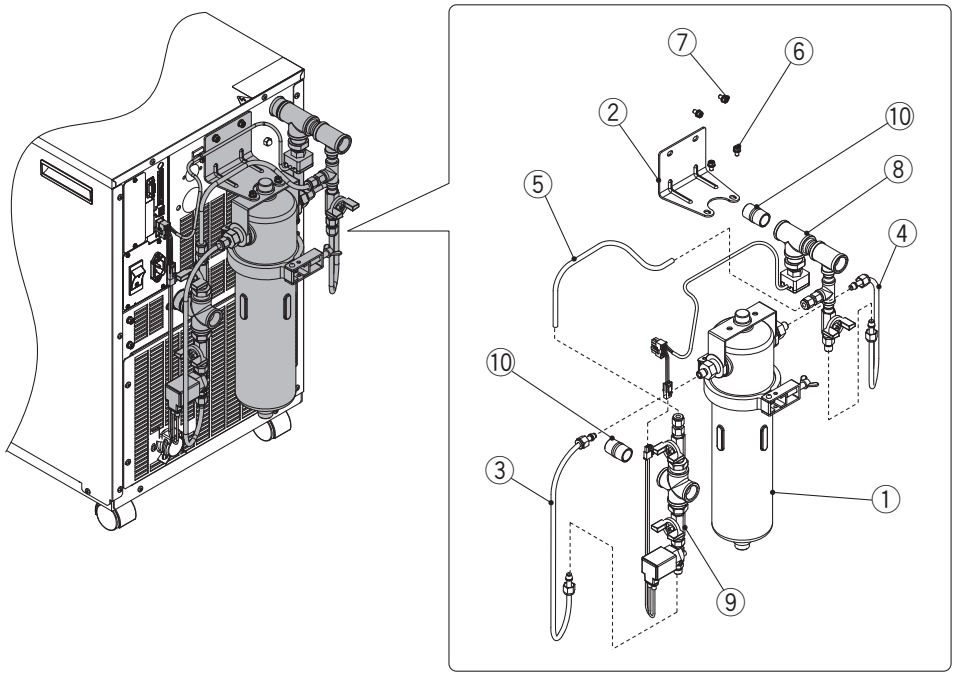
[③ Mounting example: HRS012-A-20 + HRS-DI001]



Parts List

No.	Description
①	Electrical resistance sensor
②	Nipple (Size: 1/2) (1 pc.)

[⑥ Mounting example: HRS012-A-20-M + HRS-DI003]



Parts List

No.	Description
①	DI filter vessel (Stainless steel)
②	Mounting bracket
③	DI filter inlet tube
④	DI filter outlet tube
⑤	Bypass tube
⑥	Mounting screw (M6, 2 pcs.)
⑦	Mounting screw (M5, 2 pcs.)
⑧	Electrical resistance sensor
⑨	Solenoid valve for control
⑩	Nipple (Size: 1/2) (2 pcs.)

⑨ Particle Filter Set

Removes foreign objects in the circulating fluid.

HRS−PF001−W075−H
PF002
PF003
PF004

Filtration

Symbol	Nominal filtration accuracy [μm]	Element part no. for PF001/ PF003 (individual part)	Element part no. for PF002/ PF004 (individual part)
Nil	Without element	—	—
W005	5	EJ202S-005X11	EJ302S-005X11
W075	75	EJ202S-075X11	EJ302S-075X11

Accessory

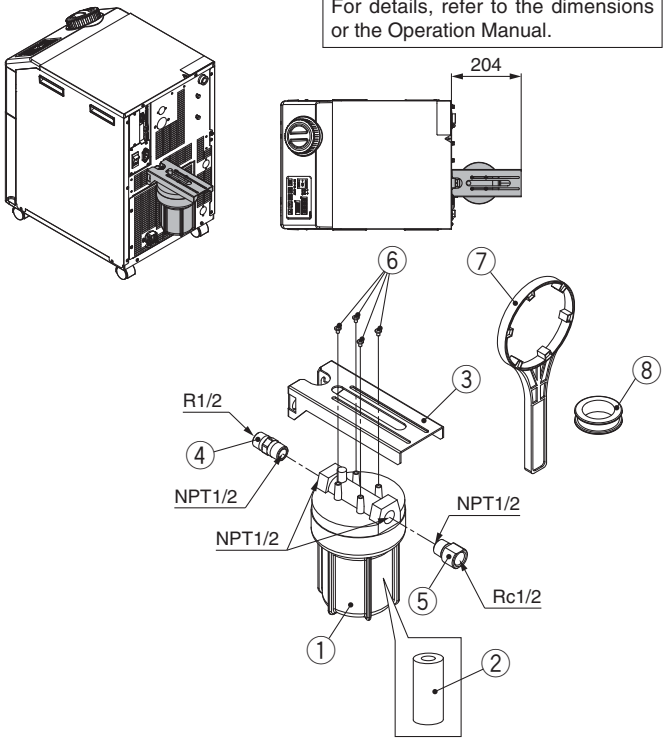
Symbol	Accessory
Nil	None
H	With handle

■ For circulating fluid outlet

Part no.	Applicable model
HRS-PF001 (Element length L = 125 mm)	HRS012-□□-□ HRS018-□□-□ HRS024-□□-□ HRS030-□□-□ HRS050-□□-□ HRS060-□□-□
HRS-PF002 (Element length L = 250 mm)	HRS050-□□-□ HRS060-□□-□

Mounting view

The following reference drawing shows the HRS-PF001 mounted on the HRS012 to 024.
For details, refer to the dimensions or the Operation Manual.

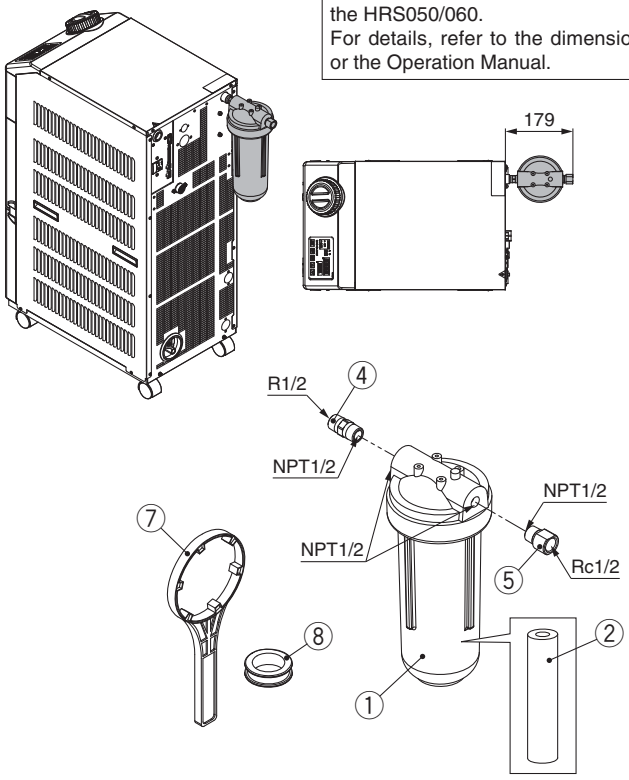


■ For circulating fluid return port

Part no.	Applicable model
HRS-PF003 (Element length L = 125 mm)	HRS012-□□-□ HRS018-□□-□ HRS024-□□-□ HRS030-□□-□ HRS050-□□-□ HRS060-□□-□
HRS-PF004 (Element length L = 250 mm)	HRS050-□□-□ HRS060-□□-□

Mounting view

The following reference drawing shows the HRS-PF004 mounted on the HRS050/060.
For details, refer to the dimensions or the Operation Manual.



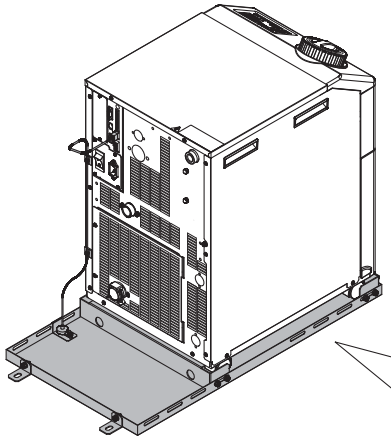
Parts List

No.	Model	Description	Material	Q'ty	Note
①	—	Body	PP	1	—
②	EJ202S-005X11	Element (Length L = 125 mm)	PP/PE	1	For HRS-PF001/003
	EJ202S-075X11			1	
	EJ302S-005X11	Element (Length L = 250 mm)		1	For HRS-PF002/004
	EJ302S-075X11			1	
③	—	Particle filter bracket	SGCC	1	For HRS-PF001/002
④	—	Nipple	Stainless steel	1	Conversion from R to NPT
⑤	—	Extension piece	Stainless steel	1	Conversion from NPT to Rc
⑥	—	Tapping screw	—	4	—
⑦	—	Handle	—	1	When -H is selected
⑧	—	Sealant tape	PTFE	1	—

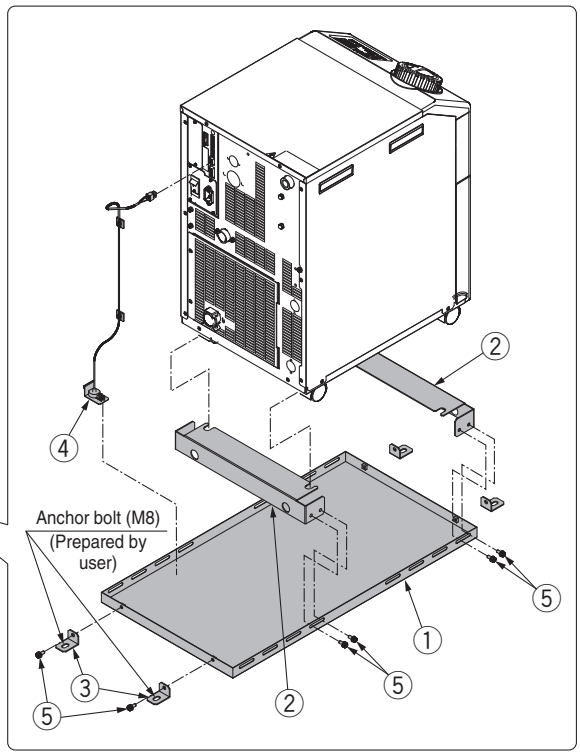
⑩ Drain Pan Set (With Water Leakage Sensor)

Drain pan for the thermo-chiller. Liquid leakage from the thermo-chiller can be detected by mounting the attached water leakage sensor. Anchor bolt (M8) suitable for the flooring material should be prepared separately by user.

Part no.	Applicable model
HRS-WL001	HRS012-□□-□ HRS018-□□-□ HRS024-□□-□ HRS030-□□-□



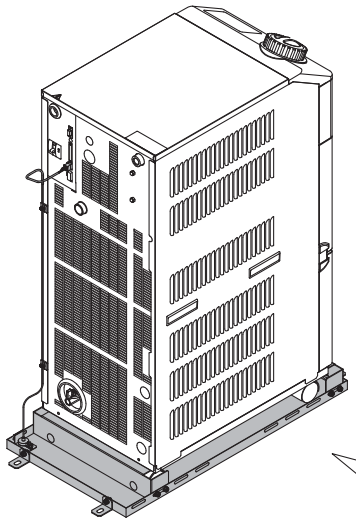
HRS012/018/024/030



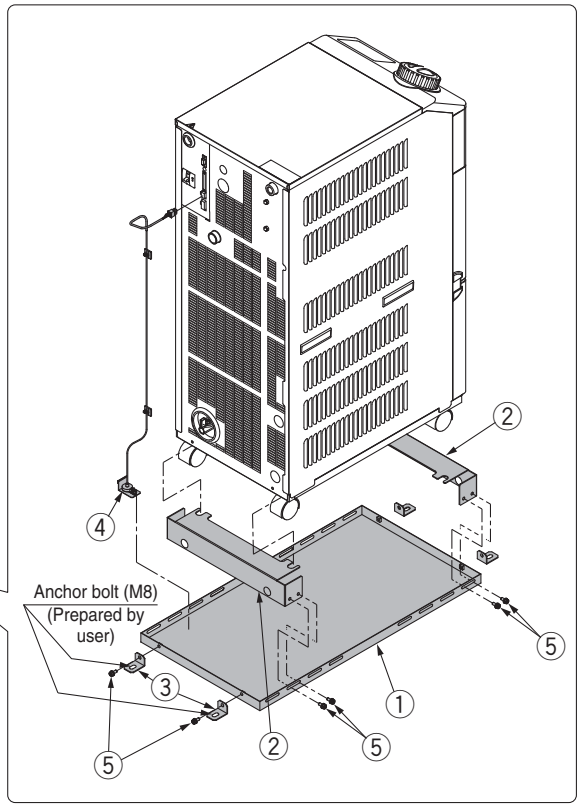
Parts List

No.	Description
①	Drain pan
②	Thermo-chiller fixing bracket (2 pcs.)
③	Drain pan fixing bracket (4 pcs.)
④	Water leakage sensor
⑤	Bracket fixing screw (M6 screw, 12 pcs.)

Part no.	Applicable model
HRS-WL002	HRS050-□□-□ HRS060-□□-□



HRS050/060



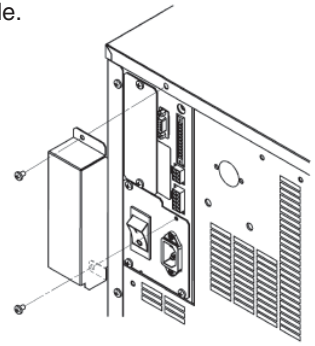
Parts List

No.	Description
①	Drain pan
②	Thermo-chiller fixing bracket (2 pcs.)
③	Drain pan fixing bracket (4 pcs.)
④	Water leakage sensor
⑤	Bracket fixing screw (M6 screw, 12 pcs.)

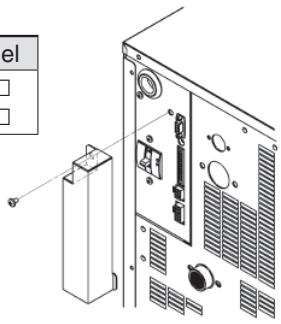
⑪ Connector Cover

Protects the connector on the rear side.

Part no.	Applicable model
HRS-BK001	HRS012-□□-□ HRS018-□□-□ HRS024-□□-□ HRS030-□□-□



Part no.	Applicable model
HRS-BK002	HRS050-□□-□ HRS060-□□-□



⑫ Analog Gateway Unit

This is an expansion unit for adding analog communication functions.
"Analog communication, contact input/output" functions can be used.

●Analog communication

The set circulating fluid temperature can be changed by entering the analog voltage.
Converts the current circulating fluid temperature and current electrical resistance value (∗1) to an analog voltage for output.
∗1: Displayed when optional "Electrical resistance sensor set/HRS-DI001, DI003, DI004 and DI005" are used.

●Contact input/output

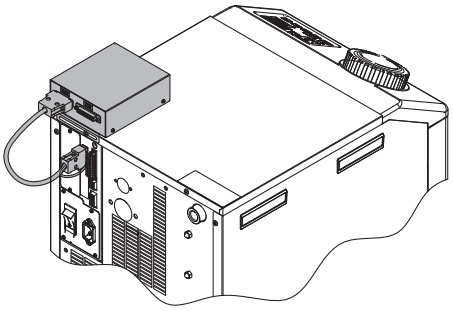
The Run/Stop of the thermo-chiller HRS series can be operated by a contact signal.
The contact signal of the operation status, alarm occurrence status and the TEMP READY status can also be output.

Part no.	Applicable model
HRS-CV001	HRS012-□□-□ HRS018-□□-□ HRS024-□□-□ HRS030-□□-□ HRS050-□□-□ HRS060-□□-□

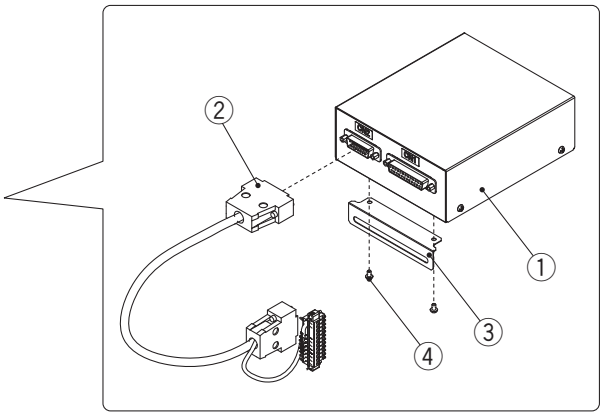
Parts List

No.	Description
①	Analog gateway box
②	Connection cable
③	Mounting bracket
④	Mounting screw (M3, 2 pcs.)

When this product is used, the "contact input/output" and "serial communication" functions standardly equipped in the thermo-chiller HRS series cannot be used.



Mounting example



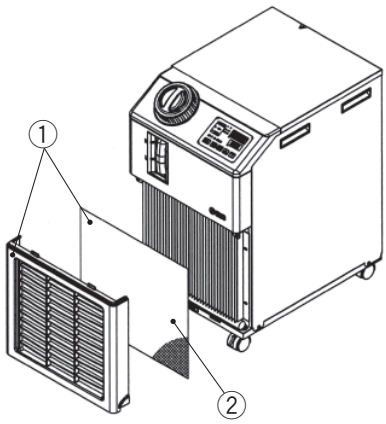
⑬ Replacement Type Dustproof Filter Set

A disposable dustproof filter is mounted instead of the dustproof net on the front panel.

Part no.	Applicable model
HRS-FL001	HRS012-A□-□ HRS018-A□-□ HRS024-A□-□

Parts List

No.	Description	Part no.	Note
①	Replacement type dustproof filter set	HRS-FL001	Front panel with hook-and-loop fastener for holding filter 5 filters are included. (No dustproof net is included.)
②	Replacement type dustproof filter	HRS-FL002	5 filters per set Size: 300 x 370



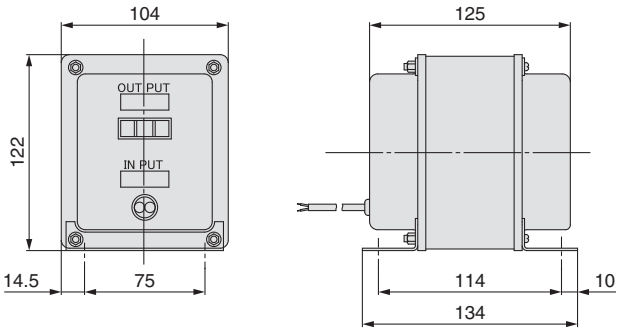
⑭ Separately Installed Power Transformer

Specifications

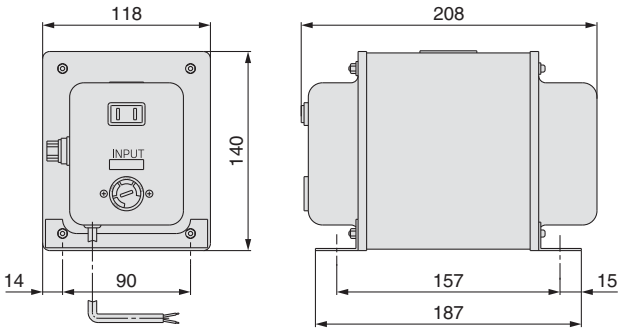
Part no.	Applicable model	Volume	Type	Inlet voltage		Outlet voltage	
				50 Hz	60 Hz	50 Hz	60 Hz
IDF-TR1000-1	HRS012-□-10 HRS018-□-10	1 kVA	Single-phase	110 VAC	120 VAC	100 VAC	100, 110 VAC
IDF-TR1000-2				240 VAC	240 to 260 VAC		
IDF-TR1000-3				380, 400, 415 VAC	380 to 420 VAC		
IDF-TR1000-4				420, 440, 480 VAC	420 to 520 VAC		
IDF-TR2000-9	HRS012-□-20 HRS018-□-20 HRS024-□-20 HRS030-□-20	2 kVA		—	240 VAC	200 VAC	200, 220 VAC
IDF-TR2000-10				380, 400, 415 VAC	380 to 400, 400 to 415, 415 to 440 VAC		
IDF-TR2000-11				440, 460 VAC	440 to 460, 460 to 500 VAC		

∗ For the HRS050/060 models: To be prepared by user.

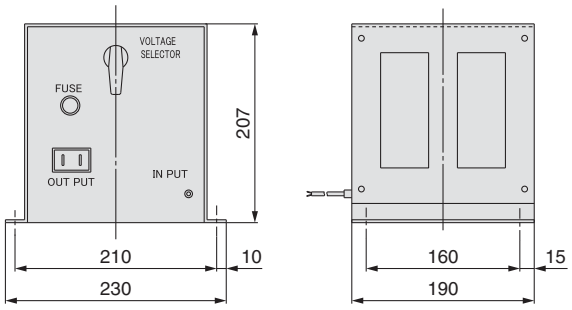
IDF-TR1000-1



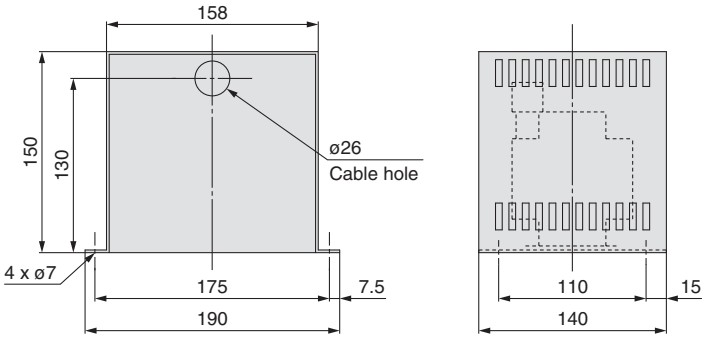
IDF-TR1000-2



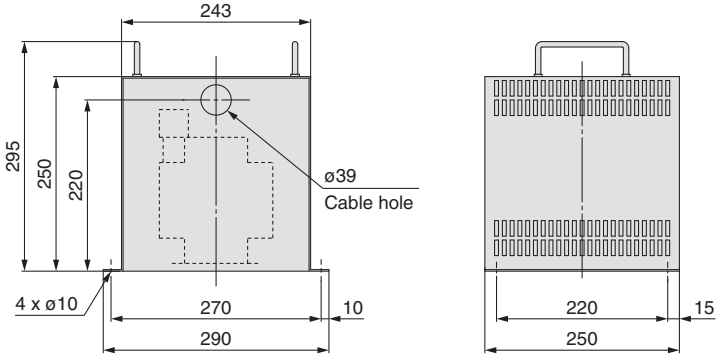
IDF-TR1000-3, 4



IDF-TR2000-9



IDF-TR2000-10, 11

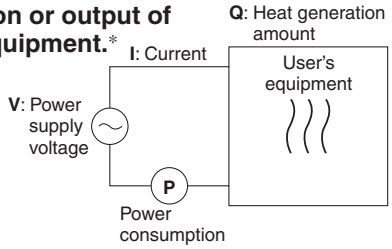


Series HRS
Cooling Capacity Calculation

Required Cooling Capacity Calculation

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

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



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

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

Q = P = 1000 [W]

Cooling capacity = Considering a safety factor of 20%,

1000 [W] x 1.2 = 1200 [W]

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

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

Q = P = V x I x Power factor

In this example, using a power factor of 0.85:

= 1.0 [kVA] x 0.85 = 0.85 [kW] = 850 [W]

Cooling capacity = Considering a safety factor of 20%,

850 [W] x 1.2 = 1020 [W]

③ **Derive the heat generation amount from the output.**

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

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

In this example, using an efficiency of 0.7:

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

Cooling capacity = Considering a safety factor of 20%,

1143 [W] x 1.2 = 1372 [W]

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

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

Obtain the temperature difference between inlet and outlet by circulating the circulating fluid inside the user's equipment.

Heat generation amount by user's equipment **Q**	: Unknown [W] ([J/s])
Circulating fluid	: Tap water*
Circulating fluid mass flow rate q_m	: (= ρ x q_v ÷ 60) [kg/s]
Circulating fluid density ρ	: 1 [kg/dm^3]
Circulating fluid (volume) flow rate q_v	: 10 [dm^3/min]
Circulating fluid specific heat **C**	: 4.2 x 10^3 [J/(kg·K)]
Circulating fluid outlet temperature T_1	: 293 [K] (20 [°C])
Circulating fluid return temperature T_2	: 295 [K] (22 [°C])
Circulating fluid temperature difference ΔT	: 2.0 [K] (= $T_2 - T_1$)
Conversion factor: minutes to seconds (SI units)	: 60 [s/min]

* Refer to page 58 for the typical physical property value of tap water or other circulating fluids.

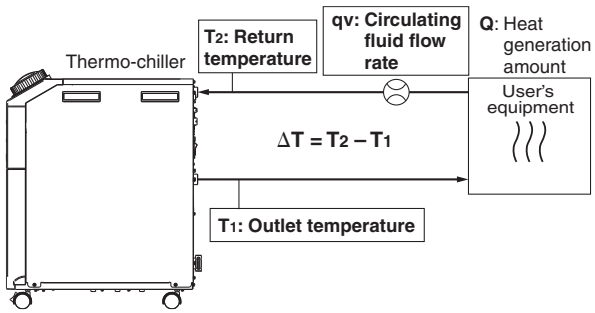
$$\mathbf{Q = q_m \times C \times (T_2 - T_1)}$$

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

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

Cooling capacity = Considering a safety factor of 20%,

1400 [W] x 1.2 = 1680 [W]



Example of conventional measurement units (Reference)

Heat generation amount by user's equipment **Q**	: Unknown [cal/h] → [W]
Circulating fluid	: Tap water*
Circulating fluid weight flow rate q_m	: (= ρ x q_v x 60) [kgf/h]
Circulating fluid weight volume ratio γ	: 1 [kgf/L]
Circulating fluid (volume) flow rate q_v	: 10 [L/min]
Circulating fluid specific heat **C**	: 1.0 x 10^3 [cal/(kgf·°C)]
Circulating fluid outlet temperature T_1	: 20 [°C]
Circulating fluid return temperature T_2	: 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]

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

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

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

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

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

Cooling capacity = Considering a safety factor of 20%,

1400 [W] x 1.2 = 1680 [W]

Required Cooling Capacity Calculation

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

Heat quantity by cooled substance (per unit time) **Q** : Unknown [W] ([J/s])
Cooled substance : Water
Cooled substance mass **m** : (= ρ x **V**) [kg]
Cooled substance density ρ : 1 [kg/L]
Cooled substance total volume **V** : 20 [dm^3]
Cooled substance specific heat **C** : 4.2 x 10^3 [J/(kg·K)]
Cooled substance temperature when cooling begins T_0 : 305 [K] (32 [°C])
Cooled substance temperature after t hour T_t : 293 [K] (20 [°C])
Cooling temperature difference ΔT : 12 [K] (= $T_0 - T_t$)
Cooling time Δt : 900 [s] (= 15 [min])

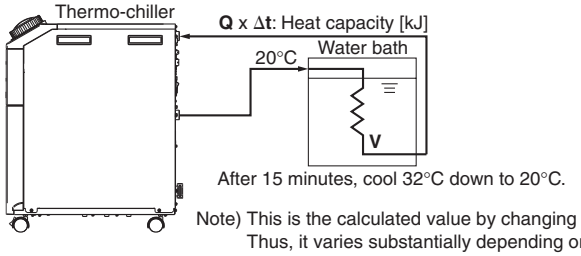
∗ Refer to the following for the typical physical property values by circulating fluid.

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

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

Cooling capacity = Considering a safety factor of 20%,

1120 [W] x 1.2 = 1344 [W]



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

Example of conventional measurement units (Reference)

Heat quantity by cooled substance (per unit time) **Q** : Unknown [cal/h] → [W]
Cooled substance : Water
Cooled substance weight **m** : (= ρ x **V**) [kgf]
Cooled substance weight volume ratio γ : 1 [kgf/L]
Cooled substance total volume **V** : 20 [L]
Cooled substance specific heat **C** : 1.0 x 10^3 [cal/(kgf·°C)]
Cooled substance temperature 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]

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

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

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

Cooling capacity = Considering a safety factor of 20%,

1120 [W] x 1.2 = 1344 [W]

Precautions on Cooling Capacity Calculation

1. Heating capacity

When the circulating fluid temperature is set above room temperature, it needs to be heated by the thermo-chiller. The heating capacity depends on the circulating fluid temperature. Consider the radiation rate and heat capacity of the user's equipment and check beforehand if the required heating capacity is provided.

2. Pump capacity

<Circulating fluid flow rate>

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

<Circulating fluid discharge pressure>

Circulating fluid discharge pressure has the possibility to increase up to the maximum pressure in the pump capacity curves. Check beforehand if the circulating fluid pipings or circulating fluid circuit of the user's equipment are fully durable against this pressure.

Circulating Fluid Typical Physical Property Values

1. This catalog uses the following values for density and specific heat in calculating the required cooling capacity.

Density ρ: 1 [kg/L] (or, using conventional unit system, weight volume ratio γ = 1 [kgf/L])
Specific heat **C**: 4.19 x 10^3 [J/(kg·K)] (or, using conventional unit system, 1 x 10^3 [cal/(kgf·°C)])

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

Water

Physical property value / Temperature	Density ρ [kg/L]	Specific heat C [J/(kg·K)]	Conventional unit system	
			Weight volume ratio γ [kgf/L]	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/L]	Specific heat C [J/(kg·K)]	Conventional unit system	
			Weight volume ratio γ [kgf/L]	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 shown are reference values. Contact circulating fluid supplier for details.

Series HRS
Specific Product Precautions 1

Be sure to read this before handling. Refer to page 341 for Safety Instructions. For Temperature Control Equipment Precautions, refer to pages 342 to 345 and the Operation Manual on SMC website, http://www.smcworld.com

Design

⚠ Warning

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

1) Check the specifications 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.

3. Use non-corrosive material for fluid contact parts of circulating fluid.

Using corrosive materials such as aluminum or iron for fluid contact parts such as piping may cause clogging or leakage in the circulating fluid circuit. Provide protection against corrosion when you use the product.

Selection

⚠ Warning

1. Model selection

For selecting a model of thermo-chiller, it is required to know the heat generation amount of the user's equipment. Obtain the heat generation amount, referring to "Cooling Capacity Calculation" on pages 57 and 58 before selecting a model.

Handling

⚠ Warning

1. Thoroughly read the Operation Manual.

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

Transportation/Carriage/Movement

⚠ Warning

1. This product is heavy. Pay attention to safety and position of the product when it is transported, carried and moved.

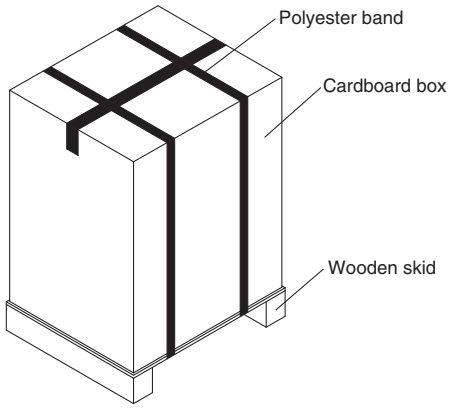
2. Read the Operation Manual carefully to move the product after unpacking.

Transportation/Carriage/Movement

⚠ Caution

1. Never put the product down sideway as this may cause failure.

The product will be delivered in the packaging shown below.



Model	Weight [kg] Note)	Dimensions [mm]
HRS012-□□-10 **HRS018-□□-10**	49	Height 790 x Width 470 x Depth 580
HRS012-□□-20 **HRS018-□□-20** **HRS024-□□-20**	52	Height 790 x Width 470 x Depth 580
HRS030-A□-20	56	Height 830 x Width 470 x Depth 580
HRS030-W□-20	55	
HRS050-A□-20	80	Height 1160 x Width 450 x Depth 670
HRS050-W□-20	78	
HRS060-A□-20	84	
HRS060-W□-20	78	

Note) For models with an option, the weights are increased as below.

Option symbol	Description	Additional weight
-B	With earth leakage breaker	No addition
-J	With automatic water fill function	+1 kg
-M	Applicable to deionized water piping	No addition
-T	High pressure pump mounted (100 V type)	+4 kg
	High pressure pump mounted (200 V type)	+6 kg
-G	High temperature environment specification	No addition

Series HRS
Specific Product Precautions 2

Be sure to read this before handling. Refer to page 341 for Safety Instructions. For Temperature Control Equipment Precautions, refer to pages 342 to 345 and the Operation Manual on SMC website, http://www.smcworld.com

Operating Environment/Storage Environment

⚠ Warning

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

1) Outdoors
2) In locations where water, water vapor, salt water, and oil may splash on the product.
3) In locations where there are dust and particles.
4) In locations where corrosive gases, organic solvents, chemical fluids, or flammable gases are present. (This product is not explosion proof.)
5) In locations where the ambient temperature exceeds the limits as mentioned below.
   During transportation/storage: 0 to 50°C (But as long as water or circulating fluid are not left inside the pipings)
   During operation: 5 to 40°C (When option G, high temperature environment specification, is selected: 5 to 45°C)
6) In locations where the ambient humidity is out of the following range or where condensation occurs.
   During transportation/storage: 15 to 85%
   During operation: 30 to 70%
7) In locations which receive direct sunlight or radiated heat.
8) In locations where there is a heat source nearby and the ventilation is poor.
9) In locations where temperature substantially changes.
10) In locations where strong magnetic noise occurs. (In locations where strong electric fields, strong magnetic fields and surge voltage occur.)
11) In locations where static electricity occurs, or conditions which make the product discharge static electricity.
12) In locations where high frequency occurs.
13) In locations where damage is likely to occur due to lightning.
14) In locations at altitude of 3000 m or higher (Except during storage and transportation)
   * For altitude of 1000 m or higher
   Because of lower air density, the heat radiation efficiencies of the devices in the product will be lower in the location at altitude of 1000 m or higher. Therefore, the maximum ambient temperature to use and the cooling capacity will lower according to the descriptions in the table below. Select the thermo-chiller considering the descriptions.
   ① Upper limit of ambient temperature: Use the product in ambient temperature of the described value or lower at each altitude.
   ② Cooling capacity coefficient: The product's cooling capacity will lower to one that multiplied by the described value at each altitude.

Altitude [m]	① Upper limit of ambient temperature [°C]		② Cooling capacity coefficient
	40°C products	45°C products (For high temperature environment specification, Option G)	
Less than 1000 m	40	45	1.00
Less than 1500 m	38	42	0.85
Less than 2000 m	36	38	0.80
Less than 2500 m	34	35	0.75
Less than 3000 m	32	32	0.70

15) In locations where strong impacts or vibrations occur.
16) In locations where a massive force strong enough to deform the product is applied or a weight from a heavy object is applied.
17) In locations where there is not sufficient space for maintenance.

⚠ Warning

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.

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.

Series HRS
Specific Product Precautions 3

Be sure to read this before handling. Refer to page 341 for Safety Instructions. For Temperature Control Equipment Precautions, refer to pages 342 to 345 and the Operation Manual on SMC website, http://www.smcworld.com

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. When installing without the casters, use the adjuster feet etc. to raise the chiller to the following heights or more.

This product cannot be directly installed on the floor as some screws come out from the bottom of the product.

- HRS012 to 030 10 mm
- HRS050/060 15 mm

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. Also, using corrosive materials such as aluminum or iron for fluid contact parts such as piping may cause clogging or leakage in the circulating fluid and facility water circuits. Provide protection against corrosion when you use the product.

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 inlet and outlet, drain port or overflow port of this product, use a pipe wrench to clamp the connection ports.

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 are constant-temperature fluid circulating machines 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

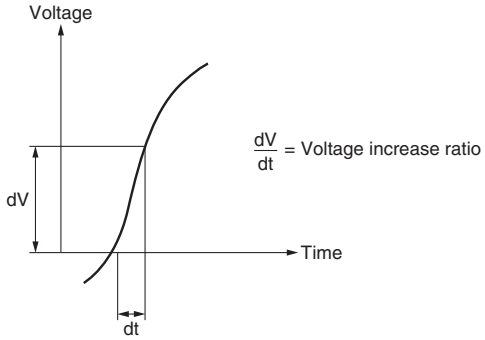
1. Communication cable should be prepared by user.

Electrical Wiring

⚠ Caution

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.



Circulating Fluid

⚠ Caution

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

2. When water is used as a circulating fluid, use tap water that conforms to the appropriate water quality standards.

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

Tap Water (as Circulating Fluid) Quality Standards

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

	Item	Unit	Standard value	Influence	
				Corrosion	Scale generation
Standard item	pH (at 25°C)	—	6.0 to 8.0	○	○
	Electric 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		○
	Ionic state silica (SiO_2)	[mg/L]	30 or less		○
Reference item	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.
- ○: Factors that have an effect on corrosion or scale generation.
- Even if the water quality standards are met, complete prevention of corrosion is not guaranteed.

3. Use an ethylene glycol aqueous solution that does not contain additives such as preservatives.

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

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 4

Be sure to read this before handling. Refer to page 341 for Safety Instructions. For Temperature Control Equipment Precautions, refer to pages 342 to 345 and the Operation Manual on SMC website, http://www.smcworld.com

Facility Water Supply

⚠ Warning

<Water-cooled refrigeration>

1. The water-cooled refrigeration type thermo-chiller radiates heat to the facility water.
Prepare the facility water system that satisfies the heat radiation and the facility water specifications below.

■ Required facility water system

<Heat radiation amount/Facility water specifications>

Model	Heat radiation [kW]	Facility water specifications
HRS012-W□-□	Approx. 2	Refer to "Facility water system" in the specifications.
HRS018-W□-□	Approx. 4	
HRS024-W□-20	Approx. 5	
HRS030-W□-20	Approx. 6	
HRS050-W□-20	Approx. 10	
HRS060-W□-20	Approx. 12	

2. When using tap water as facility water, use tap water that conforms to the appropriate water quality standards.
Use tap water that conforms to the standards shown below.

<Tap Water (as Facility Water) Quality Standards>

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

	Item	Unit	Standard value	Influence	
				Corrosion	Scale generation
Standard item	pH (at 25°C)	—	6.5 to 8.2	○	○
	Electric conductivity (25°C)	[μS/cm]	100* to 800*	○	○
	Chloride ion (Cl^-)	[mg/L]	200 or less	○	
	Sulfuric acid ion (SO_4^{2-})	[mg/L]	200 or less	○	
	Acid consumption amount (at pH4.8)	[mg/L]	100 or less		○
	Total hardness	[mg/L]	200 or less		○
	Calcium hardness ($CaCO_3$)	[mg/L]	150 or less		○
	Ionic state silica (SiO_2)	[mg/L]	50 or less		○
Reference item	Iron (Fe)	[mg/L]	1.0 or less	○	○
	Copper (Cu)	[mg/L]	0.3 or less	○	
	Sulfide ion (S^{2-})	[mg/L]	Should not be detected.	○	
	Ammonium ion (NH_4^+)	[mg/L]	1.0 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 0.001 to 0.01.
- ○: Factors that have an effect on corrosion or scale generation.
- Even if the water quality standards are met, complete prevention of corrosion is not guaranteed.

3. Supply pressure of 0.5 MPa or less.
If the supply pressure is high, it will cause water leakage.

4. Be sure to prepare your utilities so that the pressure of the thermo-chiller facility water outlet is at 0 MPa (atmospheric pressure) or more.
If the facility water outlet pressure becomes negative, the internal facility water piping may collapse, and proper flow control of facility water will be impossible.

Using deionized water as facility water may cause problems such as clogging in the piping due to metal ion.

Operation

⚠ 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 the 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.
Pump can be operated independently.

2. Confirmation during operation

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

3. Emergency stop method

- When an abnormality is confirmed, stop the 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 ±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 the user's equipment is too high.
- Ambient temperature is too high. (40°C or more)
- Refrigerant pressure is too high.
- Ventilation hole is clogged with dust or dirt.

Specific Product Precautions 5

Be sure to read this before handling. Refer to page 341 for Safety Instructions. For Temperature Control Equipment Precautions, refer to pages 342 to 345 and the Operation Manual on SMC website, http://www.smcworld.com

Maintenance

⚠ Caution

<Periodical inspection every one month>

1. Clean the ventilation hole.

If the dustproof filter becomes clogged with dust or debris, a decline in cooling performance can result.

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

<Periodical inspection every three months>

1. Inspect the circulating fluid.

1) When using tap water

- Replacement of tap water
  Failure to replace the tap 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.

■ **Trademark Information**
Modbus® is a registered trademark of Schneider Electric, licensed to the Modbus Organization, Inc.

Series HRS100/150

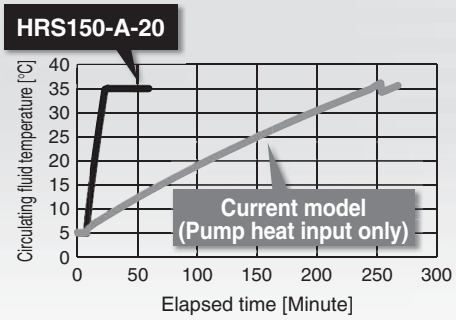
Standard Type

(Only 400 VAC type)

RoHS

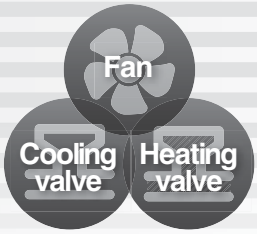
No heater required, circulating fluid is heated using heat exhausted by refrigerating circuit.

■ Heating-up time: 1/10



[Test conditions]
Circulating fluid temperature: 5→35°C
Ambient temperature: 32°C
Power supply: 200 VAC/50 Hz
Circulating fluid flow rate: Rated flow
Circulating fluid: Water
External piping: Bypass piping

- Cooling valve control
- Air-cooled condenser fan
- Heating valve control



Cooling capacity	10 kW/15 kW
Temperature stability	±1.0°C
Set temperature range	5°C to 35°C
Low-noise design	70 dB(A)
Max. ambient temperature	45°C
Outdoor installation	IPX4

Compact, Space-saving



<Air-cooled>



<Water-cooled>

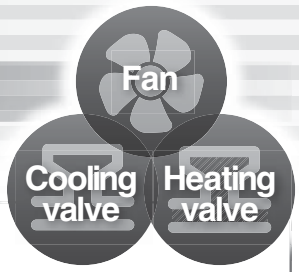
Added Variations!

Option
- With fluid fill port

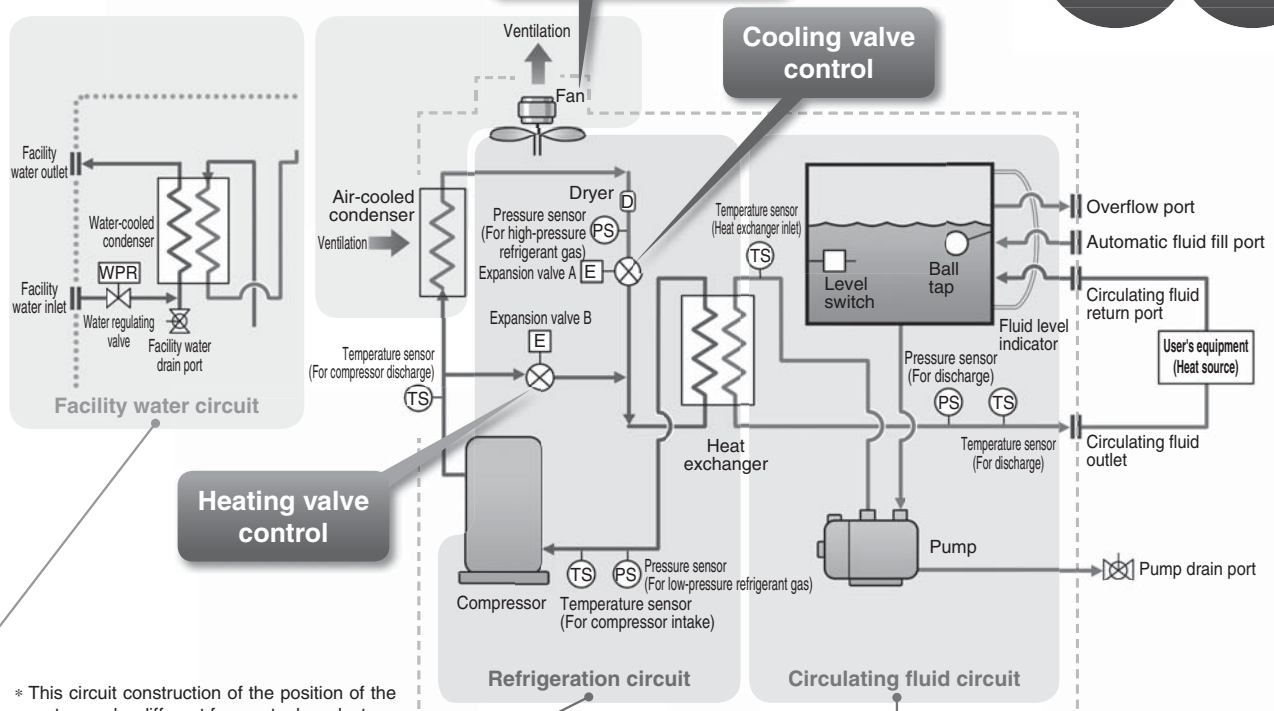
Optional accessories
- Electric conductivity control set
- Relief valve set
- Snow protection hood (Air-cooled only)

Compatible power supplies in Europe, Asia, Oceania, North, Central and South America
- 3-phase 200 VAC
- 3-phase 400 VAC

Triple controller



Circuit diagram



* This circuit construction of the position of the parts may be different from actual product.

Facility water circuit

For water-cooled refrigeration
HRS□-W-□

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

Refrigeration circuit

- The compressor compresses the refrigerant gas, and discharges the high temperature and high pressure refrigerant gas.
- In the case of air-cooled refrigeration, the high temperature and high pressure refrigerant gas is cooled down by an air-cooled condenser with the ventilation of the fan, and becomes a liquid. In the case of water-cooled refrigeration, the refrigerant gas is cooled by a water-cooled condenser with the facility water in the facility water circuit, and becomes a liquid.
- The liquefied high pressure refrigerant gas expands and its temperature lowers when it passes through expansion valve A and vaporizes by taking heat from the circulating fluid in the evaporator.
- The vaporized refrigerant gas is sucked into the compressor and compressed again.
- When heating the circulating fluid, the high pressure and high temperature refrigerant gas is bypassed into the evaporator by expansion valve B, to heat the circulating fluid.

Point

The combination of precise control of **expansion valve A** for cooling, and **expansion valve B** for heating realized high temperature stability.

Circulating fluid circuit

- The circulating fluid discharged from the pump, is heated or cooled by the user's equipment and returns to the thermo-chiller.
- The circulating fluid is controlled to a set temperature by the refrigeration circuit, to be discharged to the user's equipment side again by the thermo-chiller.

Point

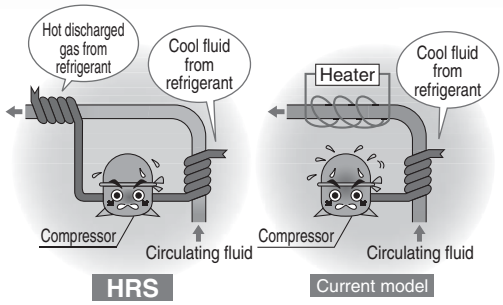
Since the refrigeration circuit is controlled by the signal from **2 temperature sensors (for return and discharge)**, precise temperature control of the circulating fluid can be performed. Therefore, there is no necessity of absorbing the temperature difference in the circulating fluid with a large tank capacity, and realizes high temperature stability even with a **small-size tank**. Also, contributes to space-saving.

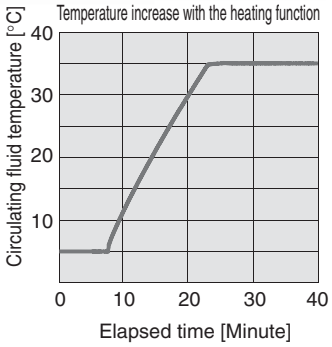
Variations

Model		Cooling method	Cooling capacity [kW] (50/60 Hz)	Power supply	Option Page 82	Optional accessories Pages 83 to 87
	**HRS100**	Air-cooled refrigeration	9.0/9.5	· 3-phase 200 VAC (50 Hz), 3-phase 200 to 230 VAC (60 Hz) · 3-phase 380 to 415 VAC (50 Hz/60 Hz)	· With caster adjuster-foot · With earth leakage breaker (For 400 V type as standard) · With fluid fill port	· Piping conversion fitting · Caster adjuster-foot kit · Electric conductivity control set · Bypass piping set · Relief valve set · Snow protection hood (Air-cooled only) · Particle filter set
	HRS150		13.0/14.5			
	**HRS100**	Water-cooled refrigeration	10.0/11.0			
	HRS150		14.5/16.5			

Circulating fluid can be heated without a heater.

Heating method using discharged heat makes a heater unnecessary.

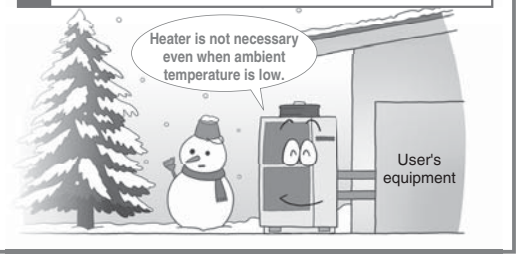




∗ This is just an example diagram.

∗ **For HRS150-A-20**

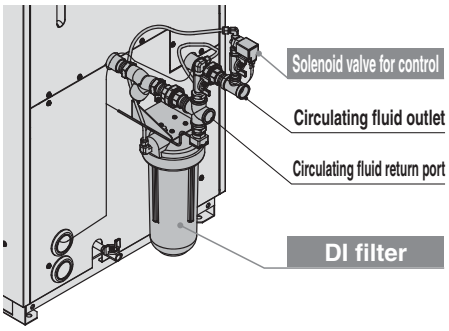
Conditions
- Circulating fluid temperature: 5→35°C
- Ambient temperature: 32°C
- Power supply: 200 V/50 Hz
- Circulating fluid flow rate: Rated flow
- Circulating fluid: Water
- External piping: Bypass piping



Electric conductivity control set (Optional accessories)
(With DI filter + Solenoid valve kit for control)

The electric conductivity of the circulating fluid can be set with the controller monitor arbitrarily.

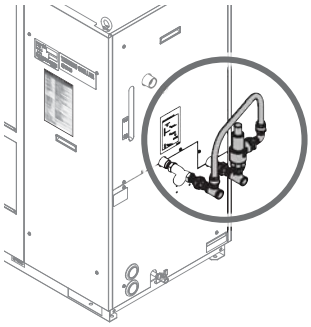
Set control range: 5.0 to 45.0 μS/cm



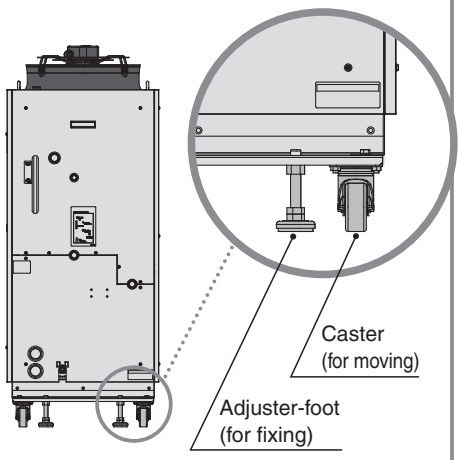
Relief valve set
(Optional accessories)

Prevents increase in circulating fluid discharge pressure.

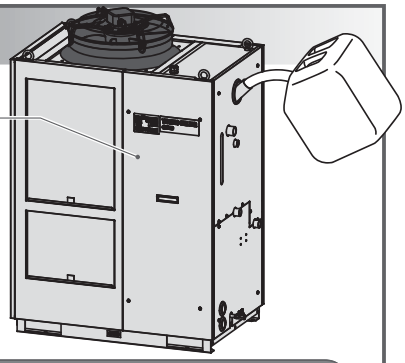
(Relief pressure: 0.32 MPa)



With caster adjuster-foot
(Option)



Improved maintenance performance



Circulating fluid fill port (Option)

Fluid fill port is equipped in the upper part of the tank in addition to the automatic fluid fill port for a tap water piping connection.

Front side access

All the electrical components can be checked from the front side for the easier maintenance work.

Alarm code list

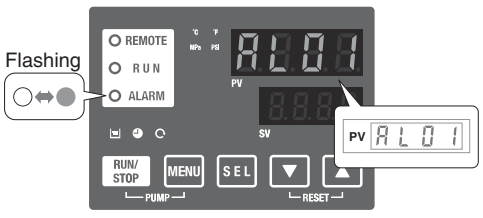
Alarm code list stickers (English 1 pc./Japanese 1 pc.) are included.
This can be put under the operation panel for reference.
(**Alarm ▶ Page 80**)



Operation display panel Easy maintenance with the check display

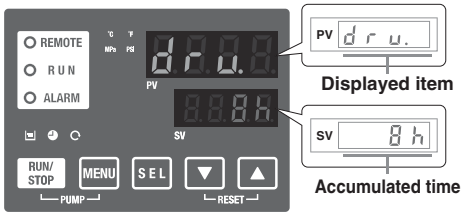
Alarm codes notify of checking times.
Notifies when to check the pump and fan motor. Helpful for facility maintenance.

Ex. **AL01 "Low level in tank"**



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

Ex. **drv. "Accumulated operating time"**



Displayed item	
Temperature	Circulating fluid outlet temperature
	Circulating fluid return temperature
	Compressor gas temperature
Flow rate	Circulating fluid flow rate∗1
Pressure	Circulating fluid outlet pressure
	Compressor gas discharge pressure
	Compressor gas return pressure
Operating time	Accumulated operating time
	Accumulated operating time of pump
	Accumulated operating time of fan ∗2
	Accumulated operating time of compressor
	Accumulated operation time of dustproof filter ∗2

∗1 This is not measurement value. Use it for reference. ∗2 These are displayed only for air-cooled refrigeration.

Convenient functions **Details ▶ Page 80**

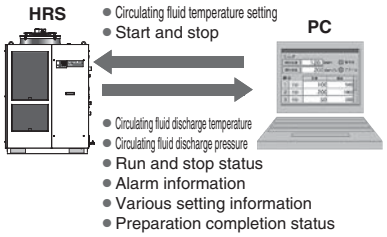
Timer function, Anti-freezing function, Power failure auto-restart function, Warming-up function, Key-lock function, etc.

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 equipment 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 PF3W, etc.).

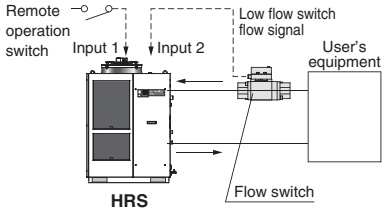
Ex.1 Remote signal I/O through serial communication

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



Ex.2 Remote operation signal input

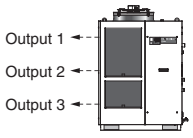
One of the contact inputs is used for remote operation and the other is used for a flow switch to monitor the flow, and their warning outputs are taken in.



Power for flow switch (24 VDC) can be supplied from the thermo-chiller.

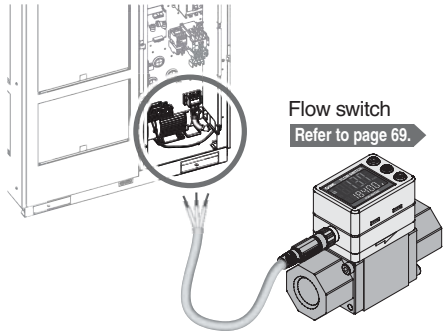
Ex.3 Alarm and operation status (start, stop, etc.) signal output

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



• Output setting example
Output 1: Temperature rise
Output 2: Pressure rise
Output 3: Operation status (start, stop, etc.)

Power supply (24 VDC) available



Power can be supplied from the terminal block of the thermo-chiller to external switches etc.

IPX4

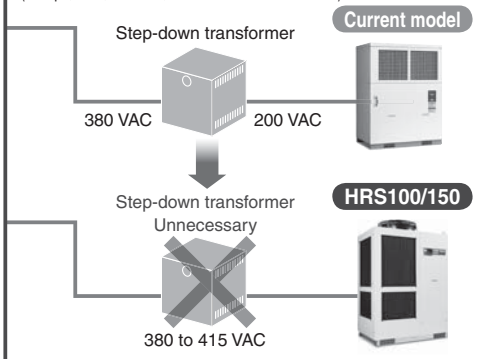
IP (International Protection) is the industrial standard for "Degrees of protection provided by outer defensive enclosures of electric equipment (IP Code)" according to IEC 60529 and JIS C 0920.

IPX4: No harmful influence by water splash is acceptable from every direction.



Globally compatible power supplies CE

(Europe, Asia, Oceania, Central and South America) (Only 400 V type)



Transformer unnecessary

Power supply Applicable to **200** to **230 VAC**, or **380** to **415 VAC**

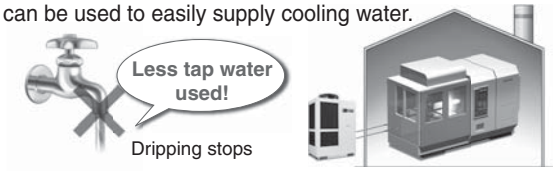
Transformers are unnecessary even when used overseas.

Makes cooling water easily available, anytime, anywhere.

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

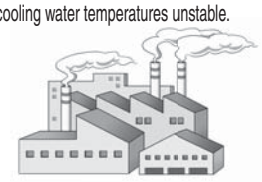


→ Even without a cooling tower, an air-cooled refrigerated chiller can be used to easily supply cooling water.



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


Cooling tower



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



Applications



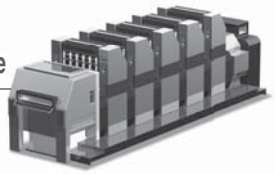
Laser beam machine/ Laser welding machine

Cooling of the laser oscillation part and power source



Printing machine

Temperature control of the roller



Cleaning machine

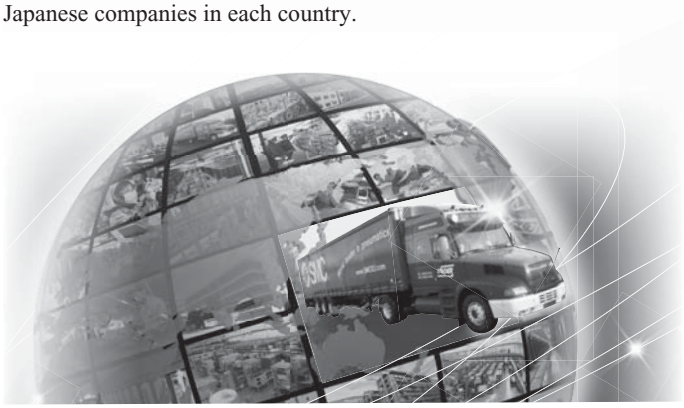
Temperature control of cleaning solution



Global Supply Network

SMC has a comprehensive network in the global market.

We now have a presence of more than 400 branch offices and distributors in 78 countries world wide such as Asia, Oceania, North/Central/South America, and Europe. With this global network, we are able to provide a global supply of our substantial range of products with the best service. We also provide full support to local factories, foreign manufacturing companies and Japanese companies in each country.





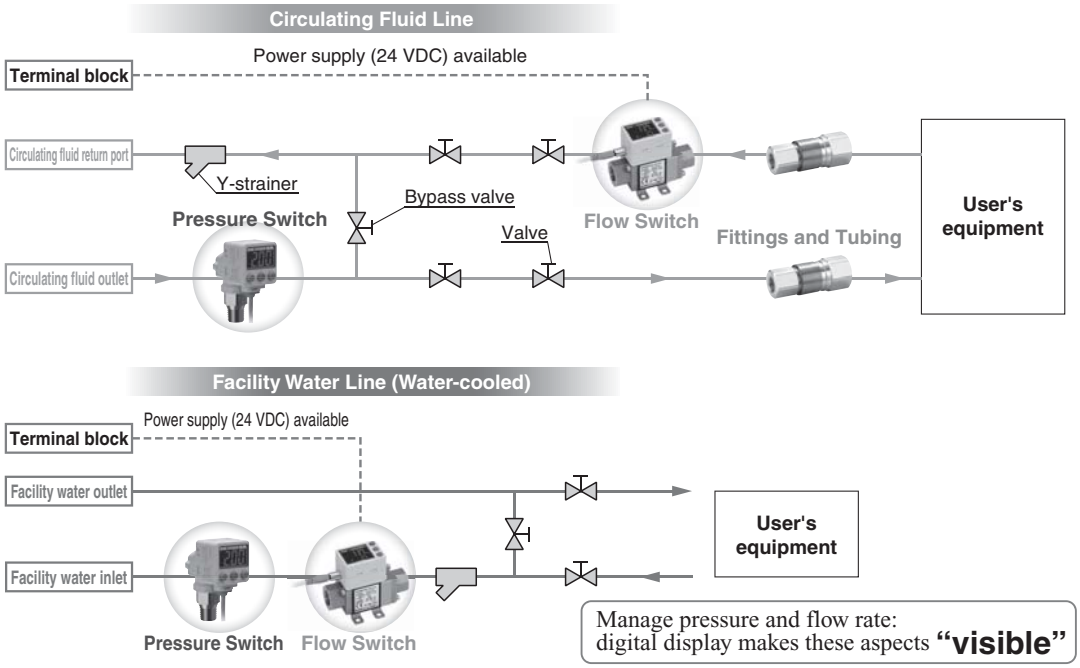
SMC Thermo-chiller Variations

Lots of variations are available in response to the users' requirements.

Series	Temperature stability [°C]	Set temperature range [°C]	Cooling capacity [kW]												Environment	International standards
			1.2	1.8	2.4	3	5	6	9	10	15	20	25	28		
 **HRSE Basic type**	±2.0	10 to 30	●	●	●										Indoor use	CE (Only 230 VAC type)
 **HRS Standard type**	±0.1	5 to 40	●	●	●	●	●	●							Indoor use	CE (MET) (Only 60 Hz)
 **HRS100/150 Standard type**	±1.0	5 to 35								●	●				Outdoor installation IPX4	CE (400 V as standard)
 **HRSH090 Inverter type**	±0.1	5 to 40							●						Indoor use	CE (400 V as standard) (ETL) (Only 200 V as an option)
 **HRSH Inverter type**	±0.1	5 to 35								●	●	●	●	●	Outdoor installation IPX4	CE (400 V as standard, 200 V as an option) (MET) (Only 200 V as an option)

Circulating Fluid/Facility Water Line Equipment





Manage pressure and flow rate:
digital display makes these aspects **"visible"**

Flow Switch: Monitors the flow rate and temperature of the circulating fluid and facility water.

Refer to the **WEB catalog** or the Best Pneumatics No. 6 for details.

3-Color Display Digital Flow Switch for Water *PF3W*



Integrated flow adjustment valve and temperature sensor



PVC Piping

3-Color Display Electromagnetic Type Digital Flow Switch *LFE*



Digital Flow Switch for Deionized Water and Chemical Liquids *PF2D*
4-Channel Flow Monitor *PF2□200*



Pressure Switch: Monitors pressure of the circulating fluid and facility water.

Refer to the **WEB catalog** or the Best Pneumatics No. 6 for details.



2-Color Display High-Precision Digital Pressure Switch *ISE80*



Pressure Sensor for General Fluids *PSE56□*
Pressure Sensor Controller *PSE200,300*

Fittings and Tubing

Refer to the **WEB catalog** or the Best Pneumatics No. 6 for details.

S Coupler *KK*



S Coupler/Stainless Steel (Stainless Steel 304) *KKA*



Tubing *T□*



Series	Material
T	Nylon
TU	Polyurethane
TH	FEP (Fluoropolymer)
TD	Modified PTFE (Soft fluoropolymer)
TL	Super PFA
TLM	PFA

Metal One-touch Fittings *KQB2*



Stainless Steel 316 One-touch Fittings *KQG2*



Stainless Steel 316 Insert Fittings *KFG2*



Fluoropolymer Fittings *LQ*



CONTENTS

Series HRS100/150 Standard Type



Thermo-chiller Series HRS100/150

How to Order/Specifications

Air-cooled 200 V ····· Page 71

Water-cooled 200 V ····· Page 72

Air-cooled 400 V ····· Page 73

Water-cooled 400 V ····· Page 74

Cooling Capacity ····· Page 75

Pump Capacity ····· Page 76

Dimensions ····· Page 77

Recommended External Piping Flow ····· Page 79

Cable Specifications ····· Page 79

Operation Display Panel ····· Page 80

List of Function ····· Page 80

Alarm ····· Page 80

Communication Function ····· Page 81

Options

With Caster Adjuster-foot ····· Page 82

With Earth Leakage Breaker ····· Page 82

With Fluid Fill Port ····· Page 82

Optional Accessories

① Piping Conversion Fitting ····· Page 83

② Caster Adjuster-foot Kit ····· Page 83

③ Electric Conductivity Control Set ····· Page 84

④ Bypass Piping Set ····· Page 84

⑤ Relief Valve Set ····· Page 85

⑥ Snow Protection Hood ····· Page 86

⑦ Particle Filter Set ····· Page 87

Cooling Capacity Calculation

Required Cooling Capacity Calculation ····· Page 88

Precautions on Cooling Capacity Calculation ····· Page 89

Circulating Fluid Typical Physical Property Values ····· Page 89

Specific Product Precautions ····· Page 90

Thermo-chiller Standard Type
Air-cooled 200 V Type
Series HRS100/150

RoHS



How to Order

HRS 100 – A □ – 20 – □

Cooling capacity

100	10 kW
150	15 kW

Cooling method

A	Air-cooled refrigeration

Pipe thread type

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

Power supply

20	3-phase 200 VAC (50 Hz) 3-phase 200 to 230 VAC (60 Hz)

Option

Nil	None
A	With caster adjuster-foot
B	With earth leakage breaker
K Note)	With fluid fill port

Note) This is a manual fluid fill port that is different from the automatic fluid fill port. Fluid can be supplied manually into the tank without removing the side panel. (Fluid can be supplied manually for models without option -K if the side panel is removed.)

Specifications

Model				HRS100-A□-20-□	HRS150-A□-20-□
Cooling method				Air-cooled refrigeration	
Refrigerant				R410A (HFC)	
Control method				PID control	
Ambient temperature Note 1)			°C	–5 to 45	
Circulating fluid system	Circulating fluid Note 2)			Tap water, 15% ethylene glycol aqueous solution, Deionized water	
	Set temperature range Note 1)		°C	5 to 35	
	Cooling capacity 50/60 Hz Note 3)		kW	9.0/9.5	13.0/14.5
	Heating capacity 50/60 Hz Note 4)		kW	1.7/2.2	2.5/3.0
	Temperature stability Note 5)		°C	±1.0	
	Pump capacity	Rated flow 50/60 Hz (Outlet) Note 6)	L/min	42/56	
		Maximum flow rate 50/60 Hz	L/min	55/68	
		Maximum pump head	m	50	
	Minimum operating flow rate 50/60 Hz Note 7)		L/min	28/42	
	Tank capacity		L	18	
	Circulating fluid outlet, circulating fluid return port			Rc3/4 (Symbol F: G3/4, Symbol N: NPT3/4)	
	Tank drain port			Rc1/4 (Symbol F: G1/4, Symbol N: NPT1/4)	
	Automatic fluid fill system (Standard)	Supply side pressure range	MPa	0.2 to 0.5	
		Supply side fluid temperature	°C	5 to 35	
		Automatic fluid fill port		Rc1/2 (Symbol F: G1/2, Symbol N: NPT1/2)	
		Overflow port		Rc1 (Symbol F: G1, Symbol N: NPT1)	
	Fluid contact material			Stainless steel, Copper (Heat exchanger brazing), Brass, Bronze, PTFE, PU, EPDM, PVC, NBR, PE, NR, PBT, PP, POM, Carbon, Ceramic	
Electrical system	Power supply			3-phase 200 VAC (50 Hz), 3-phase 200 to 230 VAC (60 Hz) Allowable voltage range ±10% (No continuous voltage fluctuation)	
	Applicable earth leakage breaker Note 8)	Rated current	A	30	40
		Sensitivity of leak current	mA	30	
	Rated operating current 50/60 Hz Note 5)		A	14/15	16/19
	Rated power consumption 50/60 Hz Note 5)		kW (kVA)	3.8/4.8 (4.9/5.3)	4.7/6.1 (5.6/6.7)
Noise level (Front 1 m/Height 1 m) Note 5)			dB (A)	70	70
Waterproof specification				IPX4	
Accessories				Alarm code list stickers 2 pcs. (English 1 pc./Japanese 1 pc.), Operation Manual (for installation/operation) 2 pcs. (English 1 pc./Japanese 1 pc.), Y-strainer 20A 1 pc., Barrel nipple 20A 1 pc., Drain pan for the pump	
Weight (dry state)			kg	171	177

Note 1) Use a 15% ethylene glycol aqueous solution if operating in a place where the ambient temperature and/or circulating fluid temperature is 10°C or less.
Note 2) Use fluid in condition below as the circulating fluid.
Tap water: Standard of The Japan Refrigeration And Air Conditioning Industry Association (JRA GL-02-1994)
15% ethylene glycol aqueous solution: diluted by tap water in condition above without any additives such as antiseptics.
Deionized water: Electric conductivity 1 μS/cm or higher (Electric resistivity 1 MΩ·cm or lower)
Note 3) ① Ambient temperature: 32°C, ② Circulating fluid: Tap water, ③ Circulating fluid temperature: 20°C, ④ Circulating fluid flow rate: Rated flow, ⑤ Power supply: 200 VAC
Note 4) ① Ambient temperature: 32°C, ② Circulating fluid: Tap water, ③ Circulating fluid flow rate: Rated flow, ④ Power supply: 200 VAC
Note 5) ① Ambient temperature: 32°C, ② Circulating fluid: Tap water, ③ Circulating fluid temperature: 20°C, ④ Load: Same as the cooling capacity, ⑤ Circulating fluid flow rate: Rated flow, ⑥ Power supply: 200 VAC, ⑦ Piping length: Shortest
Note 6) When circulating fluid outlet port pressure – return port pressure = 0.25 MPa.
Note 7) Fluid flow rate to maintain the cooling capacity and to keep the circulating fluid discharge pressure to 0.5 MPa or less. If the actual flow rate is lower than this, install a bypass piping.
Note 8) To be prepared by user. A specified earth leakage breaker is installed for option B [With earth leakage breaker].
Note 9) If the product is used at altitude of 1000 m or higher, refer to "Operating Environment/Storage Environment" (page 90) Item 13 "∗ For altitude of 1000 m or higher".

Thermo-chiller Standard Type
Water-cooled 200 V Type
Series HRS100/150

RoHS



How to Order

HRS 100 – W □ – 20 – □

Cooling capacity

100	10 kW
150	15 kW

Cooling method

W	Water-cooled refrigeration

Pipe thread type

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

Power supply

20	3-phase 200 VAC (50 Hz) 3-phase 200 to 230 VAC (60 Hz)

Option

Nil	None
A	With caster adjuster-foot
B	With earth leakage breaker
K Note)	With fluid fill port

Note) This is a manual fluid fill port that is different from the automatic fluid fill port. Fluid can be supplied manually into the tank without removing the side panel. (Fluid can be supplied manually for models without option -K if the side panel is removed.)

Specifications

Model				HRS100-W□-20-□	HRS150-W□-20-□
Cooling method				Water-cooled refrigeration	
Refrigerant				R410A (HFC)	
Control method				PID control	
Ambient temperature Note 1)			°C	2 to 45	
Circulating fluid system	Circulating fluid Note 2)			Tap water, 15% ethylene glycol aqueous solution, Deionized water	
	Set temperature range Note 1)		°C	5 to 35	
	Cooling capacity 50/60 Hz Note 3)		kW	10.0/11.0	14.5/16.5
	Heating capacity 50/60 Hz Note 4)		kW	1.7/2.2	2.5/3.0
	Temperature stability Note 5)		°C	±1.0	
	Pump capacity	Rated flow 50/60 Hz (Outlet) Note 6)	L/min	42/56	
		Maximum flow rate 50/60 Hz	L/min	55/68	
		Maximum pump head	m	50	
	Minimum operating flow rate 50/60 Hz Note 7)		L/min	28/42	
	Tank capacity		L	18	
	Circulating fluid outlet, circulating fluid return port			Rc3/4 (Symbol F: G3/4, Symbol N: NPT3/4)	
	Tank drain port			Rc1/4 (Symbol F: G1/4, Symbol N: NPT1/4)	
	Automatic fluid fill system (Standard)	Supply side pressure range	MPa	0.2 to 0.5	
		Supply side fluid temperature	°C	5 to 35	
		Automatic fluid fill port		Rc1/2 (Symbol F: G1/2, Symbol N: NPT1/2)	
		Overflow port		Rc1 (Symbol F: G1, Symbol N: NPT1)	
	Fluid contact material			Stainless steel, Copper (Heat exchanger brazing), Brass, Bronze, PTFE, PU, EPDM, PVC, NBR, PE, NR, PBT, PP, POM, Carbon, Ceramic	
Facility water system	Temperature range		°C	5 to 40	
	Pressure range		MPa	0.3 to 0.5	
	Required flow 50/60 Hz		L/min	33/34	38/40
	Facility water pressure differential		MPa	0.3 or more	
	Facility water inlet/outlet			Rc3/4	
	Fluid contact material			Stainless steel, Copper (Heat exchanger brazing), Bronze, Brass PTFE, NBR, EPDM	
Electrical system	Power supply			3-phase 200 VAC (50 Hz), 3-phase 200 to 230 VAC (60 Hz) Allowable voltage range ±10% (No continuous voltage fluctuation)	
	Applicable earth leakage breaker Note 8)	Rated current	A	30	40
		Sensitivity of leak current	mA	30	
	Rated operating current 50/60 Hz Note 5)		A	13/14	16/19
	Rated power consumption 50/60 Hz Note 5)		kW (kVA)	3.4/4.4 (4.4/5.0)	4.6/6.0 (5.6/6.6)
Noise level (Front 1 m/Height 1 m) Note 5)			dB (A)	70	70
Waterproof specification				IPX4	
Accessories				Alarm code list stickers 2 pcs. (English 1 pc./Japanese 1 pc.), Operation Manual (for installation/operation) 2 pcs. (English 1 pc./Japanese 1 pc.), Y-strainer 20A 1 pc., Barrel nipple 20A 1 pc., Drain pan for the pump	
Weight (dry state)			kg	151	154

Note 1) Use a 15% ethylene glycol aqueous solution if operating in a place where the ambient temperature and/or circulating fluid temperature is 10°C or less. Also, when there is a possibility of the facility water being frozen, make sure to discharge all the facility water from the facility water circuit.

Note 2) Use fluid in condition below as the circulating fluid. Also, when there is a possibility of the facility water being frozen, make sure to discharge all the facility water from the facility water circuit.
Tap water: Standard of The Japan Refrigeration And Air Conditioning Industry Association (JRA GL-02-1994)
15% ethylene glycol aqueous solution: diluted by tap water in condition above without any additives such as antiseptics.
Deionized water: Electric conductivity 1 μS/cm or higher (Electric resistivity 1 MΩ·cm or lower)

Note 3) ① Facility water temperature: 32°C, ② Circulating fluid: Tap water, ③ Circulating fluid temperature: 20°C, ④ Circulating fluid flow rate: Rated flow, ⑤ Power supply: 200 VAC

Note 4) ① Facility water temperature: 32°C, ② Circulating fluid: Tap water, ③ Circulating fluid flow rate: Rated flow, ④ Power supply: 200 VAC

Note 5) ① Facility water temperature: 32°C, ② Circulating fluid: Tap water, ③ Circulating fluid temperature: 20°C, ④ Load: Same as the cooling capacity, ⑤ Circulating fluid flow rate: Rated flow, ⑥ Power supply: 200 VAC, ⑦ Piping length: Shortest

Note 6) When circulating fluid outlet port pressure – return port pressure = 0.25 MPa.

Note 7) Fluid flow rate to maintain the cooling capacity and to keep the circulating fluid discharge pressure to 0.5 MPa or less. If the actual flow rate is lower than this, install a bypass piping.

Note 8) To be prepared by user. A specified earth leakage breaker is installed for option B [With earth leakage breaker].

Note 9) If the product is used at altitude of 1000 m or higher, refer to "Operating Environment/Storage Environment" (page 90) Item 13 "∗ For altitude of 1000 m or higher".

Thermo-chiller Standard Type
Air-cooled 400 V Type
Series HRS100/150



How to Order

HRS 100 – A □ – 40 – □

Cooling capacity

100	10 kW
150	15 kW

Cooling method

A	Air-cooled refrigeration

Pipe thread type

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

Power supply

40	3-phase 380 to 415 VAC (50/60 Hz)

Option

Nil Note 1)	None
A	With caster adjuster-foot
K Note 2)	With fluid fill port

Note 1) 400 V type is provided with an earth leakage breaker (-B) as standard.
Note 2) This is a manual fluid fill port that is different from the automatic fluid fill port. Fluid can be supplied manually into the tank without removing the side panel. (Fluid can be supplied manually for models without option -K if the side panel is removed.)

Specifications

Model				HRS100-A□-40-□	HRS150-A□-40-□
Cooling method				Air-cooled refrigeration	
Refrigerant				R410A (HFC)	
Control method				PID control	
Ambient temperature Note 1)			°C	–5 to 45	
Circulating fluid system	Circulating fluid Note 2)			Tap water, 15% ethylene glycol aqueous solution, Deionized water	
	Set temperature range Note 1)		°C	5 to 35	
	Cooling capacity 50/60 Hz Note 3)		kW	9.0/9.5	13.0/14.5
	Heating capacity 50/60 Hz Note 4)		kW	1.7/2.2	2.5/3.0
	Temperature stability Note 5)		°C	±1.0	
	Pump capacity	Rated flow 50/60 Hz (Outlet) Note 6)	L/min	42/56	
		Maximum flow rate 50/60 Hz	L/min	55/68	
		Maximum pump head	m	50	
	Minimum operating flow rate 50/60 Hz Note 7)		L/min	28/42	
	Tank capacity		L	18	
	Circulating fluid outlet, circulating fluid return port			Rc3/4 (Symbol F: G3/4, Symbol N: NPT3/4)	
	Pump drain port			Rc1/4 (Symbol F: G1/4, Symbol N: NPT1/4)	
	Automatic fluid fill system (Standard)	Supply side pressure range	MPa	0.2 to 0.5	
		Supply side fluid temperature	°C	5 to 35	
		Automatic fluid fill port		Rc1/2 (Symbol F: G1/2, Symbol N: NPT1/2)	
		Overflow port		Rc1 (Symbol F: G1, Symbol N: NPT1)	
	Fluid contact material			Stainless steel, Copper (Heat exchanger brazing), Brass, Bronze, PTFE, PU, EPDM, PVC, NBR, PE, NR, PBT, PP, POM, Carbon, Ceramic	
Electrical system	Power supply			3-phase 380 to 415 VAC (50/60 Hz) Allowable voltage range ±10% (No continuous voltage fluctuation)	
	Earth leakage breaker (Standard/With handle)	Rated current	A	20	
		Sensitivity of leak current	mA	30	
	Rated operating current 50/60 Hz Note 5)		A	6.9/7.5	8.1/9.6
	Rated power consumption 50/60 Hz Note 5)		kW (kVA)	3.7/4.7 (4.7/5.3)	4.8/6.1 (5.7/6.6)
Noise level (Front 1 m/Height 1 m) Note 5)			dB (A)	70	72
Waterproof specification				IPX4	
Accessories				Alarm code list stickers 2 pcs. (English 1 pc./Japanese 1 pc.), Operation Manual (for installation/operation) 2 pcs. (English 1 pc./Japanese 1 pc.), Y-strainer 20A 1 pc., Barrel nipple 20A 1 pc., Drain pan for the pump 1 pc.	
Weight (dry state)			kg	171	177
Compliant standards	CE marking	EMC Directive		2004/108/EC	
		Machinery Directive		2006/42/EC	

Note 1) Use a 15% ethylene glycol aqueous solution if operating in a place where the ambient temperature and/or circulating fluid temperature is 10°C or less.
Note 2) Use fluid in condition below as the circulating fluid.
Tap water: Standard of The Japan Refrigeration And Air Conditioning Industry Association (JRA GL-02-1994)
15% ethylene glycol aqueous solution: diluted by tap water in condition above without any additives such as antiseptics.
Deionized water: Electric conductivity 1 μS/cm or higher (Electric resistivity 1 MΩ·cm or lower)
Note 3) ① Ambient temperature: 32°C, ② Circulating fluid: Tap water, ③ Circulating fluid temperature: 20°C, ④ Circulating fluid flow rate: Rated flow, ⑤ Power supply: 400 VAC
Note 4) ① Ambient temperature: 32°C, ② Circulating fluid: Tap water, ③ Circulating fluid flow rate: Rated flow, ④ Power supply: 400 VAC
Note 5) ① Ambient temperature: 32°C, ② Circulating fluid: Tap water, ③ Circulating fluid temperature: 20°C, ④ Load: Same as the cooling capacity, ⑤ Circulating fluid flow rate: Rated flow, ⑥ Power supply: 400 VAC, ⑦ Piping length: Shortest
Note 6) When circulating fluid outlet port pressure – return port pressure = 0.25 MPa.
Note 7) Fluid flow rate to maintain the cooling capacity and to keep the circulating fluid discharge pressure to 0.5 MPa or less. If the actual flow rate is lower than this, install a bypass piping.

Thermo-chiller Standard Type
Water-cooled 400 V Type
Series HRS100/150



How to Order

HRS **100** – **W** **□** – **40** – **□**

Cooling capacity

100	10 kW
150	15 kW

Cooling method

W	Water-cooled refrigeration

Pipe thread type

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

Power supply

40	3-phase 380 to 415 VAC (50/60 Hz)

Option

Nil Note 1)	None
A	With caster adjuster-foot
K Note 2)	With fluid fill port

Note 1) 400 V type is provided with an earth leakage breaker (-B) as standard.

Note 2) This is a manual fluid fill port that is different from the automatic fluid fill port. Fluid can be supplied manually into the tank without removing the side panel. (Fluid can be supplied manually for models without option -K if the side panel is removed.)

Specifications

Model				HRS100-W□-40-□	HRS150-W□-40-□
Cooling method				Water-cooled refrigeration	
Refrigerant				R410A (HFC)	
Control method				PID control	
Ambient temperature Note 1)			°C	2 to 45	
Circulating fluid system	Circulating fluid Note 2)			Tap water, 15% ethylene glycol aqueous solution, Deionized water	
	Set temperature range Note 1)		°C	5 to 35	
	Cooling capacity 50/60 Hz Note 3)		kW	10.0/11.0	14.5/16.5
	Heating capacity 50/60 Hz Note 4)		kW	1.7/2.2	2.5/3.0
	Temperature stability Note 5)		°C	±1.0	
	Pump capacity	Rated flow 50/60 Hz (Outlet) Note 6) (When circulating fluid outlet port pressure – return port pressure = 0.25 MPa.)	L/min	42/56	
		Maximum flow rate 50/60 Hz	L/min	55/68	
		Maximum pump head	m	50	
	Minimum operating flow rate 50/60 Hz Note 7)		L/min	28/42	
	Tank capacity		L	18	
	Circulating fluid outlet, circulating fluid return port			Rc3/4 (Symbol F: G3/4, Symbol N: NPT3/4)	
	Pump drain port			Rc1/4 (Symbol F: G1/4, Symbol N: NPT1/4)	
	Automatic fluid fill system (Standard)	Supply side pressure range	MPa	0.2 to 0.5	
		Supply side fluid temperature	°C	5 to 35	
		Automatic fluid fill port		Rc1/2 (Symbol F: G1/2, Symbol N: NPT1/2)	
		Overflow port		Rc1 (Symbol F: G1, Symbol N: NPT1)	
	Fluid contact material			Stainless steel, Copper (Heat exchanger brazing), Brass, Bronze, PTFE, PU, EPDM, PVC, NBR, PE, NR, PBT, PP, POM, Carbon, Ceramic	
Facility water system	Temperature range		°C	5 to 40	
	Pressure range		MPa	0.3 to 0.5	
	Required flow 50/60 Hz		L/min	33/34	38/40
	Facility water pressure differential		MPa	0.3 or more	
	Facility water inlet/outlet			Rc3/4 (Symbol F: G3/4, Symbol N: NPT3/4)	
	Fluid contact material			Stainless steel, Copper (Heat exchanger brazing), Bronze, Brass PTFE, NBR, EPDM	
Electrical system	Power supply			3-phase 200 VAC (50 Hz), 3-phase 200 to 230 VAC (60 Hz) Allowable voltage range ±10% (No continuous voltage fluctuation)	
	Earth leakage breaker (Standard/With handle)	Rated current	A	20	
		Sensitivity of leak current	mA	30	
	Rated operating current 50/60 Hz Note 5)		A	6.4/7.2	7.7/9.5
	Rated power consumption 50/60 Hz Note 5)		kW (kVA)	3.4/4.4 (4.5/5.0)	4.5/6.0 (5.4/6.6)
Noise level (Front 1 m/Height 1 m) Note 5)			dB (A)	70	
Waterproof specification				IPX4	
Accessories				Alarm code list stickers 2 pcs. (English 1 pc./Japanese 1 pc.), Operation Manual (for installation/operation) 2 pcs. (English 1 pc./Japanese 1 pc.), Y-strainer 20A 1 pc., Barrel nipple 20A 1 pc., Drain pan for the pump 1 pc.	
Weight (dry state)			kg	151	154
Compliant standards	CE marking	EMC Directive		2004/108/EC	
		Machinery Directive		2006/42/EC	

Note 1) Use a 15% ethylene glycol aqueous solution if operating in a place where the ambient temperature and/or circulating fluid temperature is 10°C or less. Also, when there is a possibility of the facility water being frozen, make sure to discharge all the facility water from the facility water circuit.

Note 2) Use fluid in condition below as the circulating fluid. Also, when there is a possibility of the facility water being frozen, make sure to discharge all the facility water from the facility water circuit.
Tap water: Standard of The Japan Refrigeration And Air Conditioning Industry Association (JRA GL-02-1994)
15% ethylene glycol aqueous solution: diluted by tap water in condition above without any additives such as antiseptics.
Deionized water: Electric conductivity 1 μS/cm or higher (Electric resistivity 1 MΩ·cm or lower)

Note 3) ① Facility water temperature: 32°C, ② Circulating fluid: Tap water, ③ Circulating fluid temperature: 20°C, ④ Circulating fluid flow rate: Rated flow, ⑤ Power supply: 400 VAC

Note 4) ① Facility water temperature: 32°C, ② Circulating fluid: Tap water, ③ Circulating fluid flow rate: Rated flow, ④ Power supply: 400 VAC

Note 5) ① Facility water temperature: 32°C, ② Circulating fluid: Tap water, ③ Circulating fluid temperature: 20°C, ④ Load: Same as the cooling capacity, ⑤ Circulating fluid flow rate: Rated flow, ⑥ Power supply: 400 VAC, ⑦ Piping length: Shortest

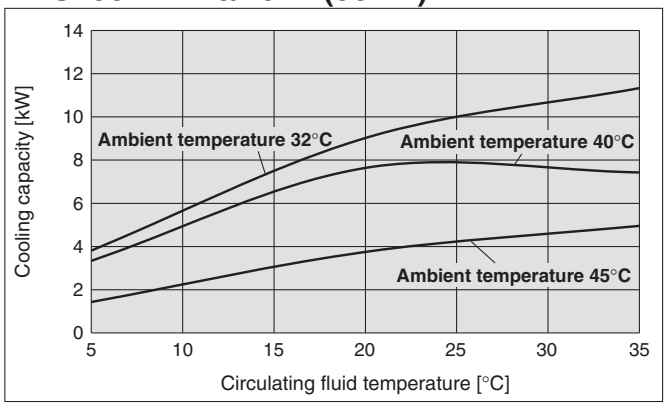
Note 6) When circulating fluid outlet port pressure – return port pressure = 0.25 MPa.

Note 7) Fluid flow rate to maintain the cooling capacity and to keep the circulating fluid discharge pressure to 0.5 MPa or less. If the actual flow rate is lower than this, install a bypass piping.

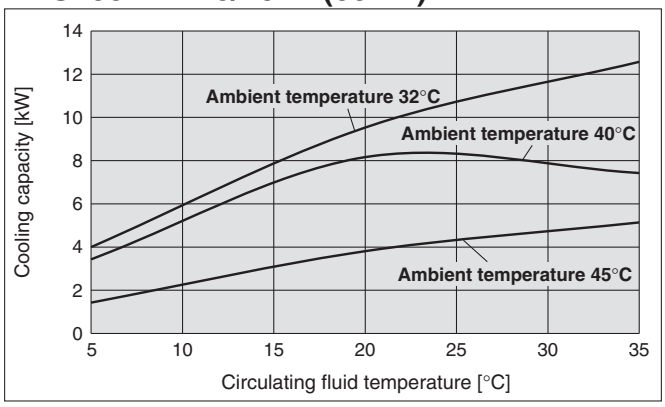
Cooling Capacity

∗ If the product is used at altitude of 1000 m or higher, refer to “Operating Environment/ Storage Environment” (page 90) Item 13 “∗ For altitude of 1000 m or higher”.

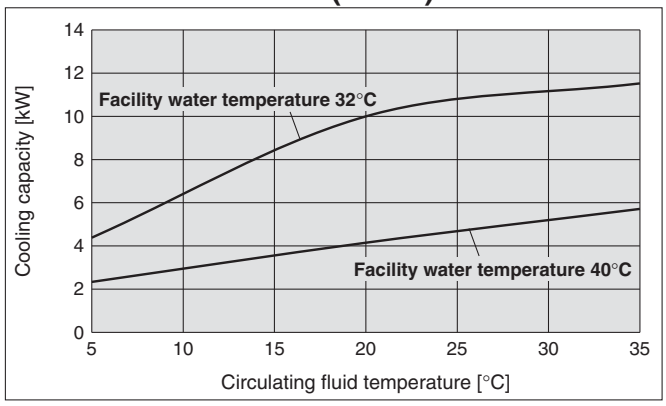
HRS100-A□-20/40-□ (50 Hz)



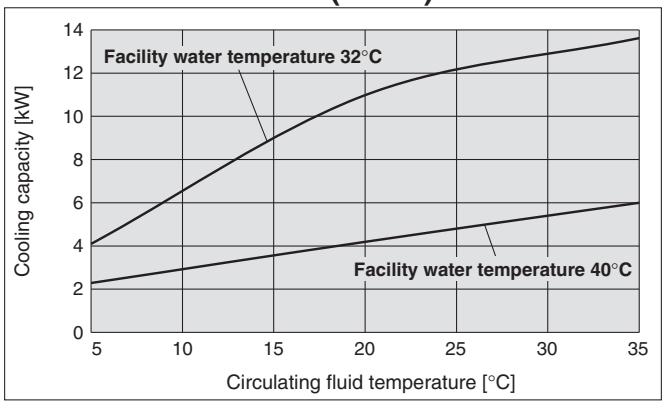
HRS100-A□-20/40-□ (60 Hz)



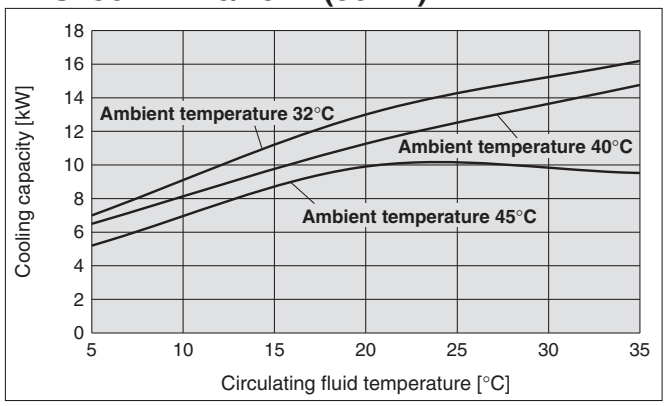
HRS100-W□-20/40-□ (50 Hz)



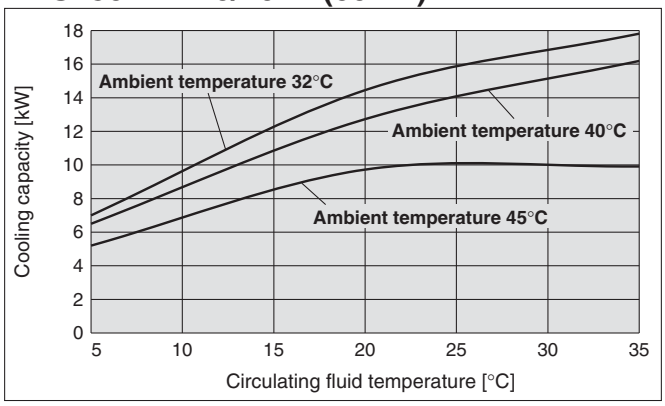
HRS100-W□-20/40-□ (60 Hz)



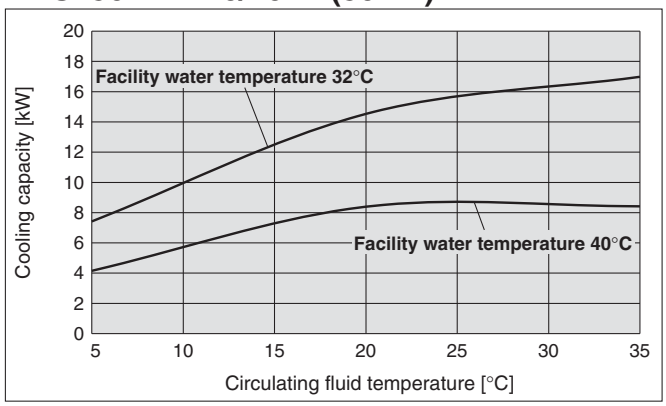
HRS150-A□-20/40-□ (50 Hz)



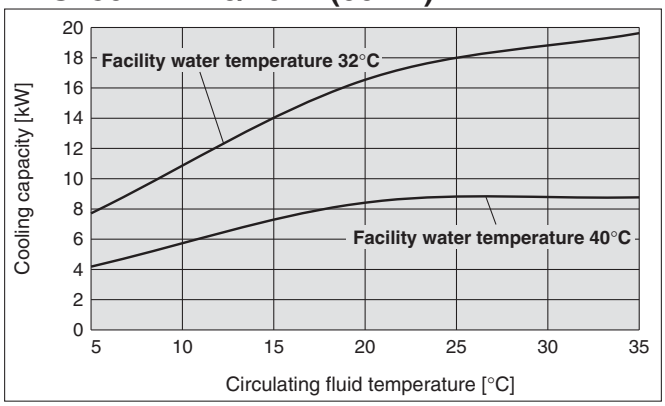
HRS150-A□-20/40-□ (60 Hz)



HRS150-W□-20/40-□ (50 Hz)

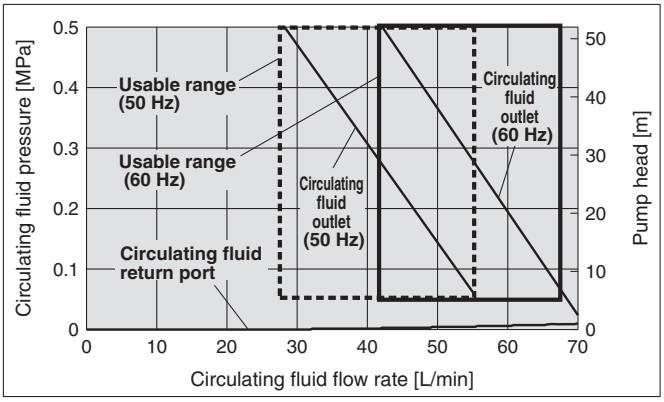


HRS150-W□-20/40-□ (60 Hz)



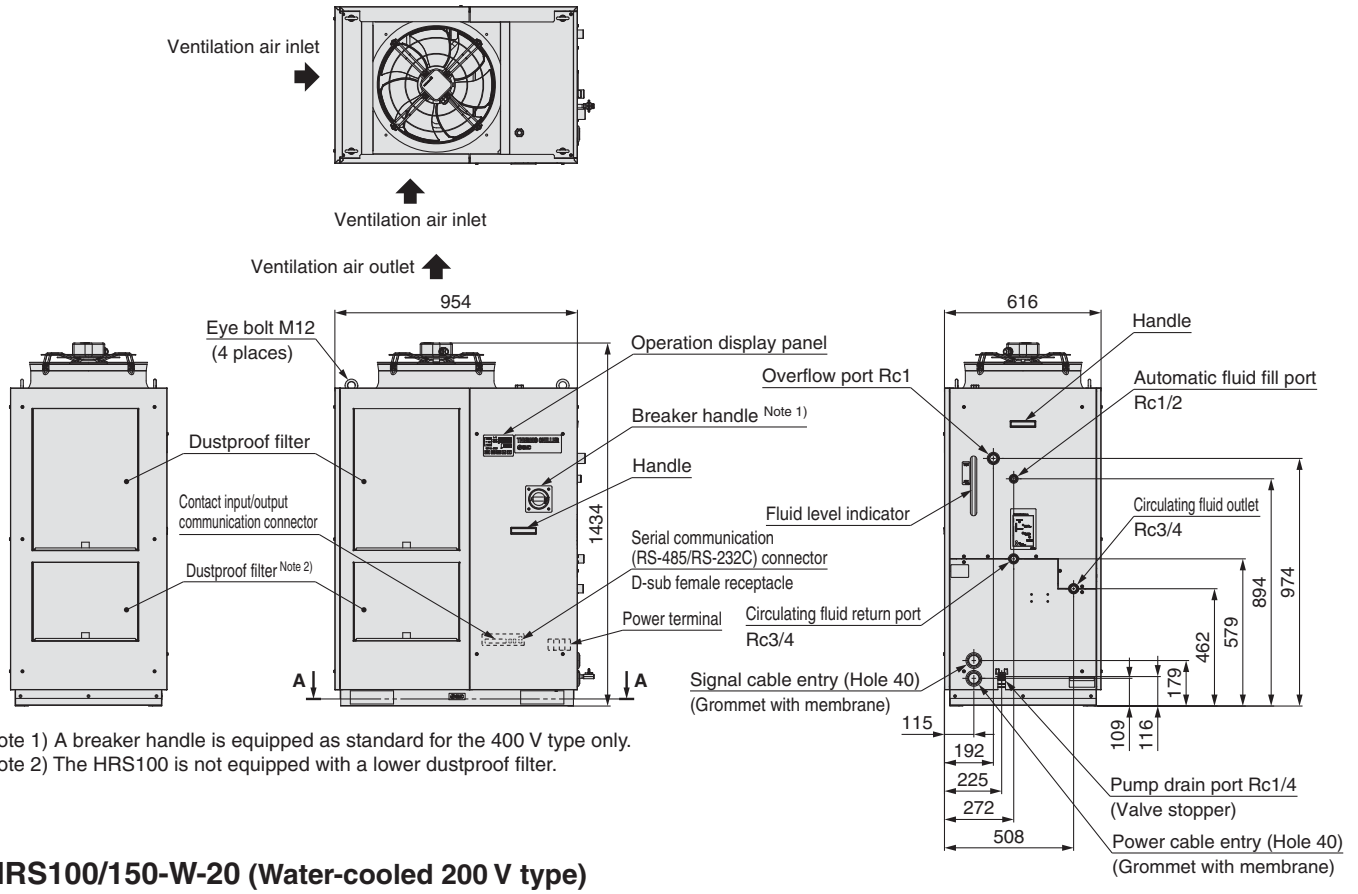
Pump Capacity

HRS100/150-A□-20/40-□
HRS100/150-W□-20/40-□



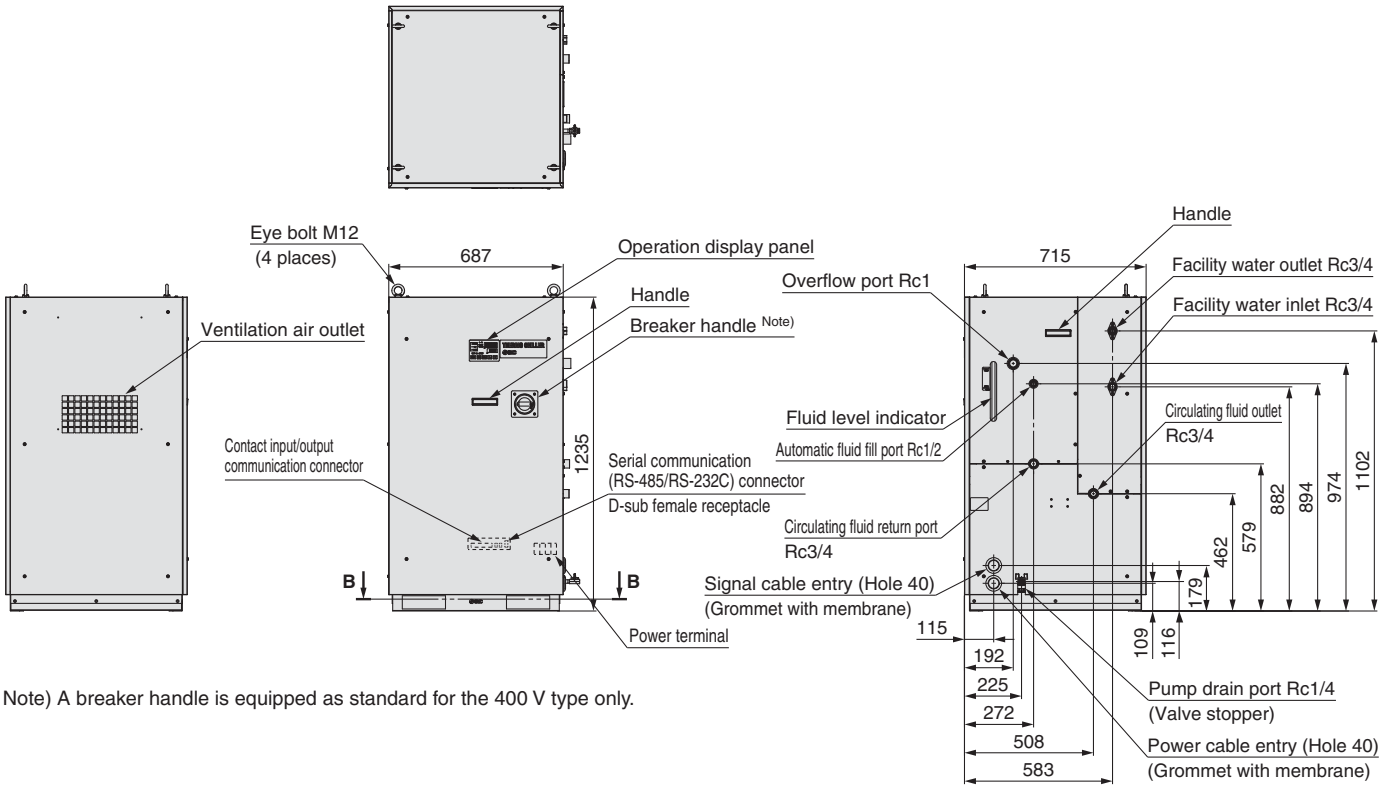
Dimensions

HRS100/150-A-20 (Air-cooled 200 V type)
HRS100/150-A-40 (Air-cooled 400 V type)



Note 1) A breaker handle is equipped as standard for the 400 V type only.
Note 2) The HRS100 is not equipped with a lower dustproof filter.

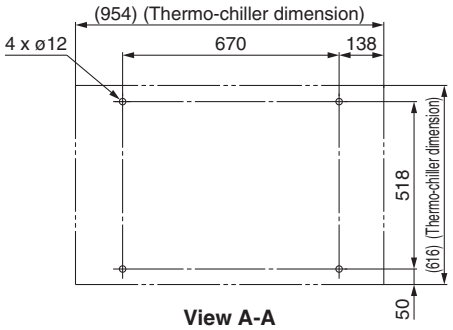
HRS100/150-W-20 (Water-cooled 200 V type)
HRS100/150-W-40 (Water-cooled 400 V type)



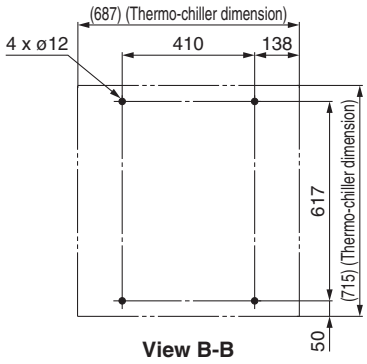
Note) A breaker handle is equipped as standard for the 400 V type only.

Dimensions

HRS100/150-A-20 (Air-cooled 200 V type)
HRS100/150-A-40 (Air-cooled 400 V type)
Anchor bolt fixing position A

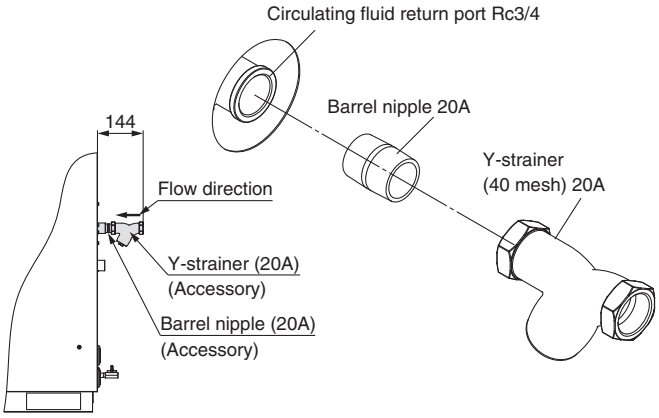


HRS100/150-W-20 (Water-cooled 200 V type)
HRS100/150-W-40 (Water-cooled 400 V type)
Anchor bolt fixing position B



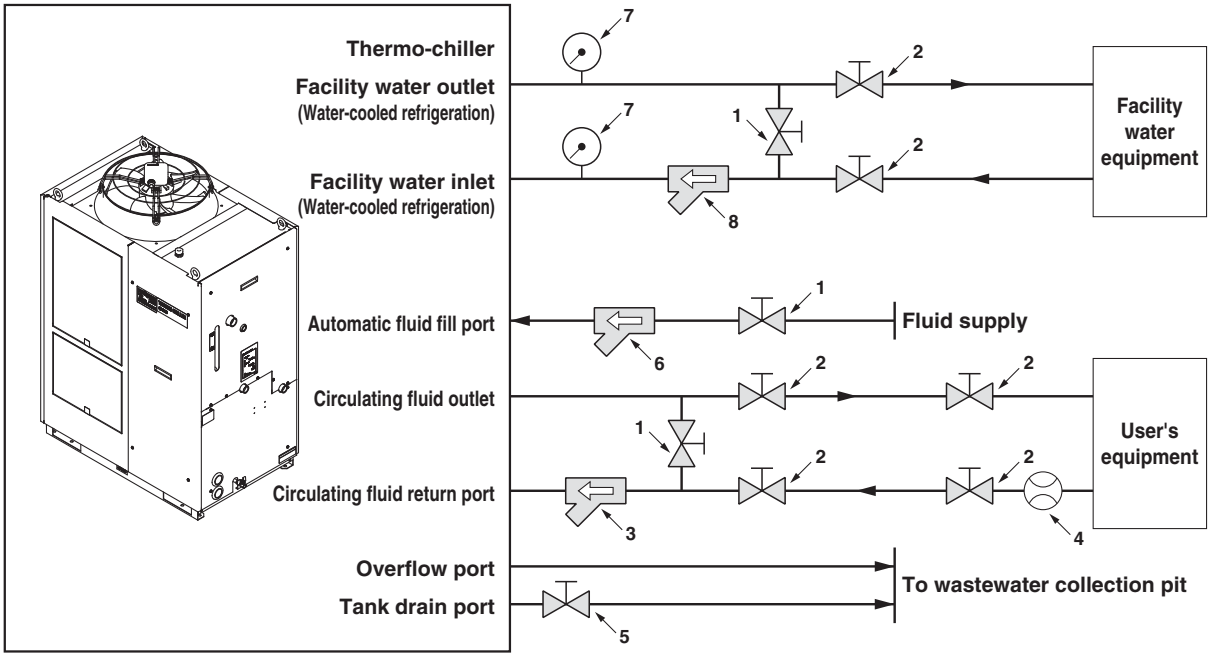
Accessory: Y-strainer mounting view

∗ Mount it by yourself on the circulating fluid return port.



Recommended External Piping Flow

External piping circuit is recommended as shown below.



∗ Ensure that the overflow port is connected to the wastewater collection pit in order to avoid damage to the tank of the thermo-chiller.

No.	Description	Size
1	Valve	Rc1/2
2	Valve	Rc3/4
3	Y-strainer (#40) (Accessory)	Rc3/4
4	Flow meter	Prepare a flow meter with an appropriate flow range.
5	Valve (Part of thermo-chiller)	Rc1/4
6	Y-strainer (#40)	Rc1/2
7	Pressure gauge	0 to 1 MPa
8	Y-strainer (#40) or filter	Rc3/4

Cable Specifications

Power supply and signal cable should be prepared by user.

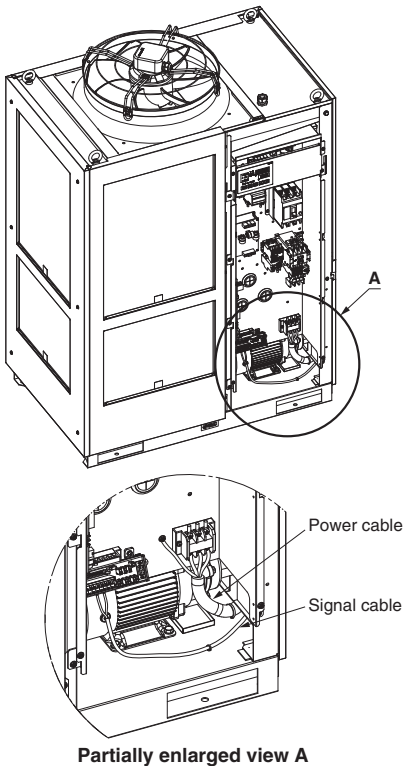
Power Cable Specifications

Applicable model	Rated value for thermo-chiller			Power cable examples	
	Power supply	Applicable breaker rated current	Terminal block screw dia.	Cable size	Crimped terminal on the thermo-chiller side
HRS100-A□-20-□ **HRS100-W□-20-□**	3-phase 200 VAC (50 Hz)	30 A	M5	4 cores x 5.5 mm^2 (4 cores x AWG10) (Including grounding cable R5.5-5)	R5.5-5
HRS150-A□-20-□ **HRS150-W□-20-□**	3-phase 200 to 230 VAC (60 Hz)	40 A		4 cores x 8 mm^2 (4 cores x AWG8) (Including grounding cable R8-5)	R8-5
HRS100-A□-40-□ **HRS100-W□-40-□**	3-phase 380 to 415 VAC (50/60 Hz)	20 A	M5	4 cores x 5.5 mm^2 (4 cores x AWG10) (Including grounding cable R5.5-5)	R5.5-5
HRS150-A□-40-□ **HRS150-W□-40-□**					

Note) An example of the cable specifications is when two kinds of vinyl insulated wires with a continuous allowable operating temperature of 70°C at 600 V, are used at an ambient temperature of 30°C. Select the proper size of cable according to an actual condition.

Signal Cable Specifications

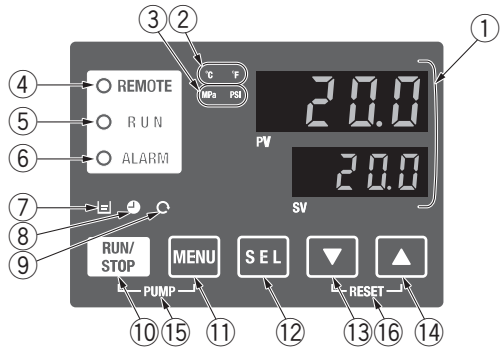
Terminal specifications		Cable specifications
Terminal block screw diameter	Recommended crimped terminal	0.75 mm^2 (AWG18) Shielded cable
M3	Y-shape crimped terminal 1.25Y-3	



Partially enlarged view A

Operation Display Panel

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



No.	Description	Function	
①	**Digital display (7 segment, 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 displayed temperature (default setting: °C).	
③	**[MPa] [PSI] lamp**	Equipped with a unit conversion function. Displays the unit of displayed 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	**[ ] 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. 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.	

List of Function

No.	Function	Outline
1	**Main display**	Displays the current and set temperature of the circulating fluid, discharge pressure of the circulating fluid. Changes the circulating fluid set temperature.
2	**Alarm display menu**	Indicates alarm number when an alarm occurs.
3	**Inspection monitor menu**	Product temperature, pressure and accumulated operating time can be checked as daily inspection. Use these for daily inspection.
4	**Key-lock**	Keys can be locked so that set values cannot be changed by operator error.
5	**Timer for operation start/stop**	Timer is used to set the operation start/stop.
6	**Signal for the completion of preparation**	A signal is output when the circulating fluid temperature reaches the set temperature, when using contact input/output and serial communication.
7	**Offset function**	Use this function when there is a temperature offset between the discharge temperature of the thermo-chiller and user's equipment.
8	**Reset after power failure**	Start operation automatically after the power supply is turned on.
9	**Key click sound setting**	Operation panel key sound can be set on/off.
10	**Changing temp. unit**	Temperature unit can be changed. Centigrade (°C) ⇔ Fahrenheit (°F)
11	**Changing pressure unit**	Pressure unit can be changed. MPa ⇔ PSI
12	**Data reset**	Functions can be reset to the default settings (settings when shipped from the factory).
13	**Accumulation time reset**	Reset function when the pump, the fan or the compressor is replaced. Reset the accumulated time here.
14	**Anti-freezing function**	Circulating fluid is protected from freezing during winter or at night. Set beforehand if there is a risk of freezing.
15	**Warming-up function**	When circulating fluid temperature rising time at starting needs shortening during winter or at night, set beforehand.
16	**Anti-snow coverage function**	If there will be a possibility of the snow coverage due to the change of the installation environment (season, weather), set beforehand.
17	**Alarm buzzer sound setting**	Alarm sound can be set to on/off.
18	**Alarm customizing**	Operation during alarm condition and threshold values can be changed depending on the alarm type.
19	**Communication**	This function is used for contact input/output or serial communication.

Alarm

This unit has 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.

Code	Alarm message
AL01	Low level in tank
AL02	High circulating fluid discharge temp.
AL03	Circulating fluid discharge temp. rise
AL04	Circulating fluid discharge temp. drop
AL05	High circulating fluid return temp.
AL06	High circulating fluid discharge pressure
AL07	Abnormal pump operation
AL08	Circulating fluid discharge pressure rise
AL09	Circulating fluid discharge pressure drop
AL10	High compressor intake temp.
AL11	Low compressor intake temp.
AL12	Low super heat temp.
AL13	High compressor discharge pressure
AL15	Refrigeration circuit pressure (high pressure side) drop
AL16	Refrigeration circuit pressure (low pressure side) rise

Code	Alarm message
AL17	Refrigeration circuit pressure (low pressure side) drop
AL18	Compressor running failure
AL19	Communication error
AL20	Memory error
AL21	DC line fuse cut
AL22	Circulating fluid discharge temp. sensor failure
AL23	Circulating fluid return temp. sensor failure
AL24	Compressor intake temp. sensor failure
AL25	Circulating fluid discharge pressure sensor failure
AL26	Compressor discharge pressure sensor failure
AL27	Compressor intake pressure sensor failure
AL28	Pump maintenance
AL29	Fan maintenance
AL30	Compressor maintenance
AL31	Contact input 1 signal detection

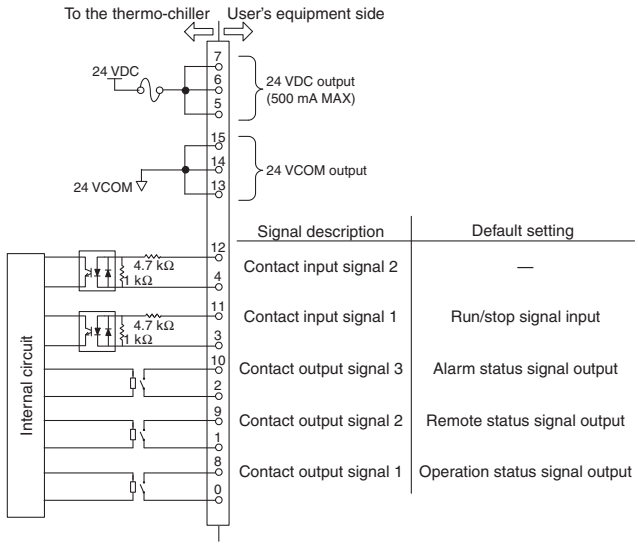
Code	Alarm message
AL32	Contact input 2 signal detection
AL37	Compressor discharge temp. sensor failure
AL38	Compressor discharge temp. rise
AL40	Dustproof filter maintenance Note 1)
AL41	Power stoppage
AL42	Compressor waiting
AL43	Fan failure Note 1)
AL45	Compressor over current
AL47	Pump over current
AL49	Air exhaust fan stoppage Note 2)
AL50	Incorrect phase error
AL51	Phase board over current

Note 1) Does not occur on the product of water-cooled refrigeration type.
Note 2) Does not occur on the product of air-cooled refrigeration type.
∗ For details, read the Operation Manual.

For details, refer to the Operation Manual. Please download it via our website, http://www.smcworld.com

Communication Function

Contact Input/Output

Item		Specifications
Connector type		M3 terminal block
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
Contact output signal	**Rated load voltage**	48 VAC or less/30 VDC or less
	Maximum load current	500 mA AC/DC (resistance load)
	Minimum load current	5 VDC 10 mA
Output voltage		24 VDC ±10% 500 mA MAX (No inductive load)
Circuit diagram		

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

Serial Communication

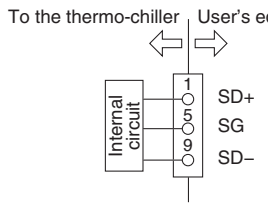
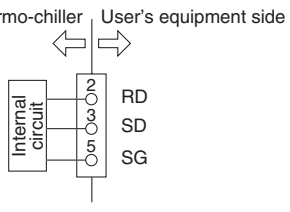
The serial communication (RS-485/RS-232C) enables the following items to be written and read out.
For details, refer to the Operation Manual for communication.

Writing

Run/Stop
Circulating fluid temperature setting (SV)

Readout

Circulating fluid present temperature
Circulating fluid discharge pressure
Status information
Alarm occurrence information

Item	Specifications	
Connector type	D-sub 9-pin, Female connector	
Protocol	Modicon Modbus compliant/Simple communication protocol	
Standards	EIA standard RS-485	EIA standard RS-232C
Circuit diagram		

∗ The terminal resistance of RS-485 (120 Ω) can be switched by the operation display panel. For details, refer to the Operation Manual for communication.
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 HRS100/150
Options

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

A Option symbol

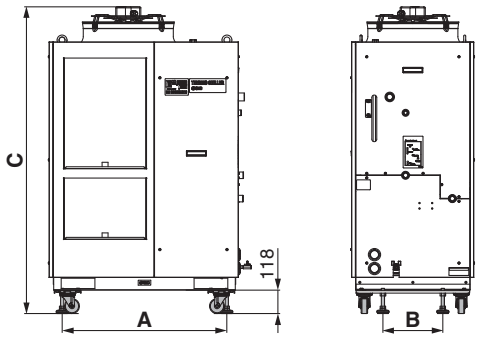
With Caster Adjuster-foot

HRS□−□□−□−A

With caster adjuster-foot

Unfixed casters and adjuster feet stops are mounted.

Applicable model	Dimension [mm]		
	A	B	C
HRS100/150-A-20/40-A	830	302	1552
HRS100/150-W-20/40-A	570	401	1353



B Option symbol

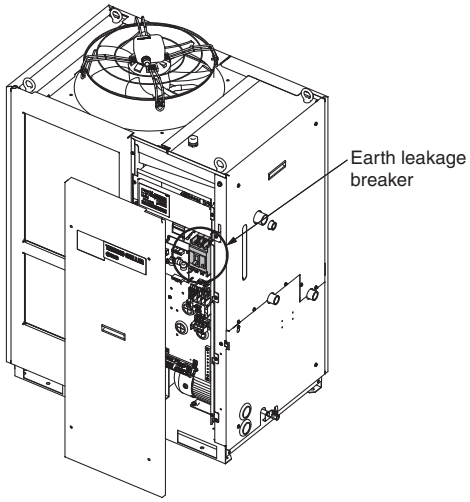
With Earth Leakage Breaker

HRS□−□□−20−B

With earth leakage breaker

A leakage breaker is built in to automatically stop the supply power when it has short-circuit, over current or electrical leakage.

Applicable model	Rated current [A]	Sensitivity of leak current [mA]	Short circuit display method
HRS100-A/W-20	30	30	Mechanical button
HRS150-A/W-20	40		



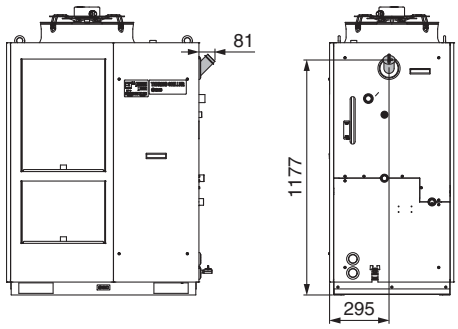
K Option symbol

With Fluid Fill Port

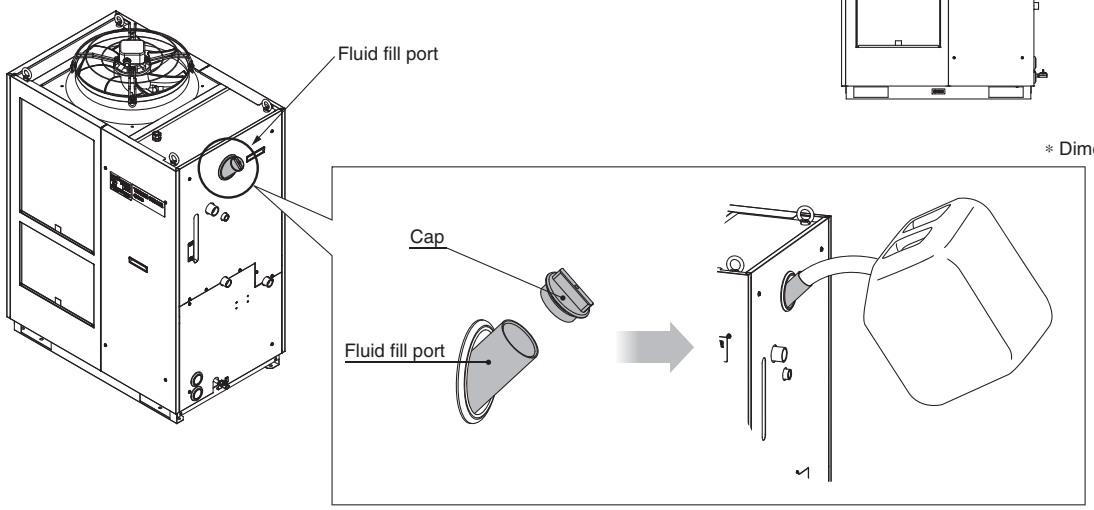
HRS□−□□−□−K

With fluid fill port

When the automatic fluid fill port is not used, fluid can be supplied manually without removing the panel.



∗ Dimensions are common to all models.

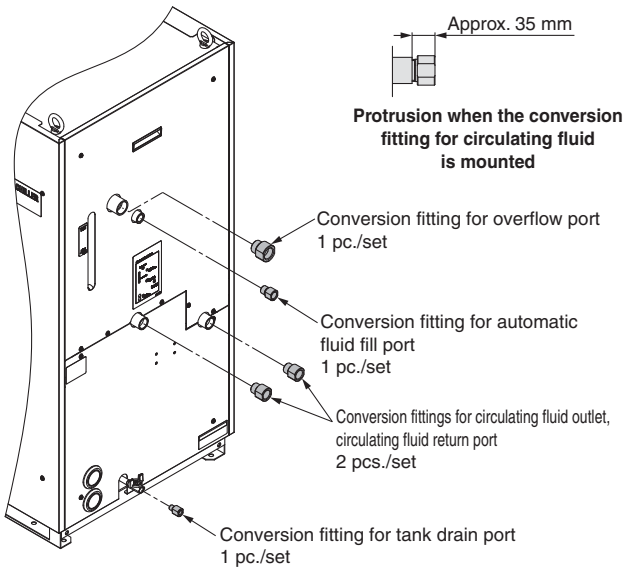


Series HRS100/150
Optional Accessories

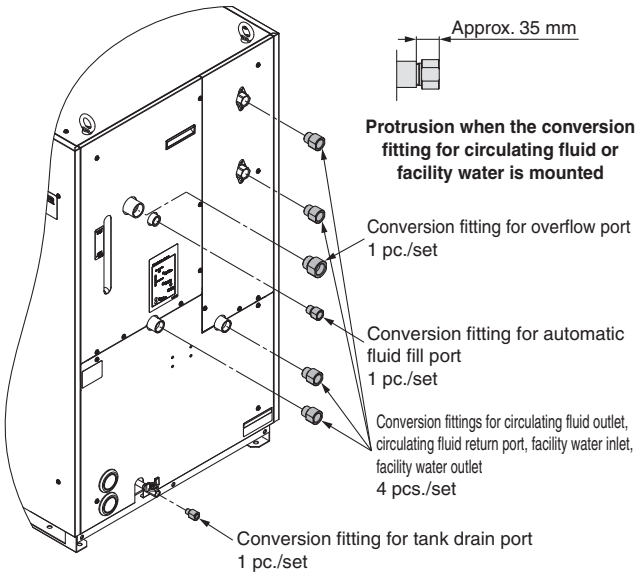
① Piping Conversion Fitting

This is a fitting to change the port from Rc to G or NPT.
· Circulating fluid outlet, Circulating fluid return port Rc3/4 → NPT3/4 or G3/4
· Overflow port Rc1 → NPT1 or G1
· Automatic fluid fill port Rc1/2 → NPT1/2 or G1/2
· Facility water inlet, Facility water outlet Rc3/4 → NPT3/4 or G3/4 (for HRS-EP029 or HRS-EP030)
(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.	Contents	Applicable model	Material
HRS-EP027	NPT thread conversion fitting set	**HRS100/150-A-□**	Stainless steel
HRS-EP028	G thread conversion fitting set		
HRS-EP029	NPT thread conversion fitting set	**HRS100/150-W-□**	
HRS-EP030	G thread conversion fitting set		



HRS-EP027, HRS-EP028



HRS-EP029, HRS-EP030

② Caster Adjuster-foot Kit

This is a set of unfixed casters and adjuster feet stop.
When installed by user, it is necessary to lift the thermo-chiller by a forklift or sling work.
Carefully read the procedure manual included with this kit before performing the installation.

Part no.	Applicable model	Dimension [mm]	
		A	**B**
HRS-KS003	**HRS100/150-A□-□**	830	302
HRS-KS002	**HRS100/150-W□-□**	570	401

Parts List

Description
Procedure manual
Caster adjuster-foot bracket (2 pcs.)
Fixing bolt (M8) (8 pcs.)

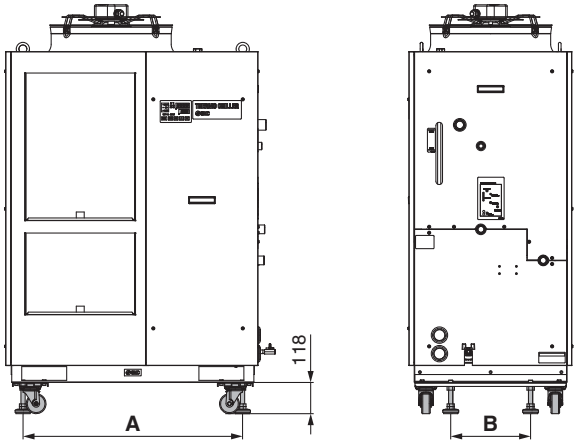


Fig. 1 Mounting view

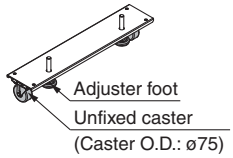


Fig. 2 Caster adjuster-foot bracket (2 pcs.)

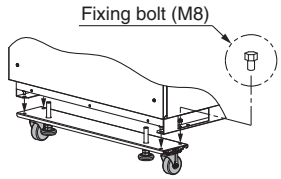


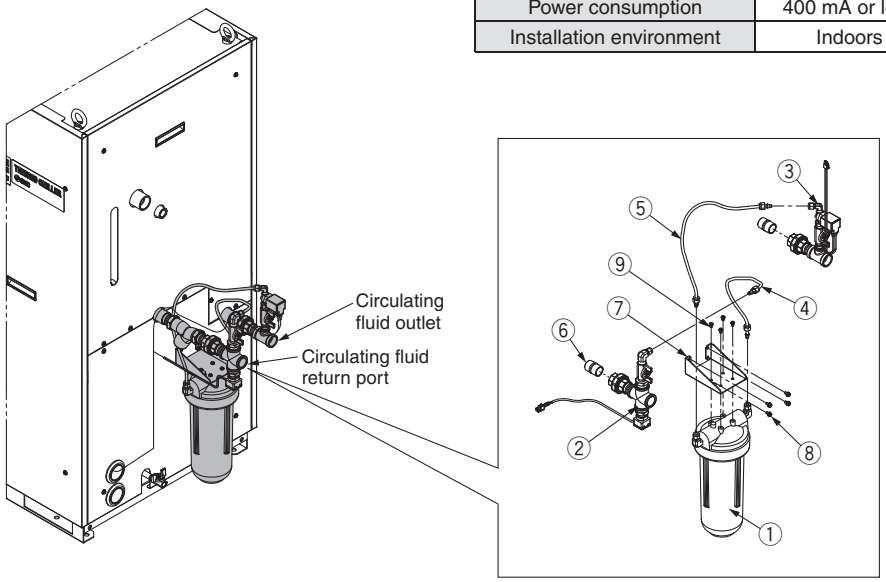
Fig. 3 Fixing bolt (8 pcs.)

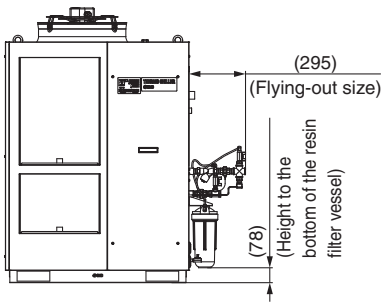
③ Electric Conductivity Control Set

The set indicates and controls the electric conductivity of the circulating fluid. Refer to the Operation Manual for details.

Part no.	Applicable model
HRS-DI010	**HRS100-□□-□** **HRS150-□□-□**

Measurement range of electric conductivity	2.0 to 48.0 μS/cm
Set range of electric conductivity target	5.0 to 45.0 μS/cm
Set range of electric conductivity hysteresis	2.0 to 10.0 μS/cm
Operating temperature range (Circulating fluid temperature)	5 to 60°C
Power consumption	400 mA or less
Installation environment	Indoors





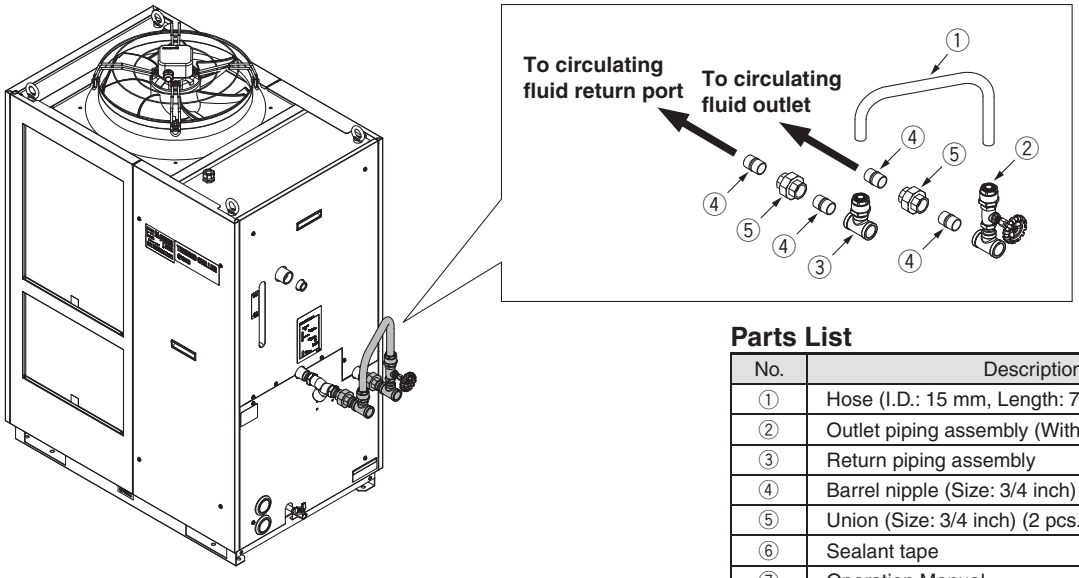
Parts List

No.	Description
①	DI filter vessel (resin)
②	DI sensor assembly
③	DI control piping assembly
④	DI filter outlet tube
⑤	DI filter inlet tube
⑥	Nipple (2 pcs.)
⑦	Mounting bracket
⑧	Mounting screw (4 pcs.)
⑨	Tapping screw (4 pcs.)

④ Bypass Piping Set

Ensure that the circulating fluid flow rate will be more than the minimum required flow rate using a bypass piping set so that the circulating fluid discharge pressure would be 0.5 MPa or less. Otherwise, an alarm due to circulating fluid discharge pressure or pump over current may occur.

Part no.	Applicable model	Minimum operating flow rate [L/min] (50/60 Hz)
HRS-BP007	**HRS100-□□-□**	28/42
	HRS150-□□-□	



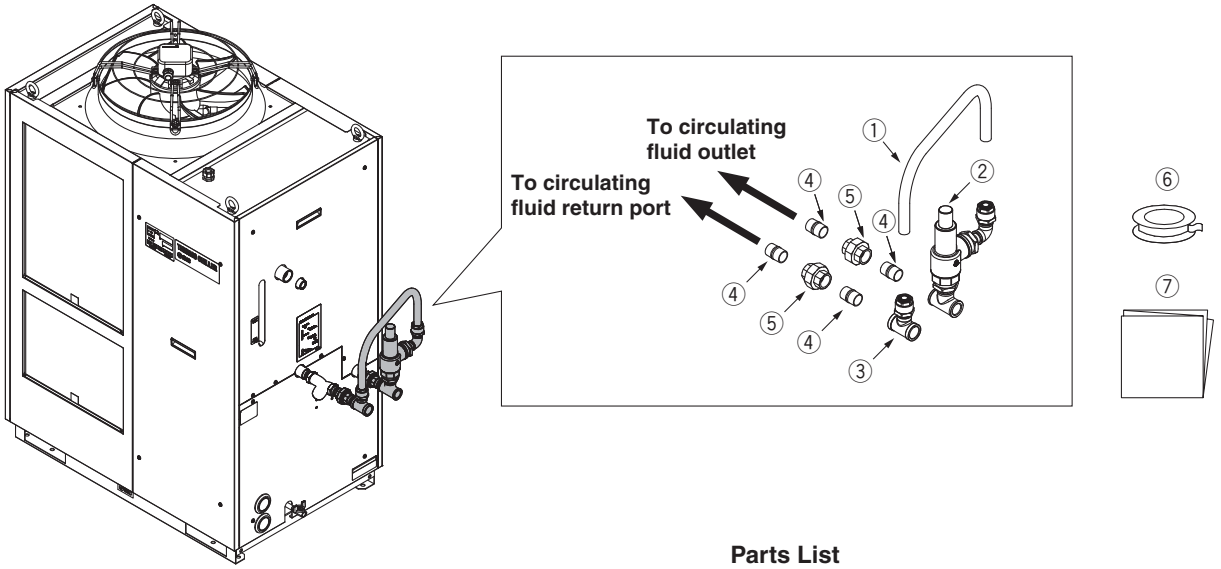
Parts List

No.	Description
①	Hose (I.D.: 15 mm, Length: 700 mm)
②	Outlet piping assembly (With globe valve)
③	Return piping assembly
④	Barrel nipple (Size: 3/4 inch) (2 pcs.)
⑤	Union (Size: 3/4 inch) (2 pcs.)
⑥	Sealant tape
⑦	Operation Manual

⑤ Relief Valve Set

If a solenoid valve is installed in the user's system and the circulating fluid supply stops or decreases during thermo-chiller operation, the circulating fluid discharge pressure of the thermo-chiller increases and an alarm may occur. The relief valve set opens the valve when the pressure exceeds the set pressure level, which prevents pressure increase.

Part no.	Applicable model
HRS-BP008	**HRS100-□□-□** **HRS150-□□-□**



(The figure shows the HRS-150-A-20.)

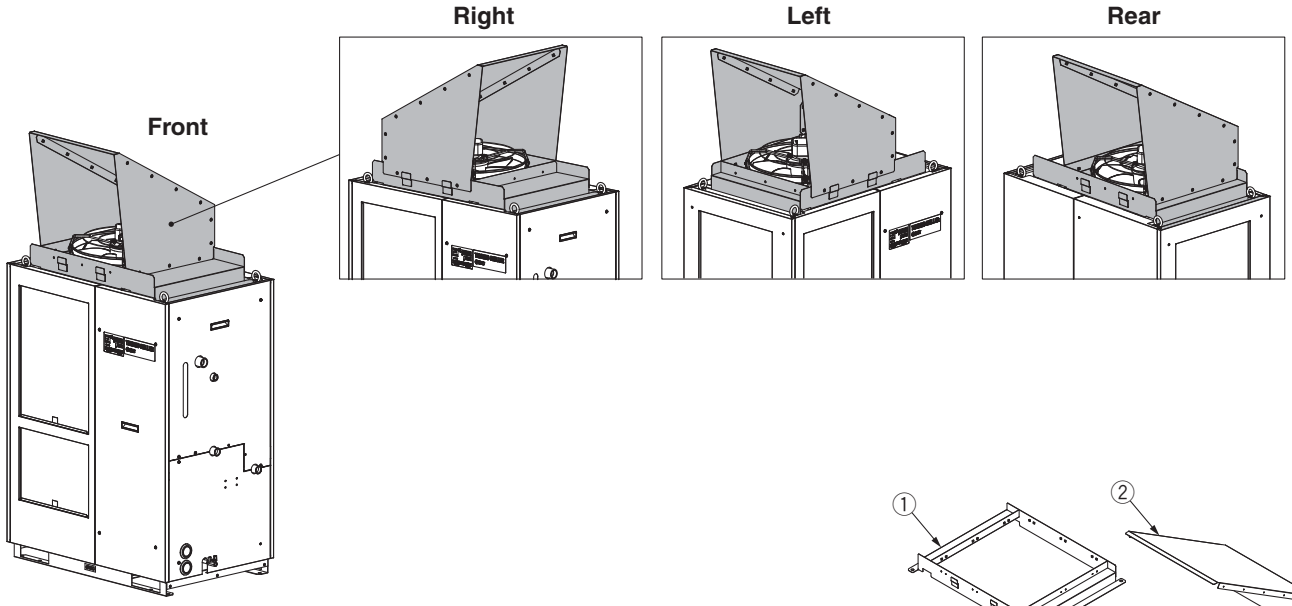
- Relief valve set pressure: 0.32 MPa (The relief valve starts to open when the circulating fluid discharge pressure reaches 0.32 MPa.)
- The setting is made so that the circulating fluid discharge pressure of the thermo-chiller does not exceed 0.5 MPa even when the thermo-chiller is operated at 60 Hz and the water is no longer supplied to the user's system.
- The set pressure of the relief valve should not be adjusted (or changed) by the user. If the set pressure needs to be adjusted, it should be conducted by authorized engineers.

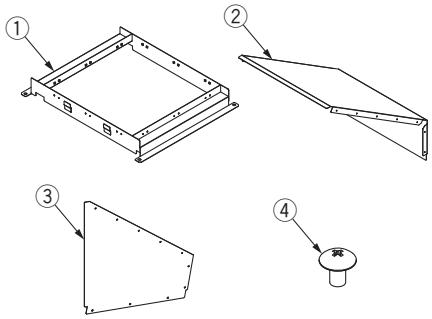
Parts List

No.	Description
①	Hose (I.D.: 15 mm, Length: 700 mm)
②	Outlet piping assembly (With globe valve)
③	Return piping assembly
④	Barrel nipple (Size: 3/4 inch) (4 pcs.)
⑤	Union (Size: 3/4 inch) (4 pcs.)
⑥	Sealant tape
⑦	Operation Manual

⑥ Snow Protection Hood

Snow protection hood for air-cooled chiller. According to the mounting direction of the snow protection hood, the ventilation from the fan can be selected from four directions, front, rear, left and right.

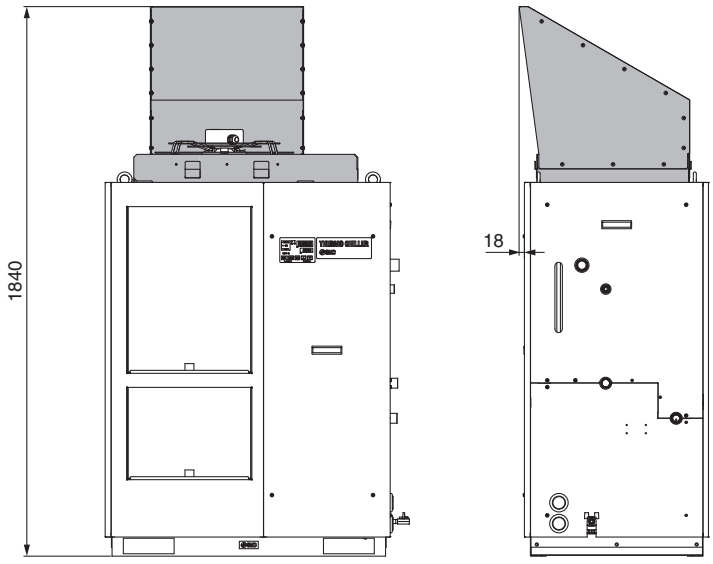




Part no.	Applicable model
HRS-BK005	**HRS100-A□-□** **HRS150-A□-□**

Parts List

No.	Description	Q'ty
①	Snow protection hood base	1
②	Snow protection hood A	1
③	Snow protection hood B	2
④	Assembly/Mounting screw	18



Mounting condition for HRS-BK005

∗ This hood does not completely prevent snow from entering the inside of the chiller.

⑦ Particle Filter Set

Removes foreign objects in the circulating fluid. This set cannot be directly connected to the thermo-chiller. Install it in the user's piping system. Refer to the Operation Manual for details.

Particle Filter Set

HRS−PF005−H

Accessory

Symbol	Accessory
Nil	None
H	With handle

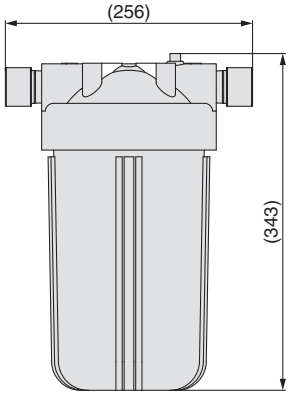
Fluid	Tap water
Max. operating pressure	0.65 MPa
Operating temperature range	5 to 35°C
Nominal filtration accuracy	5 μm
Installation environment	Indoors

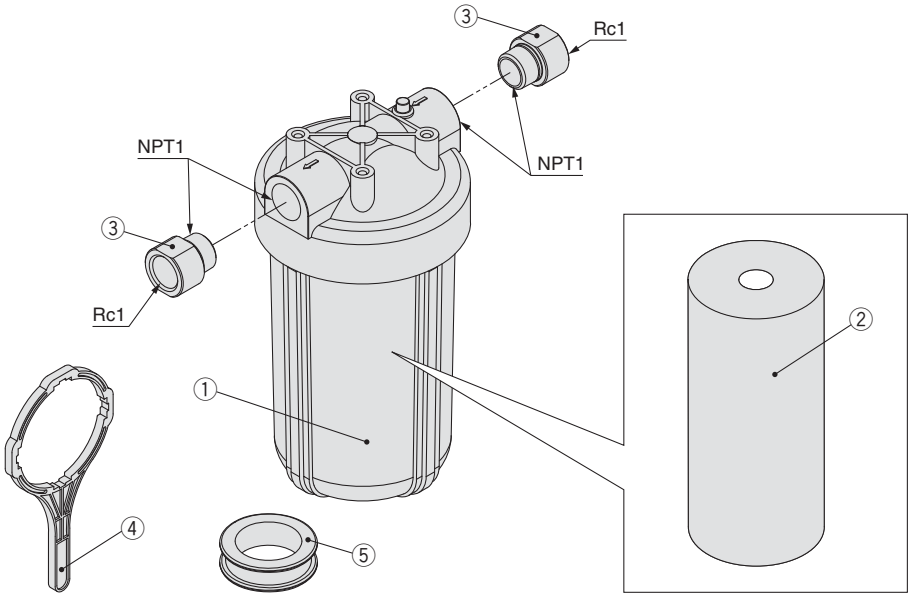
Parts List

No.	Description	Material	Q'ty	Note
①	Body	PC, PP	1	—
②	Element	PP	1	—
③	Extension piece	Stainless steel	2	Conversion from NPT to Rc
④	Handle	—	1	When -H is selected
⑤	Sealant tape	PTFE	1	—

Replacement Element

HRS−PF006



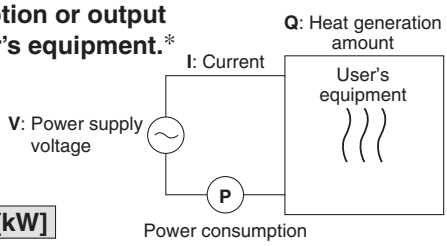


Series HRS100/150
Cooling Capacity Calculation

Required Cooling Capacity Calculation

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

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



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

Power consumption **P**: 7 [kW]

Q = P = 7 [kW]

Cooling capacity = Considering a safety factor of 20%, **7 [kW] x 1.2 =** **8.4 [kW]**

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

Power supply output **VI**: 8.8 [kVA]

Q = P = V x I x Power factor

In this example, using a power factor of 0.85:

= 8.8 [kVA] x 0.85 = 7.5 [kW]

Cooling capacity = Considering a safety factor of 20%,

7.5 [kW] x 1.2 = **9.0 [kW]**

③ **Derive the heat generation amount from the output.**

Output (shaft power etc.) **W**: 5.1 [kW]

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

In this example, using an efficiency of 0.7:

$$\mathbf{= \frac{5.1}{0.7} = 7.3\ [kW]}$$

Cooling capacity = Considering a safety factor of 20%,

7.3 [kW] x 1.2 = **8.8 [kW]**

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

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

Obtain the temperature difference between inlet and outlet by circulating the circulating fluid inside the user's equipment.

Heat generation amount by user's equipment **Q**	: Unknown [W] ([J/s])
Circulating fluid	: Tap water*
Circulating fluid mass flow rate **qm**	: (= ρ x **qv** ÷ 60) [kg/s]
Circulating fluid density ρ	: 1 [kg/L]
Circulating fluid (volume) flow rate **qv**	: 35 [L/min]
Circulating fluid specific heat **C**	: 4.186 x 10^3 [J/(kg·K)]
Circulating fluid outlet temperature $\mathbf{T_1}$	: 293 [K] (20 [°C])
Circulating fluid return temperature $\mathbf{T_2}$	: 296 [K] (23 [°C])
Circulating fluid temperature difference **ΔT**	: 3 [K] (= $\mathbf{T_2 - T_1}$)
Conversion factor: minutes to seconds (SI units)	: 60 [s/min]

* Refer to page 89 for the typical physical property value of tap water or other circulating fluids.

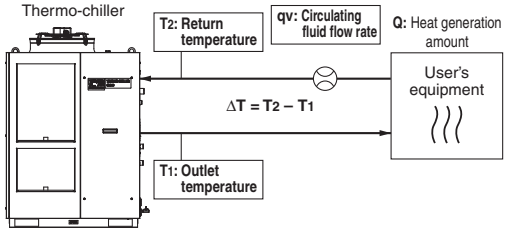
$$\mathbf{Q = qm \times C \times (T_2 - T_1)}$$

$$\mathbf{= \frac{\rho \times qv \times C \times \Delta T}{60} = \frac{1 \times 35 \times 4.186 \times 10^3 \times 3.0}{60}}$$

$$\mathbf{= 7325\ [J/s] \approx 7325\ [W] = 7.3\ [kW]}$$

Cooling capacity = Considering a safety factor of 20%,

7.3 [kW] x 1.2 = **8.8 [kW]**



Example of conventional measurement units (Reference)

Heat generation amount by user's equipment **Q**	: Unknown [cal/h] → [W]
Circulating fluid	: Tap water*
Circulating fluid weight flow rate **qm**	: (= ρ x **qv** x 60) [kgf/h]
Circulating fluid weight volume ratio γ	: 1 [kgf/L]
Circulating fluid (volume) flow rate **qv**	: 35 [L/min]
Circulating fluid specific heat **C**	: 1.0 x 10^3 [cal/(kgf·°C)]
Circulating fluid outlet temperature $\mathbf{T_1}$	: 20 [°C]
Circulating fluid return temperature $\mathbf{T_2}$	: 23 [°C]
Circulating fluid temperature difference **ΔT**	: 3 [°C] (= $\mathbf{T_2 - T_1}$)
Conversion factor: hours to minutes	: 60 [min/h]
Conversion factor: kcal/h to kW	: 860 [(cal/h)/W]

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

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

$$\mathbf{= \frac{1 \times 35 \times 60 \times 1.0 \times 10^3 \times 3.0}{860}}$$

$$\mathbf{\approx 7325\ [W] = 7.3\ [kW]}$$

Cooling capacity = Considering a safety factor of 20%,

7.3 [kW] x 1.2 = **8.8 [kW]**

Required Cooling Capacity Calculation

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

Heat quantity by cooled substance (per unit time) **Q** : Unknown [W] ([J/s])
Cooled substance : Water
Cooled substance mass **m** : (= ρ x **V**) [kg]
Cooled substance density ρ : 1 [kg/L]
Cooled substance total volume **V** : 150 [L]
Cooled substance specific heat **C** : 4.186 x 10^3 [J/(kg·K)]
Cooled substance temperature when cooling begins T_0 : 303 [K] (30 [°C])
Cooled substance temperature after t hour T_t : 293 [K] (20 [°C])
Cooling temperature difference ΔT : 10 [K] (= $T_0 - T_t$)
Cooling time Δt : 900 [s] (= 15 [min])

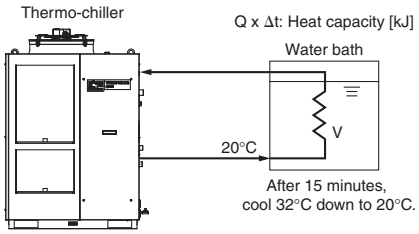
∗ Refer to the following for the typical physical property values by circulating fluid.

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

$$= \frac{1 \times 150 \times 4.186 \times 10^3 \times 10}{900} = 6977 \text{ [J/s]} \approx 7.0 \text{ [kW]}$$

Cooling capacity = Considering a safety factor of 20%,

7.0 [kW] x 1.2 = 8.4 [kW]



Example of conventional measurement units (Reference)

Heat quantity by cooled substance (per unit time) **Q** : Unknown [cal/h] → [W]
Cooled substance : Water
Cooled substance weight **m** : (= ρ x **V**) [kgf]
Cooled substance weight volume ratio γ : 1 [kgf/L]
Cooled substance total volume **V** : 150 [L]
Cooled substance specific heat **C** : 1.0 x 10^3 [cal/(kgf·°C)]
Cooled substance temperature when cooling begins T_0 : 30 [°C]
Cooled substance temperature after t hour T_t : 20 [°C]
Cooling temperature difference ΔT : 10 [°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]

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

$$= \frac{1 \times 150 \times 60 \times 1.0 \times 10^3 \times 10}{15 \times 860}$$

$$\approx 6977 \text{ [W]} = 7.0 \text{ [kW]}$$

Cooling capacity = Considering a safety factor of 20%,

7.0 [kW] x 1.2 = 8.4 [kW]

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

Precautions on Cooling Capacity Calculation

1. Heating capacity

When the circulating fluid temperature is set above room temperature, it needs to be heated by the thermo-chiller. The heating capacity depends on the circulating fluid temperature. Consider the radiation rate and heat capacity of the user's equipment and check beforehand if the required heating capacity is provided.

2. Pump capacity

<Circulating fluid flow rate>

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

<Circulating fluid discharge pressure>

Circulating fluid discharge pressure has the possibility to increase up to the maximum pressure in the pump capacity curves.
Check beforehand if the circulating fluid pipings or circulating fluid circuit of the user's equipment are fully durable against this pressure.

Circulating Fluid Typical Physical Property Values

1. This catalog uses the following values for density and specific heat in calculating the required cooling capacity.

Density ρ: 1 [kg/L] (or, using conventional unit system, weight volume ratio γ = 1 [kgf/L])
Specific heat **C**: 4.19 x 10^3 [J/(kg·K)] (or, using conventional unit system, 1 x 10^3 [cal/(kgf·°C)])

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

Water

Physical property value / Temperature	Density ρ [kg/L]	Specific heat C [J/(kg·K)]	Conventional unit system	
			Weight volume ratio γ [kgf/L]	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/L]	Specific heat C [J/(kg·K)]	Conventional unit system	
			Weight volume ratio γ [kgf/L]	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 shown are reference values. Contact circulating fluid supplier for details.

Series HRS100/150
Specific Product Precautions 1

Be sure to read this before handling. Refer to page 341 for Safety Instructions. For Temperature Control Equipment Precautions, refer to pages 342 to 345 and the Operation Manual on SMC website, http://www.smcworld.com

Design

⚠ Warning

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

1) Check the specifications 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.

3. Use non-corrosive material for fluid contact of circulating fluid and facility water.

Using corrosive materials such as aluminum or iron for fluid contact parts such as piping may cause clogging or leakage in the circulating fluid and facility water circuits. Provide protection against corrosion when you use the product.

4. The facility water outlet temperature (water-cooled type) may increase up to around 60°C.

When selecting the facility water pipings, consider the suitability for temperature.

Selection

⚠ Warning

Model selection

For selecting a model of thermo-chiller, it is required to know the heat generation amount of the user's equipment. Obtain the heat generation amount, referring to "Cooling Capacity Calculation" on pages 88 and 89 before selecting a model.

Handling

⚠ Warning

Thoroughly read the Operation Manual.

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

Operating Environment/Storage Environment

⚠ Warning

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

1) In locations where water vapor, salt water, and oil may splash on the product.
2) In locations where there are dust and particles.
3) In locations where corrosive gases, organic solvents, chemical fluids, or flammable gases are present. (This product is not explosion proof.)
4) In locations where the ambient temperature exceeds the limits as mentioned below.
   During transportation/storage: –15°C to 50°C (But as long as water or circulating fluid are not left inside the pipings)
   During operation: –5°C to 45°C (However, use a 15% ethylene glycol aqueous solution if operating in a place where the ambient temperature or circulating fluid temperature is 10°C or less.)
5) In locations where condensation may occur.
6) In locations which receive direct sunlight or radiated heat.
7) In locations where there is a heat source nearby and the ventilation is poor.
8) In locations where temperature substantially changes.
9) In locations where strong magnetic noise occurs.
   (In locations where strong electric fields, strong magnetic fields and surge voltage occur.)
10) In locations where static electricity occurs, or conditions which make the product discharge static electricity.
11) In locations where high frequency occurs.
12) In locations where damage is likely to occur due to lightning.
13) In locations at altitude of 3000 m or higher (Except during storage and transportation)
   * For altitude of 1000 m or higher
   Because of lower air density, the heat radiation efficiencies of the devices in the product will be lower in the location at altitude of 1000 m or higher. Therefore, the maximum ambient temperature to use and the cooling capacity will lower according to the descriptions in the table below.
   Select the thermo-chiller considering the descriptions.
   ① Upper limit of ambient temperature: Use the product in ambient temperature of the described value or lower at each altitude.
   ② Cooling capacity coefficient: The product's cooling capacity will lower to one that multiplied by the described value at each altitude.

Altitude [m]	① Upper limit of ambient temperature [°C]	② Cooling capacity coefficient
Less than 1000 m	45	1.00
Less than 1500 m	42	0.85
Less than 2000 m	38	0.80
Less than 2500 m	35	0.75
Less than 3000 m	32	0.70

14) In locations where strong impacts or vibrations occur.
15) In locations where a massive force strong enough to deform the product is applied or a weight from a heavy object is applied.
16) In locations where there is not sufficient space for maintenance.
17) In locations where liquid that exceeds the conditions required for the degrees of protection IPX4 may splash on the product.
18) Insects or plants may enter the unit.

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

Series HRS100/150
Specific Product Precautions 2

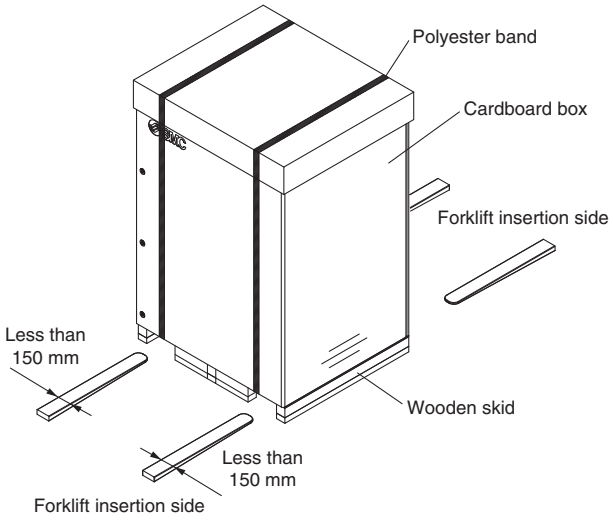
Be sure to read this before handling. Refer to page 341 for Safety Instructions. For Temperature Control Equipment Precautions, refer to pages 342 to 345 and the Operation Manual on SMC website, http://www.smcworld.com

Transportation/Carriage/Movement

⚠ Warning

1. This product will require an acceptance with the product not unloaded from the truck, and the user will need to unload the product by himself. Prepare a forklift.

The product will be delivered in the packaging shown below.



<When packaged>

Model	Weight [kg]	Dimensions [mm]
HRS100-A□-□	212	Height 1585 x Width 1185 x Depth 955
HRS150-A□-□	218	
HRS100-W□-□	186	Height 1485 x Width 925 x Depth 955
HRS150-W□-□	189	
HRS100-A□-□-A	231	Height 1710 x Width 1185 x Depth 955
HRS150-A□-□-A	237	
HRS100-W□-□-A	205	Height 1610 x Width 925 x Depth 955
HRS150-W□-□-A	208	

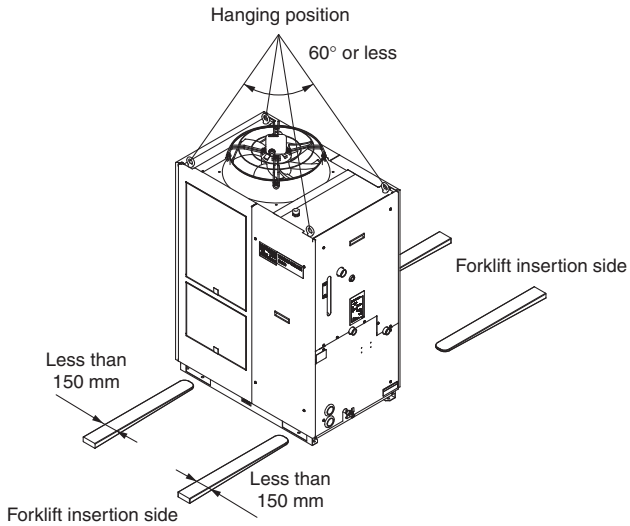
2. Transportation by forklift

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

⚠ Warning

3. Hanging transportation

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



HRS150-A-20

<When using option A>

4. Transporting using casters

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

Mounting/Installation

⚠ Warning

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.

Series HRS100/150
Specific Product Precautions 3

Be sure to read this before handling. Refer to page 341 for Safety Instructions. For Temperature Control Equipment Precautions, refer to pages 342 to 345 and the Operation Manual on SMC website, http://www.smcworld.com

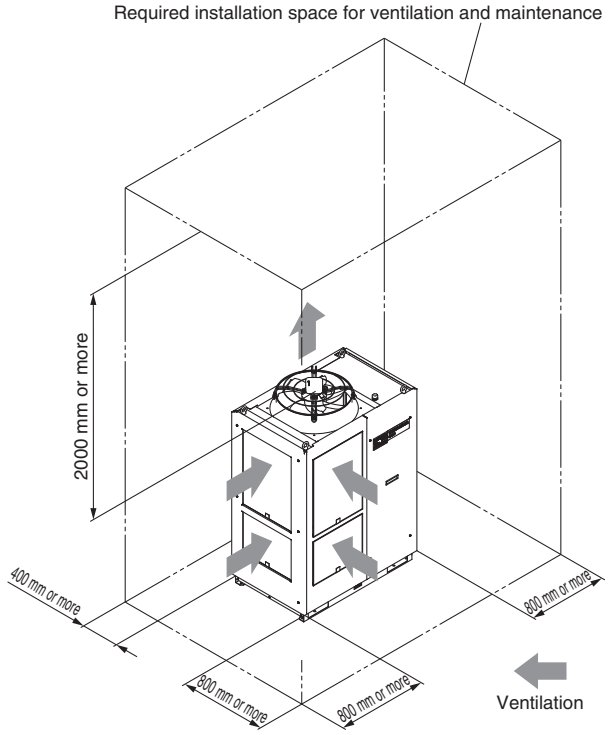
Mounting/Installation

⚠ Caution

3. Refer to the Operation Manual for this product, and secure an installation space that is necessary for the maintenance and ventilation.

<Air-cooled refrigeration>

1. The air-cooled type product exhausts heat using the fan that is mounted to the product. If the product is operated with insufficient ventilation, ambient temperature may exceed 45°C, and this will affect the performance and life of the product. To prevent this ensure that suitable ventilation is available (see below).
2. For installation indoors, ventilation ports and a ventilation fan should be equipped as needed.



HRS150-A-20

3. If it is impossible to exhaust heat from the installation area indoors, or when the installation area is conditioned, provide a duct for heat exhaustion to the air outlet port of this product for ventilation. Do not mount the inlet of the duct (flange) directly to the air vent of the product, and keep a space larger than the diameter of the duct. Additionally, consider the resistance of the duct when making the air vent port for the duct.

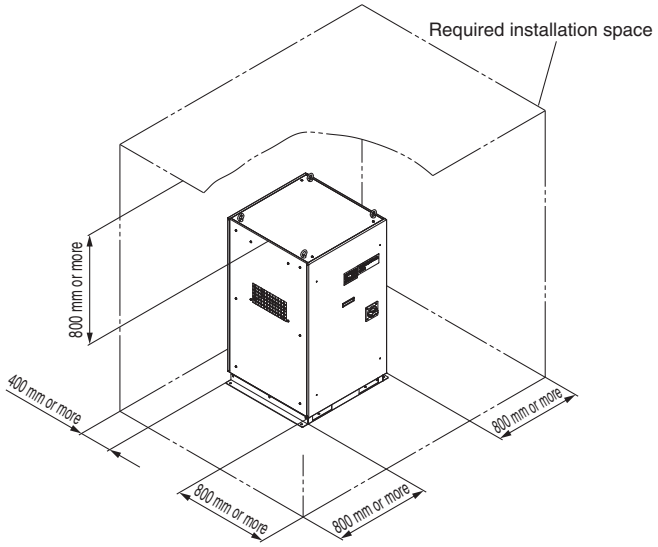
<Heat radiation amount/Required ventilation rate>

Model	Heat radiation amount [kW]	Required ventilation rate [m³/min]	
		Differential temp. of 3°C between inside and outside of installation area	Differential temp. of 6°C between inside and outside of installation area
HRS100-A-□	Approx. 18	305	155
HRS150-A-□	Approx. 26	440	220

⚠ Caution

<Water-cooled refrigeration>

When installing the product, keep the space for maintenance as shown below.



Piping

⚠ Caution

1. Regarding the circulating fluid and facility water pipings, consider carefully the suitability for temperature, circulating fluid and facility water.

If the operating performance is not sufficient, the pipings may burst during operation. Using corrosive materials such as aluminum or iron for fluid contact parts such as piping may cause clogging or leakage in the circulating fluid and facility water circuits. Provide protection against corrosion when you use the product.

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 drain port of this product, use a pipe wrench to clamp the connection ports.

4. Supply water pressure to the automatic fluid fill port of this product should be 0.2 to 0.5 MPa.

This product has a built-in ball (float) tap. If you attach it to the faucet of a sink etc. it will automatically supply water to the rated fluid level of the tank (halfway between HIGH and LOW.) If the water supply pressure is too high, the pipes may burst during use. Proceed with caution.

5. Ensure that piping is connected to the overflow port so that the circulating fluid can be exhausted to the drainage pit when the fluid level in the tank increases.

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

7. This product series are constant-temperature fluid circulating machines 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.

Series HRS100/150
Specific Product Precautions 4

Be sure to read this before handling. Refer to page 341 for Safety Instructions. For Temperature Control Equipment Precautions, refer to pages 342 to 345 and the Operation Manual on SMC website, http://www.smcworld.com

Electrical Wiring

⚠ Warning

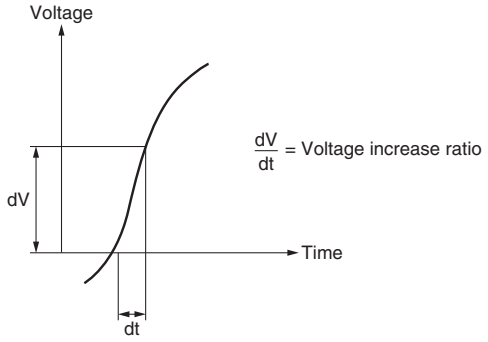
Grounding should never be connected to a water line, gas line or lightning rod.

⚠ Caution

1. Power supply and communication cables should be prepared by user.

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.

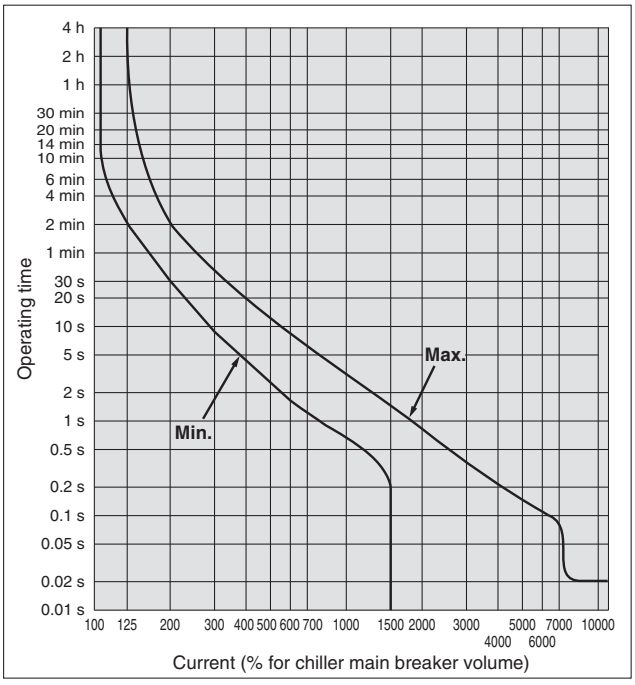


<For option B [With earth leakage breaker]>

3. This product is installed with a breaker with the following operating characteristics.

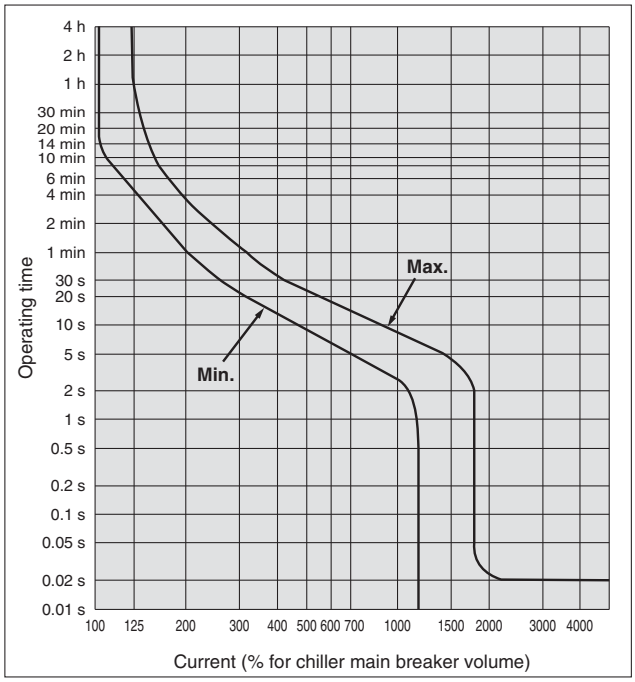
For the user's equipment (inlet side), use a breaker whose operating time is equal to or longer than the breaker of this product. If a breaker with shorter operating time is connected, the user's equipment could be cut off due to the inrush current of the motor of this product.

HRS100-A/W-20/40, HRS150-A/W-40



⚠ Caution

HRS150-A/W-20



SMC

Series HRS100/150
Specific Product Precautions 5

Be sure to read this before handling. Refer to page 341 for Safety Instructions. For Temperature Control Equipment Precautions, refer to pages 342 to 345 and the Operation Manual on SMC website, http://www.smcworld.com

Circulating Fluid

⚠ Caution

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

2. When water is used as a circulating fluid, use tap water that conforms to the appropriate water quality standards.

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

Tap Water (as Circulating Fluid) Quality Standards

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

	Item	Unit	Standard value	Influence	
				Corrosion	Scale generation
Standard item	pH (at 25°C)	—	6.0 to 8.0	○	○
	Electric 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		○
	Ionic state silica (SiO_2)	[mg/L]	30 or less		○
Reference item	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.
• ○: Factors that have an effect on corrosion or scale generation.
• Even if the water quality standards are met, complete prevention of corrosion is not guaranteed.

3. Use an ethylene glycol that does not contain additives such as preservatives.

4. When using an 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. When deionized water is used, the electric conductivity should be 1 μS/cm or higher (Electric resistivity: 1 MΩ·cm or lower).

Facility Water Supply

⚠ Warning

<Water-cooled refrigeration>

1. The water-cooled refrigeration type thermo-chiller radiates heat to the facility water.
Prepare the facility water system that satisfies the heat radiation and the facility water specifications below.

■ Required facility water system
<Heat radiation amount/Facility water specifications>

Model	Heat radiation [kW]	Facility water specifications
HRS100-W-□	Approx. 19	Refer to "Facility water system" in the specifications on page 72.
HRS150-W-□	Approx. 28	

2. When using tap water as facility water, use tap water that conforms to the appropriate water quality standards.
Use tap water that conforms to the standards shown below.

Tap Water (as Facility Water) Quality Standards

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

	Item	Unit	Standard value	Influence	
				Corrosion	Scale generation
Standard item	pH (at 25°C)	—	6.5 to 8.2	○	○
	Electric conductivity (25°C)	[μS/cm]	100* to 800*	○	○
	Chloride ion (Cl^-)	[mg/L]	200 or less	○	
	Sulfuric acid ion (SO_4^{2-})	[mg/L]	200 or less	○	
	Acid consumption amount (at pH4.8)	[mg/L]	100 or less		○
	Total hardness	[mg/L]	200 or less		○
	Calcium hardness ($CaCO_3$)	[mg/L]	150 or less		○
	Ionic state silica (SiO_2)	[mg/L]	50 or less		○
Reference item	Iron (Fe)	[mg/L]	1.0 or less	○	○
	Copper (Cu)	[mg/L]	0.3 or less	○	
	Sulfide ion (S^{2-})	[mg/L]	Should not be detected.	○	
	Ammonium ion (NH_4^+)	[mg/L]	1.0 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 0.001 to 0.01.
• ○: Factors that have an effect on corrosion or scale generation.
• Even if the water quality standards are met, complete prevention of corrosion is not guaranteed.

3. Set the supply pressure between 0.3 to 0.5 MPa. Ensure a pressure difference at the facility water inlet/outlet of 0.3 MPa or more.

If the supply pressure is high, it will cause water leakage. If the supply pressure and pressure difference at the facility water inlet/outlet is low, it will cause an insufficient flow rate of the facility water, and poor temperature control.

Series HRS100/150
Specific Product Precautions 6

Be sure to read this before handling. Refer to page 341 for Safety Instructions. For Temperature Control Equipment Precautions, refer to pages 342 to 345 and the Operation Manual on SMC website, http://www.smcworld.com

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 the 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.
Pump can be operated independently.

2. Confirmation during operation

• Check the circulating fluid temperature.
The operating temperature range of the circulating fluid is between 5 and 35°C.
When the amount of heat generated from the user's equipment is greater than the product's capability, the circulating fluid temperature may exceed this range. Use caution regarding this matter.

3. Emergency stop method

• When an abnormality is confirmed, stop the machine immediately. After the machine has stopped, make sure to turn off the breaker of the user's equipment (on the upstream side).

Operation Restart Time

⚠ Caution

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

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

• Power supply voltage is not within the rated voltage range of ±10%.
• In case the water level inside the tank is reduced abnormally.
• Circulating fluid temperature is too high.
• Compared to the cooling capacity, the heat generation amount of the user's equipment is too high.
• Ambient temperature is over 45°C.
• Ventilation hole is clogged with dust or dirt.

Maintenance

⚠ Caution

<Periodical inspection every one month>

Clean the ventilation hole.

If the dustproof filter of water-cooled type product becomes clogged with dust or debris, a decline in cooling performance can result.
In order to avoid deforming or damaging the dustproof filter, clean it with a long-haired brush or air gun.

<Periodical inspection every three months>

Inspect the circulating fluid.

1. When using tap water or deionized water
• Replacement of circulating fluid
Failure to replace the circulating fluid can lead to the development of bacteria or algae. Replace it regularly depending on your usage conditions.
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 and facility water freezing when the product is stopped, release the circulating fluid and facility water in advance.

2. Consult a professional.

This product has an "anti-freezing function", "warming-up function", and "anti-snow coverage function". Read the Operation Manual carefully, and if any additional anti-freezing function (e.g. tape heater) is needed, ask for it from the vendor.

Circulating Fluid Temperature Controller

Thermo-chiller

Series HRSH090

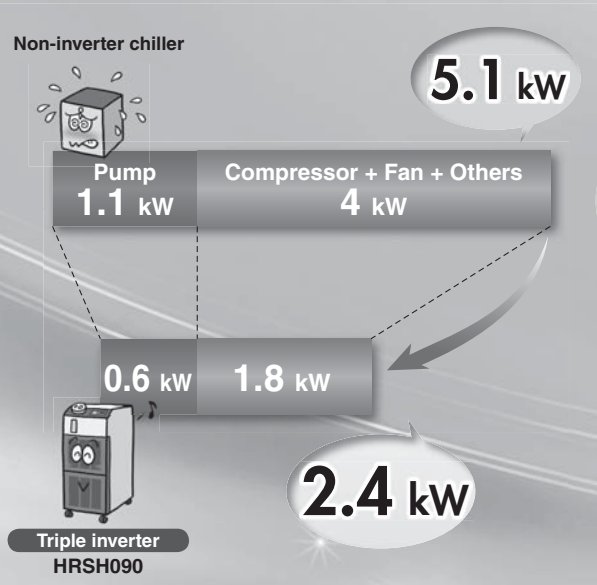
Inverter Type

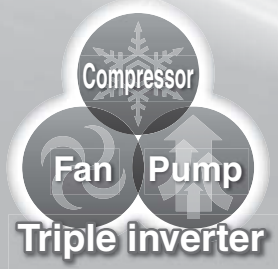
Power consumption reduced by 53%*

(Only 400 VAC type) (UL Standard)

RoHS

Outstanding energy saving effect with the triple inverter!





1. DC inverter compressor
2. DC inverter fan (For air-cooled type)
3. Inverter pump

*1 Under the conditions shown on page 97

Water-cooled refrigeration | Air-cooled refrigeration



Cooling capacity 9.5 kW

Temperature stability ±0.1°C (when a load is stable)

Set temperature range 5°C to 40°C

Compact, Space-saving

W 377 x H 1080 x D 970 mm

Low-noise design Operating noise Max. 66 dB

Max. ambient temperature 45°C

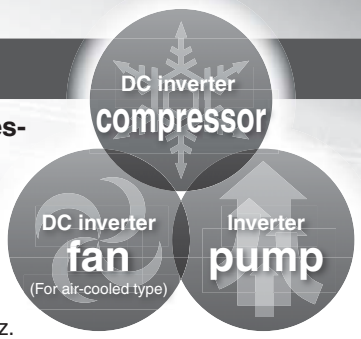
Indoor use

Compatible power supplies in Europe, Asia, Oceania, North, Central and South America

- 3-phase 200 V
- 3-phase 400 V

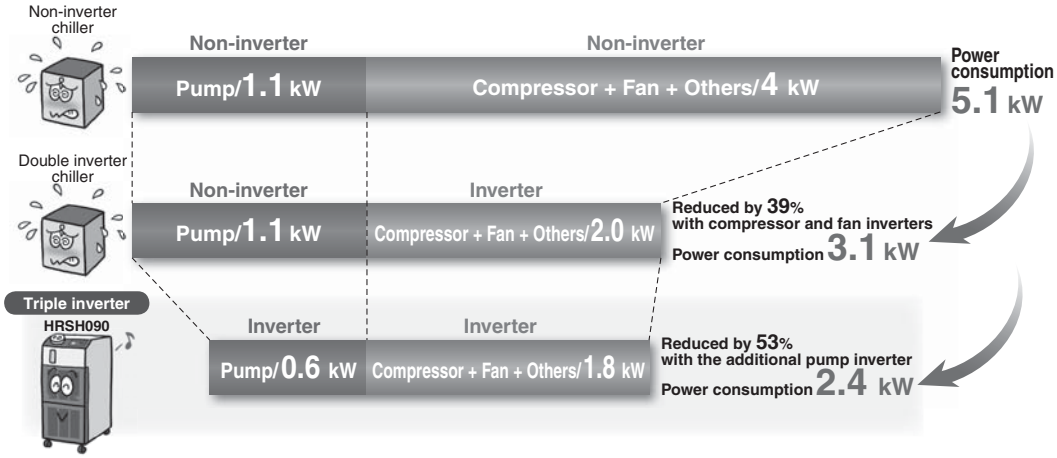
Triple inverter

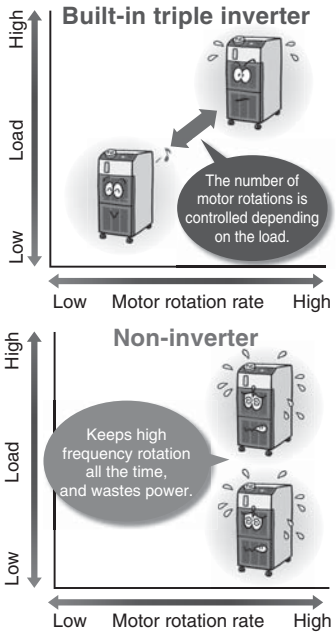
The inverter respectively controls the number of motor rotations of the compressor, fan and pump depending on the load from the user's equipment.



Power consumption **reduced by 53%**
compared with a non-inverter

With the inverter, it is possible to operate with the same performance even with the power supply of 50 Hz.





Operating ratio: Ratio of 9.5 kW (with heat load) to 0 kW (without heat load) Operating ratio: 50%, with heat load of 9.5 kW all the time

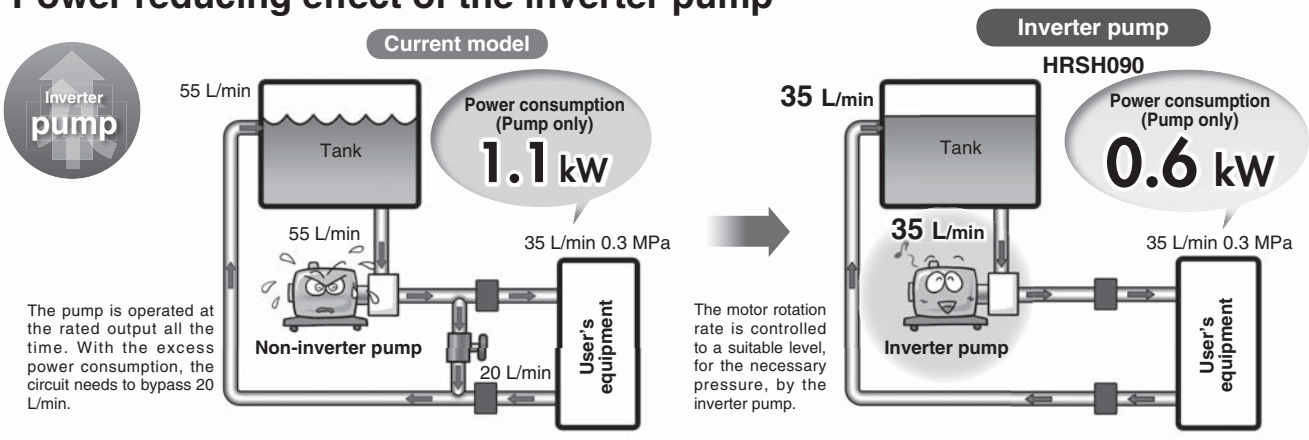
Conditions

Common conditions for non-inverter and triple inverter:
- Ambient temperature: 32°C
- Circulating fluid temperature: 20°C
- Circulating fluid flow rate: 35 L/min@0.3 MPa (60 Hz)
- Heat load: 9.5 kW

Conditions for non-inverter chiller: Continuous operation of the compressor which can cool down 9.5 kW at 60 Hz. The pump shall be same as that of the HRSH.

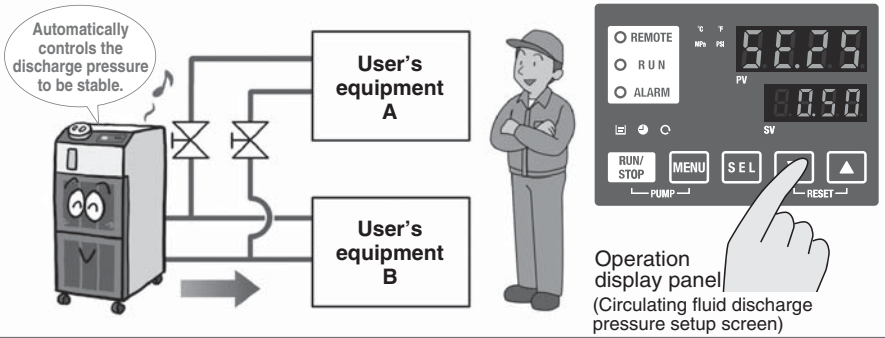
Inverter pump

Power reducing effect of the inverter pump



Circulating fluid pressure adjustable

Discharge pressure of the circulating fluid can be set with the operation panel. The inverter pump automatically controls the discharge pressure to the set pressure without adjusting the bypass piping under various piping conditions. Power consumption can be reduced by this control.
(Operation to the set pump operating frequency is also possible.)

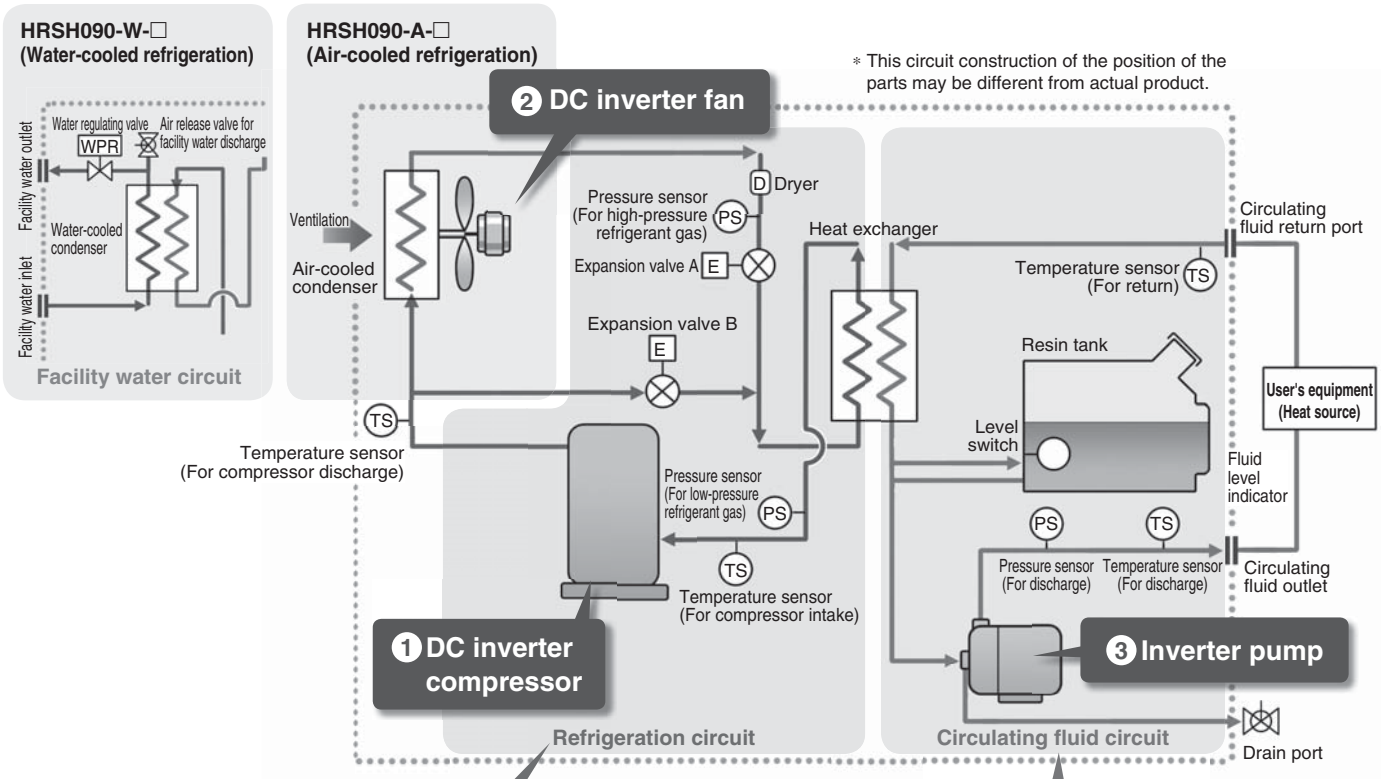


When the product is used with the flow path switched for maintenance, the pressure adjusting function controls the discharge pressure to be stable. (Secure the specified minimum flow for each branch circuit.)

Variations

Model	Cooling method	Cooling capacity	Power supply	Option Page 114	Optional accessories Pages 115, 116	International standards
	Air-cooled refrigeration	9.5 kW	· 3-phase 200 VAC (50 Hz), 3-phase 200 to 230 VAC (60 Hz) · 3-phase 380 to 415 VAC (50/60 Hz)	· With earth leakage breaker (For 400 V type as standard) · Applicable to deionized water piping	· Piping conversion fitting · Bypass piping set · Electric conductivity control set · Particle filter set	CE (400 V as standard) (Only 200 V as an option)
	Water-cooled refrigeration	11.0 kW				

Circuit diagram



Refrigeration circuit

- The DC inverter compressor compresses the refrigerant gas, and discharges the high temperature and high pressure refrigerant gas.
- In the case of air-cooled refrigeration, the high temperature and high pressure refrigerant gas is cooled down by an air-cooled condenser with the ventilation of the DC inverter fan, and becomes a liquid. In the case of water-cooled refrigeration, the refrigerant gas is cooled by a water-cooled condenser with the facility water in the facility water circuit, and becomes a liquid.
- The liquefied high pressure refrigerant gas expands and its temperature lowers when it passes through expansion valve A and vaporizes by taking heat from the circulating fluid in the evaporator.
- The vaporized refrigerant gas is sucked into the DC inverter compressor and compressed again.
- When heating the circulating fluid, the high pressure and high temperature refrigerant gas is bypassed into the evaporator by expansion valve B, to heat the circulating fluid.

POINT

The combination of inverter control of the compressor and fan (facility water flow control by a water regulating valve is used in water-cooled refrigeration), and the precise control of expansion valves A and B realizes energy saving operation without waste and high temperature stability.

Circulating fluid circuit

- The circulating fluid discharged from the inverter pump, is heated or cooled by the user's equipment and returns to the tank.
- The circulating fluid is sent to the evaporator by the inverter pump, and is controlled to a set temperature by the refrigeration circuit, to be discharged to the user's equipment side again by the thermo-chiller.

POINT

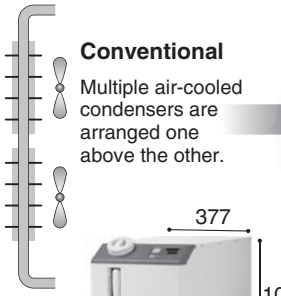
Adjusting the discharge pressure by pump inverter control eliminates wasteful discharge of the circulating fluid and realizes energy saving operation.

POINT

Since the refrigeration circuit is controlled by the signal from 2 temperature sensors (for return and discharge), precise temperature control of the circulating fluid can be performed. Therefore, there is no necessity of absorbing the temperature difference in the circulating fluid with a large tank capacity, and realizes high temperature stability even with a small-size tank. Also, contributes to space-saving.

Compact and lightweight 130 kg

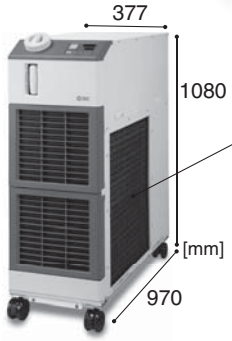
Reduced-height double condenser structure



Conventional

Multiple air-cooled condensers are arranged one above the other.

Achieved a maximum reduction in the height of the product while expanding the cooling capacity, by providing overlapped air-cooled condensers.



Aluminum air-cooled condenser

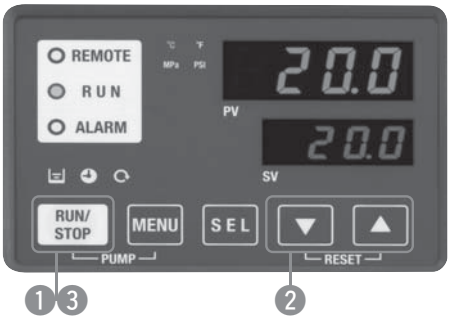
High heat transfer efficiency, Lightweight

Compact tank 18 L

Temperature followability control reduced the tank capacity required as a buffer.

Simple operation

Step ❶ Press the RUN/STOP key.
Step ❷ Adjust the temperature setting with the ▼/▲ keys.
Step ❸ Press the RUN/STOP key to stop.
Easy operation by these steps



Large digital display

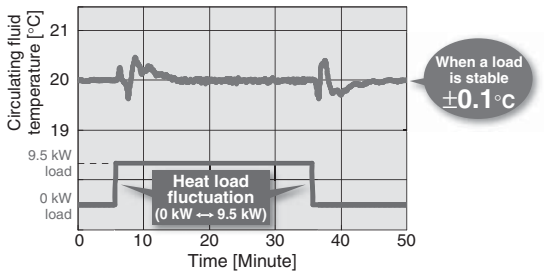
The "large digital display" (7-segment and 4 digits) and "2 row display" provide a clearer view of the current value (PV) and set value (SV).

Temperature stability ±0.1°C (when a load is stable)

By controlling the DC inverter compressor, DC inverter fan, and electronic expansion valve simultaneously, it maintains the good temperature stability when the heat load fluctuates.

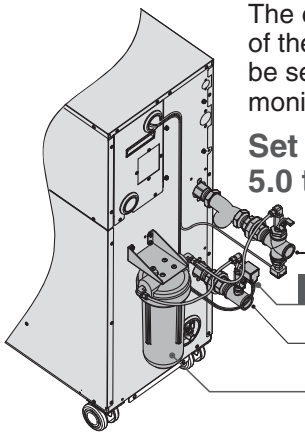
∗ **For HRSH090-A-20**

Conditions
- Outdoor air temperature: 32°C
- Heat load in the user's equipment: 9.5 kW
- Circulating fluid flow: 45 L/min@0.5 MPa
- Circulating fluid temperature setting: 20°C
- Power supply: 200 V, 60 Hz
- External piping: Bypass piping + Heat load



Electric conductivity control set

(With DI filter + Solenoid valve kit for control)



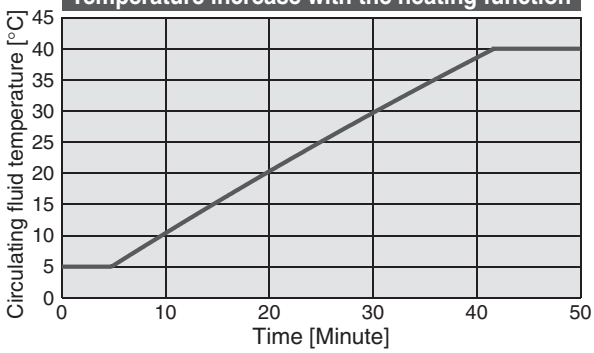
The electric conductivity of the circulating fluid can be set with the controller monitor arbitrarily.

Set control range: 5.0 to 45.0 μS/cm

Circulating fluid return port
Solenoid valve for control
Circulating fluid outlet
DI filter

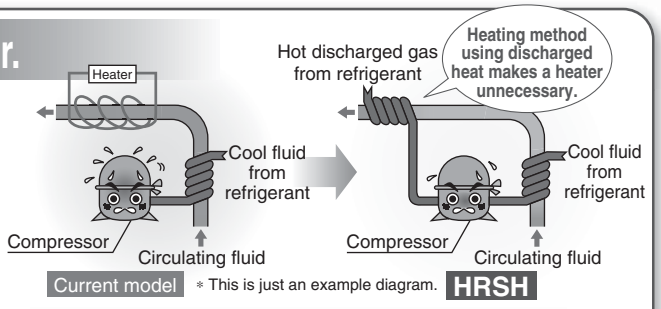
Circulating fluid can be heated without a heater.

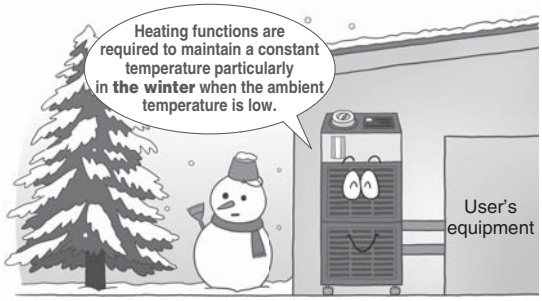
Temperature increase with the heating function



∗ **For HRSH090-A-20**

Conditions
- Ambient temperature: 5°C
- Circulating fluid flow: 45 L/min@0.5 MPa
- External piping: Bypass piping
- Power supply: 200 V, 60 Hz





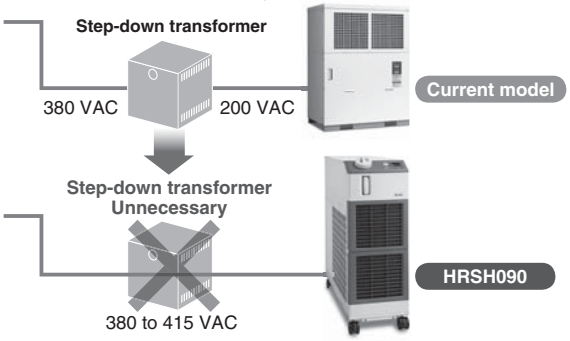
Globally compatible power supplies CE (400 V type only)

(Europe, Asia, Oceania, Central and South America)

Transformer unnecessary

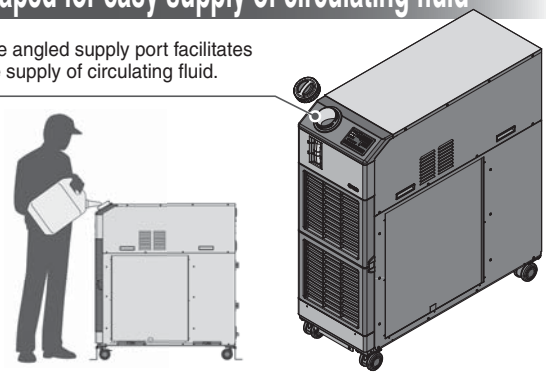
Power supply Applicable to **200 to 230 VAC**, or **380 to 415 VAC**

Transformers are unnecessary even when used overseas.

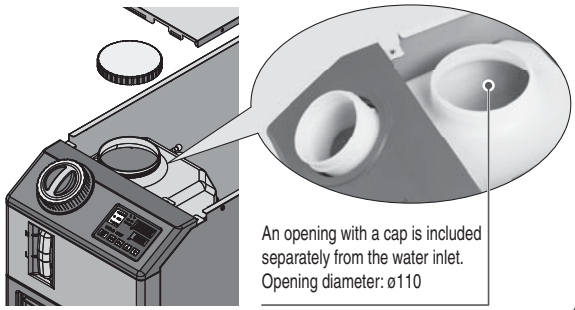


Shaped for easy supply of circulating fluid

The angled supply port facilitates the supply of circulating fluid.

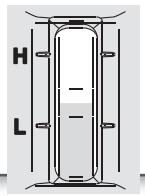


Easy cleaning of the tank



An opening with a cap is included separately from the water inlet.
Opening diameter: ø110

Easy check of the circulating fluid level



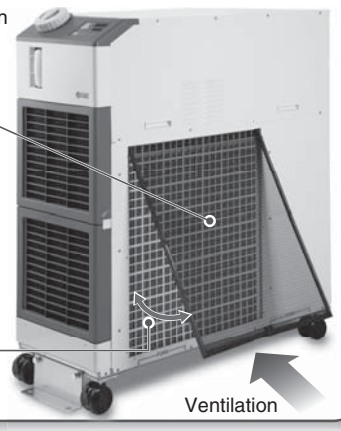
Tool-less inspection and cleaning of air-cooled condenser

* For air-cooled refrigeration

Dustproof filter

* It can be removed with no tools.

Easy to clean dust and cutting chips etc. stuck to the dustproof net with a brush or air blow.

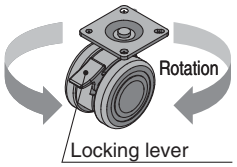




Anchor bolt fixing bracket

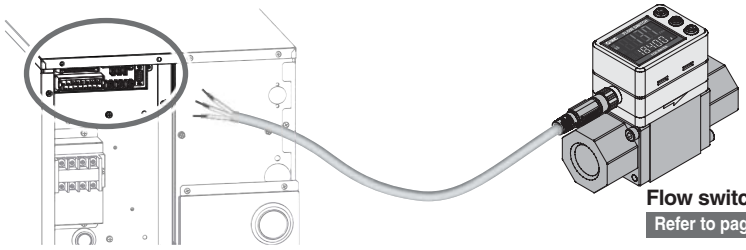
* Remove bracket when moving, using casters.

With unfixed caster



Power supply (24 VDC) available

Power can be supplied from the terminal block on the rear side to external switches etc.



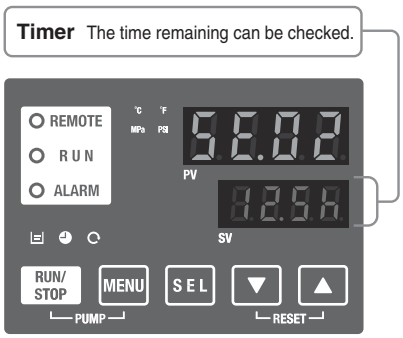
Refer to page 104.

Convenient functions (Refer to the Operation Manual for details.)

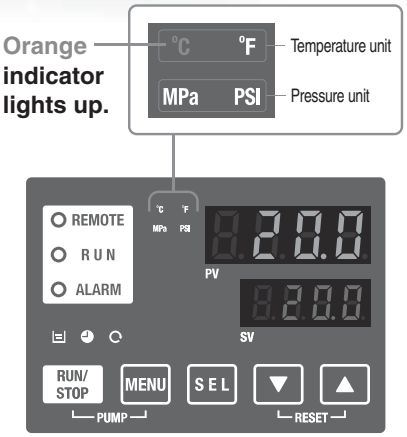
Timer operation function
Timer for ON and OFF can be set in units of 0.5 h up to 99.5 h.

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

Ex. **SE.02 "ON timer"**



Unit conversion function
Temperature and pressure units can be changed.



Power failure auto-restart function
Automatic restart from stoppage due to power failure etc. is possible without pressing the RUN/STOP key and remote operation.

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.

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.

Independent operation of the pump
The pump can be operated independently while chiller is powered off. You can check piping leak and remove the air.

Self diagnosis and check display

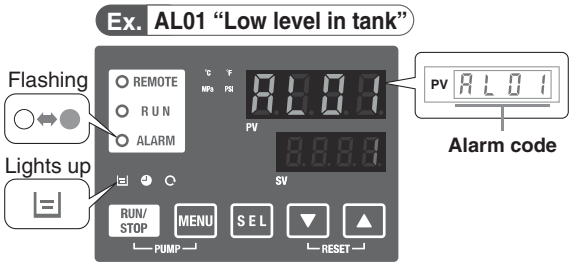
Display of individual alarm codes For details, refer to page 112.

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.
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 55°C
Circulating fluid discharge temperature drop	1 to 39°C
Circulating fluid discharge pressure rise	0.05 to 0.6 MPa
Circulating fluid discharge pressure drop	0.05 to 0.6 MPa

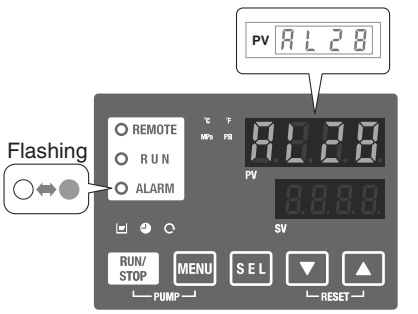
Ex. **AL01 "Low level in tank"**



Alarm codes notify of checking times.
Notifies when to check the pump and fan motor.
Helpful for facility maintenance.

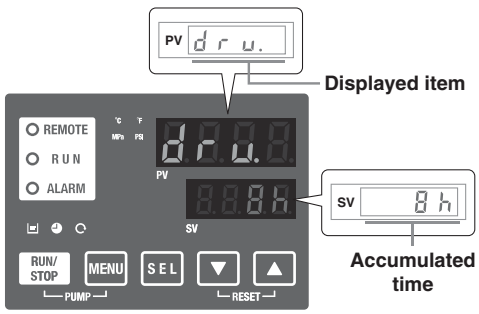
∗ The fan motor is not used in water-cooled refrigeration.

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 outlet temperature
Circulating fluid return temperature
Circulating fluid flow rate *1
Compressor gas temperature
Circulating fluid outlet pressure
Compressor gas discharge pressure
Compressor gas return pressure
Accumulated operating time
Accumulated operating time of pump
Accumulated operating time of fan *2
Accumulated operating time of compressor
Accumulated operation time of dustproof filter *2

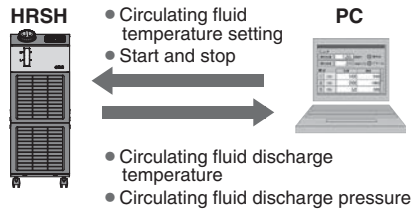
∗1 This is not measurement value. Use it for reference.
∗2 These are displayed only for air-cooled refrigeration.

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 equipment 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.).

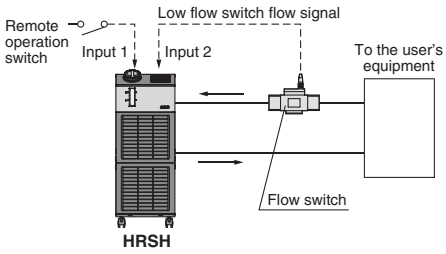
Ex. 1 Remote signal I/O through serial communication

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



Ex. 2 Remote operation signal input

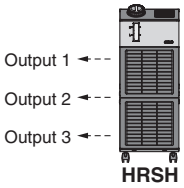
One of the contact inputs is used for remote operation and the other is used for a flow switch to monitor the flow, and their warning outputs are taken in.



Power for flow switch (24 VDC) can be supplied from thermo-chiller.

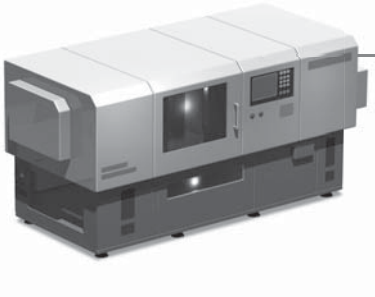
Ex. 3 Alarm and operation status (start, stop, etc.) signal output

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



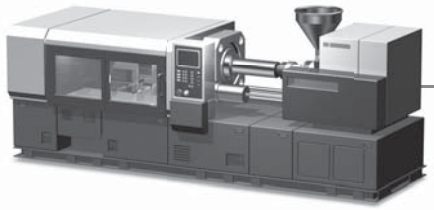
· Output setting example
Output 1: Temperature rise
Output 2: Pressure rise
Output 3: Operation status (start, stop, etc.)

Applications

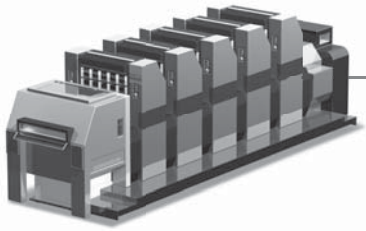


Laser beam machine/Laser welding machine

Cooling of the laser oscillation part and power source

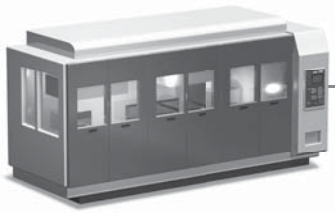


Injection molding



Printing machine

Temperature control of the roller

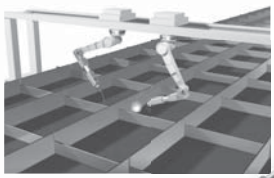


Cleaning machine

Temperature control of cleaning solution

Arc welding machine

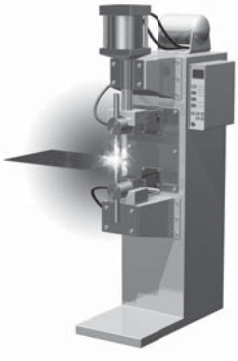
Cooling of the power source





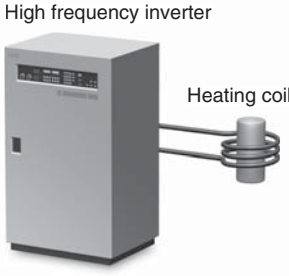
Resistance welding machine (Spot welding)

Cooling of the welding head electrodes, transformers and transistors (thyristors)



High frequency induction heating equipment

Cooling of the heating coils, high frequency power source and around inverters



Global Supply Network

SMC has a comprehensive network in the global market.

We now have a presence of more than 400 branch offices and distributors in 78 countries world wide such as Asia, Oceania, North/Central/South America, and Europe. With this global network, we are able to provide a global supply of our substantial range of products with the best service. We also provide full support to local factories, foreign manufacturing companies and Japanese companies in each country.





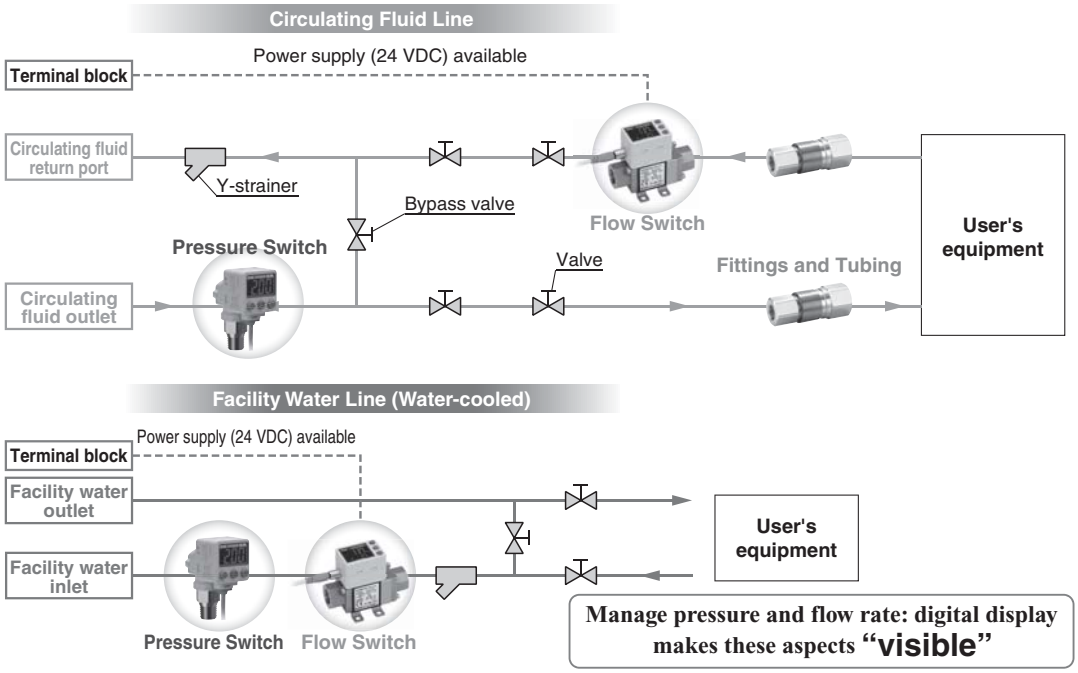
SMC Thermo-chiller Variations

Lots of variations are available in response to the users' requirements.

Series	Temperature stability [°C]	Set temperature range [°C]	Cooling capacity [kW]												Environment	International standards
			1.2	1.8	2.4	3	5	6	9	10	15	20	25	28		
 **HRSE Basic type**	±2.0	10 to 30	●	●	●										Indoor use	CE (Only 230 VAC type)
 **HRS Standard type**	±0.1	5 to 40	●	●	●	●	●	●							Indoor use	CE (60 Hz only)
 **HRS100/150 Standard type**	±1.0	5 to 35								●	●				Outdoor installation IPX4	CE (400 V as standard)
 **HRSH090 Inverter type**	±0.1	5 to 40							●						Indoor use	CE (400 V as standard) ETL (Only 200 V as an option)
 **HRSH Inverter type**	±0.1	5 to 35								●	●	●	●	●	Outdoor installation IPX4	CE (400 V as standard, 200 V as an option) ETL (Only 200 V as an option)

Circulating Fluid/Facility Water Line Equipment





Manage pressure and flow rate: digital display makes these aspects "visible"

Flow Switch: Monitors flow rate and temperature of the circulating fluid.

Refer to **the WEB catalog** or the Best Pneumatics No. 6 for details.

3-Color Display Digital Flow Switch for Water ***PF3W***



Integrated flow adjustment valve and temperature sensor



PVC Piping

3-Color Display Electromagnetic Type Digital Flow Switch ***LFE***



Digital Flow Switch for Deionized Water and Chemical Liquids ***PF2D***
4-Channel Flow Monitor ***PF2□200***



Pressure Switch: Monitors pressure of the circulating fluid.

Refer to **the WEB catalog** or the Best Pneumatics No. 6 for details.



2-Color Display High-Precision Digital Pressure Switch ***ISE80***



Pressure Sensor for General Fluids ***PSE56□***
Pressure Sensor Controller ***PSE200,300***

Fittings and Tubing

Refer to **the WEB catalog** or the Best Pneumatics No. 6 for details.

S Coupler ***KK***



S Coupler/Stainless Steel (Stainless Steel 304) ***KKA***



Metal One-touch Fittings ***KQB2***



Stainless Steel 316 One-touch Fittings ***KQG2***



Stainless Steel 316 Insert Fittings ***KFG2***



Fluoropolymer Fittings ***LQ***



Tubing ***T□***



Series	Material
T	Nylon
TU	Polyurethane
TH	FEP (Fluoropolymer)
TD	Modified PTFE (Soft fluoropolymer)
TL	Super PFA
TLM	PFA

CONTENTS

Series HRSH090 Inverter Type



Thermo-chiller Series HRSH090

How to Order/Specifications
- Air-cooled 200 V/400 V ····· Page 107
- Water-cooled 200 V/400 V ····· Page 108

Cooling Capacity ····· Page 109
Pump Capacity ····· Page 109
Dimensions ····· Page 110
Recommended External Piping Flow ····· Page 111
Cable Specifications ····· Page 111
Operation Display Panel ····· Page 112
List of Function ····· Page 112
Alarm ····· Page 112
Communication Function ····· Page 113

Options
With Earth Leakage Breaker ····· Page 114
With Automatic Fluid Fill Function ····· Page 114
Applicable to Deionized Water Piping ····· Page 114
Conforming to CE/UL Standards ····· Page 114

Optional Accessories
① Piping Conversion Fitting ····· Page 115
② Bypass Piping Set ····· Page 115
③ Electric Conductivity Control Set ····· Page 116
④ Particle Filter Set ····· Page 116

Cooling Capacity Calculation
Required Cooling Capacity Calculation ····· Page 117
Precautions on Cooling Capacity Calculation ··· Page 118
Circulating Fluid Typical Physical Property Values ··· Page 118

Specific Product Precautions ····· Page 119

Thermo-chiller Inverter Type
Air-cooled 200 V/400 V Type
Series HRSH090

(400 V type only) (UL Standards)

RoHS



How to Order

HRSH 090 – A □ – 20 – □

Cooling capacity

090	9.5 kW

Cooling method

A	Air-cooled refrigeration

Pipe thread type

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

Power supply

20	3-phase 200 VAC (50 Hz) 3-phase 200 to 230 VAC (60 Hz)
40	3-phase 380 to 415 VAC (50/60 Hz)

Option

Nil	None
B Note 1)	With earth leakage breaker
J	With automatic fluid fill function
M	Applicable to deionized water piping
S Note 2)	Conforming to CE/UL standards

- When multiple options are combined, indicate symbols in alphabetical order.

Note 1) 200 V type only.
400 V type is provided with an earth leakage breaker as standard.

Note 2) 200 V type only.
Combination with option B is not necessary.
An earth leakage breaker is equipped as standard.

Specifications

Model				HRSH090-A□-20-□	HRSH090-A□-40-□
Cooling method				Air-cooled refrigeration	
Refrigerant				R410A (HFC) (GWP1975)	
Control method				PID control	
Ambient temperature/humidity Note 1), 9)			°C/%	5 to 45/30 to 70%	
Circulating fluid system	Circulating fluid Note 2)			Tap water, 15% Ethylene glycol aqueous solution, Deionized water	
	Set temperature range Note 1)		°C	5 to 40	
	Cooling capacity Note 3), 9)		kW	9.5	
	Heating capacity Note 4)		kW	2.5	
	Temperature stability Note 5)		°C	±0.1	
	Pump capacity	Rated flow (Outlet)	L/min	45 (0.5 MPa)	
		Maximum flow rate	L/min	60	
		Maximum pump head	m	50	
	Settable pressure range Note 6)		MPa	0.1 to 0.5	
	Minimum operating flow rate Note 7)		L/min	20	
	Tank capacity		L	18	
	Circulating fluid outlet, circulating fluid return port			Rc1 (Symbol F: G1, Symbol N: NPT1)	
	Tank drain port			Rc1/4 (Symbol F: G1/4, Symbol N: NPT1/4)	
	Fluid contact material			Stainless steel, Copper (Heat exchanger brazing), Brass, Bronze, Carbon, Ceramic, PE, PVC, POM, PTFE, NBR, EPDM, FKM, PP	
Electrical system	Power supply			3-phase 200 VAC (50 Hz), 3-phase 200 to 230 VAC (60 Hz) Allowable voltage range ±10% (No continuous voltage fluctuation)	3-phase 380 to 415 VAC (50/60 Hz) Allowable voltage range ±10% (No continuous voltage fluctuation)
	Applicable earth leakage breaker Note 8)	Rated current	A	30	20
		Sensitivity of leak current	mA	30	
	Rated operating current Note 5)		A	15	8
	Rated power consumption Note 5)		kW (kVA)	4.6 (5.2)	5.0 (5.6)
Noise level (Front 1 m/Height 1 m) Note 5)			dB (A)	66	
Accessories				Alarm code list stickers 2 pcs. (English 1 pc./Japanese 1 pc.), Operation Manual (for installation/operation) 2 pcs. (English 1 pc./Japanese 1 pc.), Y-strainer (40 meshes) 25A, Barrel nipple 25A, Anchor bolt fixing brackets 2 pcs. (including 4 M10 bolts) Note 10)	
Weight (dry state)			kg	Approx. 130	

Note 1) Use a 15% ethylene glycol aqueous solution if operating in a place where the ambient temperature and/or circulating fluid temperature is 10°C or less.
Note 2) Use fluid in condition below as the circulating fluid.
Tap water: Standard of The Japan Refrigeration And Air Conditioning Industry Association (JRA GL-02-1994)
15% ethylene glycol aqueous solution: diluted by tap water in condition above without any additives such as antiseptics.
Deionized water: Electric conductivity 1 μS/cm or higher (Electric resistivity 1 MΩ·cm or lower)
Note 3) ① Ambient temperature: 32°C, ② Circulating fluid: Tap water, ③ Circulating fluid temperature: 20°C, ④ Circulating fluid flow rate: Rated flow, ⑤ Power supply: 200/400 VAC
Note 4) ① Ambient temperature: 32°C, ② Circulating fluid: Tap water, ③ Circulating fluid flow rate: Rated flow, ④ Power supply: 200/400 VAC
Note 5) ① Ambient temperature: 32°C, ② Circulating fluid: Tap water, ③ Circulating fluid temperature: 20°C, ④ Load: Same as the cooling capacity, ⑤ Circulating fluid flow rate: Rated flow, ⑥ Power supply: 200/400 VAC, ⑦ Piping length: Shortest
Note 6) With the pressure control mode by inverter. When the pressure control mode is not used, the pump power frequency set mode can be used.
Note 7) Fluid flow rate to maintain the cooling capacity. If the actual flow rate is lower than this, install a bypass piping.
Note 8) To be prepared by user. A specified earth leakage breaker is installed for option B [With earth leakage breaker], option S [Conforming to CE/UL standards] and 400 V type.
Note 9) If the product is used at altitude of 1000 m or higher, refer to "Operating Environment/Storage Environment" (page 119) Item 14 "∗ For altitude of 1000 m or higher".
Note 10) The anchor bolt fixing brackets (including 4 M10 bolts) are used for fixing to wooden skids when packaging the thermo-chiller. No anchor bolt is included.

Thermo-chiller Inverter Type
Water-cooled 200 V/400 V Type
Series HRSH090

(400 V type only) (UL Standards)

RoHS



How to Order

HRSH 090 – W □ – 20 – □

Cooling capacity

090	11.0 kW

Cooling method

W	Water-cooled refrigeration

Pipe thread type

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

Power supply

20	3-phase 200 VAC (50 Hz) 3-phase 200 to 230 VAC (60 Hz)
40	3-phase 380 to 415 VAC (50/60 Hz)

Option

Nil	None
B Note 1)	With earth leakage breaker
J	With automatic fluid fill function
M	Applicable to deionized water piping
S Note 2)	Conforming to CE/UL standards

- When multiple options are combined, indicate symbols in alphabetical order.

Note 1) Provided as standard for power supply specification "40". (Symbol "B" is not required.)
Note 2) 200 V type only.
Combination with option B is not necessary.
An earth leakage breaker is equipped as standard.

Specifications

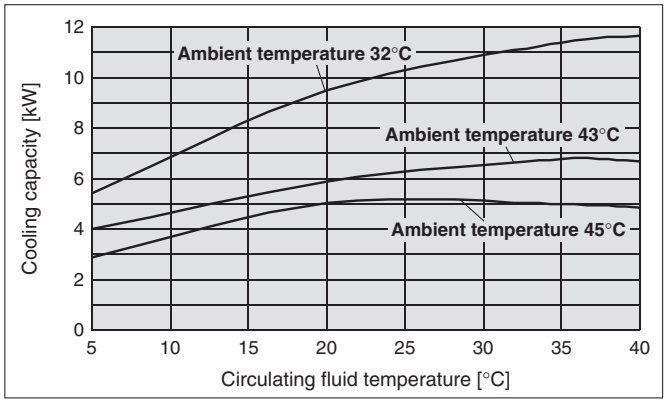
Model				HRSH090-W□-20-□	HRSH090-W□-40-□
Cooling method				Water-cooled refrigeration	
Refrigerant				R410A (HFC) (GWP1975)	
Control method				PID control	
Ambient temperature/humidity Note 1), 9)			°C/%	5 to 45/30 to 70%	
Circulating fluid system	Circulating fluid Note 2)			Tap water, 15% Ethylene glycol aqueous solution, Deionized water	
	Set temperature range Note 1)		°C	5 to 40	
	Cooling capacity Note 3), 9)		kW	11.0	
	Heating capacity Note 4)		kW	2.5	
	Temperature stability Note 5)		°C	±0.1	
	Pump capacity	Rated flow (Outlet)	L/min	45 (0.5 MPa)	
		Maximum flow rate	L/min	60	
		Maximum pump head	m	50	
	Settable pressure range Note 6)		MPa	0.1 to 0.5	
	Minimum operating flow rate Note 7)		L/min	20	
	Tank capacity		L	18	
	Circulating fluid outlet, circulating fluid return port			Rc1 (Symbol F: G1, Symbol N: NPT1)	
	Tank drain port			Rc1/4 (Symbol F: G1/4, Symbol N: NPT1/4)	
	Fluid contact material			Stainless steel, Copper (Heat exchanger brazing), Brass, Bronze, Carbon, Ceramic, PE, PVC, POM, PTFE, NBR, EPDM, FKM, PP	
Facility water system	Temperature range		°C	5 to 40	
	Pressure range		MPa	0.3 to 0.5	
	Required flow		L/min	25	
	Facility water pressure differential		MPa	0.3 or more	
	Facility water inlet/outlet			Rc1/2	
	Fluid contact material			Stainless steel, Copper (Heat exchanger brazing), Bronze, Brass, PTFE, NBR, EPDM	
Electrical system	Power supply			3-phase 200 VAC (50 Hz), 3-phase 200 to 230 VAC (60 Hz) Allowable voltage range ±10% (No continuous voltage fluctuation)	3-phase 380 to 415 VAC (50/60 Hz) Allowable voltage range ±10% (No continuous voltage fluctuation)
	Applicable earth leakage breaker Note 8)	Rated current	A	30	20
		Sensitivity of leak current	mA	30	
	Rated operating current Note 5)		A	12	6.8
	Rated power consumption Note 5)		kW (kVA)	3.8 (4.0)	4.0 (4.7)
Noise level (Front 1 m/Height 1 m) Note 5)			dB (A)	65	
Accessories				Alarm code list stickers 2 pcs. (English 1 pc./Japanese 1 pc.), Operation Manual (for installation/operation) 2 pcs. (English 1 pc./Japanese 1 pc.), Y-strainer (40 meshes) 25A, Barrel nipple 25A, Anchor bolt fixing brackets 2 pcs. (including 4 M10 bolts) Note 10)	
Weight (dry state)			kg	Approx. 121	

Note 1) Use a 15% ethylene glycol aqueous solution if operating in a place where the ambient temperature and/or circulating fluid temperature is 10°C or less.
Note 2) Use fluid in condition below as the circulating fluid.
Tap water: Standard of The Japan Refrigeration And Air Conditioning Industry Association (JRA GL-02-1994)
15% ethylene glycol aqueous solution: diluted by tap water in condition above without any additives such as antiseptics.
Deionized water: Electric conductivity 1 μS/cm or higher (Electric resistivity 1 MΩ·cm or lower)
Note 3) ① Ambient temperature: 32°C, ② Circulating fluid: Tap water, ③ Circulating fluid temperature: 20°C, ④ Circulating fluid flow rate: Rated flow, ⑤ Power supply: 200/400 VAC
Note 4) ① Ambient temperature: 32°C, ② Circulating fluid: Tap water, ③ Circulating fluid flow rate: Rated flow, ④ Power supply: 200/400 VAC
Note 5) ① Ambient temperature: 32°C, ② Circulating fluid: Tap water, ③ Circulating fluid temperature: 20°C, ④ Load: Same as the cooling capacity, ⑤ Circulating fluid flow rate: Rated flow, ⑥ Power supply: 200/400 VAC, ⑦ Piping length: Shortest
Note 6) With the pressure control mode by inverter. When the pressure control mode is not used, the pump power frequency set mode can be used.
Note 7) Fluid flow rate to maintain the cooling capacity. If the actual flow rate is lower than this, install a bypass piping.
Note 8) To be prepared by user. A specified earth leakage breaker is installed for option B [With earth leakage breaker], option S [Conforming to CE/UL standards] and 400 V type.
Note 9) If the product is used at altitude of 1000 m or higher, refer to "Operating Environment/Storage Environment" (page 119) Item 14 "∗ For altitude of 1000 m or higher".
Note 10) The anchor bolt fixing brackets (including 4 M10 bolts) are used for fixing to wooden skids when packaging the thermo-chiller. No anchor bolt is included.

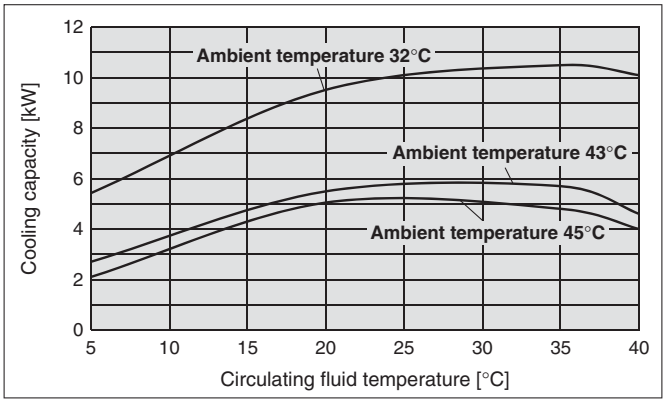
Cooling Capacity

∗ If the product is used at altitude of 1000 m or higher, refer to “Operating Environment/ Storage Environment” (page 119) Item 14 “∗ For altitude of 1000 m or higher.”

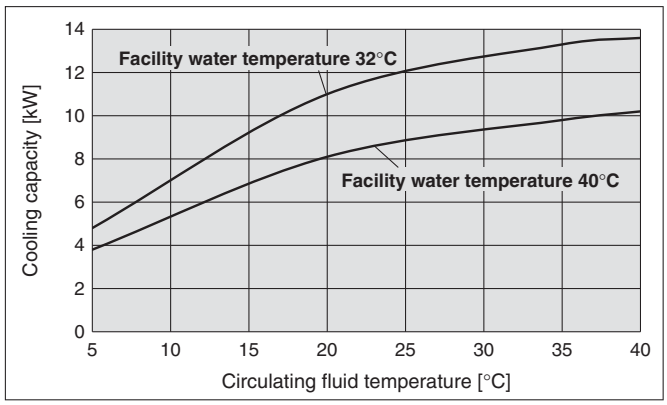
HRSH090-A□-20-□



HRSH090-A□-40-□

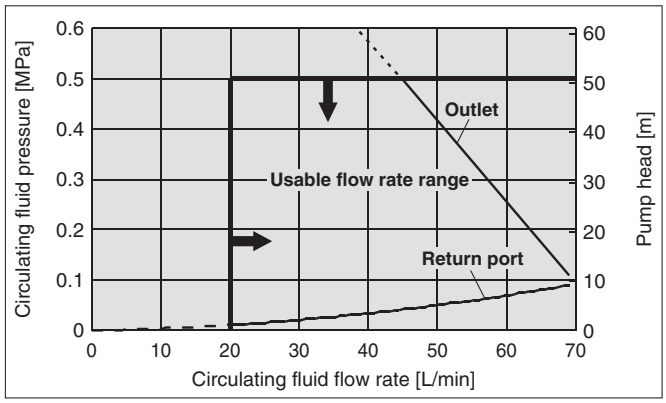


HRSH090-W□-20/40-□



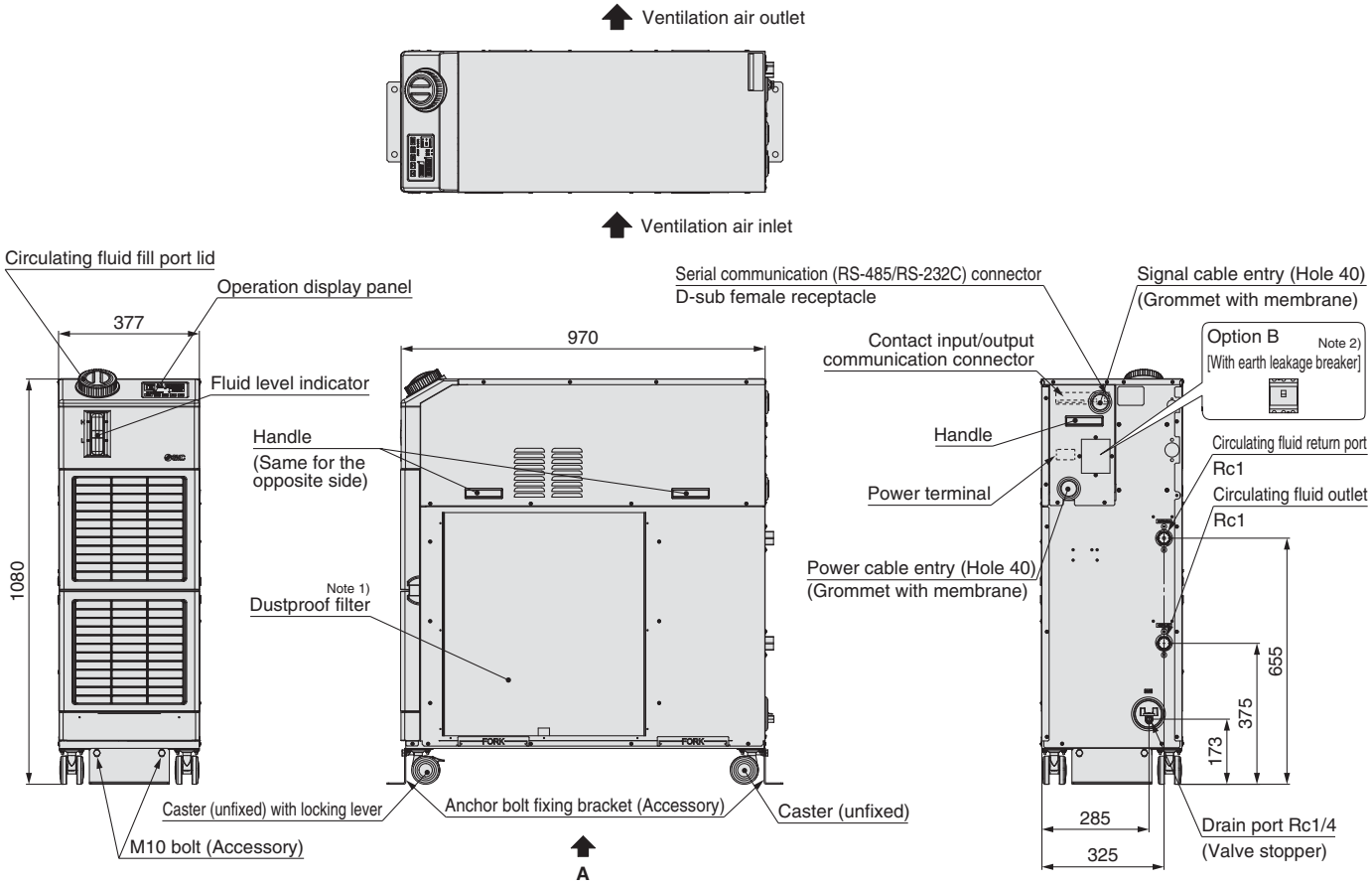
Pump Capacity

HRSH090-□□-20/40-□



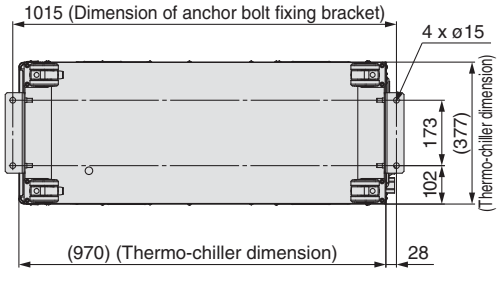
Dimensions

HRSH090-□-20/40

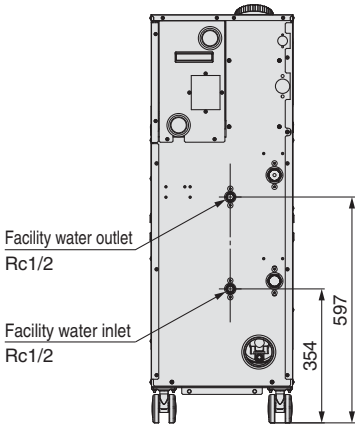


Note 1) The water-cooled type is not equipped with a dustproof filter.
Note 2) 400 V type is provided with an earth leakage breaker "-B" as standard.

Anchor bolt fixing position



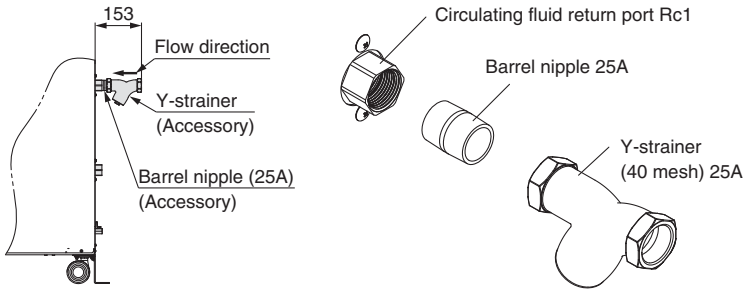
View A



For water-cooled type

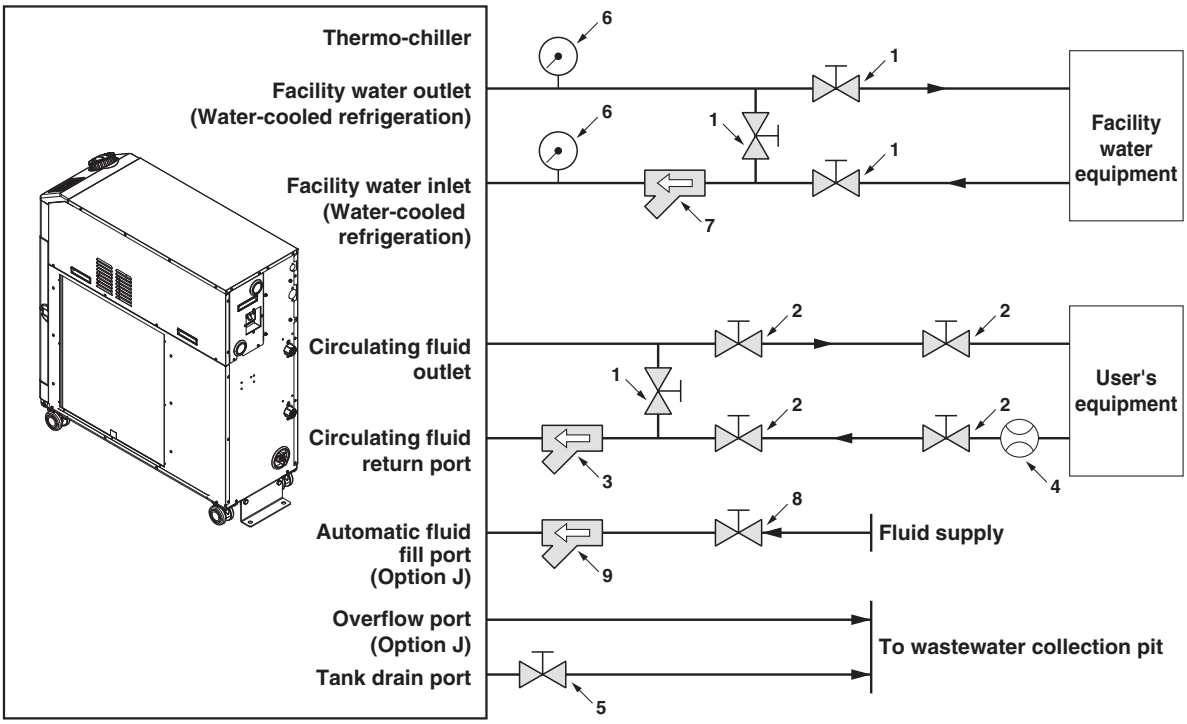
Accessory: Y-strainer mounting view

∗ Mount it by yourself on the circulating fluid return port.



Recommended External Piping Flow

External piping circuit is recommended as shown below.



No.	Description	Size
1	Valve	Rc1/2
2	Valve	Rc1
3	Y-strainer (#40) (Accessory)*	Rc1
4	Flow meter	Prepare a flow meter with an appropriate flow range.
5	Valve (Part of thermo-chiller)	Rc1/4
6	Pressure gauge	0 to 1 MPa
7	Y-strainer (#40) or filter	Rc1/2
8	Valve	Rc3/8
9	Y-strainer (#40) or filter	Rc3/8

* If foreign objects of 20 μm or larger may enter, install a particle filter separately.

Cable Specifications

Power supply and signal cable should be prepared by user.

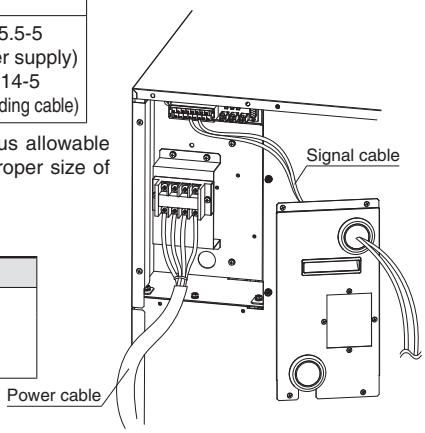
Power Cable Specifications

Applicable model	Rated value for thermo-chiller			Power cable examples	
	Power supply	Applicable breaker rated current	Terminal block screw diameter	Cable size	Crimped terminal on the thermo-chiller side
HRSH090-□□-20	3-phase 200 VAC (50 Hz) 3-phase 200 to 230 VAC (60 Hz)	30 A	M5	4 cores x 5.5 mm^2 (4 cores x AWG10) (Including grounding cable)	R5.5-5
HRSH090-□□-40	3-phase 380 to 415 VAC (50/60 Hz)	20 A		3 x 5.5 mm^2 (3 x AWG10) (Power supply) 1 x 14 mm^2 (1 x AWG6) (Grounding cable)	R5.5-5 (Power supply) R14-5 (Grounding cable)

Note) An example of the cable specifications is when two kinds of vinyl insulated wires with a continuous allowable operating temperature of 70°C at 600 V, are used at an ambient temperature of 30°C. Select the proper size of cable according to an actual condition.

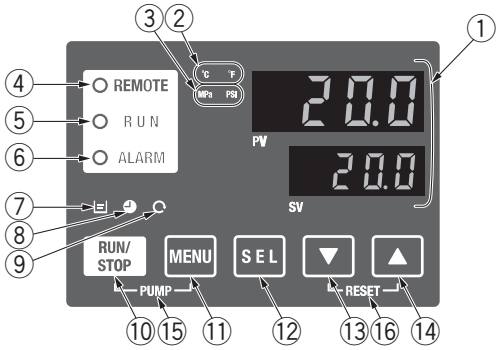
Signal Cable Specifications

Terminal specifications		Cable specifications
Terminal block screw diameter	Recommended crimped terminal	0.75 mm^2 (AWG18) Shielded cable
M3	Y-shape crimped terminal 1.25Y-3	



Operation Display Panel

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



No.	Description	Function	
①	**Digital display (7-segment, 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 displayed temperature (default setting: °C).	
③	**[MPa] [PSI] lamp**	Equipped with a unit conversion function. Displays the unit of displayed 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	**[⊨] 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. 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.	

List of Function

No.	Function	Outline
1	**Main display**	Displays the current and set temperature of the circulating fluid, discharge pressure of the circulating fluid. Changes the circulating fluid set temperature.
2	**Alarm display menu**	Indicates alarm number when an alarm occurs.
3	**Inspection monitor menu**	Product temperature, pressure and accumulated operating time can be checked as daily inspection. Use these for daily inspection.
4	**Key-lock**	Keys can be locked so that set values cannot be changed by operator error.
5	**Timer for operation start/stop**	Timer is used to set the operation start/stop.
6	**Signal for the completion of preparation**	A signal is output when the circulating fluid temperature reaches the set temperature, when using contact input/output and serial communication.
7	**Offset function**	Use this function when there is a temperature offset between the discharge temperature of the thermo-chiller and user's equipment.
8	**Reset after power failure**	Start operation automatically after the power supply is turned on.
9	**Key click sound setting**	Operation panel key sound can be set on/off.
10	**Changing temp. unit**	Temperature unit can be changed. Centigrade [°C] ⇔ Fahrenheit [°F]
11	**Changing pressure unit**	Pressure unit can be changed. MPa ⇔ PSI
12	**Data reset**	Functions can be reset to the default settings (settings when shipped from the factory).
13	**Accumulation time reset**	Reset function when the pump, the fan or the compressor is replaced. Reset the accumulated time here.
14	**Pump operation mode set**	The fluid supply mode of the pump can be changed Pressure control mode ⇔ Frequency set mode
15	**Anti-freezing function**	Circulating fluid is protected from freezing during winter or at night. Set beforehand if there is a risk of freezing.
16	**Warming-up function**	When circulating fluid temperature rising time at starting needs shortening during winter or at night, set beforehand.
17	**Alarm buzzer sound setting**	Alarm sound can be set to on/off.
18	**Alarm customizing**	Operation during alarm condition and threshold values can be changed depending on the alarm type.
19	**Communication**	This function is used for contact input/output or serial communication.

Alarm

This unit has 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.

Code	Alarm message
AL01	Low level in tank
AL02	High circulating fluid discharge temp.
AL03	Circulating fluid discharge temp. rise
AL04	Circulating fluid discharge temp. drop
AL05	High circulating fluid return temp. (60°C)
AL06	High circulating fluid discharge pressure
AL07	Abnormal pump operation
AL08	Circulating fluid discharge pressure rise
AL09	Circulating fluid discharge pressure drop
AL10	High compressor intake temp.
AL11	Low compressor intake temp.
AL12	Low super heat temp.
AL13	High compressor discharge pressure
AL15	Refrigeration circuit pressure (high pressure side) drop
AL16	Refrigeration circuit pressure (low pressure side) rise
AL17	Refrigeration circuit pressure (low pressure side) drop

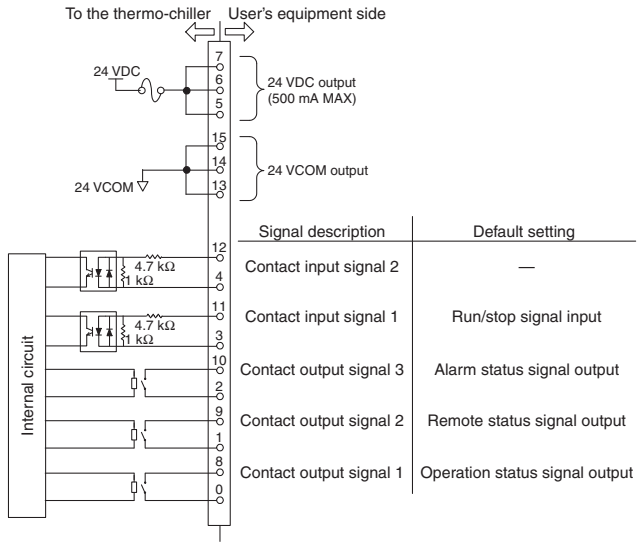
Code	Alarm message
AL18	Compressor running failure
AL19	Communication error
AL20	Memory error
AL21	DC line fuse cut
AL22	Circulating fluid discharge temp. sensor failure
AL23	Circulating fluid return temp. sensor failure
AL24	Compressor intake temp. sensor failure
AL25	Circulating fluid discharge pressure sensor failure
AL26	Compressor discharge pressure sensor failure
AL27	Compressor intake pressure sensor failure
AL28	Pump maintenance
AL29	Fan maintenance Note 1)
AL30	Compressor maintenance
AL31	Contact input 1 signal detection
AL32	Contact input 2 signal detection
AL37	Compressor discharge temp. sensor failure

Code	Alarm message
AL38	Compressor discharge temp. rise
AL39	Internal unit fan stoppage
AL40	Dustproof filter maintenance Note 1)
AL41	Power stoppage
AL42	Compressor waiting
AL43	Fan breaker trip Note 1)
AL44	Fan inverter error Note 1)
AL45	Compressor breaker trip Note 2)
AL46	Compressor inverter error
AL47	Pump breaker trip Note 2)
AL48	Pump inverter error
AL49	Air exhaust fan stoppage Note 3)

Note 1) Does not occur on the product of water-cooled refrigeration type.
Note 2) Does not occur on the product of power supply specification '-20'.
Note 3) Does not occur on the product of air-cooled refrigeration type.
∗ For details, read the Operation Manual.

Communication Function

Contact Input/Output

Item		Specifications
Connector type		M3 terminal block
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
Contact output signal	**Rated load voltage**	48 VAC or less/30 VDC or less
	Maximum load current	500 mA AC/DC (resistance load)
	Minimum load current	5 VDC 10 mA
Output voltage		24 VDC ±10% 500 mA MAX (not usable for inductive load)
Circuit diagram		

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

Serial Communication

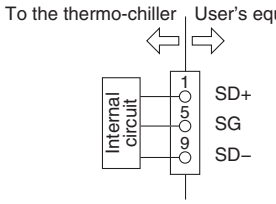
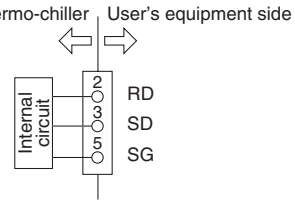
The serial communication (RS-485/RS-232C) enables the following items to be written and read out.
For details, refer to the Operation Manual, Communication function.

Writing

Run/Stop
Circulating fluid temperature setting (SV)

Readout

Circulating fluid present temperature
Circulating fluid discharge pressure
Status information
Alarm occurrence information

Item	Specifications	
Connector type	D-sub 9-pin, Female connector	
Protocol	Modicon Modbus compliant/Simple communication protocol	
Standards	EIA standard RS-485	EIA standard RS-232C
Circuit diagram		

∗ The terminal resistance of RS-485 (120 Ω) can be switched by the operation display panel. For details, refer to the Operation Manual, Communication function. 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 HRSH090
Options

Note) Select the option when ordering the thermo-chiller because the option cannot be added after purchasing the unit.

B Option symbol

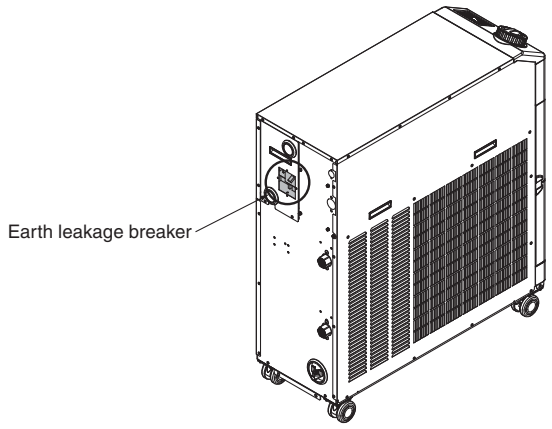
With Earth Leakage Breaker

HRSH090-□□-20-B

With earth leakage breaker

A leakage breaker is built in to automatically stop the supply power when it has short-circuit, over current or electrical leakage. (For models with power supply specification '-40', it is not necessary to select this option because an earth leakage breaker is equipped as standard.)

Applicable model	Rated current [A]	Sensitivity of leak current [mA]	Short circuit display method
HRSH090-□□-20-B	30	30	Mechanical button



∗ 400 V type is equipped as standard.

(Refer to the specifications on pages 107, 108 and the dimensions on page 110 for details.)

J Option symbol

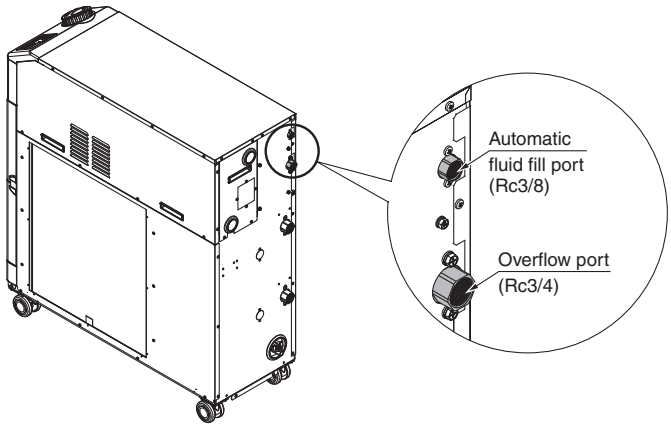
With Automatic Fluid Fill Function

HRSH090-□□-□-J

With automatic fluid fill function

By installing this at the automatic fluid fill port, the circulating fluid can be automatically supplied to the product using a built-in solenoid valve for a water fill while the circulating fluid is decreasing.

Applicable model	**HRSH090-□□-□-J**
Fluid fill method	Built-in solenoid valve for automatic water fill
Fluid fill pressure (MPa)	0.2 to 0.5
Feed water temperature (°C)	5 to 40



M Option symbol

Applicable to Deionized Water Piping

HRSH090-□□-□-M

Applicable to deionized water piping

Contact material of the circulating fluid circuit is made from non-copper materials.

Applicable model	**HRSH090-□□-□-M**
Contact material for circulating fluid	Stainless steel (including heat exchanger brazing), SiC, Carbon, PP, PE, POM, FKM, NBR, EPDM, PVC, PTFE

∗ No change in external dimensions.

S Option symbol

Conforming to CE/UL Standards

HRSH090-□□-20-S

Conforming to CE/UL standards

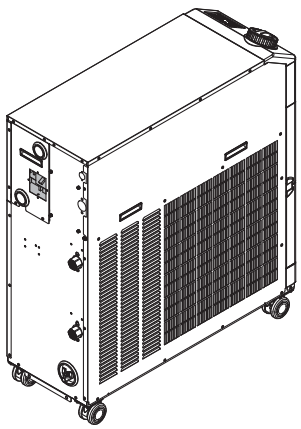
Products conforming to CE/UL standards.
The following standards are applicable.

Applicable standard		
CE marking	EMC directive	2004/108/EC
	Machinery directive	2006/42/EC
UL standard	3054524 (UL61010-1)	

When selecting this option,
- · An earth leakage breaker with a breaker handle is equipped.
  (The breaker are the same as those for option B.)
- · A caution label is added.
- · The CE/UL certification mark is added.

∗ Cannot be selected for 400 V type.

∗ Cannot be selected together with option B.



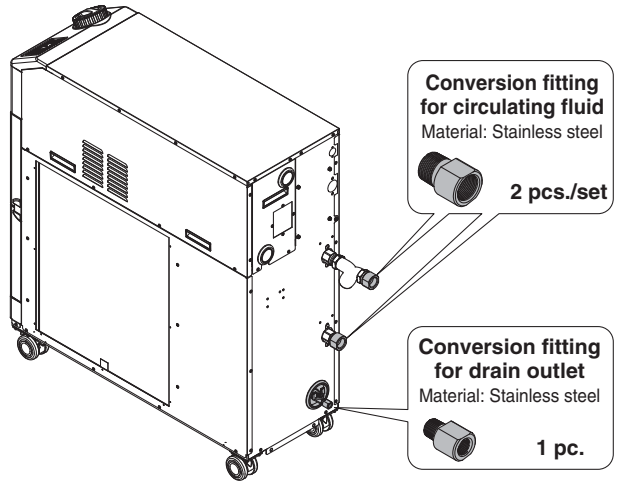
Series HRSH090
Optional Accessories

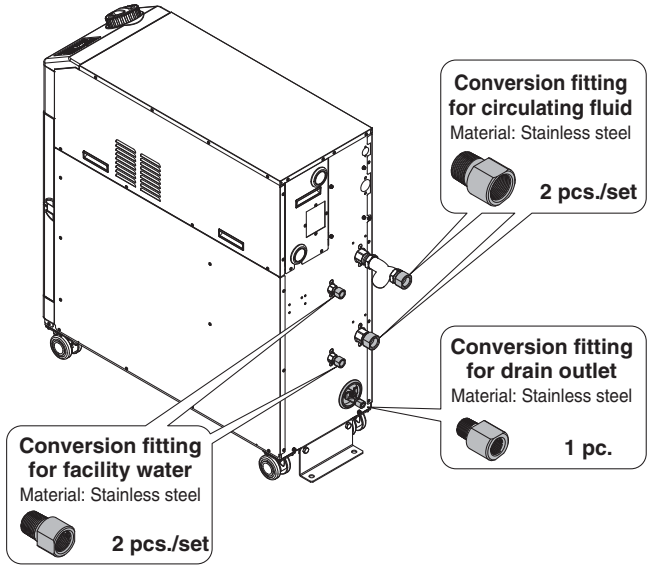
① Piping Conversion Fitting

This is a fitting to change the port from Rc to G or NPT.
· Circulating fluid outlet, Circulating fluid return port Rc1 → NPT1 or G1
· Drain port Rc1/4 → NPT1/4 or G1/4
(It is not necessary to purchase this when pipe thread type F or N is selected in "How to Order" since it is included in the product.)

Part no.	Contents	Applicable model
HRS-EP018	NPT thread conversion fitting set	**HRSH090-A-□**
HRS-EP019	G thread conversion fitting set	

Part no.	Contents	Applicable model
HRS-EP022	NPT thread conversion fitting set	**HRSH090-W-□**
HRS-EP023	G thread conversion fitting set	





When option J (With automatic fluid fill function) is included, use the following part numbers.
· Automatic fluid fill port Rc3/8 → NPT3/8 or G3/8
· Overflow port Rc3/4 → NPT3/4 or G3/4
∗ The conversion fittings for circulating fluid outlet/return port, drain port, facility water inlet/outlet (for water-cooled refrigeration) are also included.

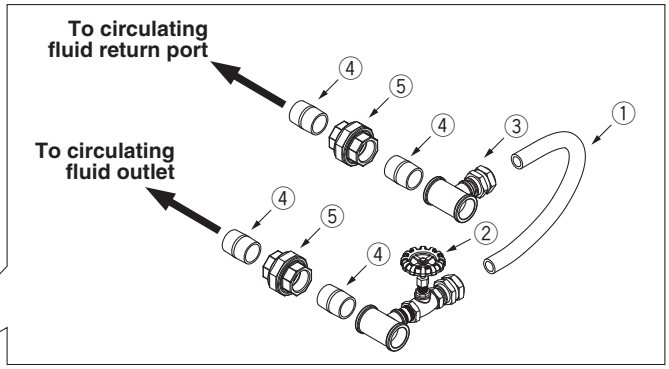
Part no.	Contents	Applicable model
HRS-EP020	NPT thread conversion fitting set	**HRSH090-A-J**
HRS-EP021	G thread conversion fitting set	

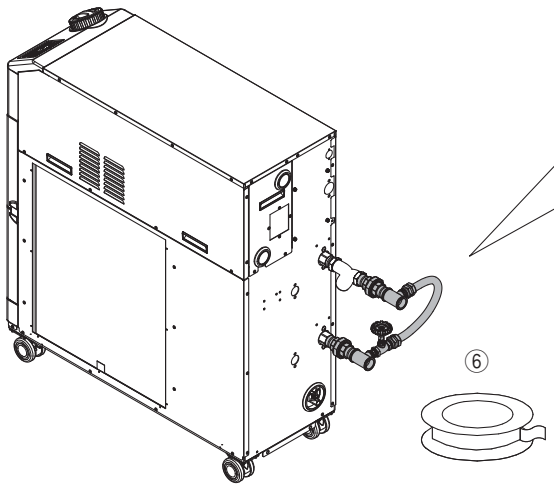
Part no.	Contents	Applicable model
HRS-EP024	NPT thread conversion fitting set	**HRSH090-W-J**
HRS-EP025	G thread conversion fitting set	

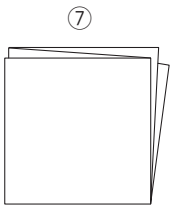
② Bypass Piping Set

When the circulating fluid goes below the minimum operating flow rate (as shown below), cooling capacity will be reduced and the temperature stability will be badly affected. Use the bypass piping set to ensure a circulating fluid flow rate of the minimum operating flow rate or more.

Part no.	Applicable model	Minimum operating flow rate [L/min]
HRS-BP005	**HRSH090-□□-□**	20







Parts List

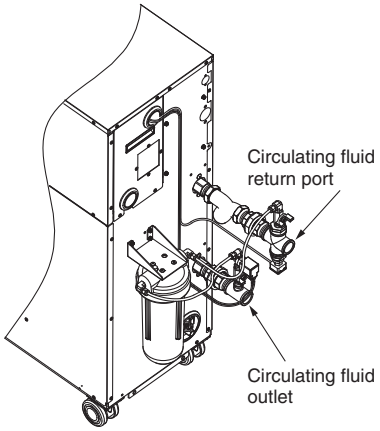
No.	Description
①	Hose (I.D.: 15 mm, Length: 700 mm)
②	Outlet piping assembly (With globe valve)
③	Return piping assembly
④	Barrel nipple (Size: 1 inch) (2 pcs.)
⑤	Union (Size: 1 inch) (2 pcs.)
⑥	Sealant tape
⑦	Operation Manual

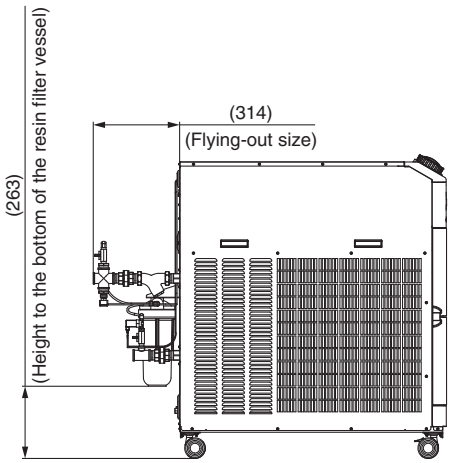
③ Electric Conductivity Control Set

The set indicates and controls the electric conductivity of the circulating fluid. Refer to the Operation Manual for details.

Part no.	Applicable model
HRS-DI007	**HRSH090-□□-□**

Measurement range of electric conductivity	2.0 to 48.0 μS/cm
Set range of electric conductivity target	5.0 to 45.0 μS/cm
Set range of electric conductivity hysteresis	2.0 to 10.0 μS/cm
Operating temperature range (Circulating fluid temperature)	5 to 60°C
Power consumption	400 mA or less





④ Particle Filter Set

Removes foreign objects in the circulating fluid. This set cannot be directly connected to the thermo-chiller. Install it in the user's piping system. Refer to the Operation Manual for details.

Particle Filter Set

HRS−PF005−H

Accessory

Symbol	Accessory
Nil	None
H	With handle

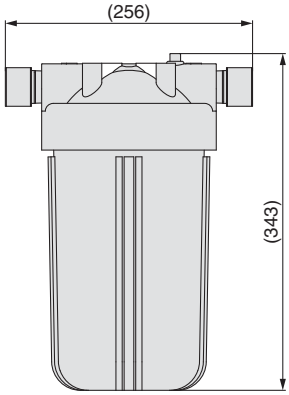
Fluid	Tap water
Max. operating pressure	0.65 MPa
Operating temperature range	5 to 35°C
Nominal filtration accuracy	5 μm
Installation environment	Indoors

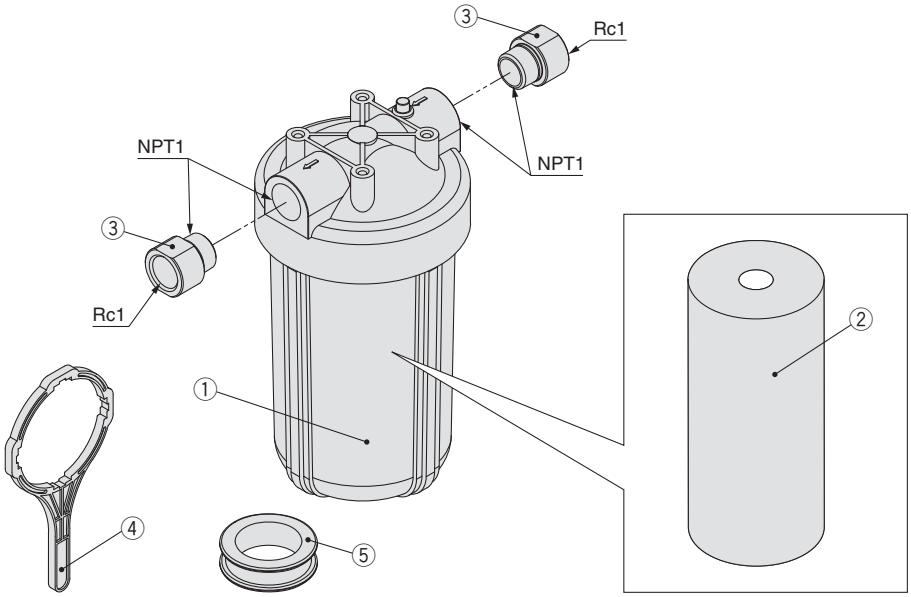
Parts List

No.	Description	Material	Q'ty	Note
①	Body	PC, PP	1	—
②	Element	PP	1	—
③	Extension piece	Stainless steel	2	Conversion from NPT to Rc
④	Handle	—	1	When -H is selected
⑤	Sealant tape	PTFE	1	—

Replacement Element

HRS−PF006



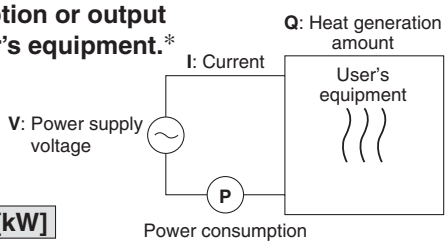


Series HRSH090
Cooling Capacity Calculation

Required Cooling Capacity Calculation

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

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



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

Power consumption **P**: 7 [kW]

Q = P = 7 [kW]

Cooling capacity = Considering a safety factor of 20%, **7 [kW] x 1.2 =** **8.4 [kW]**

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

Power supply output **VI**: 8.8 [kVA]

Q = P = V x I x Power factor

In this example, using a power factor of 0.85:

= 8.8 [kVA] x 0.85 = 7.5 [kW]

Cooling capacity = Considering a safety factor of 20%,

7.5 [kW] x 1.2 = **9.0 [kW]**

③ **Derive the heat generation amount from the output.**

Output (shaft power etc.) **W**: 13 [kW]

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

In this example, using an efficiency of 0.7:

$$\mathbf{= \frac{5.1}{0.7} = 7.3\ [kW]}$$

Cooling capacity = Considering a safety factor of 20%,

7.3 [kW] x 1.2 = **8.8 [kW]**

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

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

Obtain the temperature difference between inlet and outlet by circulating the circulating fluid inside the user's equipment.

Heat generation amount by user's equipment **Q**	: Unknown [W] ([J/s])
Circulating fluid	: Tap water*
Circulating fluid mass flow rate **qm**	: (= ρ x **qv** ÷ 60) [kg/s]
Circulating fluid density ρ	: 1 [kg/L]
Circulating fluid (volume) flow rate **qv**	: 35 [L/min]
Circulating fluid specific heat **C**	: 4.186 x 10^3 [J/(kg·K)]
Circulating fluid outlet temperature $\mathbf{T_1}$	: 293 [K] (20 [°C])
Circulating fluid return temperature $\mathbf{T_2}$	: 296 [K] (23 [°C])
Circulating fluid temperature difference **ΔT**	: 3 [K] (= $\mathbf{T_2 - T_1}$)
Conversion factor: minutes to seconds (SI units)	: 60 [s/min]

* Refer to page 118 for the typical physical property value of tap water or other circulating fluids.

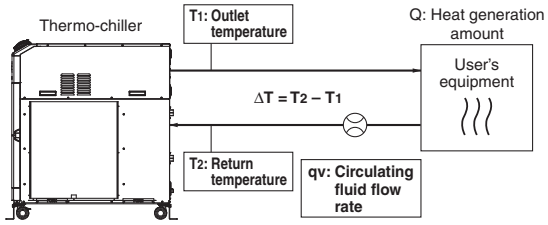
$$\mathbf{Q = qm \times C \times (T_2 - T_1)}$$

$$\mathbf{= \frac{\rho \times qv \times C \times \Delta T}{60} = \frac{1 \times 35 \times 4.186 \times 10^3 \times 3.0}{60}}$$

$$\mathbf{= 7325\ [J/s] \approx 7325\ [W] = 7.3\ [kW]}$$

Cooling capacity = Considering a safety factor of 20%,

7.3 [kW] x 1.2 = **8.8 [kW]**



HRSH090-A

Example of conventional measurement units (Reference)

Heat generation amount by user's equipment **Q**	: Unknown [cal/h] → [W]
Circulating fluid	: Tap water*
Circulating fluid weight flow rate **qm**	: (= ρ x **qv** x 60) [kgf/h]
Circulating fluid weight volume ratio γ	: 1 [kgf/L]
Circulating fluid (volume) flow rate **qv**	: 35 [L/min]
Circulating fluid specific heat **C**	: 1.0 x 10^3 [cal/(kgf·°C)]
Circulating fluid outlet temperature $\mathbf{T_1}$	: 20 [°C]
Circulating fluid return temperature $\mathbf{T_2}$	: 23 [°C]
Circulating fluid temperature difference **ΔT**	: 3 [°C] (= $\mathbf{T_2 - T_1}$)
Conversion factor: hours to minutes	: 60 [min/h]
Conversion factor: kcal/h to kW	: 860 [(cal/h)/W]

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

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

$$\mathbf{= \frac{1 \times 35 \times 60 \times 1.0 \times 10^3 \times 3.0}{860}}$$

$$\mathbf{\approx 7325\ [W] = 7.3\ [kW]}$$

Cooling capacity = Considering a safety factor of 20%,

7.3 [kW] x 1.2 = **8.8 [kW]**

Required Cooling Capacity Calculation

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

Heat quantity by cooled substance (per unit time) **Q** : Unknown [W] ([J/s])
Cooled substance : Water
Cooled substance mass **m** : (= ρ x **V**) [kg]
Cooled substance density ρ : 1 [kg/L]
Cooled substance total volume **V** : 150 [L]
Cooled substance specific heat **C** : 4.186 x 10^3 [J/(kg·K)]
Cooled substance temperature when cooling begins T_0 : 303 [K] (30 [°C])
Cooled substance temperature after t hour T_t : 293 [K] (20 [°C])
Cooling temperature difference ΔT : 10 [K] (= $T_0 - T_t$)
Cooling time Δt : 900 [s] (= 15 [min])

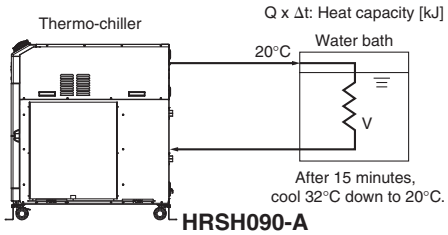
∗ Refer to the following for the typical physical property values by circulating fluid.

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

$$= \frac{1 \times 150 \times 4.186 \times 10^3 \times 10}{900} = 6977 \text{ [J/s]} \approx 7.0 \text{ [kW]}$$

Cooling capacity = Considering a safety factor of 20%,

7.0 [kW] x 1.2 = 8.4 [kW]



HRSH090-A

Example of conventional measurement units (Reference)

Heat quantity by cooled substance (per unit time) **Q** : Unknown [cal/h] → [W]
Cooled substance : Water
Cooled substance weight **m** : (= ρ x **V**) [kgf]
Cooled substance weight volume ratio γ : 1 [kgf/L]
Cooled substance total volume **V** : 150 [L]
Cooled substance specific heat **C** : 1.0 x 10^3 [cal/(kgf·°C)]
Cooled substance temperature when cooling begins T_0 : 30 [°C]
Cooled substance temperature after t hour T_t : 20 [°C]
Cooling temperature difference ΔT : 10 [°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]

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

$$= \frac{1 \times 150 \times 60 \times 1.0 \times 10^3 \times 10}{15 \times 860}$$

$$\approx 6977 \text{ [W]} = 7.0 \text{ [kW]}$$

Cooling capacity = Considering a safety factor of 20%,

7.0 [kW] x 1.2 = 8.4 [kW]

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

Precautions on Cooling Capacity Calculation

1. Heating capacity

When the circulating fluid temperature is set above room temperature, it needs to be heated by the thermo-chiller. The heating capacity depends on the circulating fluid temperature. Consider the radiation rate and heat capacity of the user's equipment and check beforehand if the required heating capacity is provided.

2. Pump capacity

<Circulating fluid flow rate>

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

<Circulating fluid discharge pressure>

Circulating fluid discharge pressure has the possibility to increase up to the maximum pressure in the pump capacity curves.
Check beforehand if the circulating fluid pipings or circulating fluid circuit of the user's equipment are fully durable against this pressure.

Circulating Fluid Typical Physical Property Values

1. This catalog uses the following values for density and specific heat in calculating the required cooling capacity.

Density ρ: 1 [kg/L] (or, using conventional unit system, weight volume ratio γ = 1 [kgf/L])
Specific heat **C**: 4.19 x 10^3 [J/(kg·K)] (or, using conventional unit system, 1 x 10^3 [cal/(kgf·°C)])

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

Water

Physical property value / Temperature	Density ρ [kg/L]	Specific heat C [J/(kg·K)]	Conventional unit system	
			Weight volume ratio γ [kgf/L]	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/L]	Specific heat C [J/(kg·K)]	Conventional unit system	
			Weight volume ratio γ [kgf/L]	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 shown are reference values. Contact circulating fluid supplier for details.

Series HRSH090
Specific Product Precautions 1

Be sure to read this before handling. Refer to page 341 for Safety Instructions. For Temperature Control Equipment Precautions, refer to pages 342 to 345 and the Operation Manual on SMC website, http://www.smcworld.com

Design

⚠ Warning

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

1. Check the specifications 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.

3. Use non-corrosive materials for fluid contact parts of circulating fluid.

Using corrosive materials such as aluminum or iron for fluid contact parts such as piping may cause clogging or leakage in the circulating fluid (facility water) circuits. Provide protection against corrosion when you use the product.

4. The facility water outlet temperature (water-cooled type) may increase up to around 60°C.

When selecting the facility water pipings, consider the suitability for temperature.

Selection

⚠ Warning

Model selection

For selecting a model of thermo-chiller, it is required to know the heat generation amount of the user's equipment. Obtain the heat generation amount, referring to "Cooling Capacity Calculation" on pages 117 and 118 before selecting a model.

Handling

⚠ Warning

Thoroughly read the Operation Manual.

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

Operating Environment/Storage Environment

⚠ Warning

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

1. Outdoors
2. In locations where water, water vapor, salt water, and oil may splash on the product.
3. In locations where there are dust and particles.
4. In locations where corrosive gases, organic solvents, chemical fluids, or flammable gases are present. (This product is not explosion proof.)
5. In locations where the ambient temperature/humidity exceeds the limits as mentioned below or where condensation occurs.
   During transportation/storage: –15°C to 50°C, 15% to 85%
   (But as long as water or circulating fluid are not left inside the pipings)
   During operation: 5°C to 45°C, 30% to 70%
   (However, use a 15% ethylene glycol aqueous solution if operating in a place where the ambient temperature or circulating fluid temperature is 10°C or less.)
6. In locations where condensation may occur.
7. In locations which receive direct sunlight or radiated heat.
8. In locations where there is a heat source nearby and the ventilation is poor.
9. In locations where temperature substantially changes.
10. In locations where strong magnetic noise occurs.
    (In locations where strong electric fields, strong magnetic fields and surge voltage occur.)
11. In locations where static electricity occurs, or conditions which make the product discharge static electricity.
12. In locations where high frequency occurs.
13. In locations where damage is likely to occur due to lightning.
14. In locations at altitude of 3000 m or higher (Except during storage and transportation)
    ∗ For altitude of 1000 m or higher
    Because of lower air density, the heat radiation efficiencies of the devices in the product will be lower in the location at altitude of 1000 m or higher. Therefore, the maximum ambient temperature to use and the cooling capacity will lower according to the descriptions in the table below.
    Select the thermo-chiller considering the descriptions.
    ① Upper limit of ambient temperature: Use the product in ambient temperature of the described value or lower at each altitude.
    ② Cooling capacity coefficient: The product's cooling capacity will lower to one that multiplied by the described value at each altitude.

Altitude [m]	① Upper limit of ambient temperature [°C]	② Cooling capacity coefficient
Less than 1000 m	45	1.00
Less than 1500 m	42	0.85
Less than 2000 m	38	0.80
Less than 2500 m	35	0.75
Less than 3000 m	32	0.70

15. In locations where strong impacts or vibrations occur.
16. In locations where a massive force strong enough to deform the product is applied or a weight from a heavy object is applied.
17. In locations where there is not sufficient space for maintenance.
18. Bevelled place
19. Insects or plants may enter the unit.

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

Series HRSH090
Specific Product Precautions 2

Be sure to read this before handling. Refer to page 341 for Safety Instructions. For Temperature Control Equipment Precautions, refer to pages 342 to 345 and the Operation Manual on SMC website, http://www.smcworld.com

Transportation/Carriage/Movement

⚠ Warning

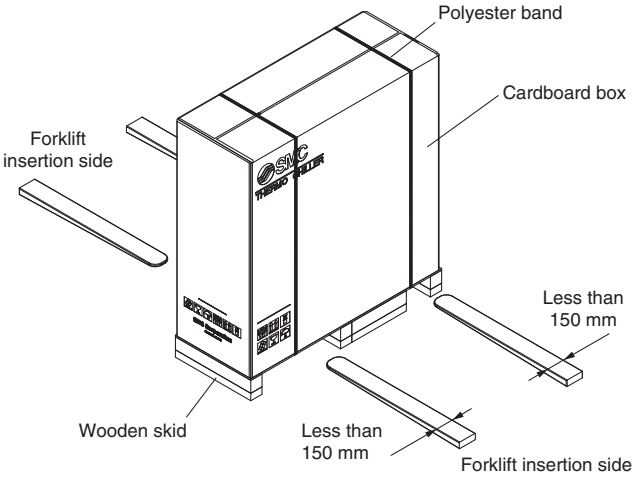
1. This product is heavy. Pay attention to safety and position of the product when it is transported, carried and moved.

2. Read the Operation Manual carefully to move the product after unpacking.

⚠ Caution

1. Never put the product down sideway as this may cause a failure.

The product will be delivered in the packaging shown below.

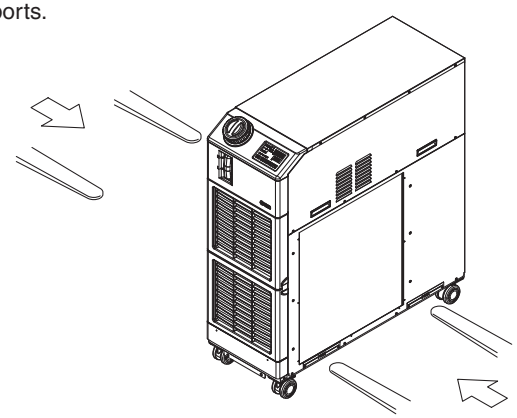


<When packaged>

Model	Weight [kg]	Dimensions [mm]
HRSH090-A-20/40	158	Height 1290 x Width 470 x Depth 1180
HRSH090-W-20/40	148	

2. Moving with forklift

1. A licensed driver should drive the forklift.
2. Insert the fork to the place specified on the label. The fork should reach through to the other side of the product.
3. Be careful not to bump the fork to the cover panel or piping ports.



3. Moving with casters

1. This is a heavy product. Make sure this product is lifted by at least two people to avoid falling.
2. Do not grip the piping port on the back side or the handles of the panel.
3. Do not pass over bumps etc. with the casters.

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.

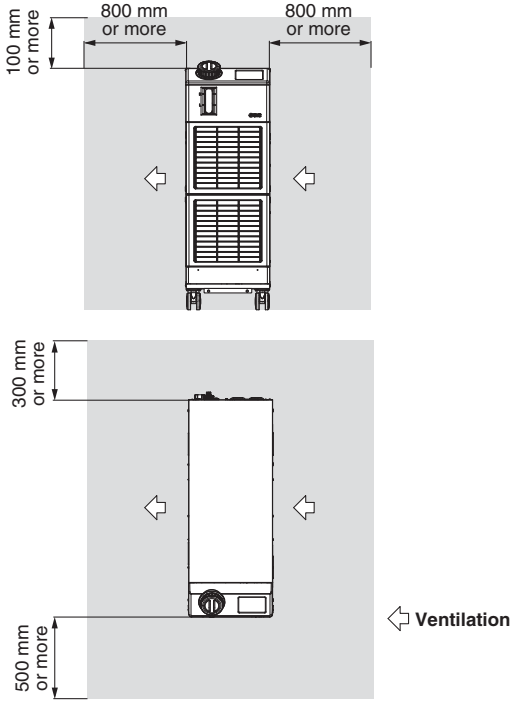
⚠ Caution

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

2. Refer to the Operation Manual for this product, and secure an installation space that is necessary for the maintenance and ventilation.

<Air-cooled refrigeration>

1. The air-cooled type product exhausts heat using the fan that is mounted to the product. If the product is operated with insufficient ventilation, ambient temperature may exceed 45°C, and this will affect the performance and life of the product. To prevent this ensure that suitable ventilation is available (see below).
2. For installation indoors, ventilation ports and a ventilation fan should be equipped as needed.



3. If it is impossible to exhaust heat from the installation area indoors, or when the installation area is conditioned, provide a duct for heat exhaustion to the air outlet port of this product for ventilation. Do not mount the inlet of the duct (flange) directly to the air vent of the product, and keep a space larger than the diameter of the duct. Additionally, consider the resistance of the duct when making the air vent port for the duct.

<Heat radiation amount/Required ventilation rate>

Model	Heat radiation amount [kW]	Required ventilation rate [m^3/min]	
		Differential temp. of 3°C between inside and outside of installation area	Differential temp. of 6°C between inside and outside of installation area
HRSH090-A-20/40	Approx. 18	305	155

Series HRSH090
Specific Product Precautions 3

Be sure to read this before handling. Refer to page 341 for Safety Instructions. For Temperature Control Equipment Precautions, refer to pages 342 to 345 and the Operation Manual on SMC website, http://www.smcworld.com

Piping

⚠ Caution

1. Regarding the circulating fluid and facility water pipings, consider carefully the suitability for temperature, circulating fluid.

If the operating performance is not sufficient, the pipings may burst during operation. Using corrosive materials such as aluminum or iron for fluid contact parts such as piping may cause clogging or leakage in the circulating fluid and facility water circuits. Provide protection against corrosion when you use the product.

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 drain port of this product, use a pipe wrench to clamp the connection ports.

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 are constant-temperature fluid circulating machines 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.

Circulating Fluid

⚠ Caution

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

2. When water is used as a circulating fluid, use tap water that conforms to the appropriate water quality standards.

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

Tap Water (as Circulating Fluid) Quality Standards

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

	Item	Unit	Standard value	Influence	
				Corrosion	Scale generation
Standard item	pH (at 25°C)	—	6.0 to 8.0	○	○
	Electric 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		○
	Ionic state silica (SiO_2)	[mg/L]	30 or less		○
Reference item	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.
• ○: Factors that have an effect on corrosion or scale generation.
• Even if the water quality standards are met, complete prevention of corrosion is not guaranteed.

3. Use an ethylene glycol aqueous solution that does not contain additives such as preservatives.

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

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.

Circulating Fluid

⚠ Caution

5. When deionized water is used, the electric conductivity should be 1 μS/cm or higher (Electric resistivity: 1 MΩ·cm or lower).

Electrical Wiring

⚠ Warning

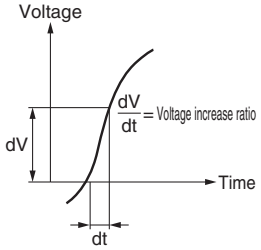
Grounding should never be connected to a water line, gas line or lightning rod.

⚠ Caution

1. Power supply and communication cables should be prepared by user.

2. Provide a stable power supply which is not affected by surge or distortion.

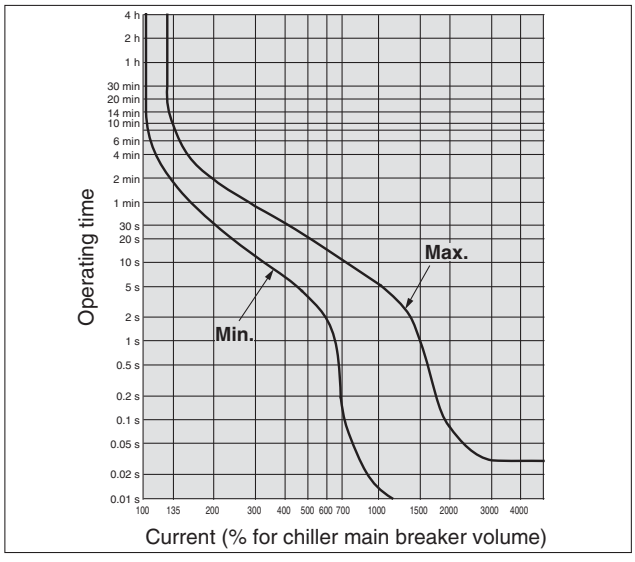
If the voltage increase ratio (dV/dt) at the zero cross should exceed 40 V/200 μsec., it may result in a malfunction.



<For option B [With earth leakage breaker]>

3. This product is installed with a breaker with the following operating characteristics.

For the user's equipment (inlet side), use a breaker whose operating time is equal to or longer than the breaker of this product. If a breaker with shorter operating time is connected, the user's equipment could be cut off due to the inrush current of the motor of this product.



Facility Water Supply

⚠ Warning

<Water-cooled refrigeration>

1. The water-cooled refrigeration type thermo-chiller radiates heat to the facility water. Prepare the facility water system that satisfies the heat radiation and the facility water specifications below.

■ Required facility water system

<Heat radiation amount/Facility water specifications>

Model	Heat radiation [kW]	Facility water specifications
HRSH090-W□-□	Approx. 20	Refer to "Facility water system" in the specifications on page 108.

Series HRSH090
Specific Product Precautions 4

Be sure to read this before handling. Refer to page 341 for Safety Instructions. For Temperature Control Equipment Precautions, refer to pages 342 to 345 and the Operation Manual on SMC website, http://www.smcworld.com

Facility Water Supply

⚠ Warning

2. When using tap water as facility water, use tap water that conforms to the appropriate water quality standards.

Use tap water that conforms to the standards shown below.

Tap Water (as Facility Water) Quality Standards

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

	Item	Unit	Standard value	Influence	
				Corrosion	Scale generation
Standard item	pH (at 25°C)	—	6.5 to 8.2	○	○
	Electric conductivity (25°C)	[μS/cm]	100* to 800*	○	○
	Chloride ion (Cl^-)	[mg/L]	200 or less	○	
	Sulfuric acid ion (SO_4^{2-})	[mg/L]	200 or less	○	
	Acid consumption amount (at pH4.8)	[mg/L]	100 or less		○
	Total hardness	[mg/L]	200 or less		○
	Calcium hardness ($CaCO_3$)	[mg/L]	150 or less		○
	Ionic state silica (SiO_2)	[mg/L]	50 or less		○
Reference item	Iron (Fe)	[mg/L]	1.0 or less	○	○
	Copper (Cu)	[mg/L]	0.3 or less	○	
	Sulfide ion (S_2^-)	[mg/L]	Should not be detected.	○	
	Ammonium ion (NH_4^+)	[mg/L]	1.0 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 0.001 to 0.01.
• ○: Factors that have an effect on corrosion or scale generation.
• Even if the water quality standards are met, complete prevention of corrosion is not guaranteed.

3. Set the supply pressure between 0.3 to 0.5 MPa. Ensure a pressure difference at the facility water inlet/outlet of 0.3 MPa or more.

If the supply pressure is high, it will cause water leakage. If the supply pressure and pressure difference at the facility water inlet/outlet is low, it will cause an insufficient flow rate of the facility water, and poor temperature control.

Operation

⚠ Warning

1. Confirmation before operation

1) The fluid level of a tank should be within the specified range of H (High) and L (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 the 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.
Pump can be operated independently.

2. Confirmation during operation

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

3. Emergency stop method

• When an abnormality is confirmed, stop the machine immediately. After stopping operation, disconnect the power supply from the user's equipment.

Operation Restart Time

⚠ Caution

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

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

• Power supply voltage is not within the rated voltage range of ±10%.
• In case the water level inside the tank is reduced abnormally.
• Circulating fluid temperature is too high.
• Compared to the cooling capacity, the heat generation amount of the user's equipment is too high.
• Ambient temperature is too high. (Check the ambient temperature in the specifications.)
• Ventilation hole is clogged with dust or dirt.

Maintenance

⚠ Caution

<Periodical inspection every one month>

Clean the ventilation hole.

If the dustproof filter of water-cooled type product becomes clogged with dust or debris, a decline in cooling performance can result.
In order to avoid deforming or damaging the dustproof filter, clean it with a long-haired brush or air gun.

<Periodical inspection every three months>

Inspect the circulating fluid.

1. When using tap water or deionized water
• Replacement of circulating fluid
Failure to replace the circulating fluid can lead to the development of bacteria or algae. Replace it regularly depending on your usage conditions.
• Tank cleaning (same as the HRS series)
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>

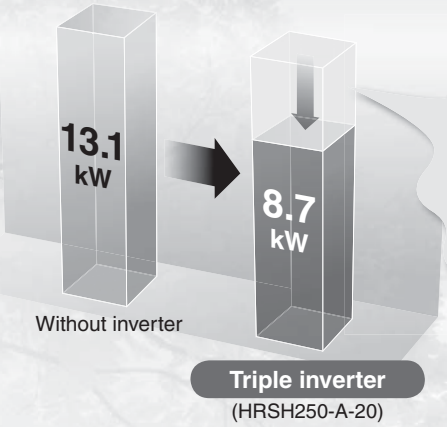
1. Make water-removal arrangements beforehand.

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

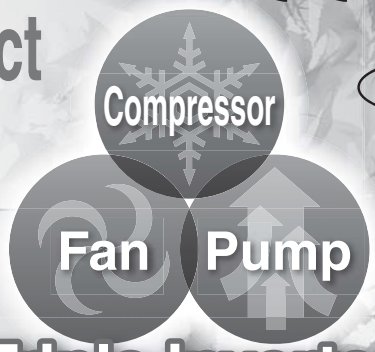
2. Consult a professional.

This product has an "anti-freezing function" and "warming-up function." Read the Operation Manual carefully, and if any additional anti-freezing function (e.g. tape heater) is needed, ask for it from the vendor.

Outstanding energy saving effect with the triple inverter!



Power consumption
34% *1
Energy saving



Triple inverter

- DC inverter compressor
- DC inverter fan (For air-cooled type) *2
- Inverter pump

CE cMETus (UL Standards)
RoHS

- Cooling capacity 10 kW, 15 kW, 20 kW, 25 kW, 28 kW
- Temperature stability ±0.1°C (when a load is stable)
- Compact, Space-saving
- Outdoor installation, Splashproof type (IPX4)
- Low-noise design Operating noise Max. 68 dB (Except HRSH300-A)
- Outdoor installation (IPX4)
- Max. ambient temperature 45°C
- Maintenance free pump
  Mechanical seal-less **immersion pump** is used.
  No need to replace the seal → Maintenance hours reduced

Added CE-/UL-compliant products to air-cooled/water-cooled 200 V type. (Option)

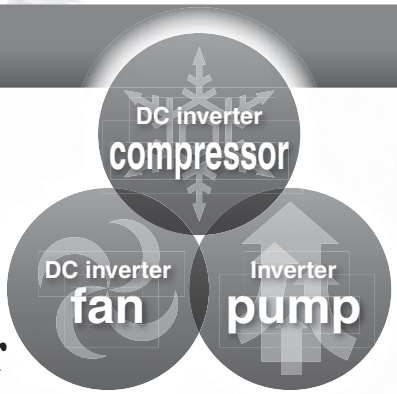


Compatible power supplies in Europe, Asia, Oceania, North, Central and South America

- 3-phase 200 VAC
- 3-phase 400 VAC

*1 Under the conditions shown on page 125
*2 For water-cooled type, a water regulating valve is used for the facility water flow control instead of a fan.

Triple inverter



(The water-cooled type is not equipped with a fan.)

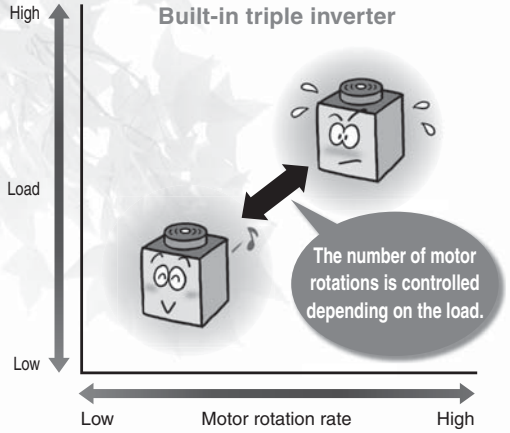
The inverter respectively controls the number of motor rotations of the compressor, fan and pump depending on the load from the user's equipment.

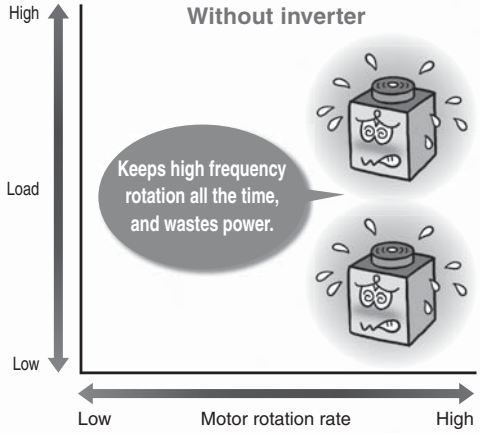
Power consumption **reduced by 34%*** **compared with a thermo-chiller without the inverter**

With the inverter, it is possible to operate with the same performance even with the power supply of 50 Hz.

* For HRSH250-A-20

Conditions
- Outdoor air temperature: 32°C ● Circulating fluid temperature setting: 20°C ● Heat load in the user's equipment: 25 kW ● Power supply: 200 V 60 Hz
- Circulating fluid flow rate: 60 L/min@0.5 MPa to the user's equipment ● External piping: The shortest distance assumed to the user's equipment
- Values shown in the graph for a thermo-chiller without inverter are found by calculation based on an assumption that a thermo-chiller is operated with a general refrigerant circuit that controls the compressor by turning the power ON/OFF, and with a bypass to the circulating fluid circuit.





Variations Cooling capacities ranging from 10 kW to 25 kW

Air-cooled refrigeration





Water-cooled refrigeration



Model		HRSH100-A	HRSH150-A	HRSH200-A
Cooling capacity		10.5 kW	15.7 kW	20.5 kW
Power supply	-20	3-phase 200 VAC (50 Hz), 3-phase 200 to 230 VAC (60 Hz)		
	-40	3-phase 380 to 415 VAC (50/60 Hz)		
Set temp. range		5 to 35°C		
Temp. stability		±0.1°C		

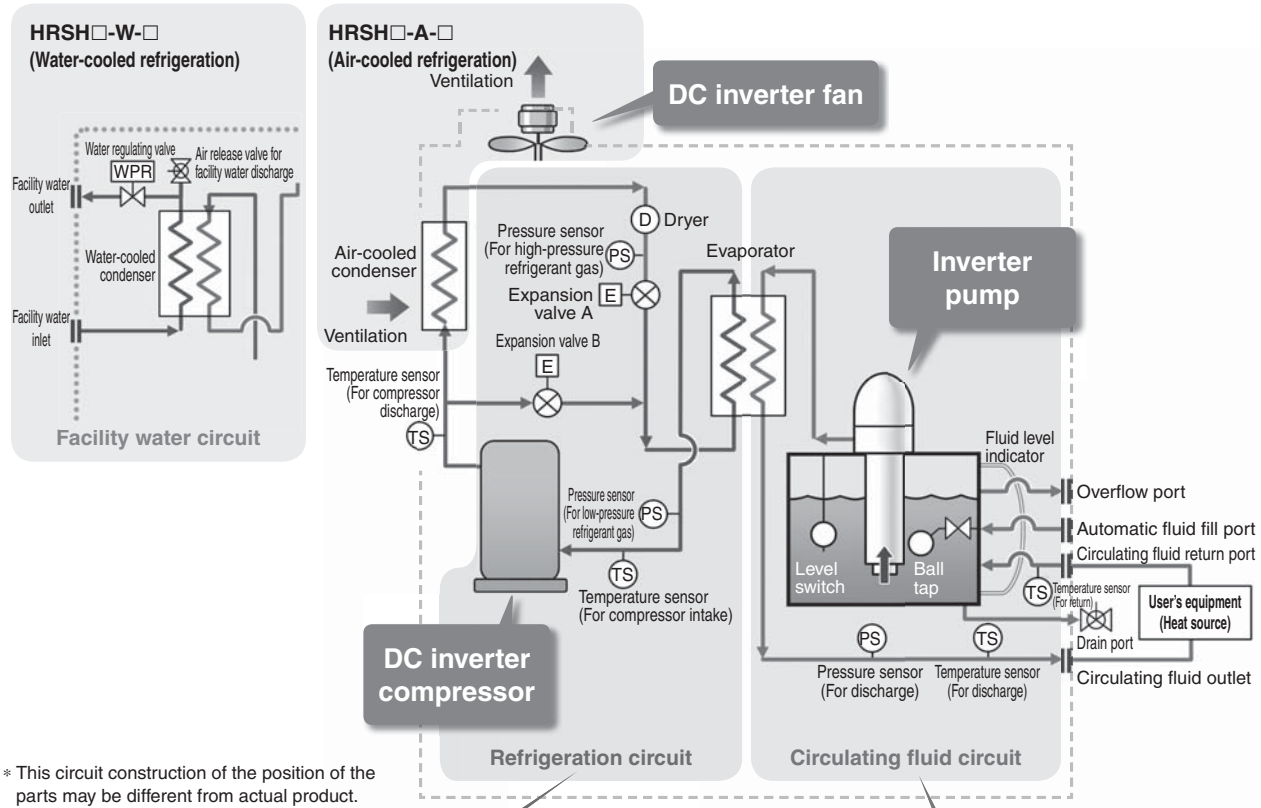
Model		HRSH250-A	HRSH300-A
Cooling capacity		25 kW	28 kW
Power supply	-20	3-phase 200 VAC (50 Hz), 3-phase 200 to 230 VAC (60 Hz)	
	-40	3-phase 380 to 415 VAC (50/60 Hz)	
Set temp. range		5 to 35°C	
Temp. stability		±0.1°C	

Model		HRSH100-W	HRSH150-W	HRSH200-W	HRSH250-W
Cooling capacity		11.5 kW	15.7 kW	20.6 kW	24 kW
Power supply	-20	3-phase 200 VAC (50 Hz), 3-phase 200 to 230 VAC (60 Hz)			
	-40	3-phase 380 to 415 VAC (50/60 Hz)			
Set temp. range		5 to 35°C			
Temp. stability		±0.1°C			

Options
▸Page 146
- With caster adjuster-foot
- With earth leakage breaker (400 V type is equipped as standard.)
- With earth leakage breaker with handle (400 V type is equipped as standard.)
- With fluid fill port

Optional accessories
▸Page 149
- Piping conversion fitting
- Caster adjuster-foot kit
- Electric conductivity control set
- Bypass piping set
- Snow protection hood (Air-cooled only)
- Particle filter set

Circuit diagram



* This circuit construction of the position of the parts may be different from actual product.

Refrigeration circuit

- The DC inverter compressor compresses the refrigerant gas, and discharges the high temperature and high pressure refrigerant gas.
- In the case of air-cooled refrigeration, the high temperature and high pressure refrigerant gas is cooled down by an air-cooled condenser with the ventilation of the DC inverter fan, and becomes a liquid. In the case of water-cooled refrigeration, the refrigerant gas is cooled by a water-cooled condenser with the facility water in the facility water circuit, and becomes a liquid.
- The liquefied high pressure refrigerant gas expands and its temperature lowers when it passes through expansion valve A and vaporizes by taking heat from the circulating fluid in the evaporator.
- The vaporized refrigerant gas is sucked into the DC inverter compressor and compressed again.
- When heating the circulating fluid, the high pressure and high temperature refrigerant gas is bypassed into the evaporator by expansion valve B, to heat the circulating fluid.

POINT

The combination of inverter control of the compressor and fan (facility water flow control by a water regulating valve is used in water-cooled refrigeration), and the precise control of expansion valves A and B realizes energy saving operation without waste and high temperature stability.

Circulating fluid circuit

- The circulating fluid discharged from the inverter pump, is heated or cooled by the user's equipment and returns to the tank.
- The circulating fluid is sent to the evaporator by the inverter pump, and is controlled to a set temperature by the refrigeration circuit, to be discharged to the user's equipment side again by the thermo-chiller.

POINT

Adjusting the discharge pressure by pump inverter control eliminates wasteful discharge of the circulating fluid and realizes energy saving operation.

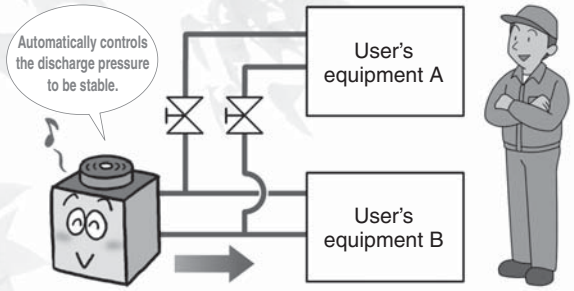
POINT

Since the refrigeration circuit is controlled by the signal from 2 temperature sensors (for return and discharge), precise temperature control of the circulating fluid can be performed. Therefore, there is no necessity of absorbing the temperature difference in the circulating fluid with a large tank capacity, and realizes high temperature stability even with a small-size tank. Also, contributes to space-saving.

Circulating fluid pressure adjustable

Inverter pump

Discharge pressure of the circulating fluid can be set with the operation panel. The inverter pump automatically controls the discharge pressure to the set pressure without adjusting the bypass piping under various piping conditions. Power consumption can be reduced by this control.
(Operation to the set pump operating frequency is also possible.)





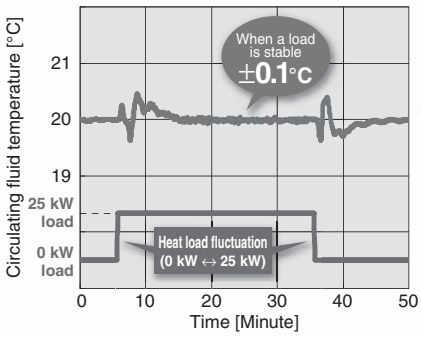
Operation display panel
(Circulating fluid discharge pressure setup screen)

When the product is used with the flow path switched for maintenance, the pressure adjusting function controls the discharge pressure to be stable. (Secure the specified minimum flow for each branch circuit.)



Temperature stability ±0.1°C (when a load is stable)

By controlling the DC inverter compressor, DC inverter fan, and electronic expansion valve simultaneously, it maintains the good temperature stability when the heat load fluctuates.

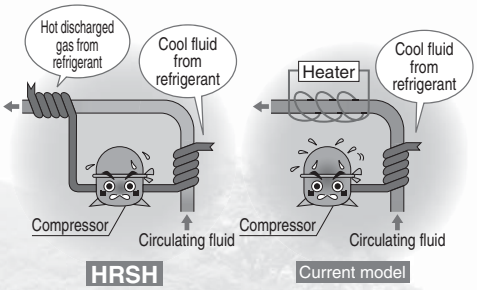


∗ For HRSH250-A-20

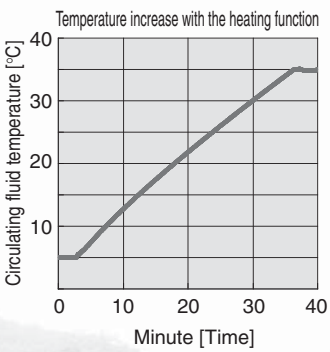
Conditions
- Outdoor air temperature: 32°C
- Circulating fluid temperature setting: 20°C
- Heat load in the user's equipment: 25 kW
- Power supply: 200 V 60 Hz
- Circulating fluid flow: 125 L/min@0.5 MPa
- External piping: Bypass piping + Heat load

Circulating fluid can be heated without a heater.

Heating method using discharged heat makes a heater unnecessary.

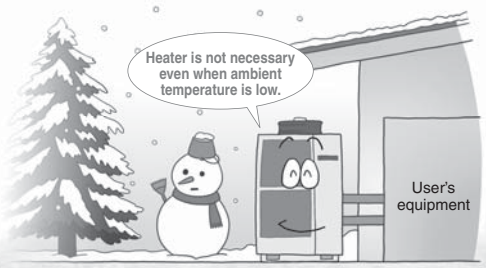


∗ This is just an example diagram.



∗ For HRSH250-A-20

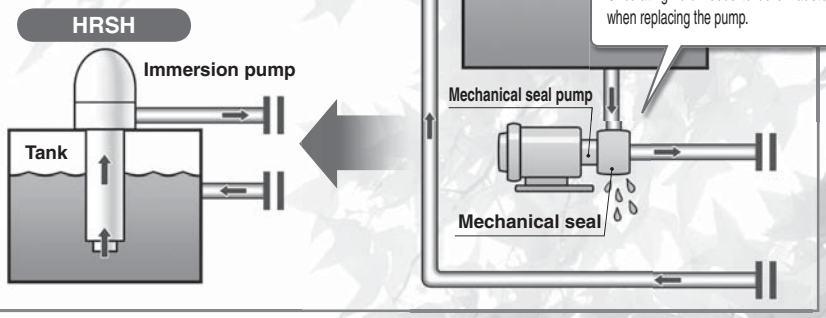
Conditions
- Ambient temperature: 5°C
- Power supply: 200 V 60 Hz
- Circulating fluid flow: 125 L/min@0.5 MPa
- External piping: Bypass piping



Reduces the maintenance hours for the pump.

Mechanical seal-less immersion pump is used.

As the pump has no external leakage of the circulating fluid, a periodic check of the pump leakage and replacement of the mechanical seal are not necessary. There is no need to exhaust the circulating fluid when removing the pump.



Compact and lightweight 280 kg (For HRSH250-A-20)

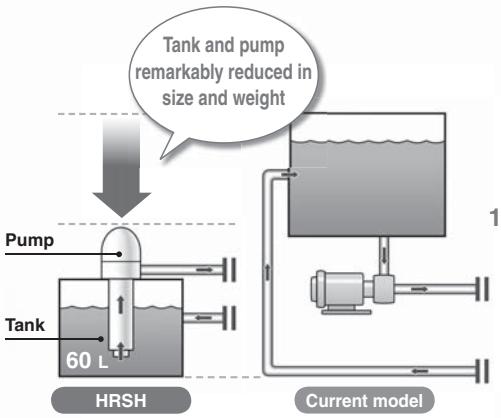
Compact tank 60 L (HRSH250-A)

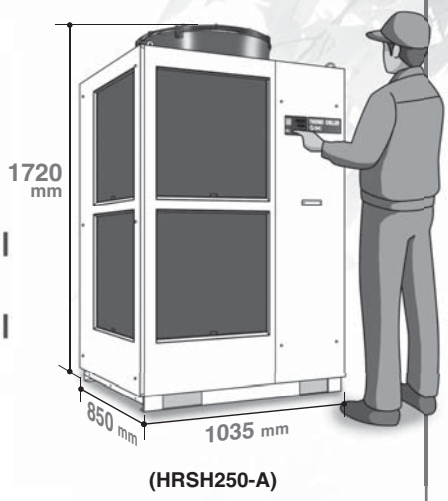
Temperature followability control reduced the tank capacity required as a buffer.

Aluminum air-cooled condenser

High heat transfer efficiency, lightweight

The integrated tank and pump saves space.

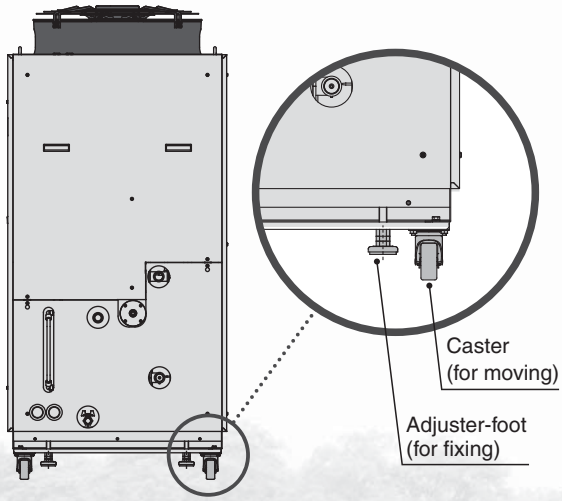




(HRSH250-A)

	Model	Height [mm]	Width [mm]	Depth [mm]	Weight [kg]
Air-cooled refrigeration	**HRSH100-A**	1420	954	715	180
	HRSH150/200-A	1420	954	715	215
	HRSH250/300-A	1720	1035	850	280
Water-cooled refrigeration	**HRSH100-W**	1235	687	715	150
	HRSH150/200/250-W	1235	687	715	180

With caster adjuster-foot (Option)

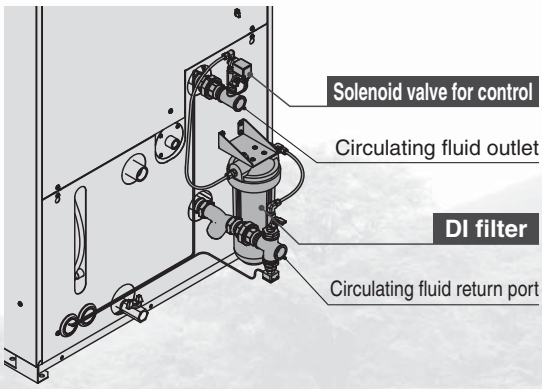


Electric conductivity control set

(With DI filter + Solenoid valve kit for control)

The electric conductivity of the circulating fluid can be set with the controller monitor arbitrarily.

Set control range: 5.0 to 45.0 μS/cm



IPX4

IP (International Protection) is the industrial standard for "Degrees of protection provided by outer defensive enclosures of electric equipment (IP Code)" according to IEC 60529 and JIS C 0920.

IPX4: No harmful influence by water splash is acceptable from every direction.

Can be installed outdoors.



Globally compatible power supplies

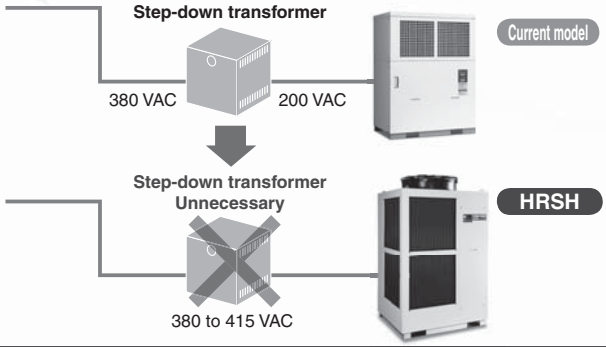
CE (400 V type only)

(Europe, Asia, Oceania, Central and South America)

Transformer unnecessary

Power supply **Applicable to 200 to 230 VAC, or 380 to 415 VAC**

Transformers are unnecessary even when used overseas.



Improved maintenance performance

Fluid fill port for the circulating fluid is available. (Option)

Fluid fill port is equipped in the upper part of the tank in addition to the automatic fluid fill port for a tap water piping connection.

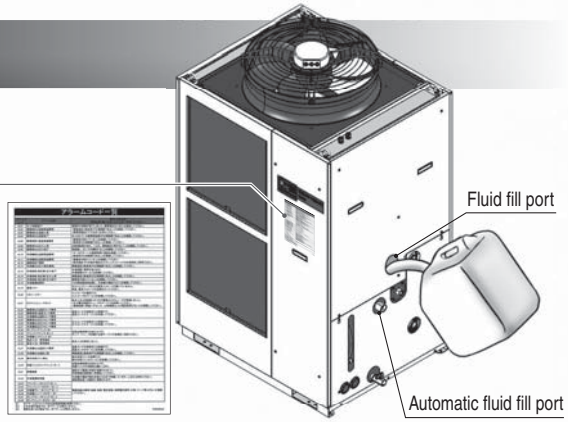
Front side access

All the electrical components can be checked from the front side for the easier maintenance work.

Alarm code list

Alarm code list stickers (English 1 pc./Japanese 1 pc.) are included. This can be put under the operation panel for reference.

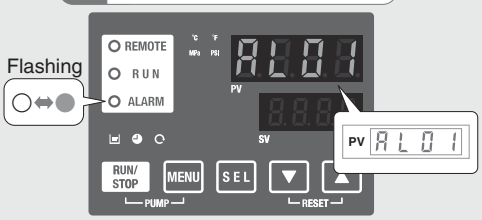
(Alarm ▶ Page 144)



Operation display panel Easy maintenance with the check display

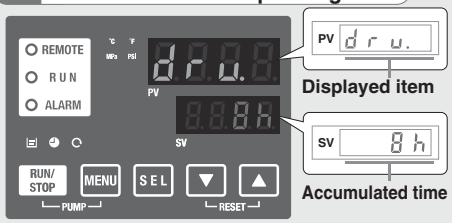
Alarm codes notify of checking times.
Notifies when to check the **pump** and **fan motor**. Helpful for facility maintenance.

Ex. **AL01 "Low level in tank"**



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

Ex. **drv. "Accumulated operating time"**



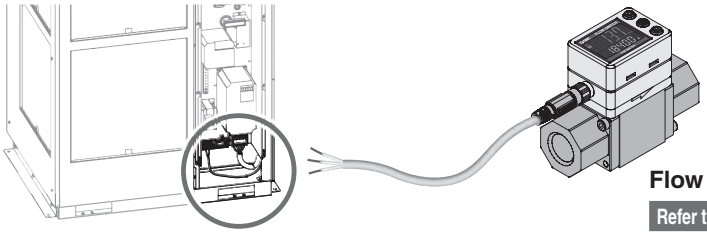
Displayed item	
Temperature	Circulating fluid outlet temperature
	Circulating fluid return temperature
	Compressor gas temperature
Flow rate	Circulating fluid flow rate*1
Pressure	Circulating fluid outlet pressure
	Compressor gas discharge pressure
	Compressor gas return pressure
Operating time	Accumulated operating time
	Accumulated operating time of pump
	Accumulated operating time of fan*2
	Accumulated operating time of compressor
	Accumulated operation time of dustproof filter*2

*1 This is not measurement value. Use it for reference. *2 These are displayed only for air-cooled refrigeration.

Convenient functions Details ▶ **Page 144** Timer function, Anti-freezing function, Power failure auto-restart function, Warming-up function, Key-lock function, etc.

Power supply (24 VDC) available

Power can be supplied from the terminal block on the rear side to external switches etc.



Flow switch

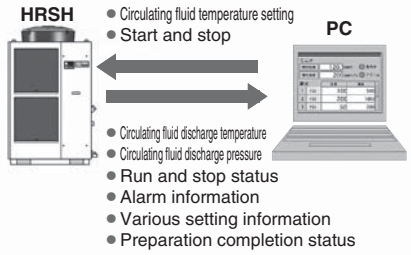
Refer to page 139.

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 equipment 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 PF3W, etc.).

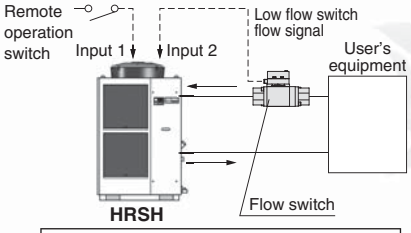
Ex.1 Remote signal I/O through serial communication

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



Ex.2 Remote operation signal input

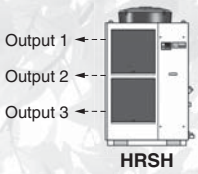
One of the contact inputs is used for remote operation and the other is used for a flow switch to monitor the flow, and their warning outputs are taken in.



Power for flow switch (24 VDC) can be supplied from the thermo-chiller.

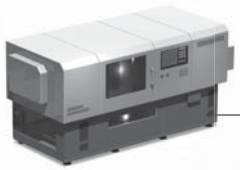
Ex.3 Alarm and operation status (start, stop, etc.) signal output

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



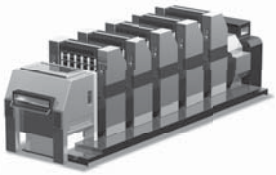
• Output setting example
Output 1: Temperature rise
Output 2: Pressure rise
Output 3: Operation status (start, stop, etc.)

Applications



Laser beam machine/ Laser welding machine

Cooling of the laser oscillation part and power source



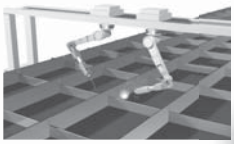
Printing machine

Temperature control of the roller



Cleaning machine

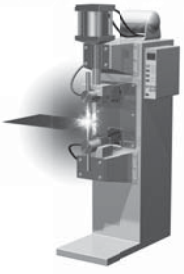
Temperature control of cleaning solution





Arc welding machine

Cooling of the power source



Resistance welding machine (Spot welding)

Cooling of the welding head electrodes, transformers and transistors (thyristors)



High frequency induction heating equipment

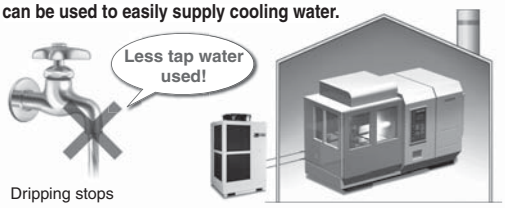
Cooling of the heating coils, high frequency power source and around inverters

Makes cooling water easily available, anytime, anywhere.

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



Even without a cooling tower, an air-cooled refrigerated chiller can be used to easily supply cooling water.



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



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



Global Supply Network

SMC has a comprehensive network in the global market.

We now have a presence of more than 400 branch offices and distributors in 78 countries world wide such as Asia, Oceania, North/Central/South America, and Europe. With this global network, we are able to provide a global supply of our substantial range of products with the best service. We also provide full support to local factories, foreign manufacturing companies and Japanese companies in each country.





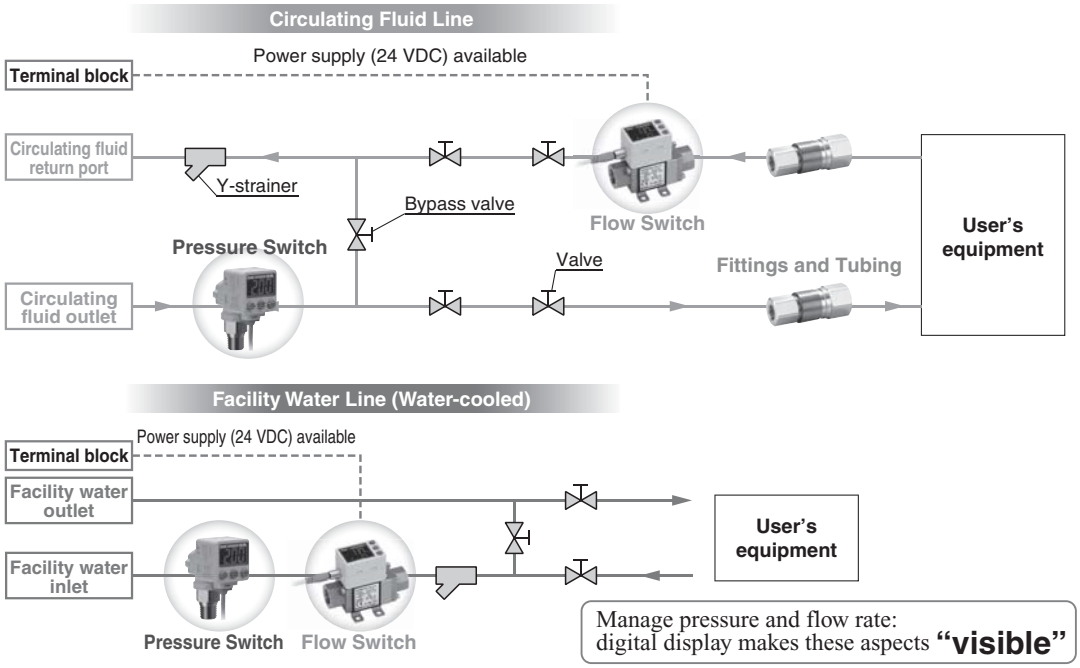
SMC Thermo-chiller Variations

Lots of variations are available in response to the users' requirements.

Series		Temperature stability [°C]	Set temperature range [°C]	Cooling capacity [kW]												Environment	International standards
				1.2	1.8	2.4	3	5	6	9	10	15	20	25	28		
	**HRSE Basic type**	±2.0	10 to 30	●	●	●										Indoor use	CE (Only 230 VAC type)
	**HRS Standard type**	±0.1	5 to 40	●	●	●	●	●	●							Indoor use	CE, MET (Only 60 Hz)
	**HRS100/150 Standard type**	±1.0	5 to 35								●	●				Outdoor installation IPX4	CE (400 V as standard)
	**HRSH090 Inverter type**	±0.1	5 to 40							●						Indoor use	CE (400 V as standard) ETL (Only 200 V as an option)
	**HRSH Inverter type**	±0.1	5 to 35								●	●	●	●	●	Outdoor installation IPX4	CE (400 V as standard, 200 V as an option) MET (Only 200 V as an option. See page 148.)

Circulating Fluid/Facility Water Line Equipment





Manage pressure and flow rate:
digital display makes these aspects **"visible"**

Flow Switch: Monitors flow rate and temperature of the circulating fluid.

Refer to the **WEB catalog** or the Best Pneumatics No. 6 for details.

3-Color Display Digital Flow Switch for Water ***PF3W***



Integrated flow adjustment valve and temperature sensor



PVC Piping

3-Color Display Electromagnetic Type Digital Flow Switch ***LFE***



Digital Flow Switch for Deionized Water and Chemical Liquids ***PF2D***
4-Channel Flow Monitor ***PF2□200***



Pressure Switch: Monitors pressure of the circulating fluid.

Refer to the **WEB catalog** or the Best Pneumatics No. 6 for details.



2-Color Display High-Precision Digital Pressure Switch ***ISE80***



Pressure Sensor for General Fluids ***PSE56□***
Pressure Sensor Controller ***PSE200,300***

Fittings and Tubing

Refer to the **WEB catalog** or the Best Pneumatics No. 6 for details.

S Coupler ***KK***



S Coupler/Stainless Steel (Stainless Steel 304) ***KKA***



Metal One-touch Fittings ***KQB2***



Stainless Steel 316 One-touch Fittings ***KQG2***



Stainless Steel 316 Insert Fittings ***KFG2***



Fluoropolymer Fittings ***LQ***



Tubing ***T□***



Series	Material
T	Nylon
TU	Polyurethane
TH	FEP (Fluoropolymer)
TD	Modified PTFE (Soft fluoropolymer)
TL	Super PFA
TLM	PFA

CONTENTS

Series HRSH Inverter Type



Thermo-chiller Series HRSH

How to Order/Specifications

Air-cooled 200 V ····· Page 135
Water-cooled 200 V ····· Page 136
Air-cooled 400 V ····· Page 137
Water-cooled 400 V ····· Page 138

Cooling Capacity ····· Page 139
Pump Capacity ····· Page 140
Dimensions ····· Page 141
Recommended External Piping Flow ····· Page 143
Cable Specifications ····· Page 143
Operation Display Panel ····· Page 144
List of Function ····· Page 144
Alarm ····· Page 144
Communication Function ····· Page 145

Options

With Caster Adjuster-foot ····· Page 146
With Earth Leakage Breaker ····· Page 146
With Earth Leakage Breaker with Handle ····· Page 147
With Fluid Fill Port ····· Page 147
Conforming to CE/UL Standards ····· Page 148

Optional Accessories

① Piping Conversion Fitting ····· Page 149
② Caster Adjuster-foot Kit ····· Page 149
③ Electric Conductivity Control Set ····· Page 150
④ Bypass Piping Set ····· Page 150
⑤ Snow Protection Hood ····· Page 151
⑥ Particle Filter Set ····· Page 152

Cooling Capacity Calculation

Required Cooling Capacity Calculation ····· Page 153
Precautions on Cooling Capacity Calculation ··· Page 154
Circulating Fluid Typical Physical Property Values ··· Page 154

Specific Product Precautions ····· Page 155

Thermo-chiller Inverter Type
Air-cooled 200 V Type
Series HRSH

(UL Standards)

RoHS



How to Order

HRSH 250 – A □ – 20 – □

Cooling capacity

100	10.5 kW
150	15.7 kW
200	20.5 kW
250	25 kW
300	28 kW

Cooling method

A	Air-cooled refrigeration

Pipe thread type

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

Power supply

20	3-phase 200 VAC (50 Hz) 3-phase 200 to 230 VAC (60 Hz)

Option

Nil	None
A	With caster adjuster-foot
B	With earth leakage breaker
B1	With earth leakage breaker with handle
K Note 1)	With fluid fill port
S Note 2)	Conforming to CE/UL standards

Models Compatible with Option S

Model	UL	CE
HRSH100	●	●
HRSH150	●	●
HRSH200	●	●
HRSH250	●	●
HRSH300	Pending	Pending

- When multiple options are combined, indicate symbols in alphabetical order.

Note 1) This is a manual fluid fill port that is different from the automatic fluid fill port. Fluid can be supplied manually into the tank without removing the side panel. (Fluid can be supplied manually for models without option K if the side panel is removed.)

Note 2) Combination with option B or option B1 is not necessary. The earth leakage breaker with a handle (Option B1) is provided as standard.

Specifications

Model				HRSH100-A□-20-□	HRSH150-A□-20-□	HRSH200-A□-20-□	HRSH250-A□-20-□	HRSH300-A□-20-□
Cooling method				Air-cooled refrigeration				
Refrigerant				R410A (HFC)				
Control method				PID control				
Ambient temperature/Altitude Note 1), 9)			°C	Temperature: –5 to 45, Altitude: less than 3000 m				
Circulating fluid system	Circulating fluid Note 2)			Tap water, 15% Ethylene glycol aqueous solution, Deionized water				
	Set temperature range Note 1)		°C	5 to 35				
	Cooling capacity Note 3), 9)		kW	10.5	15.7	20.5	25	28
	Heating capacity Note 4)		kW	2.5	3	5.5	7.5	
	Temperature stability Note 5)		°C	±0.1				
	Pump capacity	Rated flow (Outlet)	L/min	45 (0.43 MPa)	45 (0.45 MPa)		125 (0.5 MPa)	
		Maximum flow rate	L/min	120	130		180	
		Maximum pump head	m	50			80	
	Settable pressure range Note 6)		MPa	0.1 to 0.5			0.1 to 0.8	
	Minimum operating flow rate Note 7)		L/min	20	25		40	
	Tank capacity		L	25	42		60	
	Circulating fluid outlet, circulating fluid return port			Rc1 (Symbol F: G1, Symbol N: NPT1)				
	Tank drain port			Rc3/4 (Symbol F: G3/4, Symbol N: NPT3/4)				
	Automatic fluid fill system (Standard)	Supply side pressure range	MPa	0.2 to 0.5				
		Supply side fluid temperature	°C	5 to 35				
		Automatic fluid fill port		Rc1/2 (Symbol F: G1/2, Symbol N: NPT1/2)				
		Overflow port		Rc1 (Symbol F: G1, Symbol N: NPT1)				
	Fluid contact material		Metal	Stainless steel, Copper (Heat exchanger brazing), Brass, Bronze				
			Resin	PTFE, PU, FKM, EPDM, PVC, NBR, POM, PE, NR				
Electrical system	Power supply			3-phase 200 VAC (50 Hz), 3-phase 200 to 230 VAC (60 Hz) Allowable voltage range ±10% (No continuous voltage fluctuation)				
	Applicable earth leakage breaker Note 8)	Rated current	A	30		40	50	
		Sensitivity of leak current	mA	30				
	Rated operating current Note 5)		A	14	17	25	34	36
	Rated power consumption Note 5)		kW (kVA)	4.5 (4.9)	5.8 (6)	8.4 (8.7)	10.4 (11.6)	11.1 (12.2)
Noise level (Front 1 m/Height 1 m) Note 5)			dB (A)	68				71
Waterproof specification				IPX4				
Accessories				Alarm code list stickers 2 pcs. (English 1 pc./Japanese 1 pc.), Operation Manual (for installation/operation) 2 pcs. (English 1 pc./Japanese 1 pc.), Y-strainer (40 meshes) 25A, Barrel nipple 25A, Anchor bolt fixing brackets 2 pcs. (including 6 M8 bolts) Note 10)				
Weight (dry state)			kg	Approx. 180	Approx. 215		Approx. 280	

Note 1) Use a 15% ethylene glycol aqueous solution if operating in a place where the ambient temperature and/or circulating fluid temperature is 10°C or less.

Note 2) Use fluid in condition below as the circulating fluid.
Tap water: Standard of The Japan Refrigeration And Air Conditioning Industry Association (JRA GL-02-1994)
15% ethylene glycol aqueous solution: diluted by tap water in condition above without any additives such as antiseptics.
Deionized water: Electric conductivity 1 μS/cm or higher (Electric resistivity 1 MΩ·cm or lower)

Note 3) ① Ambient temperature: 32°C, ② Circulating fluid: Tap water, ③ Circulating fluid temperature: 20°C, ④ Circulating fluid flow rate: Rated flow, ⑤ Power supply: 200 VAC

Note 4) ① Ambient temperature: 32°C, ② Circulating fluid: Tap water, ③ Circulating fluid flow rate: Rated flow, ④ Power supply: 200 VAC

Note 5) ① Ambient temperature: 32°C, ② Circulating fluid: Tap water, ③ Circulating fluid temperature: 20°C, ④ Load: Same as the cooling capacity, ⑤ Circulating fluid flow rate: Rated flow, ⑥ Power supply: 200 VAC, ⑦ Piping length: Shortest

Note 6) With the pressure control mode by inverter. When the pressure control mode is not used, the pump power frequency set mode can be used.

Note 7) Fluid flow rate to maintain the cooling capacity and the temperature stability. If the actual flow rate is lower than this, install a bypass piping.

Note 8) To be prepared by user. A specified earth leakage breaker is installed for option B [With earth leakage breaker], B1 [With earth leakage breaker with handle] and S [Conforming to CE/UL standards].

Note 9) If the product is used at altitude of 1000 m or higher, refer to "Operating Environment/Storage Environment" (page 134) Item 13 "∗ For altitude of 1000 m or higher".

Note 10) The anchor bolt fixing brackets (including 6 M8 bolts) are used for fixing to wooden skids when packaging the thermo-chiller. No anchor bolt is included.

SMC

Thermo-chiller Inverter Type
Water-cooled 200 V Type
Series HRSH

(UL Standards)

RoHS



How to Order

HRSH 250 – W □ – 20 – □

Cooling capacity

100	11.5 kW	**200**	20.6 kW
150	15.7 kW	**250**	24 kW

Cooling method

W	Water-cooled refrigeration

Pipe thread type

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

Power supply

20	3-phase 200 VAC (50 Hz) 3-phase 200 to 230 VAC (60 Hz)

Option

Nil	None	**B1**	With earth leakage breaker with handle
A	With caster adjuster-foot	**K** Note 1)	With fluid fill port
B	With earth leakage breaker	**S** Note 2)	Conforming to CE/UL standards

- When multiple options are combined, indicate symbols in alphabetical order.

Note 1) This is a manual fluid fill port that is different from the automatic fluid fill port. Fluid can be supplied manually into the tank without removing the side panel. (Fluid can be supplied manually for models without option K if the side panel is removed.)

Note 2) Combination with option B or option B1 is not necessary. The earth leakage breaker with a handle (Option B1) is provided as standard.

Models Compatible with Option S

Model	UL	CE
HRSH100	●	●
HRSH150	●	●
HRSH200	●	●
HRSH250	●	●

Specifications

Model				HRSH100-W□-20-□	HRSH150-W□-20-□	HRSH200-W□-20-□	HRSH250-W□-20-□
Cooling method				Water-cooled refrigeration			
Refrigerant				R410A (HFC)			
Control method				PID control			
Ambient temperature/Altitude Note 1), 9)			°C	Temperature: 2 to 45, Altitude: less than 3000 m			
Circulating fluid system	**Circulating fluid** Note 2)			Tap water, 15% Ethylene glycol aqueous solution, Deionized water			
	Set temperature range Note 1)		°C	5 to 35			
	Cooling capacity Note 3), 9)		kW	11.5	15.7	20.6	24
	Heating capacity Note 4)		kW	2.5	3.5	4.0	7.2
	Temperature stability Note 5)		°C	±0.1			
	Pump capacity	**Rated flow (Outlet)**	L/min	45 (0.43 MPa)	45 (0.45 MPa)		
		Maximum flow rate	L/min	120	130		
		Maximum pump head	m	50			
	Settable pressure range Note 6)		MPa	0.1 to 0.5			
	Minimum operating flow rate Note 7)		L/min	20	25		
	Tank capacity		L	25	42		
	Circulating fluid outlet, circulating fluid return port			Rc1 (Symbol F: G1, Symbol N: NPT1)			
	Tank drain port			Rc3/4 (Symbol F: G3/4, Symbol N: NPT3/4)			
	Automatic fluid fill system (Standard)	**Supply side pressure range**	MPa	0.2 to 0.5			
		Supply side fluid temperature	°C	5 to 35			
		Automatic fluid fill port		Rc1/2 (Symbol F: G1/2, Symbol N: NPT1/2)			
		Overflow port		Rc1 (Symbol F: G1, Symbol N: NPT1)			
	Fluid contact material		**Metal**	Stainless steel, Copper (Heat exchanger brazing), Bronze, Brass			
			Resin	PTFE, PU, FKM, EPDM, PVC, NBR, POM, PE, NR			
Facility water system	**Supply side pressure range**		MPa	0.3 to 0.5			
	Supply side temperature range		°C	5 to 40			
	Required flow		L/min	25	30	50	55
	Facility water pressure differential		MPa	0.3 or more			
	Facility water inlet/outlet			Rc1 (Symbol F: G1, Symbol N: NPT1)			
	Fluid contact material		**Metal**	Stainless steel, Copper (Heat exchanger brazing), Bronze, Brass			
			Resin	PTFE, EPDM, NBR			
Electrical system	**Power supply**			3-phase 200 VAC (50 Hz), 3-phase 200 to 230 VAC (60 Hz), Allowable voltage range ±10% (No continuous voltage fluctuation)			
	Applicable earth leakage breaker Note 8)	**Rated current**	A	30		40	50
		Sensitivity of leak current	mA	30			
	Rated operating current Note 5)		A	14	17	21	25
	Rated power consumption Note 5)		kW (kVA)	4.2 (4.7)	5.3 (5.8)	6.6 (7.0)	8.0 (8.4)
Noise level (Front 1 m/Height 1 m) Note 5)			dB (A)	61	60		61
Waterproof specification				IPX4			
Accessories				Alarm code list stickers 2 pcs. (English 1 pc./Japanese 1 pc.), Operation Manual (for installation/operation) 2 pcs. (English 1 pc./Japanese 1 pc.), Y-strainer (40 meshes) 25A, Barrel nipple 25A, Anchor bolt fixing brackets 2 pcs. (including 6 M8 bolts) Note 10)			
Weight (dry state)			kg	Approx. 150	Approx. 180		

Note 1) Use a 15% ethylene glycol aqueous solution if operating in a place where the ambient temperature and/or circulating fluid temperature is 10°C or less.

Note 2) Use fluid in condition below as the circulating fluid.
Tap water: Standard of The Japan Refrigeration And Air Conditioning Industry Association (JRA GL-02-1994)
15% ethylene glycol aqueous solution: diluted by tap water in condition above without any additives such as antiseptics. Deionized water: Electric conductivity 1 μS/cm or higher (Electric resistivity 1 MΩ·cm or lower)

Note 3) ① Facility water temperature: 32°C, ② Circulating fluid: Tap water, ③ Circulating fluid temperature: 20°C, ④ Circulating fluid flow rate: Rated flow, ⑤ Power supply: 200 VAC

Note 4) ① Facility water temperature: 32°C, ② Circulating fluid: Tap water, ③ Circulating fluid flow rate: Rated flow, ④ Power supply: 200 VAC

Note 5) ① Facility water temperature: 32°C, ② Circulating fluid: Tap water, ③ Circulating fluid temperature: 20°C, ④ Load: Same as the cooling capacity, ⑤ Circulating fluid flow rate: Rated flow, ⑥ Power supply: 200 VAC, ⑦ Piping length: Shortest

Note 6) With the pressure control mode by inverter. When the pressure control mode is not used, the pump power frequency set mode can be used.

Note 7) Fluid flow rate to maintain the cooling capacity and the temperature stability. If the actual flow rate is lower than this, install a bypass piping.

Note 8) To be prepared by user. A specified earth leakage breaker is installed for option B [With earth leakage breaker], B1 [With earth leakage breaker with handle] and S [Conforming to CE/UL standards].

Note 9) If the product is used at altitude of 1000 m or higher, refer to "Operating Environment/Storage Environment" (page 155) Item 13 "∗ For altitude of 1000 m or higher".

Note 10) The anchor bolt fixing brackets (including 6 M8 bolts) are used for fixing to wooden skids when packaging the thermo-chiller. No anchor bolt is included.

Thermo-chiller Inverter Type
Air-cooled 400 V Type
Series HRSH



How to Order

HRSH 250 – A □ – 40 – □

Cooling capacity

100	10.5 kW
150	15.7 kW
200	20.5 kW
250	25 kW
300	28 kW

Cooling method

A	Air-cooled refrigeration

Pipe thread type

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

Power supply

40	3-phase 380 to 415 VAC (50/60 Hz)

Option

Nil Note 1)	None
A	With caster adjuster-foot
K Note 2)	With fluid fill port

Note 1) 400 V type is provided with an earth leakage breaker (-B) as standard.

Note 2) This is a manual fluid fill port that is different from the automatic fluid fill port. Fluid can be supplied manually into the tank without removing the side panel. (Fluid can be supplied manually for models without option K if the side panel is removed.)

Specifications

Model				HRSH100-A□-40-□	HRSH150-A□-40-□	HRSH200-A□-40-□	HRSH250-A□-40-□	HRSH300-A□-40-□
Cooling method				Air-cooled refrigeration				
Refrigerant				R410A (HFC)				
Control method				PID control				
Ambient temperature/Altitude Note 1), 8)			°C	Temperature: –5 to 45, Altitude: less than 3000 m				
Circulating fluid system	**Circulating fluid** Note 2)			Tap water, 15% Ethylene glycol aqueous solution, Deionized water				
	Set temperature range Note 1)		°C	5 to 35				
	Cooling capacity Note 3), 8)		kW	10.5	15.7	20.5	25	28
	Heating capacity Note 4)		kW	2.5	3	5.5	7.5	
	Temperature stability Note 5)		°C	±0.1				
	Pump capacity	**Rated flow (Outlet)**	L/min	45 (0.43 MPa)	45 (0.45 MPa)		125 (0.5 MPa)	
		Maximum flow rate	L/min	120	130		180	
		Maximum pump head	m	50			80	
	Settable pressure range Note 6)		MPa	0.1 to 0.5			0.1 to 0.8	
	Minimum operating flow rate Note 7)		L/min	20	25		40	
	Tank capacity		L	25	42		60	
	Circulating fluid outlet, circulating fluid return port			Rc1 (Symbol F: G1, Symbol N: NPT1)				
	Tank drain port			Rc3/4 (Symbol F: G3/4, Symbol N: NPT3/4)				
	Automatic fluid fill system (Standard)	**Supply side pressure range**	MPa	0.2 to 0.5				
		Supply side fluid temperature	°C	5 to 35				
		Automatic fluid fill port		Rc1/2 (Symbol F: G1/2, Symbol N: NPT1/2)				
		Overflow port		Rc1 (Symbol F: G1, Symbol N: NPT1)				
	Fluid contact material		**Metal**	Stainless steel, Copper (Heat exchanger brazing), Brass, Bronze				
			Resin	PTFE, PU, FKM, EPDM, PVC, NBR, POM, PE, NR				
Electrical system	**Power supply**			3-phase 380 to 415 VAC (50/60 Hz) Allowable voltage range ±10% (No continuous voltage fluctuation)				
	Earth leakage breaker (Standard)	**Rated current**	A	20	30			
		Sensitivity of leak current	mA	30				
	Rated operating current Note 5)		A	7.4	9.3	12.8	16	18
	Rated power consumption Note 5)		kW (kVA)	4.6 (5.1)	5.8 (6.4)	8.2 (8.9)	10.1 (11.1)	10.8 (12.3)
Noise level (Front 1 m/Height 1 m) Note 5)			dB (A)	68				71
Waterproof specification				IPX4				
Accessories				Alarm code list stickers 2 pcs. (English 1 pc./Japanese 1 pc.), Operation Manual (for installation/operation) 2 pcs. (English 1 pc./Japanese 1 pc.), Y-strainer (40 meshes) 25A, Barrel nipple 25A, Anchor bolt fixing brackets 2 pcs. (including 6 M8 bolts) Note 9)				
Weight (dry state)			kg	Approx. 180	Approx. 215		Approx. 280	
CE marking	**EMC Directive**			2004/108/EC				
	Machinery Directive			2006/42/EC				

Note 1) Use a 15% ethylene glycol aqueous solution if operating in a place where the ambient temperature and/or circulating fluid temperature is 10°C or less.

Note 2) Use fluid in condition below as the circulating fluid.
Tap water: Standard of The Japan Refrigeration And Air Conditioning Industry Association (JRA GL-02-1994)
15% ethylene glycol aqueous solution: diluted by tap water in condition above without any additives such as antiseptics.
Deionized water: Electric conductivity 1 μS/cm or higher (Electric resistivity 1 MΩ·cm or lower)

Note 3) ① Ambient temperature: 32°C, ② Circulating fluid: Tap water, ③ Circulating fluid temperature: 20°C, ④ Circulating fluid flow rate: Rated flow, ⑤ Power supply: 400 VAC

Note 4) ① Ambient temperature: 32°C, ② Circulating fluid: Tap water, ③ Circulating fluid flow rate: Rated flow, ④ Power supply: 400 VAC

Note 5) ① Ambient temperature: 32°C, ② Circulating fluid: Tap water, ③ Circulating fluid temperature: 20°C, ④ Load: Same as the cooling capacity, ⑤ Circulating fluid flow rate: Rated flow, ⑥ Power supply: 400 VAC, ⑦ Piping length: Shortest

Note 6) With the pressure control mode by inverter. When the pressure control mode is not used, the pump power frequency set mode can be used.

Note 7) Fluid flow rate to maintain the cooling capacity and the temperature stability. If the actual flow rate is lower than this, install a bypass piping.

Note 8) If the product is used at altitude of 1000 m or higher, refer to "Operating Environment/Storage Environment" (page 155) Item 13 "∗ For altitude of 1000 m or higher".

Note 9) The anchor bolt fixing brackets (including 6 M8 bolts) are used for fixing to wooden skids when packaging the thermo-chiller. No anchor bolt is included.

Thermo-chiller Inverter Type
Water-cooled 400 V Type
Series HRSH



How to Order

HRSH 250 – W □ – 40 – □

Cooling capacity

100	11.5 kW
150	15.7 kW
200	20.6 kW
250	24 kW

Cooling method

W	Water-cooled refrigeration

Pipe thread type

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

Power supply

40	3-phase 380 to 415 VAC (50/60 Hz)

Option

Nil Note 1)	None
A	With caster adjuster-foot
K Note 2)	With fluid fill port

Note 1) 400 V type is provided with an earth leakage breaker (-B) as standard.

Note 2) This is a manual fluid fill port that is different from the automatic fluid fill port. Fluid can be supplied manually into the tank without removing the side panel. (Fluid can be supplied manually for models without option K if the side panel is removed.)

Specifications

Model				HRSH100-W□-40-□	HRSH150-W□-40-□	HRSH200-W□-40-□	HRSH250-W□-40-□
Cooling method				Water-cooled refrigeration			
Refrigerant				R410A (HFC)			
Control method				PID control			
Ambient temperature/Altitude Note 1), 8)			°C	Temperature: 2 to 45, Altitude: less than 3000 m			
Circulating fluid system	Circulating fluid Note 2)			Tap water, 15% Ethylene glycol aqueous solution, Deionized water			
	Set temperature range Note 1)		°C	5 to 35			
	Cooling capacity Note 3), 8)		kW	11.5	15.7	20.6	24
	Heating capacity Note 4)		kW	2.5	3.5	4.0	7.2
	Temperature stability Note 5)		°C	±0.1			
	Pump capacity	Rated flow (Outlet)	L/min	45 (0.43 MPa)	45 (0.45 MPa)		
		Maximum flow rate	L/min	120	130		
		Maximum pump head	m	50			
	Settable pressure range Note 6)		MPa	0.1 to 0.5			
	Minimum operating flow rate Note 7)		L/min	20	25		
	Tank capacity		L	25	42		
	Circulating fluid outlet, circulating fluid return port			Rc1 (Symbol F: G1, Symbol N: NPT1)			
	Tank drain port			Rc3/4 (Symbol F: G3/4, Symbol N: NPT3/4)			
	Automatic fluid fill system (Standard)	Supply side pressure range	MPa	0.2 to 0.5			
		Supply side fluid temperature	°C	5 to 35			
		Automatic fluid fill port		Rc1/2 (Symbol F: G1/2, Symbol N: NPT1/2)			
		Overflow port		Rc1 (Symbol F: G1, Symbol N: NPT1)			
	Fluid contact material		Metal	Stainless steel, Copper (Heat exchanger brazing), Brass, Bronze			
			Resin	PTFE, PU, FKM, EPDM, PVC, NBR, POM, PE, NR			
Facility water system	Temperature range		°C	5 to 40			
	Pressure range		MPa	0.3 to 0.5			
	Required flow		L/min	25	30	50	55
	Facility water pressure differential		MPa	0.3 or more			
	Facility water inlet/outlet			Rc1 (Symbol F: G1, Symbol N: NPT1)			
	Fluid contact material		Metal	Stainless steel, Copper (Heat exchanger brazing), Bronze, Brass			
			Resin	PTFE, NBR, EPDM			
Electrical system	Power supply			3-phase 380 to 415 VAC (50/60 Hz), Allowable voltage range ±10% (No continuous voltage fluctuation)			
	Applicable earth leakage breaker (Standard)	Rated current	A	20	30		
		Sensitivity of leak current	mA	30			
	Rated operating current Note 5)		A	7.3	8.8	10.6	12.8
	Rated power consumption Note 5)		kW (kVA)	4.4 (5.0)	5.3 (6.1)	6.6 (7.4)	8.2 (8.9)
Noise level (Front 1 m/Height 1 m) Note 5)			dB (A)	61	60		61
Waterproof specification				IPX4			
Accessories				Alarm code list stickers 2 pcs. (English 1 pc./Japanese 1 pc.), Operation Manual (for installation/operation) 2 pcs. (English 1 pc./Japanese 1 pc.), Y-strainer (40 meshes) 25A, Barrel nipple 25A, Anchor bolt fixing brackets 2 pcs. (including 6 M8 bolts) Note 9)			
Weight (dry state)			kg	Approx. 150	Approx. 180		
Compliant standards	CE marking	EMC Directive		2004/108/EC			
		Machinery Directive		2006/42/EC			

Note 1) Use a 15% ethylene glycol aqueous solution if operating in a place where the ambient temperature and/or circulating fluid temperature is 10°C or less.

Note 2) Use fluid in condition below as the circulating fluid.
Tap water: Standard of The Japan Refrigeration And Air Conditioning Industry Association (JRA GL-02-1994)
15% ethylene glycol aqueous solution: diluted by tap water in condition above without any additives such as antiseptics.
Deionized water: Electric conductivity 1 μS/cm or higher (Electric resistivity 1 MΩ·cm or lower)

Note 3) ① Facility water temperature: 32°C, ② Circulating fluid: Tap water, ③ Circulating fluid temperature: 20°C, ④ Circulating fluid flow rate: Rated flow, ⑤ Power supply: 400 VAC

Note 4) ① Facility water temperature: 32°C, ② Circulating fluid: Tap water, ③ Circulating fluid flow rate: Rated flow, ④ Power supply: 400 VAC

Note 5) ① Facility water temperature: 32°C, ② Circulating fluid: Tap water, ③ Circulating fluid temperature: 20°C, ④ Load: Same as the cooling capacity, ⑤ Circulating fluid flow rate: Rated flow, ⑥ Power supply: 400 VAC, ⑦ Piping length: Shortest

Note 6) With the pressure control mode by inverter. When the pressure control mode is not used, the pump power frequency set mode can be used.

Note 7) Fluid flow rate to maintain the cooling capacity and the temperature stability. If the actual flow rate is lower than this, install a bypass piping.

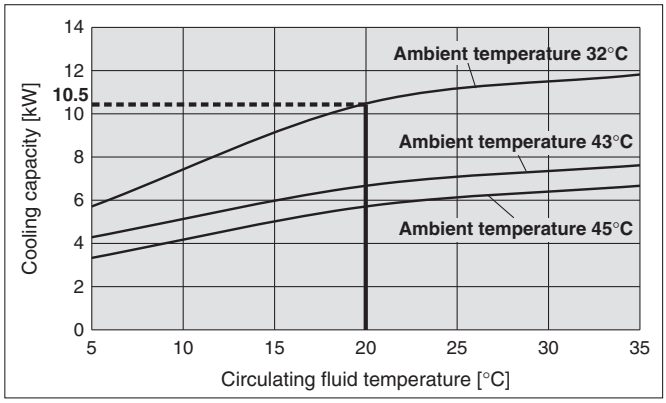
Note 8) If the product is used at altitude of 1000 m or higher, refer to "Operating Environment/Storage Environment" (page 155) Item 13 "∗ For altitude of 1000 m or higher".

Note 9) The anchor bolt fixing brackets (including 6 M8 bolts) are used for fixing to wooden skids when packaging the thermo-chiller. No anchor bolt is included.

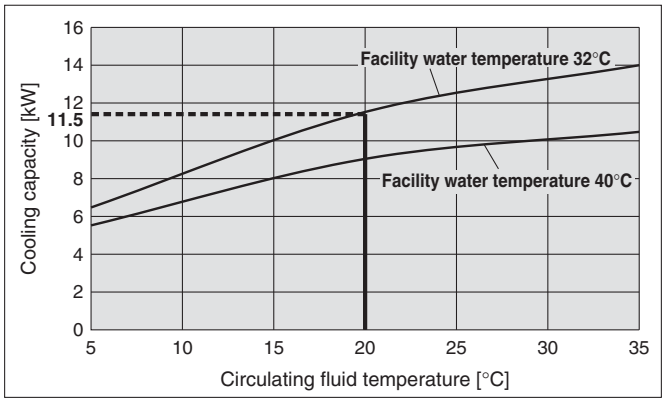
Cooling Capacity

∗ If the product is used at altitude of 1000 m or higher, refer to “Operating Environment/ Storage Environment” (page 155) Item 13 “∗ For altitude of 1000 m or higher”.

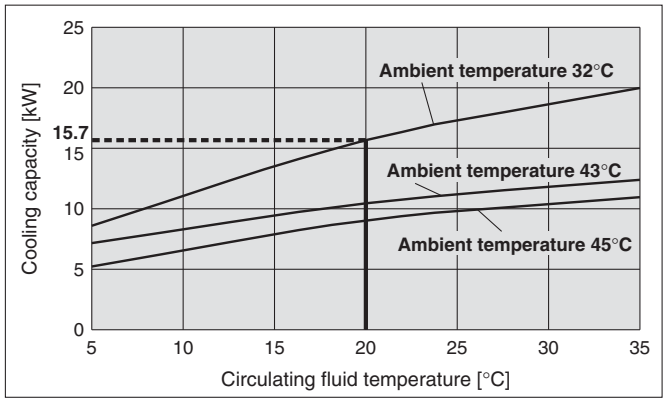
HRSH100-A□-20/40-□



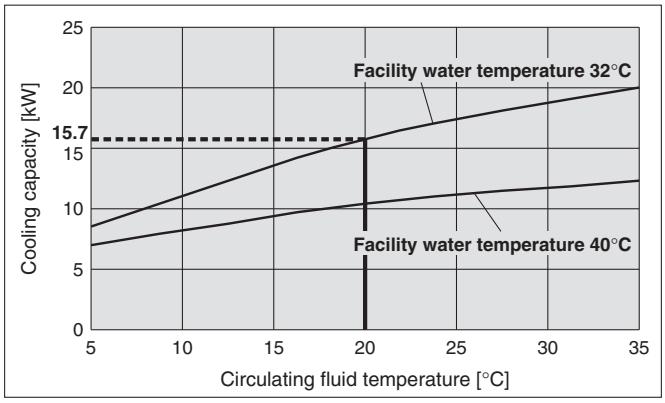
HRSH100-W□-20/40-□



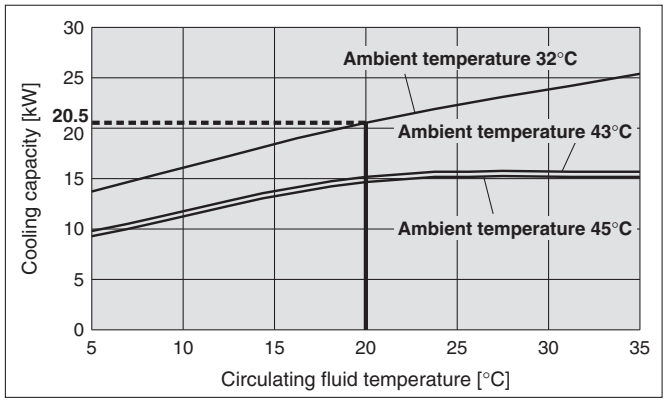
HRSH150-A□-20/40-□



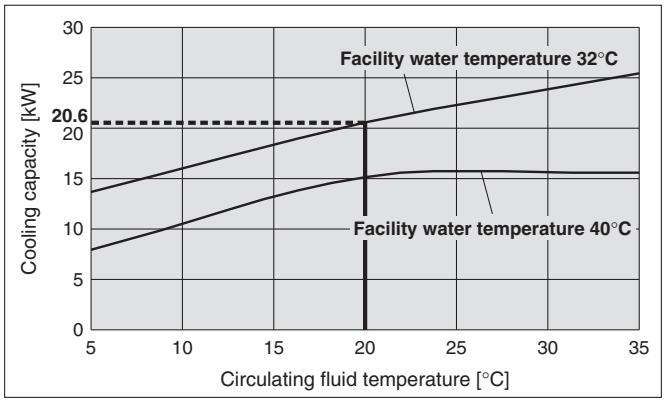
HRSH150-W□-20/40-□



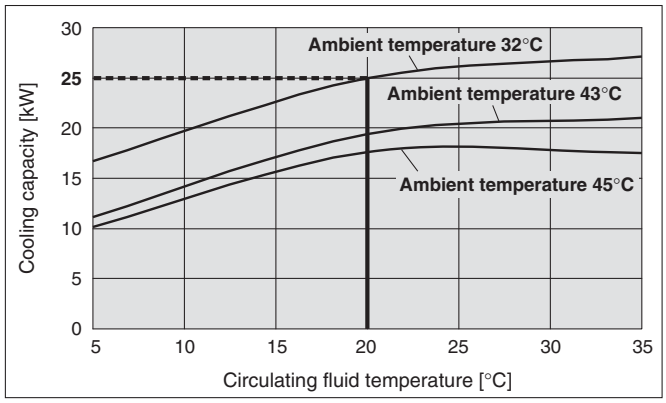
HRSH200-A□-20/40-□



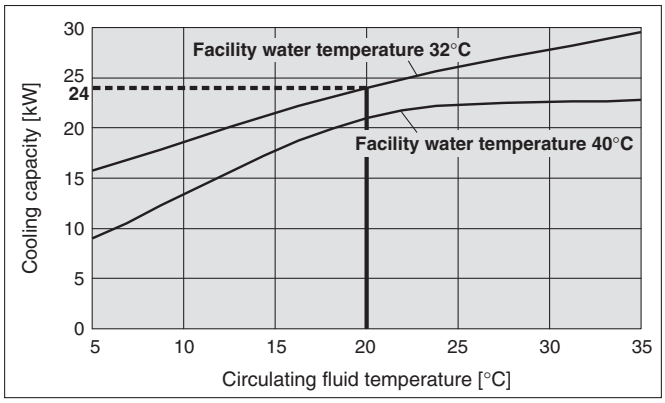
HRSH200-W□-20/40-□



HRSH250-A□-20/40-□



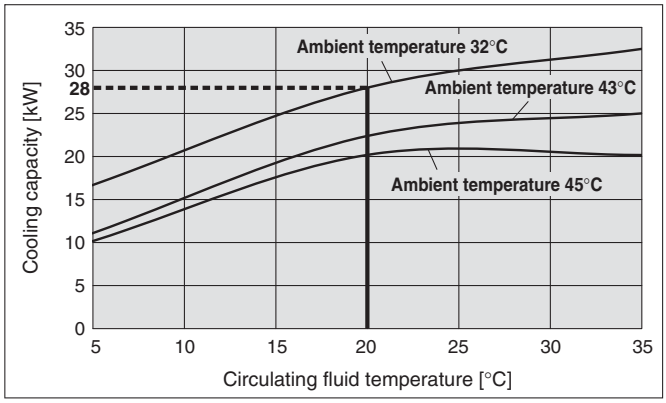
HRSH250-W□-20/40-□



Cooling Capacity

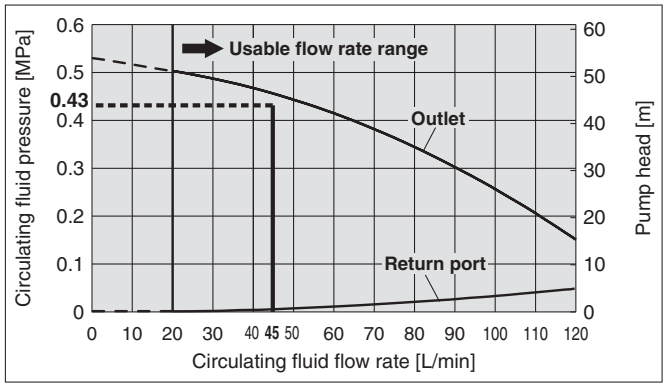
* If the product is used at altitude of 1000 m or higher, refer to “Operating Environment/ Storage Environment” (page 155) Item 13 “* For altitude of 1000 m or higher”.

HRSH300-A□-20/40-□

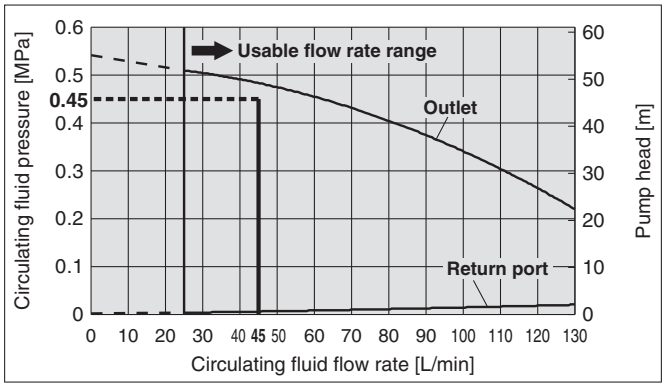


Pump Capacity

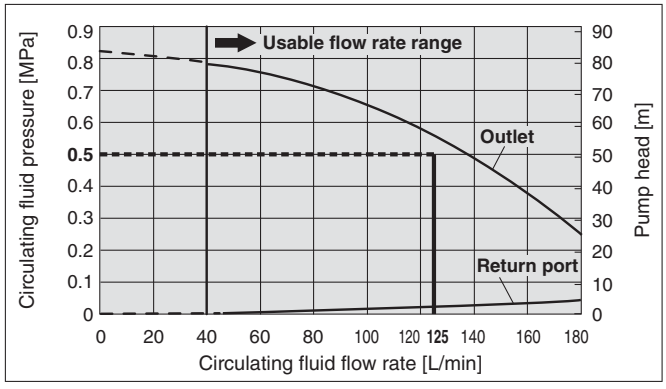
HRSH100-A□-20/40-□
HRSH100-W□-20/40-□



HRSH150/200-A□-20/40-□
HRSH150/200/250-W□-20/40-□

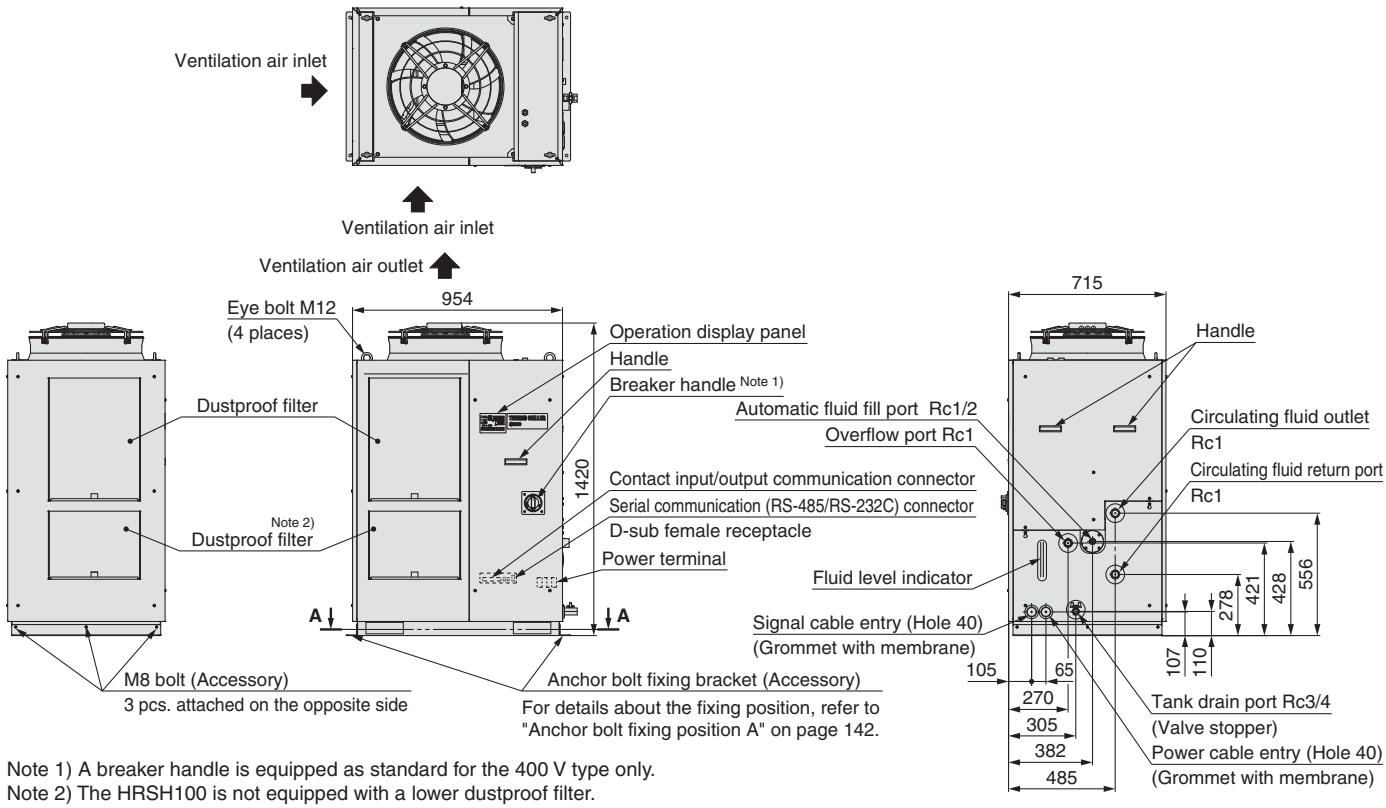


HRSH250/300-A□-20/40-□



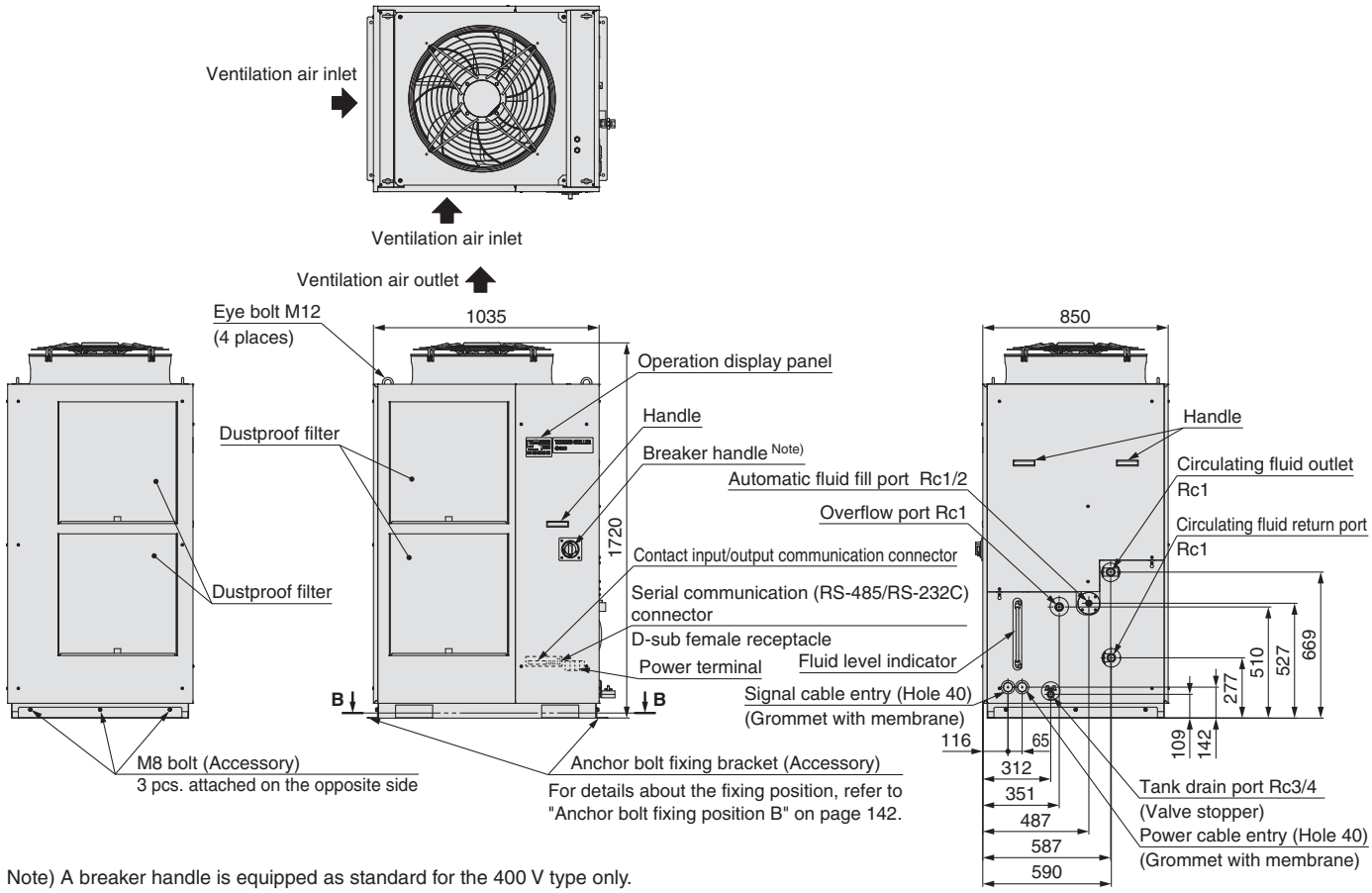
Dimensions

HRSH100/150/200-A-20 (Air-cooled 200 V type)
HRSH100/150/200-A-40 (Air-cooled 400 V type)



Note 1) A breaker handle is equipped as standard for the 400 V type only.
Note 2) The HRSH100 is not equipped with a lower dustproof filter.

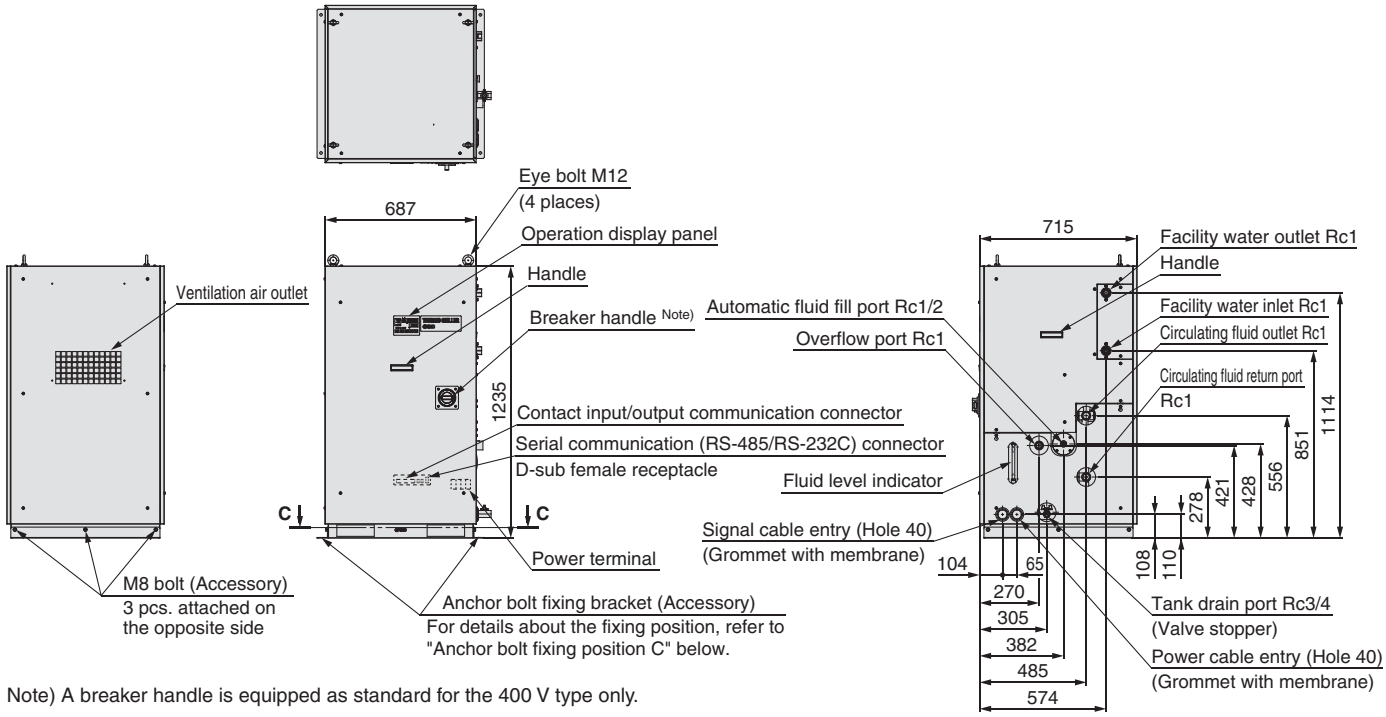
HRSH250/300-A-20 (Air-cooled 200 V type)
HRSH250/300-A-40 (Air-cooled 400 V type)



Note) A breaker handle is equipped as standard for the 400 V type only.

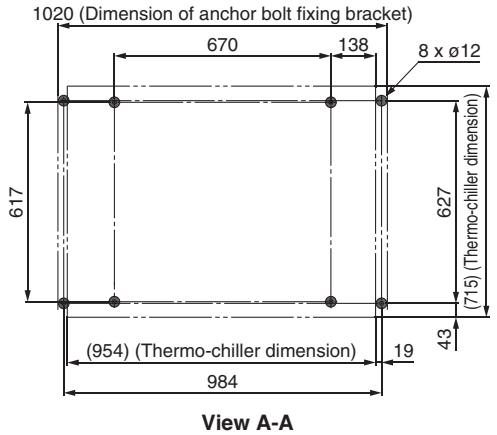
Dimensions

HRSH100/150/200/250-W-20 (Water-cooled 200 V type)
HRSH100/150/200/250-W-40 (Water-cooled 400 V type)



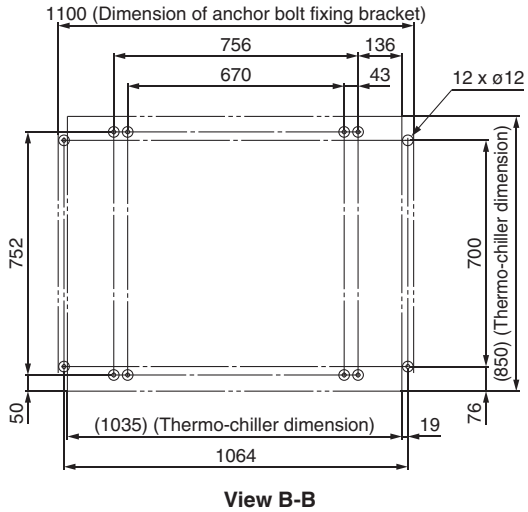
Note) A breaker handle is equipped as standard for the 400 V type only.

Anchor bolt fixing position A



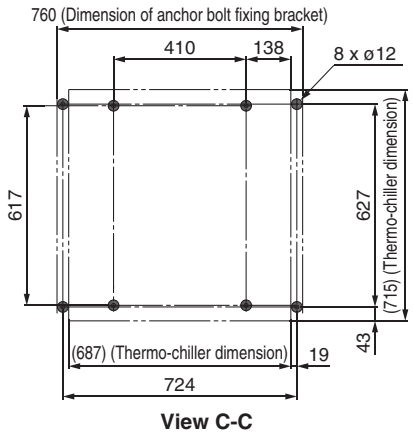
View A-A

Anchor bolt fixing position B



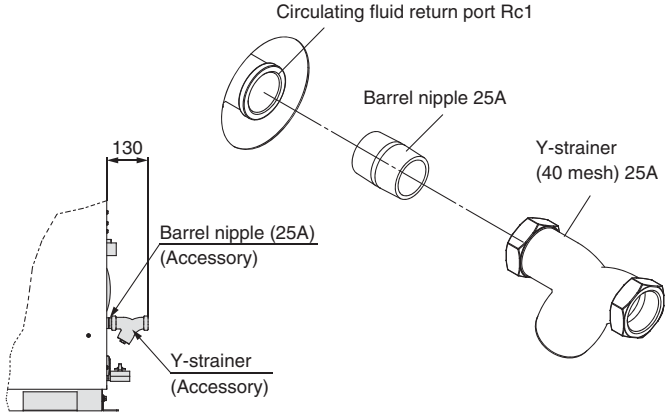
View B-B

Anchor bolt fixing position C



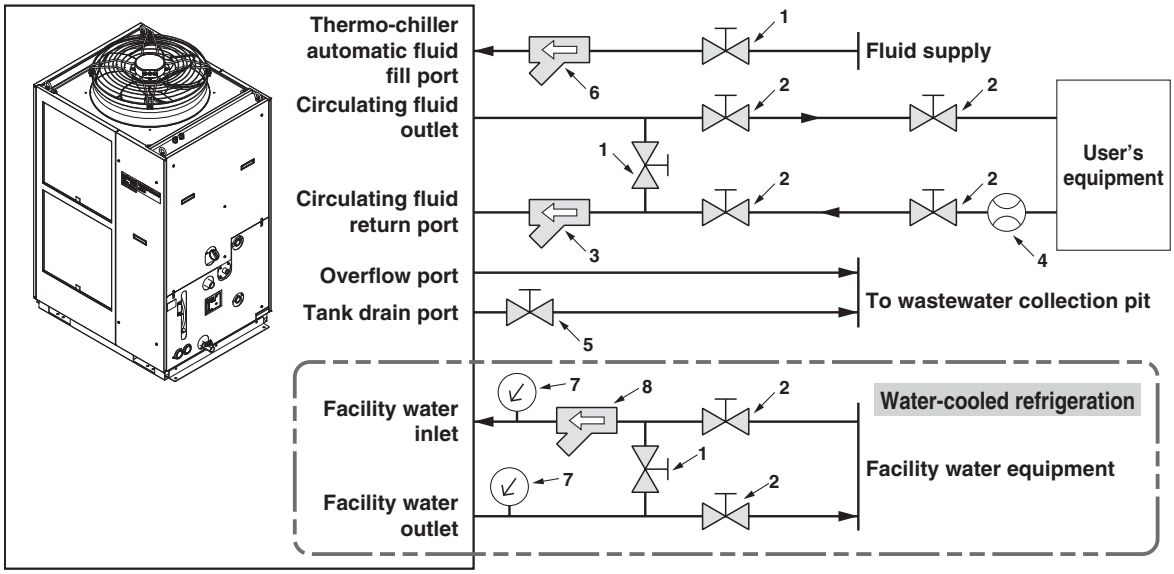
View C-C

Accessory: Y-strainer mounting view



Recommended External Piping Flow

External piping circuit is recommended as shown below.



∗ Ensure that the overflow port is connected to the wastewater collection pit in order to avoid damage to the tank of the thermo-chiller.

No.	Description	Size
1	Valve	Rc1/2
2	Valve	Rc1
3	Y-strainer (#40) (Accessory)	Rc1
4	Flow meter	Prepare a flow meter with an appropriate flow range.
5	Valve (Part of thermo-chiller)	Rc3/4
6	Y-strainer (#40)	Rc1/2
7	Pressure gauge	0 to 1.0 MPa
8	Y-strainer (#40)	Rc1

Cable Specifications

Power supply and signal cable should be prepared by user.

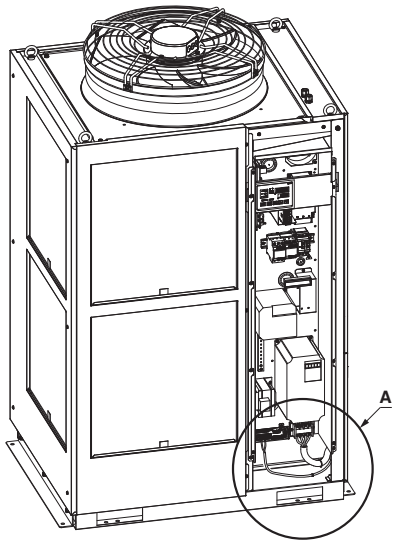
Power Cable Specifications

Applicable model	Rated value for thermo-chiller			Power cable examples	
	Power supply	Applicable breaker rated current	Terminal block thread size	Cable size	Crimped terminal on the thermo-chiller side
HRSH100-□□-20 **HRSH150-□□-20**	3-phase 200 VAC (50 Hz) 3-phase 200 to 230 VAC (60 Hz)	30 A	M5	4 cores x 5.5 mm² (4 cores x AWG10) (Including grounding cable)	R5.5-5
HRSH200-□□-20		40 A		4 cores x 8 mm² (4 cores x AWG8) (Including grounding cable)	R8-5
HRSH250-□□-20		50 A		4 cores x 8 mm² (4 cores x AWG8) (Including grounding cable)	R8-5
HRSH100-□□-40	3-phase 380 to 415 VAC (50/60 Hz)	20 A		3 x 5.5 mm² (3 x AWG10) (Power supply) 1 x 14 mm² (1 x AWG6) (Grounding cable)	R5.5-5 (Power supply) R14-5 (Grounding cable)
HRSH150-□□-40 **HRSH200-□□-40** **HRSH250-□□-40**		30 A			

Note) An example of the cable specifications is when two kinds of vinyl insulated wires with a continuous allowable operating temperature of 70°C at 600 V, are used at an ambient temperature of 30°C. Select the proper size of cable according to an actual condition.

Signal Cable Specifications

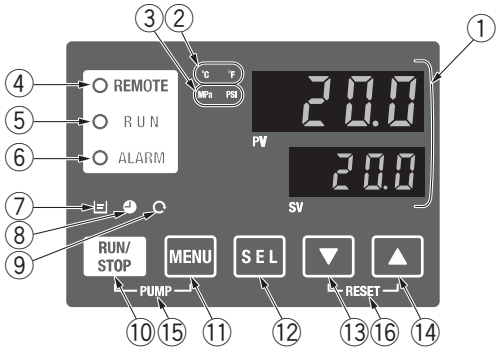
Terminal specifications		Cable specifications
Terminal block screw diameter	Recommended crimped terminal	0.75 mm² (AWG18) Shielded cable
M3	Y-shape crimped terminal 1.25Y-3	



Partially enlarged view A

Operation Display Panel

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



No.	Description	Function	
①	**Digital display (7-segment, 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 displayed temperature (default setting: °C).	
③	**[MPa] [PSI] lamp**	Equipped with a unit conversion function. Displays the unit of displayed 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	**[⊨] 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. 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.	

List of Function

No.	Function	Outline
1	**Main display**	Displays the current and set temperature of the circulating fluid, discharge pressure of the circulating fluid. Changes the circulating fluid set temperature.
2	**Alarm display menu**	Indicates alarm number when an alarm occurs.
3	**Inspection monitor menu**	Product temperature, pressure and accumulated operating time can be checked as daily inspection. Use these for daily inspection.
4	**Key-lock**	Keys can be locked so that set values cannot be changed by operator error.
5	**Timer for operation start/stop**	Timer is used to set the operation start/stop.
6	**Signal for the completion of preparation**	A signal is output when the circulating fluid temperature reaches the set temperature, when using contact input/output and serial communication.
7	**Offset function**	Use this function when there is a temperature offset between the discharge temperature of the thermo-chiller and user's equipment.
8	**Reset after power failure**	Start operation automatically after the power supply is turned on.
9	**Key click sound setting**	Operation panel key sound can be set on/off.
10	**Changing temp. unit**	Temperature unit can be changed. Centigrade (°C) ⇔ Fahrenheit (°F)
11	**Changing pressure unit**	Pressure unit can be changed. MPa ⇔ PSI
12	**Data reset**	Functions can be reset to the default settings (settings when shipped from the factory).
13	**Accumulation time reset**	Reset function when the pump, the fan or the compressor is replaced. Reset the accumulated time here.
14	**Pump operation mode set**	The fluid supply mode of the pump can be changed Pressure control mode ⇔ Frequency set mode
15	**Anti-freezing function**	Circulating fluid is protected from freezing during winter or at night. Set beforehand if there is a risk of freezing.
16	**Warming-up function**	When circulating fluid temperature rising time at starting needs shortening during winter or at night, set beforehand.
17	**Anti-snow coverage function**	If there will be a possibility of the snow coverage due to the change of the installation environment (season, weather), set beforehand.
18	**Alarm buzzer sound setting**	Alarm sound can be set to on/off.
19	**Alarm customizing**	Operation during alarm condition and threshold values can be changed depending on the alarm type.
20	**Communication**	This function is used for contact input/output or serial communication.

Alarm

This unit has 42 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.

Code	Alarm message
AL01	Low level in tank
AL02	High circulating fluid discharge temp.
AL03	Circulating fluid discharge temp. rise
AL04	Circulating fluid discharge temp. drop
AL05	High circulating fluid return temp.
AL08	Circulating fluid discharge pressure rise
AL09	Circulating fluid discharge pressure drop
AL10	High compressor intake temp.
AL11	Low compressor intake temp.
AL12	Low super heat temp.
AL13	High compressor discharge pressure
AL15	Refrigeration circuit pressure (high pressure side) drop
AL16	Refrigeration circuit pressure (low pressure side) rise
AL17	Refrigeration circuit pressure (low pressure side) drop
AL18	Compressor running failure

Code	Alarm message
AL19	Communication error
AL20	Memory error
AL21	DC line fuse cut
AL22	Circulating fluid discharge temp. sensor failure
AL23	Circulating fluid return temp. sensor failure
AL24	Compressor intake temp. sensor failure
AL25	Circulating fluid discharge pressure sensor failure
AL26	Compressor discharge pressure sensor failure
AL27	Compressor intake pressure sensor failure
AL28	Pump maintenance
AL29	Fan maintenance Note 1)
AL30	Compressor maintenance
AL31	Contact input 1 signal detection
AL32	Contact input 2 signal detection
AL37	Compressor discharge temp. sensor failure

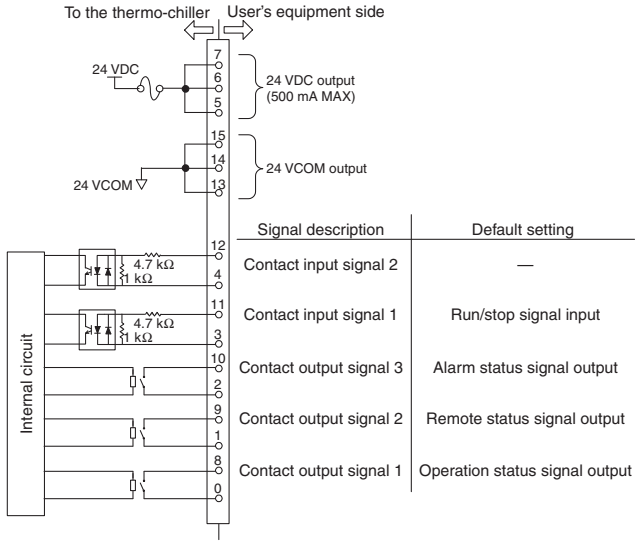
Code	Alarm message
AL38	Compressor discharge temp. rise
AL39	Internal unit fan stoppage
AL40	Dustproof filter maintenance Note 1)
AL41	Power stoppage
AL42	Compressor waiting
AL43	Fan breaker trip Note 1)
AL44	Fan inverter error Note 1)
AL45	Compressor breaker trip Note 2)
AL46	Compressor inverter error
AL47	Pump breaker trip Note 2)
AL48	Pump inverter error
AL49	Air exhaust fan stoppage Note 3)

Note 1) Does not occur on the product of water-cooled refrigeration type.
Note 2) Does not occur on the product of power supply specification '-20'.
Note 3) Does not occur on the product of air-cooled refrigeration type.
∗ For details, read the Operation Manual.

For details, refer to the Operation Manual. Please download it via our website, http://www.smcworld.com

Communication Function

Contact Input/Output

Item		Specifications
Connector type		M3 terminal block
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
Contact output signal	**Rated load voltage**	48 VAC or less/30 VDC or less
	Maximum load current	500 mA AC/DC (resistance load)
	Minimum load current	5 VDC 10 mA
Output voltage		24 VDC ±10% 500 mA MAX (No inductive load)
Circuit diagram		

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

Serial Communication

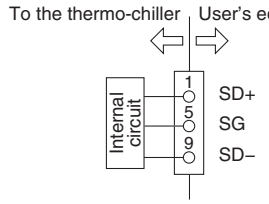
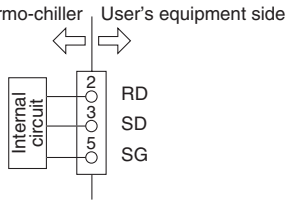
The serial communication (RS-485/RS-232C) enables the following items to be written and read out.
For details, refer to the Operation Manual for communication.

Writing

Run/Stop
Circulating fluid temperature setting (SV)

Readout

Circulating fluid present temperature
Circulating fluid discharge pressure
Status information
Alarm occurrence information

Item	Specifications	
Connector type	D-sub 9-pin, Female connector	
Protocol	Modicon Modbus compliant/Simple communication protocol	
Standards	EIA standard RS-485	EIA standard RS-232C
Circuit diagram		

∗ The terminal resistance of RS-485 (120 Ω) can be switched by the operation display panel. For details, refer to the Operation Manual for communication.
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 HRSH
Options

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

A Option symbol

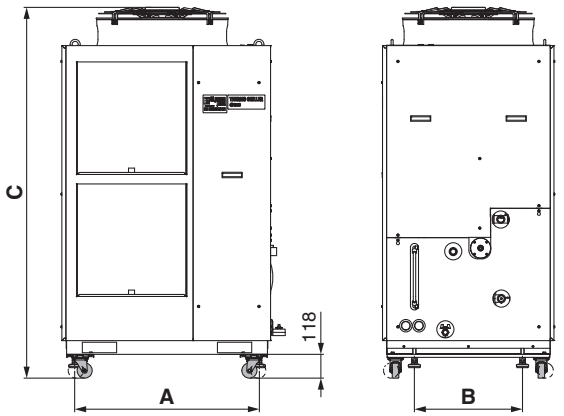
With Caster Adjuster-foot

HRSH□-□□-□-A

A: With caster adjuster-foot

Unfixed casters and adjuster feet stops are mounted.

Applicable model	Dimension [mm]		
	A	B	C
HRSH250/300-A□-□□-A	916	536	1838
HRSH100/150/200-A□-□□-A	830	401	1538
HRSH100/150/200/250-W□-□□-A	570		1353



B Option symbol

With Earth Leakage Breaker

HRSH□-□□-20-B

B: With earth leakage breaker

A leakage breaker is built in to automatically stop the supply power when it has short-circuit, over current or electrical leakage. (It is not necessary to select this option since an earth leakage breaker is installed for the models with power supply specification '-40' as standard equipment.)

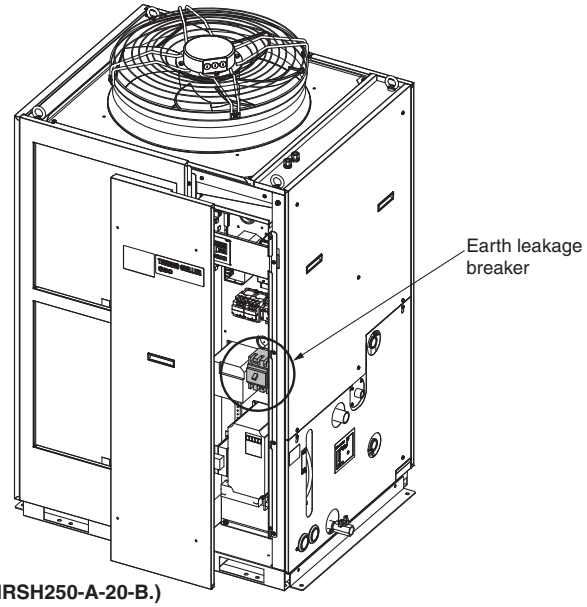
Applicable model	Rated current [A]	Sensitivity of leak current [mA]	Short circuit display method
HRSH100-□□-20-B	30	30	Mechanical button
HRSH150-□□-20-B			
HRSH200-□□-20-B	40		
HRSH250-□□-20-B	50		
HRSH300-□□-20-B			

∗ 400 V type is equipped as standard.

(Refer to the specifications on pages 137, 138 and the dimensions on pages 141, 142 for details.)

∗ Cannot be selected together with option B1.

∗ Cannot be selected together with option S.



(The figure shows the HRSH250-A-20-B.)

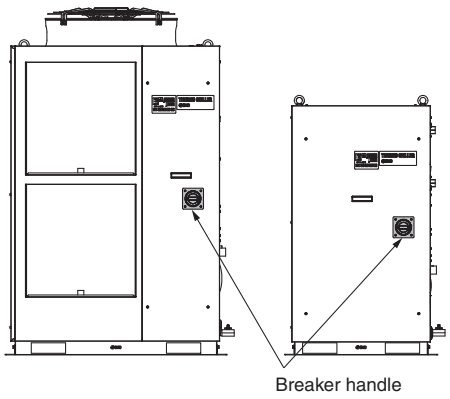
B1 Option symbol

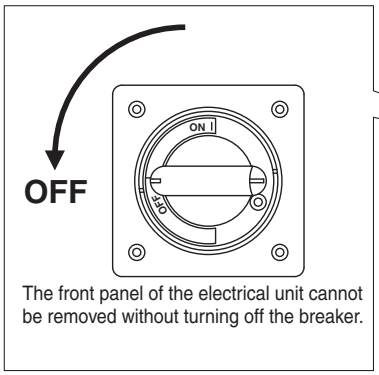
With Earth Leakage Breaker with Handle

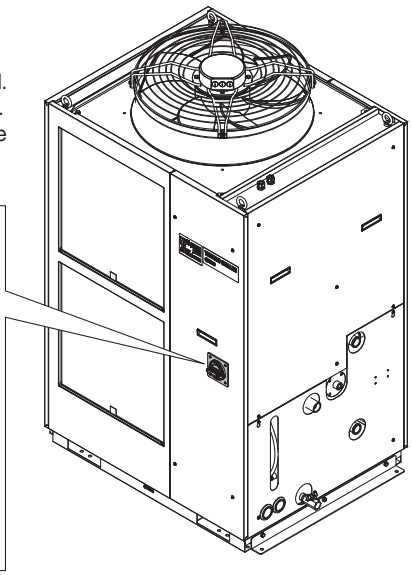
HRSH□-□□-20-B1

With earth leakage breaker with handle

A breaker operation handle that can be operated without removing the front panel for the electrical unit is mounted. Breaker capacity, sensitivity of leak current, and operating characteristics of the breaker are the same as option B. (It is not necessary to select this option since an earth leakage breaker with a handle is installed for the models with power supply specification '-40' as standard equipment.)







* 400 V type is equipped as standard.
* Cannot be selected together with option B.
* Cannot be selected together with option S.

K Option symbol

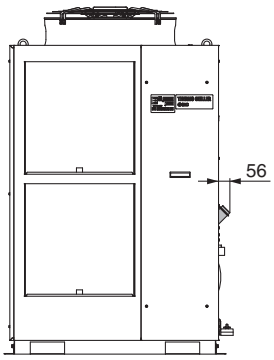
With Fluid Fill Port

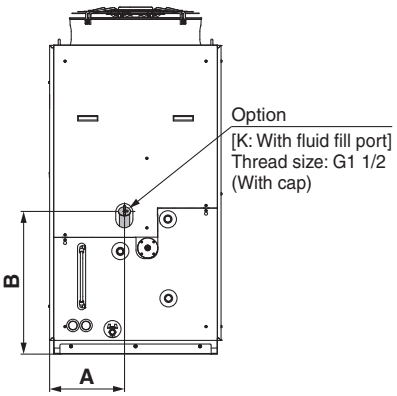
HRSH□-□□-□-K

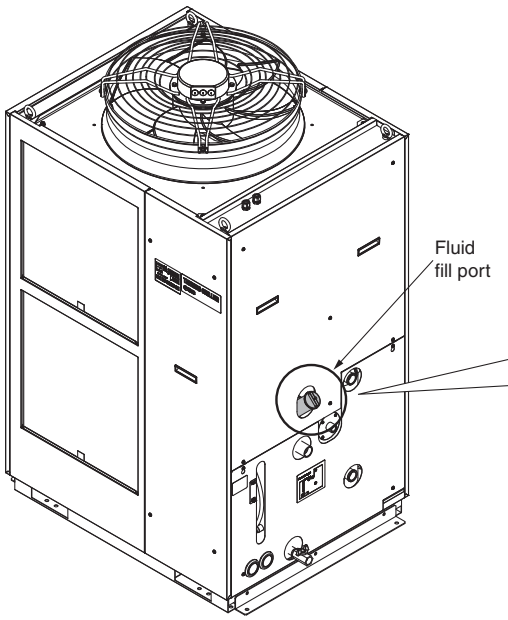
With fluid fill port

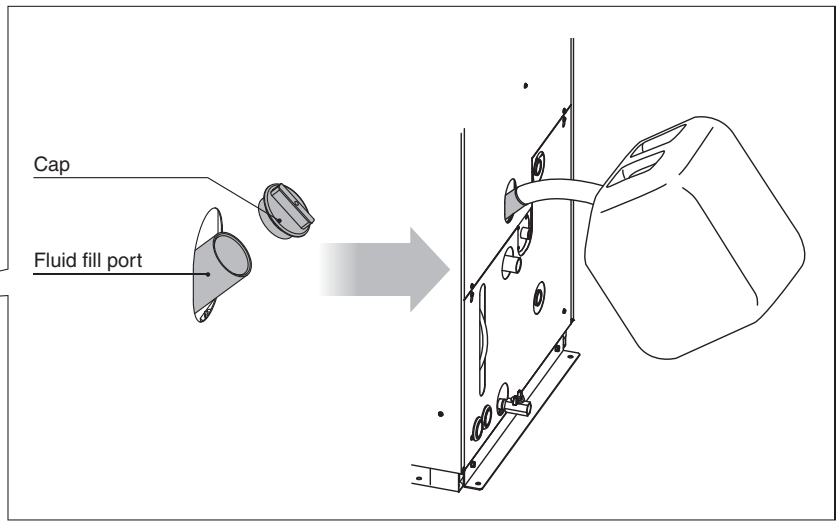
When the automatic fluid fill in port is not used, water can be supplied manually without removing the panel.

Applicable model	Dimension [mm]	
	A	B
HRSH100-□□-□-K HRSH150-□□-□-K HRSH200-□□-□-K HRSH250-W□-□-K	271	609
HRSH250-A□-□-K HRSH300-A□-□-K	372	708









(The figure shows the HRSH250-A-20-K.)

S Option symbol

Conforming to CE/UL Standards

HRSH□-□□-20-S

Conforming to CE/UL standards

Products conforming to CE/UL standards.
The following standards are applicable.

Applicable standard		
CE marking	EMC directive	2004/108/EC
	Machinery directive	2006/42/EC
UL standard	E112803 (UL61010-1)	

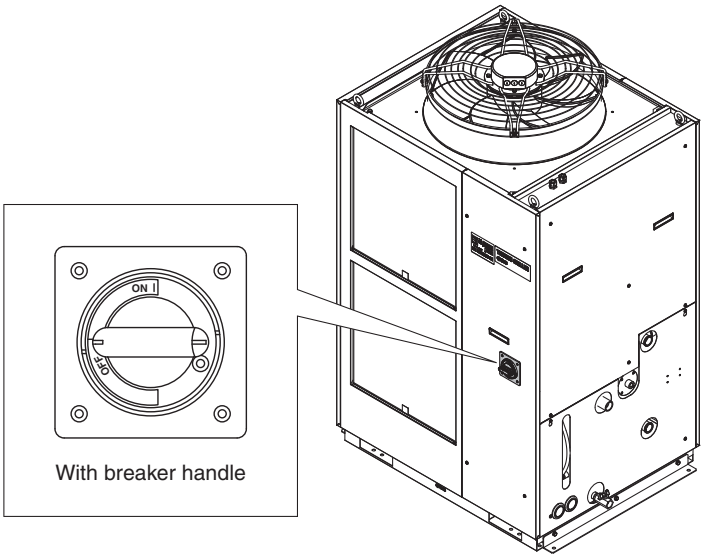
When selecting this option,
- An earth leakage breaker with a breaker handle is equipped. (The breaker are the same as those for option B1.)
- A caution label is added.
- The CE/UL certification mark is added to the model number label.

∗ Cannot be selected for 400 V type.

∗ Cannot be selected together with option B.

∗ Cannot be selected together with option B1.

∗ For the operation in accordance with the UL standard, the product should be used in an environment at a pollution degree of 2 or less. Prepare a power supply of overvoltage category Ⅱ or less.



With breaker handle

Models Compatible with Option S

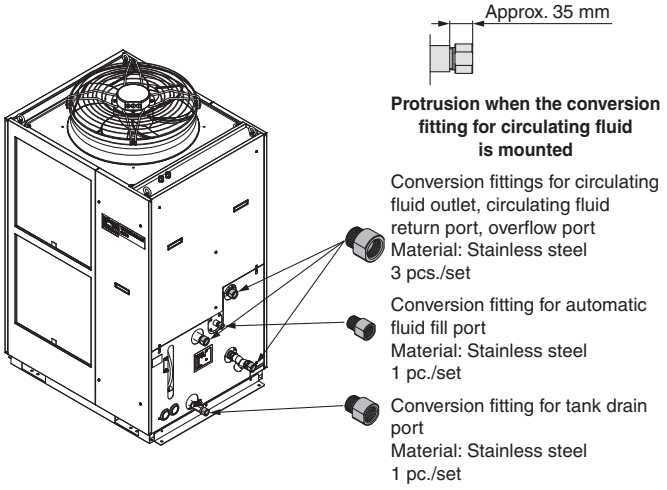
Applicable model	-A□	-W□
HRSH100-□□-20-S	●	●
HRSH150-□□-20-S	●	●
HRSH200-□□-20-S	●	●
HRSH250-□□-20-S	●	●
HRSH300-□□-20-S	Pending	Pending

Optional Accessories

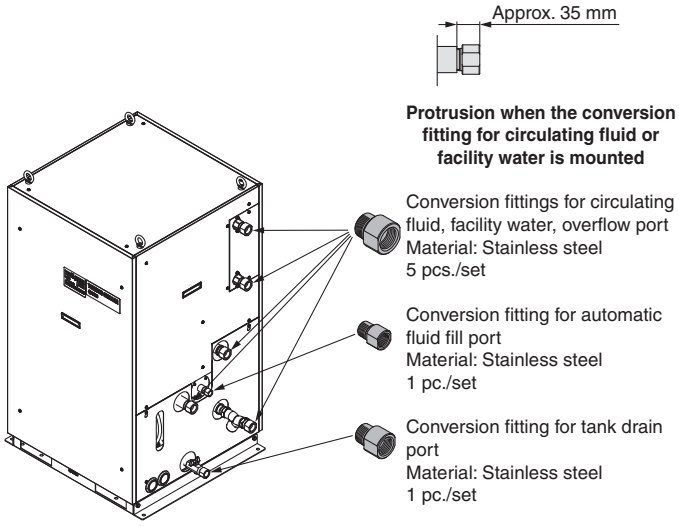
① Piping Conversion Fitting

This is a fitting to change the port from Rc to G or NPT.
· Circulating fluid outlet, Circulating fluid return port, Overflow port Rc1 → NPT1 or G1
· Drain port Rc3/4 → NPT3/4 or G3/4
· Automatic fluid fill port Rc1/2 → NPT1/2 or G1/2
· Facility water inlet, Facility water outlet Rc1 → NPT1 or G1 (for HRS-EP015 or HRS-EP016)
(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.	Contents	Applicable model
HRS-EP013	NPT thread conversion fitting set	**HRSH□-A-□**
HRS-EP014	G thread conversion fitting set	
HRS-EP015	NPT thread conversion fitting set	**HRSH□-W-□**
HES-EP016	G thread conversion fitting set	



HRS-EP013, HRS-EP014



HRS-EP015, HRS-EP016

② Caster Adjuster-foot Kit

This is a set of unfixed casters and adjuster feet stop.
When installed by user, it is necessary to lift the thermo-chiller by a forklift or sling work.
Carefully read the procedure manual included with this kit before performing the installation.

Part no.	Applicable model	Dimension [mm]	
		A	**B**
HRS-KS001	**HRSH250-A□-□** **HRSH300-A□-□**	916	536
HRS-KS002	**HRSH100-A□-□** **HRSH150-A□-□** **HRSH200-A□-□**	830	401
	HRSH100-W□-□ **HRSH150-W□-□** **HRSH200-W□-□** **HRSH250-W□-□**	570	

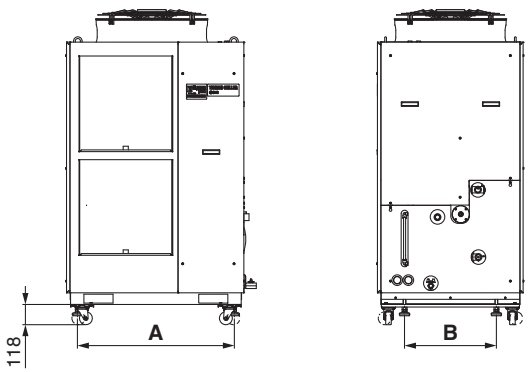


Fig. 1 Mounting view

Parts List

Description
Procedure manual
Caster adjuster-foot bracket (2 pcs.)
Fixing bolt (M8) (8 pcs.)

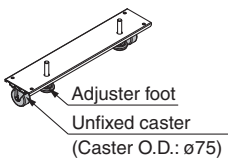


Fig. 2 Caster adjuster-foot bracket (2 pcs.)

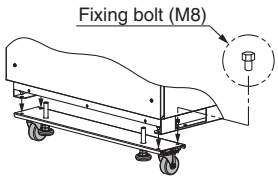


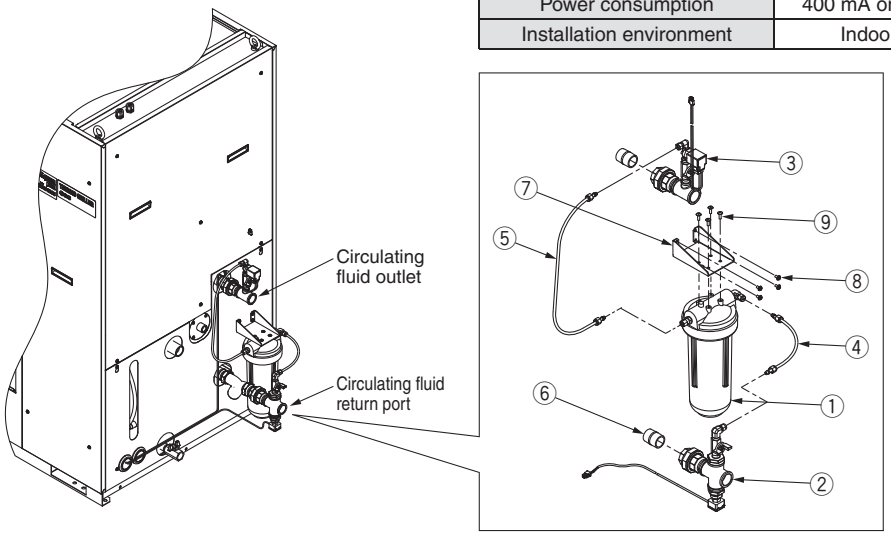
Fig. 3 Fixing bolt (8 pcs.)

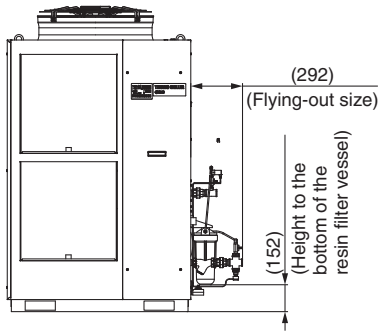
③ Electric Conductivity Control Set

The set indicates and controls the electric conductivity of the circulating fluid. Refer to the Operation Manual for details.

Part no.	Applicable model
HRS-DI006	**HRSH100-□□-□** **HRSH150-□□-□** **HRSH200-□□-□** **HRSH250-□□-□** **HRSH300-□□-□**

Measurement range of electric conductivity	2.0 to 48.0 μS/cm
Set range of electric conductivity target	5.0 to 45.0 μS/cm
Set range of electric conductivity hysteresis	2.0 to 10.0 μS/cm
Operating temperature range (Circulating fluid temperature)	5 to 60°C
Power consumption	400 mA or less
Installation environment	Indoor





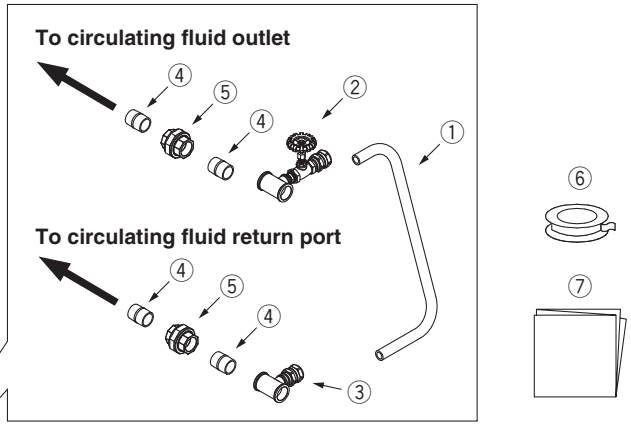
Parts List

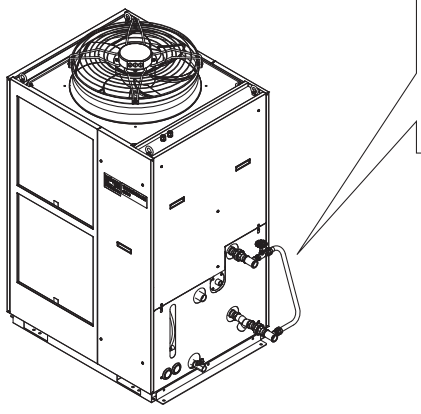
No.	Description
①	DI filter vessel (resin)
②	DI sensor assembly
③	DI control piping assembly
④	DI filter outlet tube
⑤	DI filter inlet tube
⑥	Nipple (2 pcs.)
⑦	Mounting bracket
⑧	Mounting screw (4 pcs.)
⑨	Tapping screw (4 pcs.)

④ Bypass Piping Set

When the circulating fluid goes below the minimum operating flow rate (as shown below), cooling capacity will be reduced and the temperature stability will be badly affected. Use the bypass piping set to ensure a circulating fluid flow rate of the minimum operating flow rate or more.

Part no.	Applicable model	Minimum operating flow rate [L/min]
HRS-BP005	**HRSH100-□□-□**	20
	HRSH150-□□-□ **HRSH200-□□-□** **HRSH250-W□-□**	25
	HRSH250-A□-□ **HRSH300-A□-□**	40





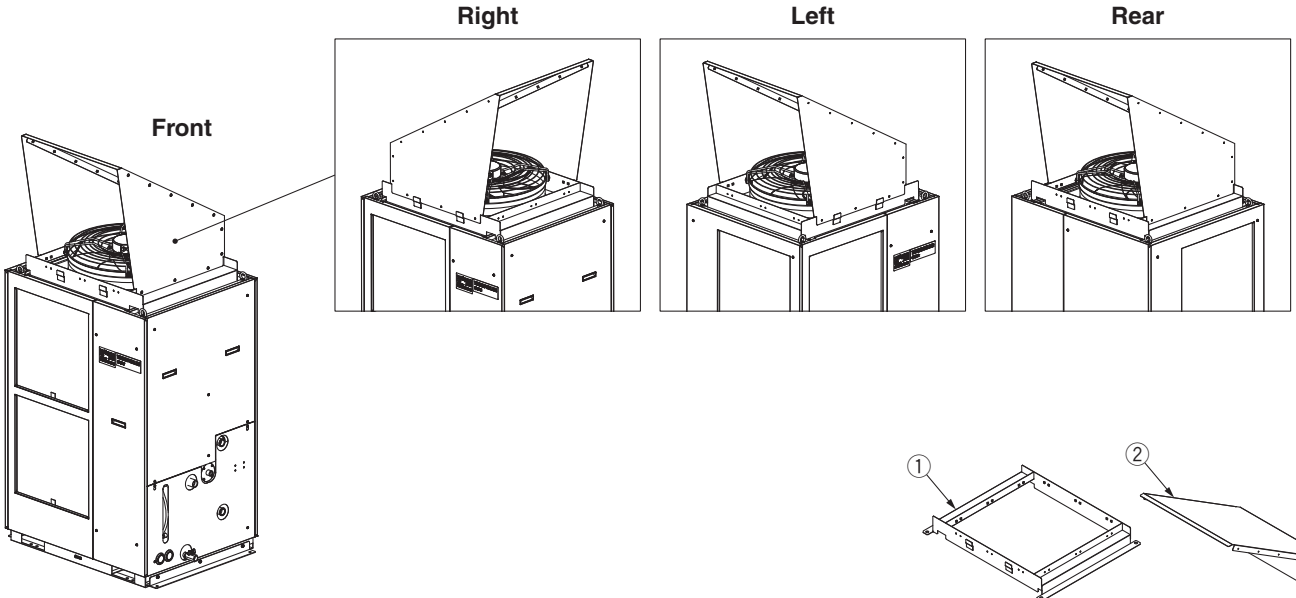
(The figure shows the HRSH250-A-20.)

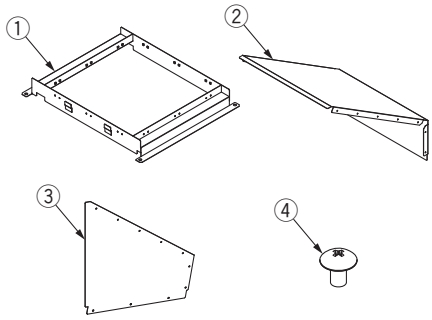
Parts List

No.	Description
①	Hose (I.D.: 15 mm, Length: 700 mm)
②	Outlet piping assembly (With globe valve)
③	Return piping assembly
④	Barrel nipple (Size: 1 inch) (2 pcs.)
⑤	Union (Size: 1 inch) (2 pcs.)
⑥	Sealant tape
⑦	Operation Manual

⑤ Snow Protection Hood

Stainless steel snow protection hood for air-cooled chiller.
According to the mounting direction of the snow protection hood, the ventilation from the fan can be selected from four directions, front, rear, left and right.

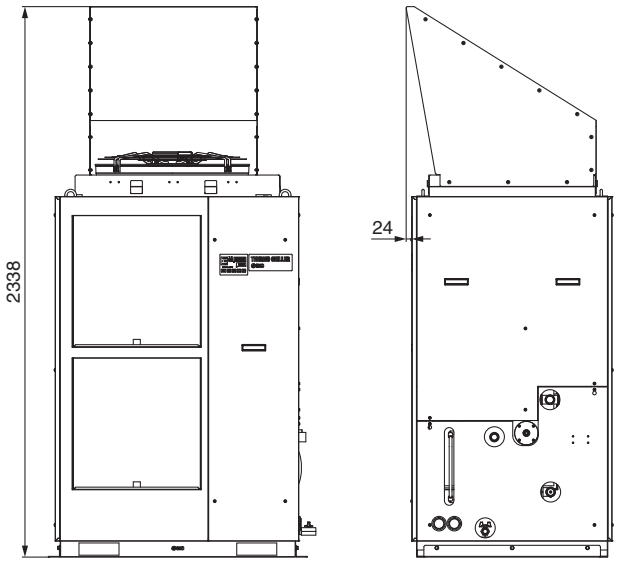




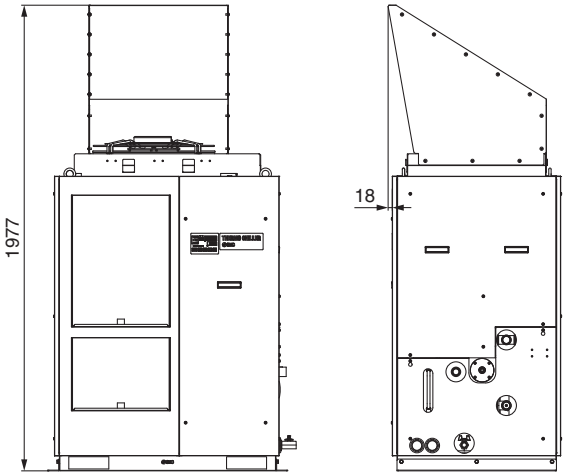
Part no.	Applicable model	Weight [kg]
HRS-BK003	**HRSH250-A□-□** **HRSH300-A□-□**	22
HRS-BK004	**HRSH100-A□-□** **HRSH150-A□-□** **HRSH200-A□-□**	18

Parts List

No.	Description	Q'ty
①	Snow protection hood base	1
②	Snow protection hood A	1
③	Snow protection hood B	2
④	Assembly/Mounting screw	20



Mounting condition for HRS-BK003



Mounting condition for HRS-BK004

∗ This hood does not completely prevent snow from entering the inside of the chiller.

⑥ Particle Filter Set

Removes foreign objects in the circulating fluid. This set cannot be directly connected to the thermo-chiller. Install it in the user's piping system. Refer to the Operation Manual for details.

Particle Filter Set

HRS−PF005−H

Accessory

Symbol	Accessory
Nil	None
H	With handle

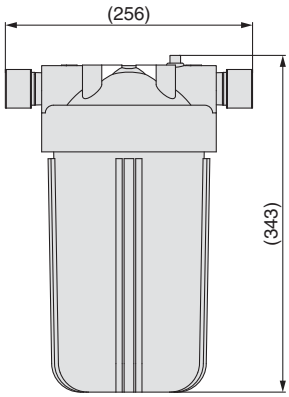
Fluid	Tap water
Max. operating pressure	0.65 MPa
Operating temperature range	5 to 35°C
Nominal filtration accuracy	5 μm
Installation environment	Indoors

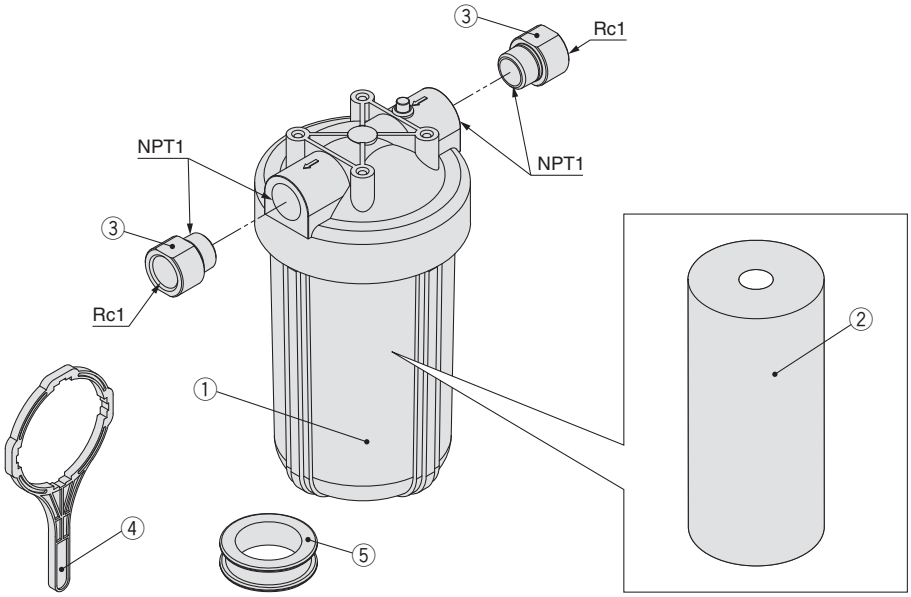
Parts List

No.	Description	Material	Q'ty	Note
①	Body	PC, PP	1	—
②	Element	PP	1	—
③	Extension piece	Stainless steel	2	Conversion from NPT to Rc
④	Handle	—	1	When -H is selected
⑤	Sealant tape	PTFE	1	—

Replacement Element

HRS−PF006



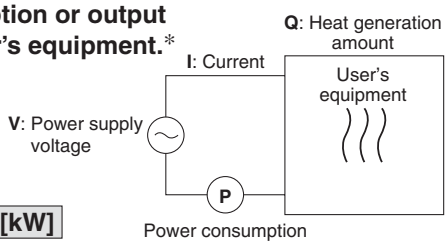


Series HRSH
Cooling Capacity Calculation

Required Cooling Capacity Calculation

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

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



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

Power consumption **P**: 20 [kW]

Q = P = 20 [kW]

Cooling capacity = Considering a safety factor of 20%, **20 [kW] x 1.2 =** **24 [kW]**

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

Power supply output **VI**: 20 [kVA]

Q = P = V x I x Power factor

In this example, using a power factor of 0.85:

= 20 [kVA] x 0.85 = 17 [kW]

Cooling capacity = Considering a safety factor of 20%,

17 [kW] x 1.2 = **20.4 [kW]**

③ **Derive the heat generation amount from the output.**

Output (shaft power etc.) **W**: 13 [kW]

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

In this example, using an efficiency of 0.7:

$$\mathbf{= \frac{13}{0.7} = 18.6\ [kW]}$$

Cooling capacity = Considering a safety factor of 20%,

18.6 [kW] x 1.2 = **22.3 [kW]**

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

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

Obtain the temperature difference between inlet and outlet by circulating the circulating fluid inside the user's equipment.

Heat generation amount by user's equipment **Q**	: Unknown [W] ([J/s])
Circulating fluid	: Tap water*
Circulating fluid mass flow rate **qm**	: (= ρ x **qv** ÷ 60) [kg/s]
Circulating fluid density ρ	: 1 [kg/L]
Circulating fluid (volume) flow rate **qv**	: 70 [L/min]
Circulating fluid specific heat **C**	: 4.186 x 10^3 [J/(kg·K)]
Circulating fluid outlet temperature $\mathbf{T_1}$	: 293 [K] (20 [°C])
Circulating fluid return temperature $\mathbf{T_2}$	: 297 [K] (24 [°C])
Circulating fluid temperature difference **ΔT**	: 4 [K] (= $\mathbf{T_2 - T_1}$)
Conversion factor: minutes to seconds (SI units)	: 60 [s/min]

* Refer to page 154 for the typical physical property value of tap water or other circulating fluids.

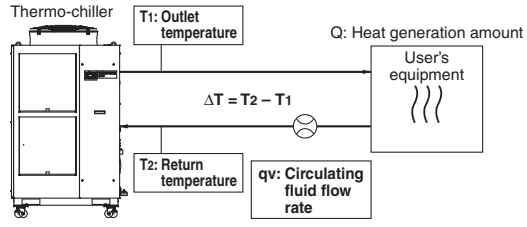
$$\mathbf{Q = qm \times C \times (T_2 - T_1)}$$

$$\mathbf{= \frac{\rho \times qv \times C \times \Delta T}{60} = \frac{1 \times 70 \times 4.186 \times 10^3 \times 4.0}{60}}$$

$$\mathbf{= 19535\ [J/s] \approx 19535\ [W] = 19.5\ [kW]}$$

Cooling capacity = Considering a safety factor of 20%,

19.5 [kW] x 1.2 = **23.4 [kW]**



HRSH250-A

Example of conventional measurement units (Reference)

Heat generation amount by user's equipment **Q**	: Unknown [cal/h] → [W]
Circulating fluid	: Tap water*
Circulating fluid weight flow rate **qm**	: (= ρ x **qv** x 60) [kgf/h]
Circulating fluid weight volume ratio γ	: 1 [kgf/L]
Circulating fluid (volume) flow rate **qv**	: 70 [L/min]
Circulating fluid specific heat **C**	: 1.0 x 10^3 [cal/(kgf·°C)]
Circulating fluid outlet temperature $\mathbf{T_1}$	: 20 [°C]
Circulating fluid return temperature $\mathbf{T_2}$	: 24 [°C]
Circulating fluid temperature difference **ΔT**	: 4 [°C] (= $\mathbf{T_2 - T_1}$)
Conversion factor: hours to minutes	: 60 [min/h]
Conversion factor: kcal/h to kW	: 860 [(cal/h)/W]

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

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

$$\mathbf{= \frac{1 \times 70 \times 60 \times 1.0 \times 10^3 \times 4.0}{860}}$$

$$\mathbf{= \frac{16800000\ [cal/h]}{860}}$$

$$\mathbf{\approx 19534\ [W] = 19.5\ [kW]}$$

Cooling capacity = Considering a safety factor of 20%,

19.5 [kW] x 1.2 = **23.4 [kW]**

Required Cooling Capacity Calculation

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

Heat quantity by cooled substance (per unit time) **Q** : Unknown [W] ([J/s])
Cooled substance : Water
Cooled substance mass **m** : (= ρ x **V**) [kg]
Cooled substance density ρ : 1 [kg/L]
Cooled substance total volume **V** : 300 [L]
Cooled substance specific heat **C** : 4.186 x 10^3 [J/(kg·K)]
Cooled substance temperature when cooling begins T_0 : 305 [K] (32 [°C])
Cooled substance temperature after t hour T_t : 293 [K] (20 [°C])
Cooling temperature difference ΔT : 12 [K] (= $T_0 - T_t$)
Cooling time Δt : 900 [s] (= 15 [min])

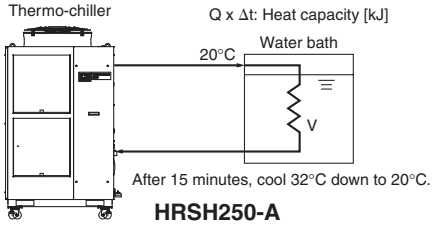
∗ Refer to the following for the typical physical property values by circulating fluid.

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

$$= \frac{1 \times 300 \times 4.186 \times 10^3 \times 12}{900} = 16744\ [J/s] \approx 16.7\ [kW]$$

Cooling capacity = Considering a safety factor of 20%,

16.7 [kW] x 1.2 = 20 [kW]



HRSH250-A

Example of conventional measurement units (Reference)

Heat quantity by cooled substance (per unit time) **Q** : Unknown [cal/h] → [W]
Cooled substance : Water
Cooled substance weight **m** : (= ρ x **V**) [kgf]
Cooled substance weight volume ratio γ : 1 [kgf/L]
Cooled substance total volume **V** : 300 [L]
Cooled substance specific heat **C** : 1.0 x 10^3 [cal/(kgf·°C)]
Cooled substance temperature 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]

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

$$= \frac{1 \times 300 \times 60 \times 1.0 \times 10^3 \times 12}{15 \times 860}$$

$$\approx 16744\ [W] = 16.7\ [kW]$$

Cooling capacity = Considering a safety factor of 20%,

16.7 [kW] x 1.2 = 20 [kW]

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

Precautions on Cooling Capacity Calculation

1. Heating capacity

When the circulating fluid temperature is set above room temperature, it needs to be heated by the thermo-chiller. The heating capacity depends on the circulating fluid temperature. Consider the radiation rate and heat capacity of the user's equipment and check beforehand if the required heating capacity is provided.

2. Pump capacity

<Circulating fluid flow rate>

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

<Circulating fluid discharge pressure>

Circulating fluid discharge pressure has the possibility to increase up to the maximum pressure in the pump capacity curves.
Check beforehand if the circulating fluid pipings or circulating fluid circuit of the user's equipment are fully durable against this pressure.

Circulating Fluid Typical Physical Property Values

1. This catalog uses the following values for density and specific heat in calculating the required cooling capacity.

Density ρ: 1 [kg/L] (or, using conventional unit system, weight volume ratio γ = 1 [kgf/L])
Specific heat **C**: 4.19 x 10^3 [J/(kg·K)] (or, using conventional unit system, 1 x 10^3 [cal/(kgf·°C)])

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

Water

Physical property value / Temperature	Density ρ [kg/L]	Specific heat C [J/(kg·K)]	Conventional unit system	
			Weight volume ratio γ [kgf/L]	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/L]	Specific heat C [J/(kg·K)]	Conventional unit system	
			Weight volume ratio γ [kgf/L]	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 shown are reference values. Contact circulating fluid supplier for details.

Series HRSH
Specific Product Precautions 1

Be sure to read this before handling. Refer to page 341 for Safety Instructions. For Temperature Control Equipment Precautions, refer to pages 342 to 345 and the Operation Manual on SMC website, http://www.smcworld.com

Design

⚠ Warning

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

1) Check the specifications 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.

3. Use non-corrosive material for fluid contact of circulating fluid and facility water.

Using corrosive materials such as aluminum or iron for fluid contact parts such as piping may cause clogging or leakage in the circulating fluid and facility water circuits. Provide protection against corrosion when you use the product.

4. The facility water outlet temperature (water-cooled type) may increase up to around 60°C.

When selecting the facility water pipings, consider the suitability for temperature.

Selection

⚠ Warning

Model selection

For selecting a model of thermo-chiller, it is required to know the heat generation amount of the user's equipment. Obtain the heat generation amount, referring to "Cooling Capacity Calculation" on pages 153 and 154 before selecting a model.

Handling

⚠ Warning

Thoroughly read the Operation Manual.

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

Operating Environment/Storage Environment

⚠ Warning

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

1) In locations where water vapor, salt water, and oil may splash on the product.
2) In locations where there are dust and particles.
3) In locations where corrosive gases, organic solvents, chemical fluids, or flammable gases are present. (This product is not explosion proof.)
4) In locations where the ambient temperature exceeds the limits as mentioned below.
   During transportation/storage: –15°C to 50°C (But as long as water or circulating fluid are not left inside the pipings)
   During operation: –5°C to 45°C (However, use a 15% ethylene glycol aqueous solution if operating in a place where the ambient temperature or circulating fluid temperature is 10°C or less.)
5) In locations where condensation may occur.
6) In locations which receive direct sunlight or radiated heat.
7) In locations where there is a heat source nearby and the ventilation is poor.
8) In locations where temperature substantially changes.
9) In locations where strong magnetic noise occurs.
   (In locations where strong electric fields, strong magnetic fields and surge voltage occur.)
10) In locations where static electricity occurs, or conditions which make the product discharge static electricity.
11) In locations where high frequency occurs.
12) In locations where damage is likely to occur due to lightning.
13) In locations at altitude of 3000 m or higher (Except during storage and transportation)
   * For altitude of 1000 m or higher
   Because of lower air density, the heat radiation efficiencies of the devices in the product will be lower in the location at altitude of 1000 m or higher. Therefore, the maximum ambient temperature to use and the cooling capacity will lower according to the descriptions in the table below.
   Select the thermo-chiller considering the descriptions.
   ① Upper limit of ambient temperature: Use the product in ambient temperature of the described value or lower at each altitude.
   ② Cooling capacity coefficient: The product's cooling capacity will lower to one that multiplied by the described value at each altitude.

Altitude [m]	① Upper limit of ambient temperature [°C]	② Cooling capacity coefficient
Less than 1000 m	45	1.00
Less than 1500 m	42	0.85
Less than 2000 m	38	0.80
Less than 2500 m	35	0.75
Less than 3000 m	32	0.70

14) In locations where strong impacts or vibrations occur.
15) In locations where a massive force strong enough to deform the product is applied or a weight from a heavy object is applied.
16) In locations where there is not sufficient space for maintenance.
17) In locations where liquid that exceeds the conditions required for the degrees of protection IPX4 may splash on the product.
18) Insects or plants may enter the unit.

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

Series HRSH
Specific Product Precautions 2

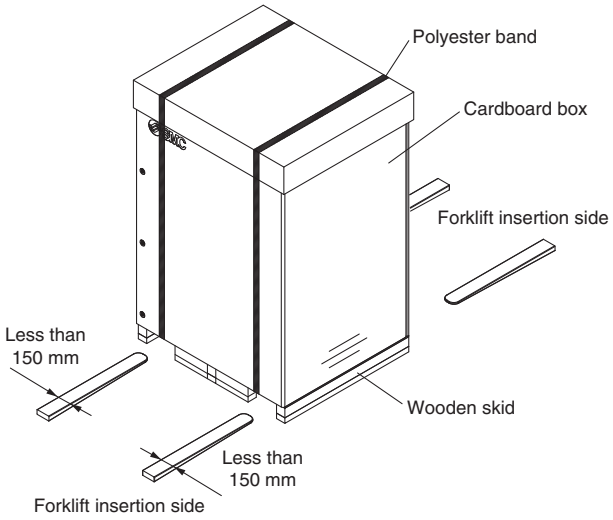
Be sure to read this before handling. Refer to page 341 for Safety Instructions. For Temperature Control Equipment Precautions, refer to pages 342 to 345 and the Operation Manual on SMC website, http://www.smcworld.com

Transportation/Carriage/Movement

⚠ Warning

1. This product will require an acceptance with the product not unloaded from the truck, and the user will need to unload the product by himself. Prepare a forklift.

The product will be delivered in the packaging shown below.



<When packaged>

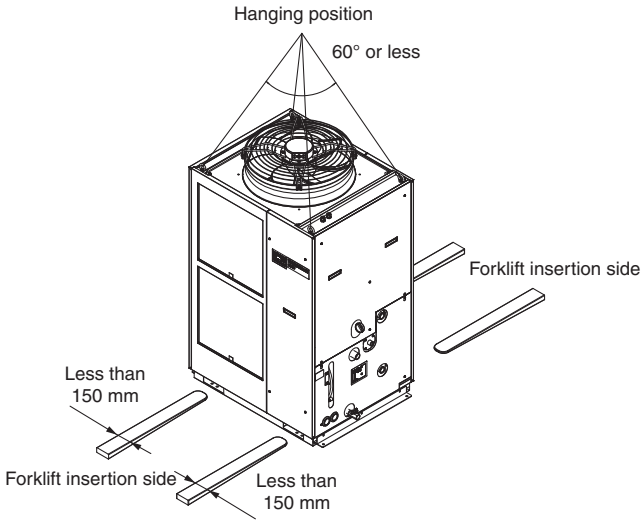
Model	Weight [kg]	Dimensions [mm]
HRSH100-A□-□	221	Height 1585 x Width 1185 x Depth 955
HRSH150-A□-□ **HRSH200-A□-□**	256	
HRSH250-A□-□	330	Height 1895 x Width 1230 x Depth 1040
HRSH100-W□-□	185	Height 1485 x Width 925 x Depth 955
HRSH150-W□-□ **HRSH200-W□-□** **HRSH250-W□-□**	215	
HRSH100-A□-A	233	Height 1710 x Width 1185 x Depth 955
HRSH150-A□-A **HRSH200-A□-A**	268	
HRSH250-A□-A **HRSH300-A□-A**	344	Height 2020 x Width 1230 x Depth 1040
HRSH100-W□-A	197	Height 1610 x Width 925 x Depth 955
HRSH150-W□-A **HRSH200-W□-A** **HRSH250-W□-A**	227	

2. Transportation by forklift

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

3. Hanging transportation

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



HRSH250-A-20

(When using option A/With caster adjuster-foot and optional accessories/Caster adjuster-foot kit HRS-KS001 or KS002)

4. Transporting using casters

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

Mounting/Installation

⚠ Warning

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.

Series HRSH
Specific Product Precautions 3

Be sure to read this before handling. Refer to page 341 for Safety Instructions. For Temperature Control Equipment Precautions, refer to pages 342 to 345 and the Operation Manual on SMC website, http://www.smcworld.com

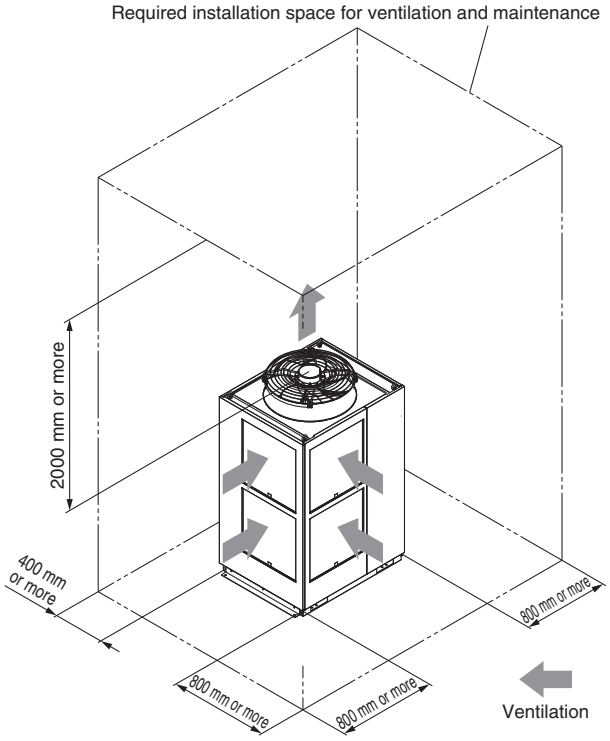
Mounting/Installation

⚠ Caution

3. Refer to the Operation Manual for this product, and secure an installation space that is necessary for the maintenance and ventilation.

<Air-cooled refrigeration>

1. The air-cooled type product exhausts heat using the fan that is mounted to the product. If the product is operated with insufficient ventilation, ambient temperature may exceed 45°C, and this will affect the performance and life of the product. To prevent this ensure that suitable ventilation is available (see below).
2. For installation indoors, ventilation ports and a ventilation fan should be equipped as needed.



HRSH250-A

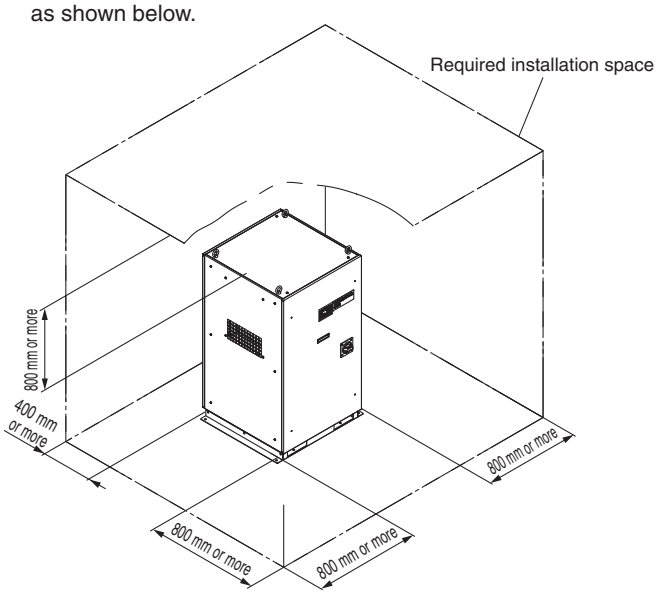
3. If it is impossible to exhaust heat from the installation area indoors, or when the installation area is conditioned, provide a duct for heat exhaustion to the air outlet port of this product for ventilation. Do not mount the inlet of the duct (flange) directly to the air vent of the product, and keep a space larger than the diameter of the duct. Additionally, consider the resistance of the duct when making the air vent port for the duct.

<Heat radiation amount/Required ventilation rate>

Model	Heat radiation amount [kW]	Required ventilation rate [m³/min]	
		Differential temp. of 3°C between inside and outside of installation area	Differential temp. of 6°C between inside and outside of installation area
HRSH100-A□-□	Approx. 18	305	155
HRSH150-A□-□	Approx. 29	490	245
HRSH200-A□-□	Approx. 35	590	295
HRSH250-A□-□	Approx. 44	730	365
HRSH300-A□-□	Approx. 45	760	380

<Water-cooled refrigeration>

When installing the product, keep the space for maintenance as shown below.



Piping

⚠ Caution

1. Regarding the circulating fluid and facility water pipings, consider carefully the suitability for temperature, circulating fluid and facility water.

If the operating performance is not sufficient, the pipings may burst during operation. Using corrosive materials such as aluminum or iron for fluid contact parts such as piping may cause clogging or leakage in the circulating fluid and facility water circuits. Provide protection against corrosion when you use the product.

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 drain port of this product, use a pipe wrench to clamp the connection ports.

4. Supply water pressure to the automatic fluid fill port of this product should be 0.2 to 0.5 MPa.

This product has a built-in ball (float) tap. If you attach it to the faucet of a sink etc. it will automatically supply water to the rated fluid level of the tank (halfway between HIGH and LOW.) If the water supply pressure is too high, the pipes may burst during use. Proceed with caution.

5. Ensure that piping is connected to the overflow port so that the circulating fluid can be exhausted to the drainage pit when the fluid level in the tank increases.

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

7. This product series are constant-temperature fluid circulating machines 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.

Series HRSH
Specific Product Precautions 4

Be sure to read this before handling. Refer to page 341 for Safety Instructions. For Temperature Control Equipment Precautions, refer to pages 342 to 345 and the Operation Manual on SMC website, http://www.smcworld.com

Electrical Wiring

⚠ Warning

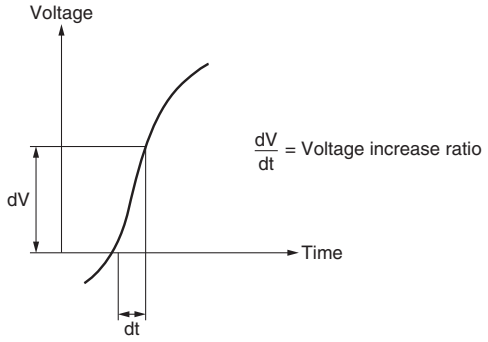
Grounding should never be connected to a water line, gas line or lightning rod.

⚠ Caution

1. Power supply and communication cables should be prepared by user.

2. Provide a stable power supply which is not affected by surge or distortion.

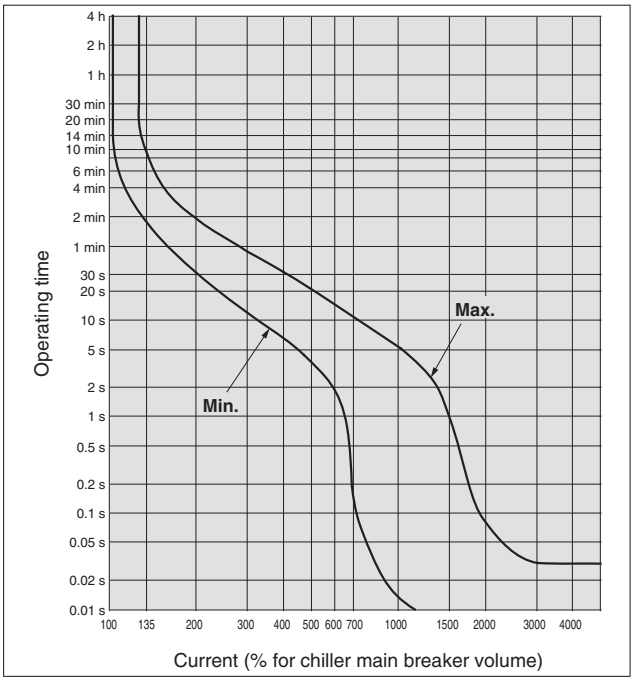
If the voltage increase ratio (dV/dt) at the zero cross should exceed 40 V/200 μsec., it may result in malfunction.



<For 400 V type and option B [With earth leakage breaker]>

3. This product is installed with a breaker with the following operating characteristics.

For the user's equipment (inlet side), use a breaker whose operating time is equal to or longer than the breaker of this product. If a breaker with shorter operating time is connected, the user's equipment could be cut off due to the inrush current of the motor of this product.



Circulating Fluid

⚠ Caution

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

2. When water is used as a circulating fluid, use tap water that conforms to the appropriate water quality standards.

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

Tap Water (as Circulating Fluid) Quality Standards

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

	Item	Unit	Standard value	Influence	
				Corrosion	Scale generation
Standard item	pH (at 25°C)	—	6.0 to 8.0	○	○
	Electric 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		○
	Ionic state silica (SiO_2)	[mg/L]	30 or less		○
Reference item	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.
• ○: Factors that have an effect on corrosion or scale generation.
• Even if the water quality standards are met, complete prevention of corrosion is not guaranteed.

3. Use an ethylene glycol aqueous solution that does not contain additives such as preservatives.

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

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. When deionized water is used, the electric conductivity should be 1 μS/cm or higher (Electric resistivity: 1 MΩ·cm or lower).

Facility Water Supply

⚠ Warning

<Water-cooled refrigeration>

1. The water-cooled refrigeration type thermo-chiller radiates heat to the facility water.
Prepare the facility water system that satisfies the heat radiation and the facility water specifications below.

■ Required facility water system
<Heat radiation amount/Facility water specifications>

Model	Heat radiation [kW]	Facility water specifications
HRSH100-W□-□	Approx. 20	Refer to "Facility water system" in the specifications on pages 136 and 138.
HRSH150-W□-□	Approx. 27	
HRSH200-W□-□	Approx. 34	
HRSH250-W□-□	Approx. 40	

Series HRSH
Specific Product Precautions 5

Be sure to read this before handling. Refer to page 341 for Safety Instructions. For Temperature Control Equipment Precautions, refer to pages 342 to 345 and the Operation Manual on SMC website, http://www.smcworld.com

Facility Water Supply

⚠ Warning

2. When using tap water as facility water, use tap water that conforms to the appropriate water quality standards.
Use water that conforms to the standards shown below.

Tap Water (as Facility Water) Quality Standards
The Japan Refrigeration and Air Conditioning Industry Association
JRA GL-02-1994 "Cooling water system – Circulation type – Make-up water"

	Item	Unit	Standard value	Influence	
				Corrosion	Scale generation
Standard item	pH (at 25°C)	—	6.5 to 8.2	○	○
	Electric conductivity (25°C)	[μS/cm]	100* to 800*	○	○
	Chloride ion (Cl^-)	[mg/L]	200 or less	○	
	Sulfuric acid ion (SO_4^{2-})	[mg/L]	200 or less	○	
	Acid consumption amount (at pH4.8)	[mg/L]	100 or less		○
	Total hardness	[mg/L]	200 or less		○
	Calcium hardness ($CaCO_3$)	[mg/L]	150 or less		○
	Ionic state silica (SiO_2)	[mg/L]	50 or less		○
Reference item	Iron (Fe)	[mg/L]	1.0 or less	○	○
	Copper (Cu)	[mg/L]	0.3 or less	○	
	Sulfide ion (S_2^-)	[mg/L]	Should not be detected.	○	
	Ammonium ion (NH_4^+)	[mg/L]	1.0 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 0.001 to 0.01.
• ○: Factors that have an effect on corrosion or scale generation.
• Even if the water quality standards are met, complete prevention of corrosion is not guaranteed.

3. Set the supply pressure between 0.3 to 0.5 MPa. Ensure a pressure difference at the facility water inlet/outlet of 0.3 MPa or more.
If the supply pressure is high, it will cause water leakage. If the supply pressure and pressure difference at the facility water inlet/outlet is low, it will cause an insufficient flow rate of the facility water, and poor temperature control.

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 the 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.
Pump can be operated independently.

2. Confirmation during operation
• Check the circulating fluid temperature.
The operating temperature range of the circulating fluid is between 5 and 35°C.
When the amount of heat generated from the user's equipment is greater than the product's capability, the circulating fluid temperature may exceed this range. Use caution regarding this matter.

3. Emergency stop method
• When an abnormality is confirmed, stop the machine immediately. After the machine has stopped, make sure to turn off the breaker of the user's equipment (on the upstream side).

Operation Restart Time

⚠ Caution

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

If operating in the below conditions, the protection circuit will activate and an operation may not be performed or will stop.
• Power supply voltage is not within the rated voltage range of ±10%.
• In case the water level inside the tank is reduced abnormally.
• Circulating fluid temperature is too high.
• Compared to the cooling capacity, the heat generation amount of the user's equipment is too high.
• Ambient temperature is over 45°C.
• Ventilation hole is clogged with dust or dirt.

Maintenance

⚠ Caution

<Periodical inspection every one month>
Clean the ventilation hole.
If the dustproof filter of water-cooled type product becomes clogged with dust or debris, a decline in cooling performance can result.
In order to avoid deforming or damaging the dustproof filter, clean it with a long-haired brush or air gun.

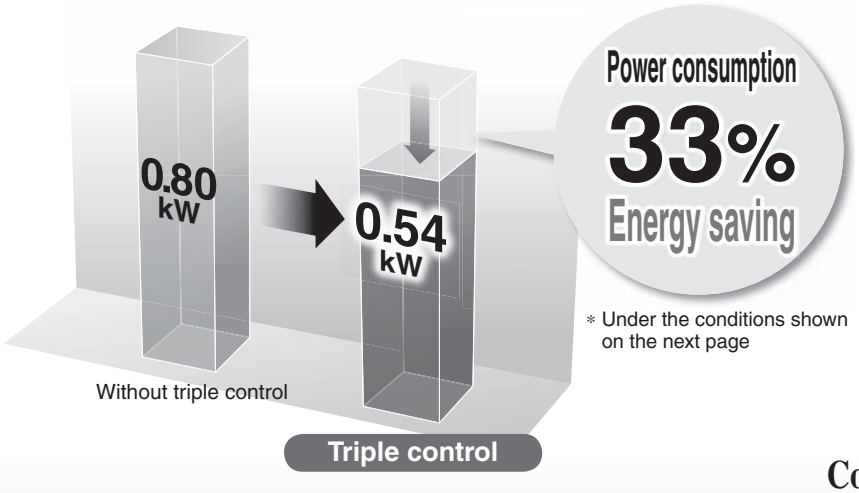
<Periodical inspection every three months>
Inspect the circulating fluid.
1. When using tap water or deionized water
• Replacement of circulating fluid
Failure to replace the circulating fluid can lead to the development of bacteria or algae. Replace it regularly depending on your usage conditions.
2. 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 and facility water freezing when the product is stopped, release the circulating fluid and facility water in advance.

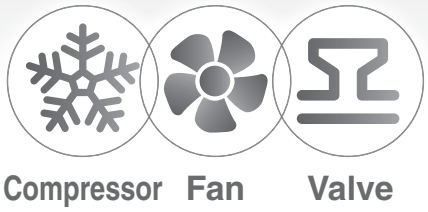
2. Consult a professional.
This product has an "anti-freezing function", "warming-up function", and "anti-snow coverage function". Read the Operation Manual carefully, and if any additional anti-freezing function (e.g. tape heater) is needed, ask for it from the vendor.

CE RoHS
(Only 230 VAC type)

Large energy saving by triple control!



* Under the conditions shown on the next page



Triple control

- Compressor ON/OFF
- Air-cooled condenser fan
- Electronic valve control

Compact/Lightweight **32 kg** (100 VAC)



Cooling capacity **1.2, 1.6, 2.2 kW**

Max. ambient temperature **40°C** (200 VAC)

Set temperature range **10 to 30°C**

Temperature stability **±2.0°C**

Maintenance free **Magnet pump**

Low-noise design **55 dB (A)**

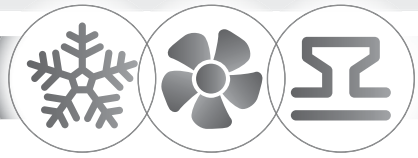
Power supply **100/200 VAC** 50/60 Hz
230 VAC 50/60 Hz

Simple function and performance

Cooling capacity	1.2, 1.6, 2.2 kW (60 Hz)

Power supply	100/200 VAC (50/60 Hz) 230 VAC (50/60 Hz)

Triple control



Triple control

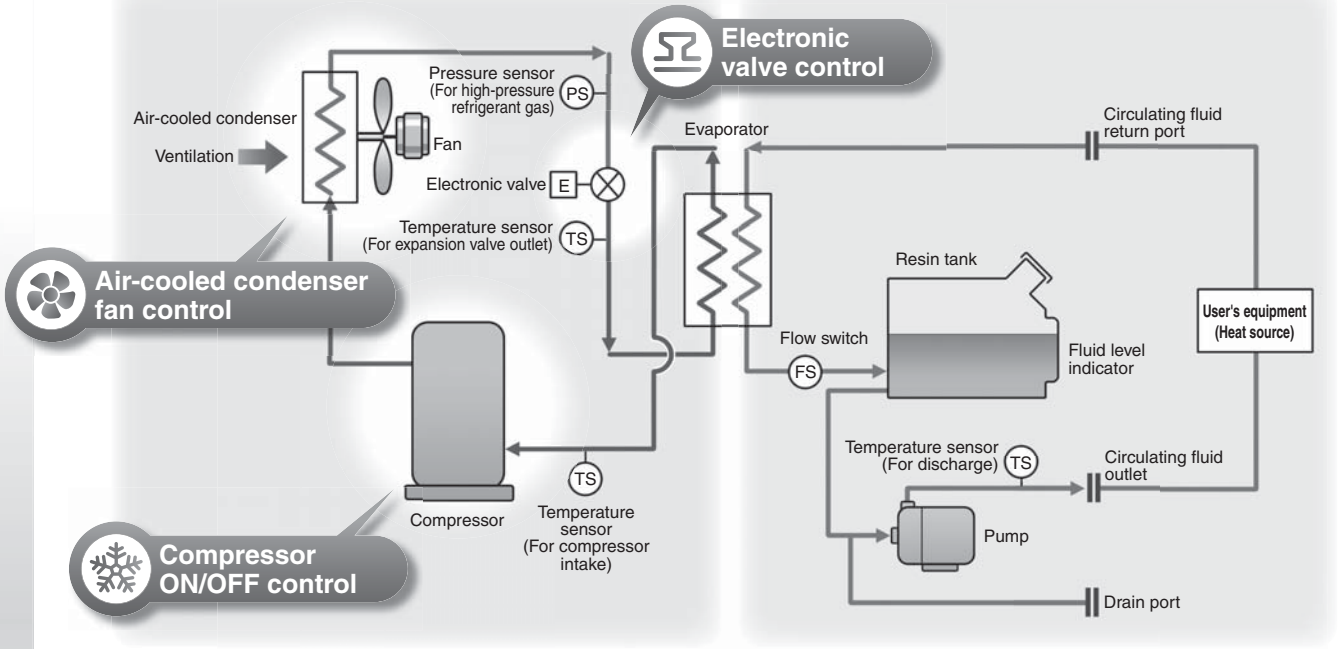
Compressor, fan and electronic control valve can be controlled depending on the heat load from the user's equipment.

Power consumption reduced by 33%

Conditions: ● 100 VAC ● Frequency: 60 Hz ● Circulating fluid temperature in the rated operation: 20°C ● Ambient temperature: 25°C ● Load: 1200 W ● Flow rate: 7 L/min

Circuit diagram

∗ This circuit construction of the position of the parts may be different from actual product.



Refrigeration circuit

- The compressor compresses the refrigerant gas, and discharges the high temperature and high pressure refrigerant gas.
- The high temperature and high pressure refrigerant gas is cooled down by an air-cooled condenser with the ventilation of the fan, and becomes a liquid.
- The liquefied high pressure refrigerant gas expands and its temperature lowers when it passes through the electronic valve and vaporizes by taking heat from the circulating fluid in the evaporator.
- The vaporized refrigerant gas is sucked into the compressor and compressed again.

Point Refrigeration circuit control system requires the minimum basic essential function.

According to the amount of heat generated from user's equipment, the system turns power ON/OFF to the compressor and controls the electronic valve. By combining the above function, the system also controls the number of rotations of the fan that is appropriate to the amount of heat and ambient temperature, to provide the performance of temperature control of ±2°C.

Circulating fluid circuit

- The circulating fluid discharged from the pump, is heated by the user's equipment and returns to the tank.
- The circulating fluid is sent to the evaporator by the pump, and is controlled to a set temperature by the refrigeration circuit, to be discharged to the user's equipment side again by the thermo-chiller.

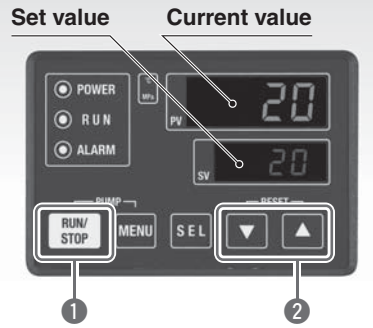
Point Temperature control system requires the minimum basic essential function.

Signal of temperature sensor for pump discharging controls the refrigeration circuit. Circulating fluid is heated by the pump heat and the amount of heat generated from user's equipment.

Thermo-chiller of the basic type

CE (Only 230 VAC type)

Simple operation



Step 1
Press the RUN/STOP key.

Step 2
Adjust the temperature setting with the ▼ / ▲ keys.

Immediate usage after fitting plug to power supply

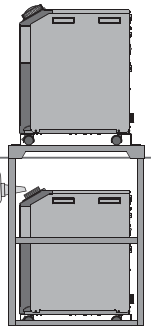


Power cable with plug
(For 100 VAC)



For 200/230 VAC

Shaped for easy supply of circulating fluid



Easy to supply circulating fluid even the product is installed under a laboratory work bench or two products are stacked.

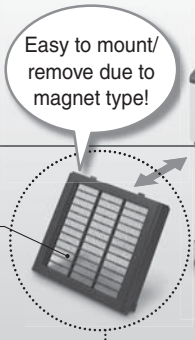
Easy check of the circulating fluid level



Easy to check the circulating fluid level at a glance!

No tools are required to mount/ remove the front panel.

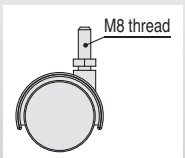
Easy to mount/ remove due to magnet type!



Easy to clean dust and cutting chips etc. stuck to the dustproof net by brush or air blow.



With casters (Removable)



Option

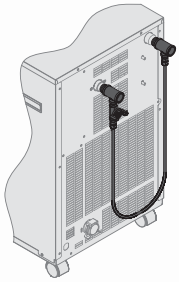
High pressure pump mounted

For large piping resistance

Optional Accessories

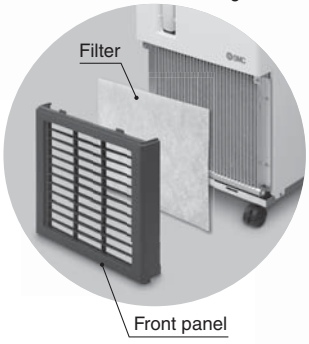
Bypass piping set

When the circulating fluid goes below the rated flow (7 L/min), cooling capacity will be reduced or the temperature stability will be badly affected. In such a case, use the bypass piping set.



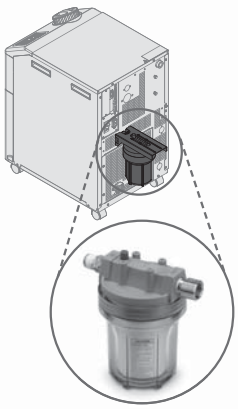
Replacement type dustproof filter set

Suitable for use in excessively dusty atmospheres. The disposable type filter saves time and effort of cleaning.



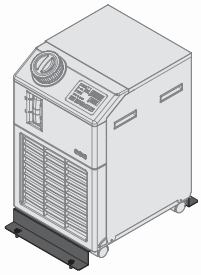
Particle filter set

Removes foreign objects in the circulating fluid.



Anti-quake bracket

Measures against earthquake.
It can be fixed to the floor or base.



Application Examples

	Heat source	Automotive	Light electrical appliance	Food	Machinery	Medical	Semiconductor
Arc welding machine	Torch	●			●		
Resistance welding machine	Tip	●	●		●		
Laser welding machine	Oscillator	●	●		●		●
UV curing device	Lamp	●	●	●		●	
X-ray instrument			●			●	●
Electronic microscope	Lens		●			●	●
Laser marker	Oscillator	●	●	●		●	●
Ultra sonic wave inspection machine		●	●		●		
Atomizing device/ Crushing equipment	Blade			●			
Linear motor	Motor	●			●		
Packaging machines (food products)	Dies/ Welded portions			●			
Mold cooling	Mold	●	●	●		●	
Temperature control of adhesive and paint material	Paint material/ Welding materials	●	●	●			
Cooling of vacuum pump	Pump	●					●
Shrink fit machine	Workpiece	●			●		
Gas cylinder cabinet							●
Concentrating equipment	Test liquid			●		●	
Reagent cooling equipment	Reagent			●		●	●
Cleaning machine (hydrocarbon-based)	Cleaning tank	●	●		●		
Printing machine	Roller		●	●	●		
Chamber electrode	Electrode						●
High frequency induction heating equipment	Power supply/ Heating coil	●			●		

Global Supply Network

SMC has a comprehensive network in the global market.

We now have a presence of more than 400 branch offices and distributors in 78 countries world wide such as Asia, Oceania, North/Central/South America, and Europe. With this global network, we are able to provide a global supply of our substantial range of products with the best service. We also provide full support to local factories, foreign manufacturing companies and Japanese companies in each country.



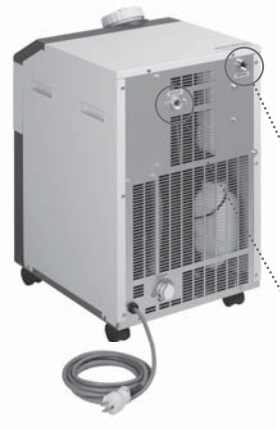


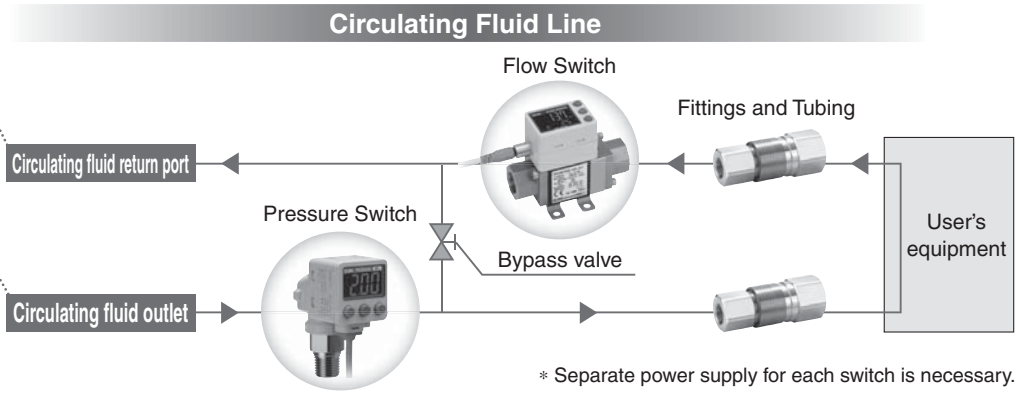
SMC Thermo-chiller Variations

Lots of variations are available in response to the users' requirements.

Series		Temperature stability [°C]	Set temperature range [°C]	Cooling capacity [kW]												Environment	International standards
				1.2	1.8	2.4	3	5	6	9	10	15	20	25	28		
	**HRSE Basic type**	±2.0	10 to 30	●	●	●										Indoor use	CE (Only 230 VAC type)
	**HRS Standard type**	±0.1	5 to 40	●	●	●	●	●	●							Indoor use	CE (Only 60 Hz)
	**HRS100/150 Standard type**	±1.0	5 to 35								●	●				Outdoor installation IPX4	CE (400 V as standard)
	**HRSH090 Inverter type**	±0.1	5 to 40							●						Indoor use	CE (400 V as standard) (Only 200 V as an option)
	**HRSH Inverter type**	±0.1	5 to 35								●	●	●	●	●	Outdoor installation IPX4	CE (400 V as standard, 200 V as an option) (Only 200 V as an option)

Circulating Fluid Line Equipment





∗ Separate power supply for each switch is necessary.

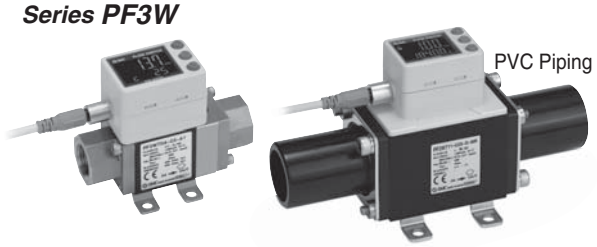
Pressure Switch

2-Color Display
High-Precision Digital Pressure Switch
Series ISE80



Flow Switch

3-Color Display
Digital Flow Switch for Water
Series PF3W



3-Color Display
Electromagnetic Type
Digital Flow Switch
Series LFE



Fittings and Tubing

S Coupler
Series KK



S Coupler/Stainless Steel (Stainless Steel 304)
Series KKA



Metal One-touch Fittings
Series KQB2



Stainless Steel 316 One-touch Fittings
Series KQG2



Stainless Steel 316 Insert Fittings
Series KFG2



Tubing
Series T□



Series	Material
T	Nylon
TU	Polyurethane
TH	FEP (Fluoropolymer)
TD	Modified PTFE (Soft fluoropolymer)
TL	Super PFA

For details of these products, refer to the **WEB catalog** or the Best Pneumatics No. 6 and 7.

CONTENTS

Series HRSE Basic Type



Thermo-chiller Series HRSE

How to Order/Specifications
- Single-phase 100 VAC ····· Page 167
- Single-phase 200 VAC ····· Page 168
- Single-phase 230 VAC ····· Page 169

Cooling Capacity ····· Page 170
Pump Capacity ····· Page 171
Dimensions ····· Page 172
Operation Display Panel ····· Page 173
Alarm ····· Page 173

Option
High Pressure Pump Mounted ····· Page 174

Optional Accessories
① Anti-quake Bracket ····· Page 174
② Bypass Piping Set ····· Page 174
③ Replacement Type Dustproof Filter Set ····· Page 175
④ Particle Filter Set ····· Page 175

Cooling Capacity Calculation
Required Cooling Capacity Calculation ····· Page 176
Precautions on Cooling Capacity Calculation ··· Page 177
Circulating Fluid Typical Physical Property Values ··· Page 177

Specific Product Precautions ····· Page 178

RoHS

Thermo-chiller Basic Type

Series HRSE



How to Order

Single-phase 100 VAC **HRSE 018 – A – 10 – □**

Cooling capacity

012	Cooling capacity 1000/1200 W (50/60 Hz)
018	Cooling capacity 1400/1600 W (50/60 Hz)

Cooling method

A	Air-cooled refrigeration

Power supply

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

Option

Symbol	Option
Nil	None
T	High pressure pump mounted Note)

Note) The cooling capacity will decrease by about 100 W from the value in the catalog. The performance is different between product models. Make sure to check the pump capacity before selecting models.

Specifications ∗ There are different values from standard specifications.

Model			HRSE012-A-10-(T)	HRSE018-A-10-(T)
Cooling method			Air-cooled refrigeration	
Refrigerant			R407C (HFC)	
Control method			Compressor ON/OFF	
Ambient temperature/Humidity/Altitude Note 1), 11)			Temperature: 5 to 35°C, Humidity: 30 to 70%, Altitude: less than 3000 m	
Circulating fluid system	**Circulating fluid** Note 2)		Tap water, 15% ethylene glycol aqueous solution	
	Set temperature range Note 1)	°C	10 to 30	
	Cooling capacity Note 3), 11) **(50/60 Hz)**	W	1000/1200 For option -T: 900/1100	1400/1600 For option -T: 1300/1500
	Temperature stability Note 4)	°C	±2	
	Pump capacity (50/60 Hz) Note 5)	MPa	0.08 (at 7 L/min)/0.11 (at 7 L/min) For option -T: 0.13 (at 7 L/min)/0.18 (at 7 L/min)	
	Rated flow (50/60 Hz) Note 6)	L/min	7/7	
	Tank capacity	L	Approx. 5	
	Port size		Rc1/2	
	Fluid contact material		Stainless steel, Copper (Heat exchanger brazing), Bronze, Brass, Ceramic, Carbon, PP, PE, POM, EPDM, PVC	
Electrical system	**Power supply**		Single-phase 100 VAC 50/60 Hz Allowable voltage range ±10%	
	Fuse	A	15	
	Power cable size Note 10)	—	3 cores x 14 AWG (2.0 mm^2), 3 m	
	Applicable earth leakage breaker capacity Note 7)	A	15	
	Rated operating current (50/60 Hz) Note 3)	A	7.1/7.8 For option -T: 7.8/8.4	7.1/7.8 For option -T: 7.8/8.4
	Rated power consumption (50/60 Hz) Note 3)	VA	0.53/0.54 For option -T: 0.62/0.62	0.63/0.63 For option -T: 0.72/0.72
Dimensions Note 8)		mm	W377 x D435 x H615 For option -T: W377 x D500 x H615	
Accessories			Fitting (for drain outlet) 1 pc., Operation Manual (for installation/operation) 1	
Weight Note 9)		kg	32 For option -T: 39	

Note 1) It should have no condensation. During seasons or in locations where the ambient temperature is likely to fall below freezing point, please contact SMC for that case.
Note 2) If tap water is used, use water that conforms to Water Quality Standards of the Japan Refrigeration and Air Conditioning Industry Association (JRA GL-02-1994 cooling water system - circulating type - make-up water).
Note 3) ① Ambient temperature: 25°C, ② Circulating fluid temperature: 20°C, ③ Circulating fluid rated flow, ④ Circulating fluid: Tap water
Note 4) Temperature at the thermo-chiller outlet when the circulating fluid flow is rated flow, and the circulating fluid outlet and return port are directly connected. Installation environment and the power supply are within specification range and stable.
Note 5) The capacity at the thermo-chiller outlet when the circulating fluid temperature is 20°C.
Note 6) Required flow rate 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 7) Purchase an earth leakage breaker with current sensitivity of 15 mA or 30 mA/power supply 100 VAC separately.
Note 8) Dimensions between panels, not including the dimensions of protrusion.
Note 9) Weight in the dry state without circulating fluids.
Note 10) Cable terminal is provided with a plug with ground terminal (JIS C 8303 Plug for the receptacle with dipoles grounding electrode).
Note 11) If the product is used at altitude of 1000 m or higher, refer to "Operating Environment/Storage Environment" (page 179) Item 14 "∗ For altitude of 1000 m or higher".



How to Order

Single-phase 200 VAC **HRSE 018 – A – 20 – □**

Cooling capacity

012	Cooling capacity 1000/1200 W (50/60 Hz)
018	Cooling capacity 1400/1600 W (50/60 Hz)
024	Cooling capacity 1900/2200 W (50/60 Hz)

Cooling method

A	Air-cooled refrigeration

Power supply

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

Option

Symbol	Option
Nil	None
T	High pressure pump mounted Note)

Note) The cooling capacity will decrease by about 100 W from the value in the catalog. The performance is different between product models. Make sure to check the pump capacity before selecting models.

Specifications ∗ There are different values from standard specifications.

Model			HRSE012-A-20-(T)	HRSE018-A-20-(T)	HRSE024-A-20-(T)
Cooling method			Air-cooled refrigeration		
Refrigerant			R407C (HFC)		
Control method			Compressor ON/OFF		
Ambient temperature/Humidity/Altitude Note 1), 11)			Temperature: 5 to 40°C, Humidity: 30 to 70%, Altitude: less than 3000 m		
Circulating fluid system	**Circulating fluid** Note 2)		Tap water, 15% ethylene glycol aqueous solution		
	Set temperature range Note 1)	°C	10 to 30		
	Cooling capacity (50/60 Hz) Note 3), 11)	W	1000/1200 For option -T: 900/1100	1400/1600 For option -T: 1300/1500	1900/2200 For option -T: 1800/2100
	Temperature stability Note 4)	°C	±2		
	Pump capacity (50/60 Hz) Note 5)	MPa	0.08 (at 7 L/min)/0.11 (at 7 L/min) For option -T: 0.13 (at 7 L/min)/0.18 (at 7 L/min)		
	Rated flow (50/60 Hz) Note 6)	L/min	7/7		
	Tank capacity	L	Approx. 5		
	Port size		Rc1/2		
	Fluid contact material		Stainless steel, Copper (Heat exchanger brazing), Bronze, Brass, Ceramic, Carbon, PP, PE, POM, EPDM, PVC		
Electrical system	**Power supply**		Single-phase 200 VAC 50/60 Hz Allowable voltage range ±10%		
	Fuse	A	15		
	Power cable size Note 10)	—	3 cores x 14 AWG (2.0 mm^2), 3 m		
	Applicable earth leakage breaker capacity Note 7)	A	15		
	Rated operating current (50/60 Hz) Note 3)	A	4.1/5.0 For option -T: 4.5/5.4	4.2/5.3 For option -T: 4.6/5.7	4.3/5.4 For option -T: 4.7/5.8
	Rated power consumption (50/60 Hz) Note 3)	VA	0.58/0.74 For option -T: 0.66/0.82	0.73/0.86 For option -T: 0.81/0.94	0.85/1.02 For option -T: 0.93/1.10
Dimensions Note 8)		mm	W377 x D435 x H615 For option -T: W377 x D500 x H615		
Accessories			Fitting (for drain outlet) 1 pc., Operation Manual (for installation/operation) 1		
Weight Note 9)		kg	35 For option -T: 42		

Note 1) It should have no condensation. During seasons or in locations where the ambient temperature is likely to fall below freezing point, please contact SMC for that case.
Note 2) If tap water is used, use water that conforms to Water Quality Standards of the Japan Refrigeration and Air Conditioning Industry Association (JRA GL-02-1994 cooling water system - circulating type - make-up water).
Note 3) ① Ambient temperature: 25°C, ② Circulating fluid temperature: 20°C, ③ Circulating fluid rated flow, ④ Circulating fluid: Tap water
Note 4) Temperature at the thermo-chiller outlet when the circulating fluid flow is rated flow, and the circulating fluid outlet and return port are directly connected. Installation environment and the power supply are within specification range and stable.
Note 5) The capacity at the thermo-chiller outlet when the circulating fluid temperature is 20°C.
Note 6) Required flow rate 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 7) Purchase an earth leakage breaker with current sensitivity of 30 mA/power supply 200 VAC separately.
Note 8) Dimensions between panels, not including the dimensions of protrusion.
Note 9) Weight in the dry state without circulating fluids.
Note 10) The end parts of all three lead wires of the cable terminal are untreated (bare cut).
Note 11) If the product is used at altitude of 1000 m or higher, refer to "Operating Environment/Storage Environment" (page 179) Item 14 "∗ For altitude of 1000 m or higher".



How to Order

Single-phase 230 VAC **HRSE 018 – A – 23 – □**

Cooling capacity

012	Cooling capacity 1000/1200 W (50/60 Hz)
018	Cooling capacity 1400/1600 W (50/60 Hz)
024	Cooling capacity 1900/2200 W (50/60 Hz)

Cooling method

A	Air-cooled refrigeration

Power supply

Symbol	Power supply
23	Single-phase 230 VAC (50/60 Hz)

Option

Symbol	Option
Nil	None
T	High pressure pump mounted Note)

Note) The cooling capacity will decrease by about 100 W from the value in the catalog. The performance is different between product models. Make sure to check the pump capacity before selecting models.

Specifications ∗ There are different values from standard specifications.

Model			HRSE012-A-23-(T)	HRSE018-A-23-(T)	HRSE024-A-23-(T)
Cooling method			Air-cooled refrigeration		
Refrigerant			R407C (HFC)		
Control method			Compressor ON/OFF		
Ambient temperature/Humidity/Altitude Note 1), 11)			Temperature: 5 to 40°C, Humidity: 30 to 70%, Altitude: less than 3000 m		
Circulating fluid system	**Circulating fluid** Note 2)		Tap water, 15% ethylene glycol aqueous solution		
	Set temperature range Note 1)	°C	10 to 30		
	Cooling capacity (50/60 Hz) Note 3), 11)	W	1000/1200 For option -T: 900/1100	1400/1600 For option -T: 1300/1500	1900/2200 For option -T: 1800/2100
	Temperature stability Note 4)	°C	±2		
	Pump capacity (50/60 Hz) Note 5)	MPa	0.08 (at 7 L/min)/0.11 (at 7 L/min) For option -T: 0.13 (at 7 L/min)/0.18 (at 7 L/min)		
	Rated flow (50/60 Hz) Note 6)	L/min	7/7		
	Tank capacity	L	Approx. 5		
	Port size		Rc1/2		
	Fluid contact material		Stainless steel, Copper (Heat exchanger brazing), Bronze, Brass, Ceramic, Carbon, PP, PE, POM, EPDM, PVC		
Electrical system	**Power supply**		Single-phase 230 VAC 50/60 Hz Allowable voltage range ±10%		
	Fuse	A	15		
	Power cable size Note 10)	—	3 cores x 14 AWG (2.0 mm^2), 3 m		
	Applicable earth leakage breaker capacity Note 7)	A	15		
	Rated operating current (50/60 Hz) Note 3)	A	4.1/5.0 For option -T: 4.5/5.4	4.2/5.3 For option -T: 4.6/5.7	4.3/5.4 For option -T: 4.7/5.8
	Rated power consumption (50/60 Hz) Note 3)	VA	0.58/0.74 For option -T: 0.66/0.82	0.73/0.86 For option -T: 0.81/0.94	0.87/1.04 For option -T: 0.93/1.10
Dimensions Note 8)		mm	W377 x D435 x H615 For option -T: W377 x D500 x H615		
Accessories			Fitting (for drain outlet) 1 pc., Operation Manual (for installation/operation) 1		
Weight Note 9)		kg	35 For option -T: 42		

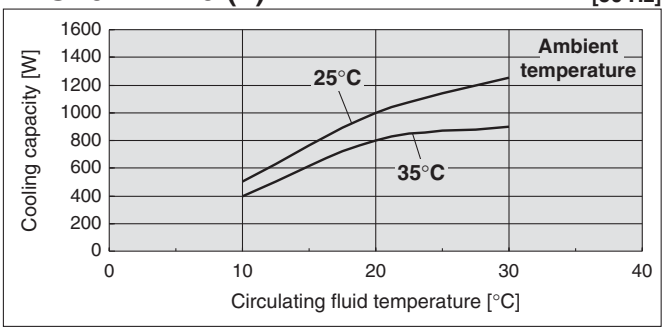
Note 1) It should have no condensation. During seasons or in locations where the ambient temperature is likely to fall below freezing point, please contact SMC for that case.
Note 2) If tap water is used, use water that conforms to Water Quality Standards of the Japan Refrigeration and Air Conditioning Industry Association (JRA GL-02-1994 cooling water system - circulating type - make-up water).
Note 3) ① Ambient temperature: 25°C, ② Circulating fluid temperature: 20°C, ③ Circulating fluid rated flow, ④ Circulating fluid: Tap water
Note 4) Temperature at the thermo-chiller outlet when the circulating fluid flow is rated flow, and the circulating fluid outlet and return port are directly connected. Installation environment and the power supply are within specification range and stable.
Note 5) The capacity at the thermo-chiller outlet when the circulating fluid temperature is 20°C.
Note 6) Required flow rate 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 7) Purchase an earth leakage breaker with current sensitivity of 30 mA/power supply 230 VAC separately.
Note 8) Dimensions between panels, not including the dimensions of protrusion.
Note 9) Weight in the dry state without circulating fluids.
Note 10) The end parts of all three lead wires of the cable terminal are untreated (bare cut).
Note 11) If the product is used at altitude of 1000 m or higher, refer to "Operating Environment/Storage Environment" (page 179) Item 14 "∗ For altitude of 1000 m or higher".

Note 1) If the product is used at altitude of 1000 m or higher, refer to "Operating Environment/Storage Environment" (page 179) Item 14 "∗ For altitude of 1000 m or higher".
Note 2) For models with high pressure pump mounted (-T), the cooling capacity will decrease by about 100 W from each graph.

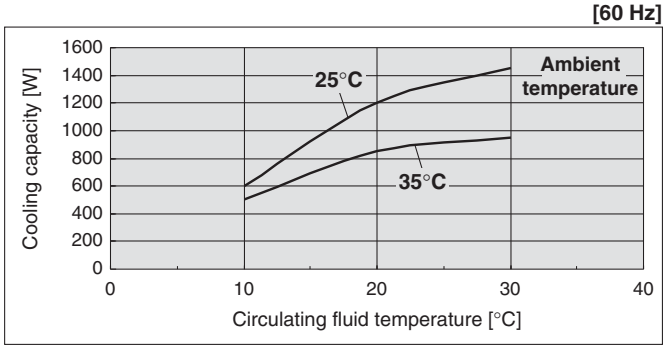
Cooling Capacity

HRSE012-A-10-(T)

[50 Hz]

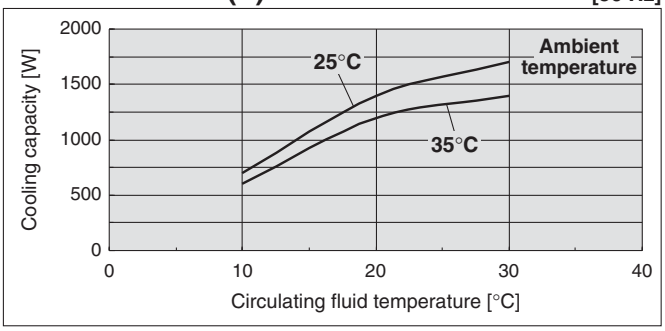


[60 Hz]

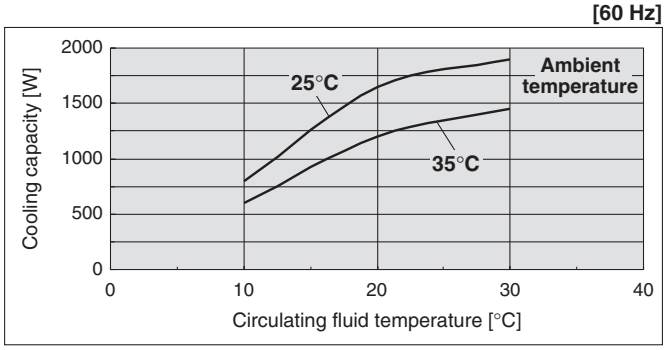


HRSE018-A-10-(T)

[50 Hz]

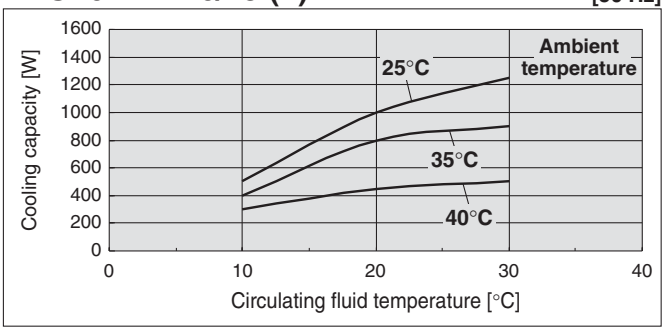


[60 Hz]

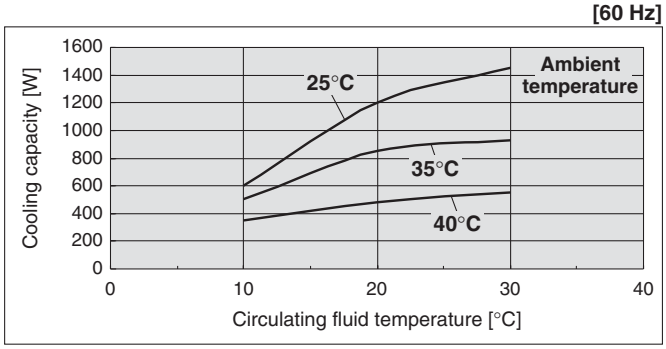


HRSE012-A-20/23-(T)

[50 Hz]

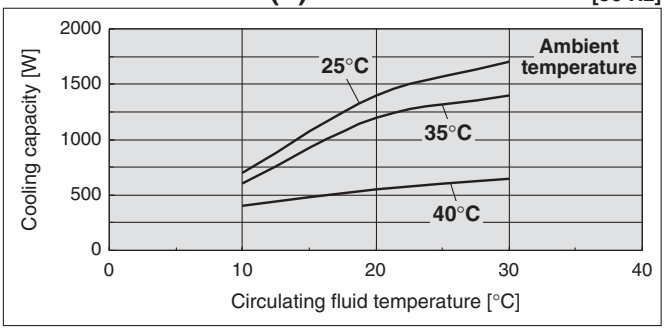


[60 Hz]

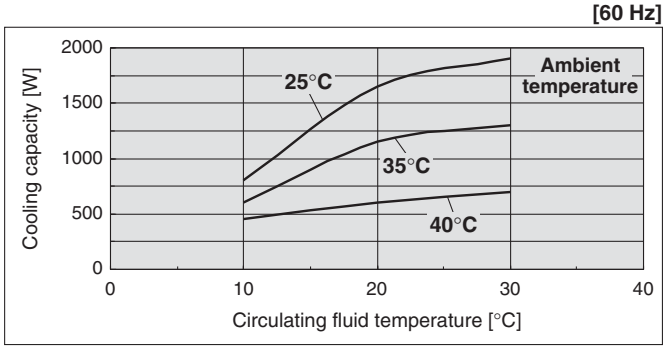


HRSE018-A-20/23-(T)

[50 Hz]

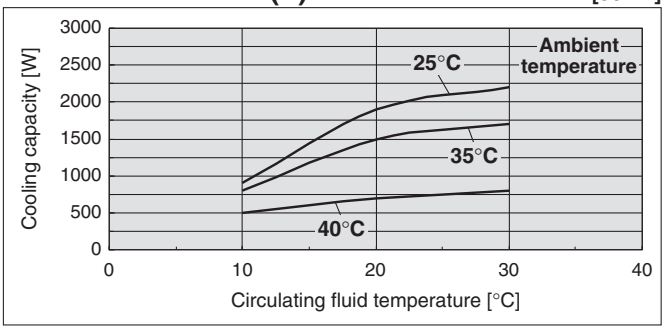


[60 Hz]

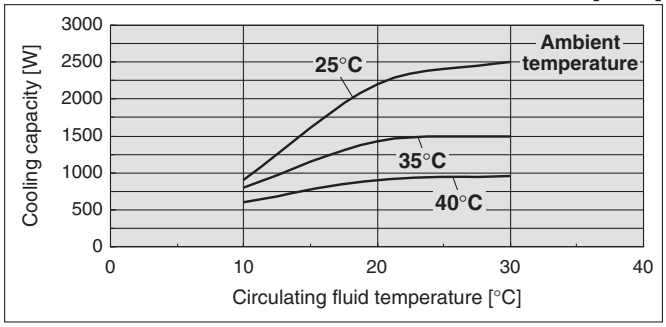


HRSE024-A-20/23-(T)

[50 Hz]

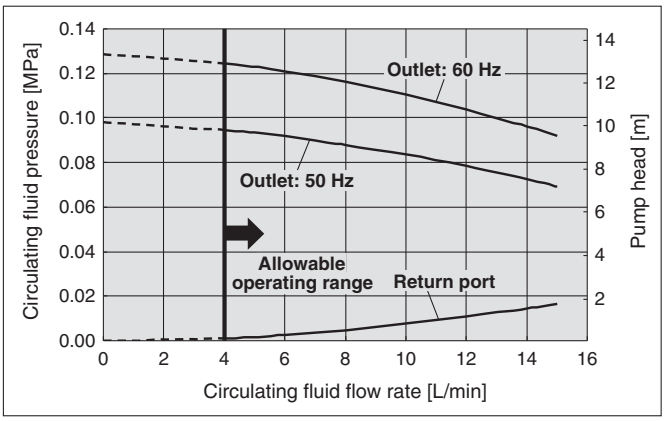


[60 Hz]

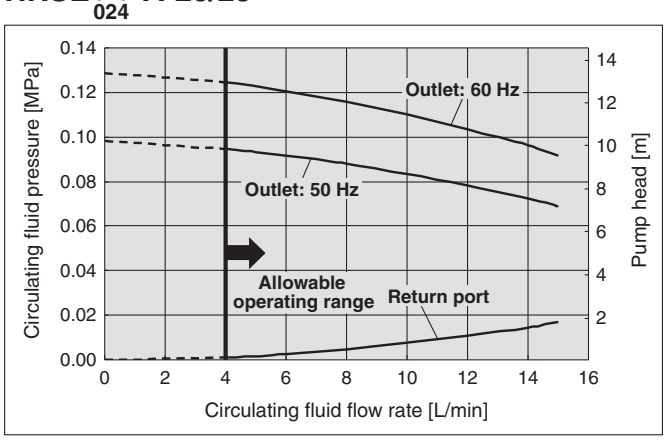


Pump Capacity

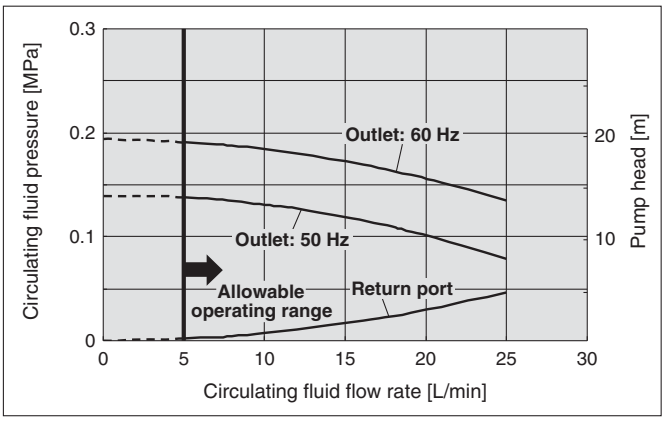
HRSE $^{012}_{018}$-A-10



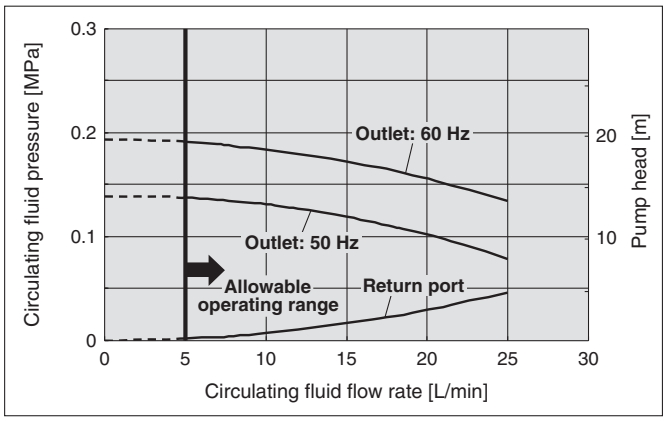
HRSE $^{012}_{018}_{024}$-A-20/23



Option (-T): High Pressure Pump Mounted
HRSE $^{012}_{018}$-A-10-T

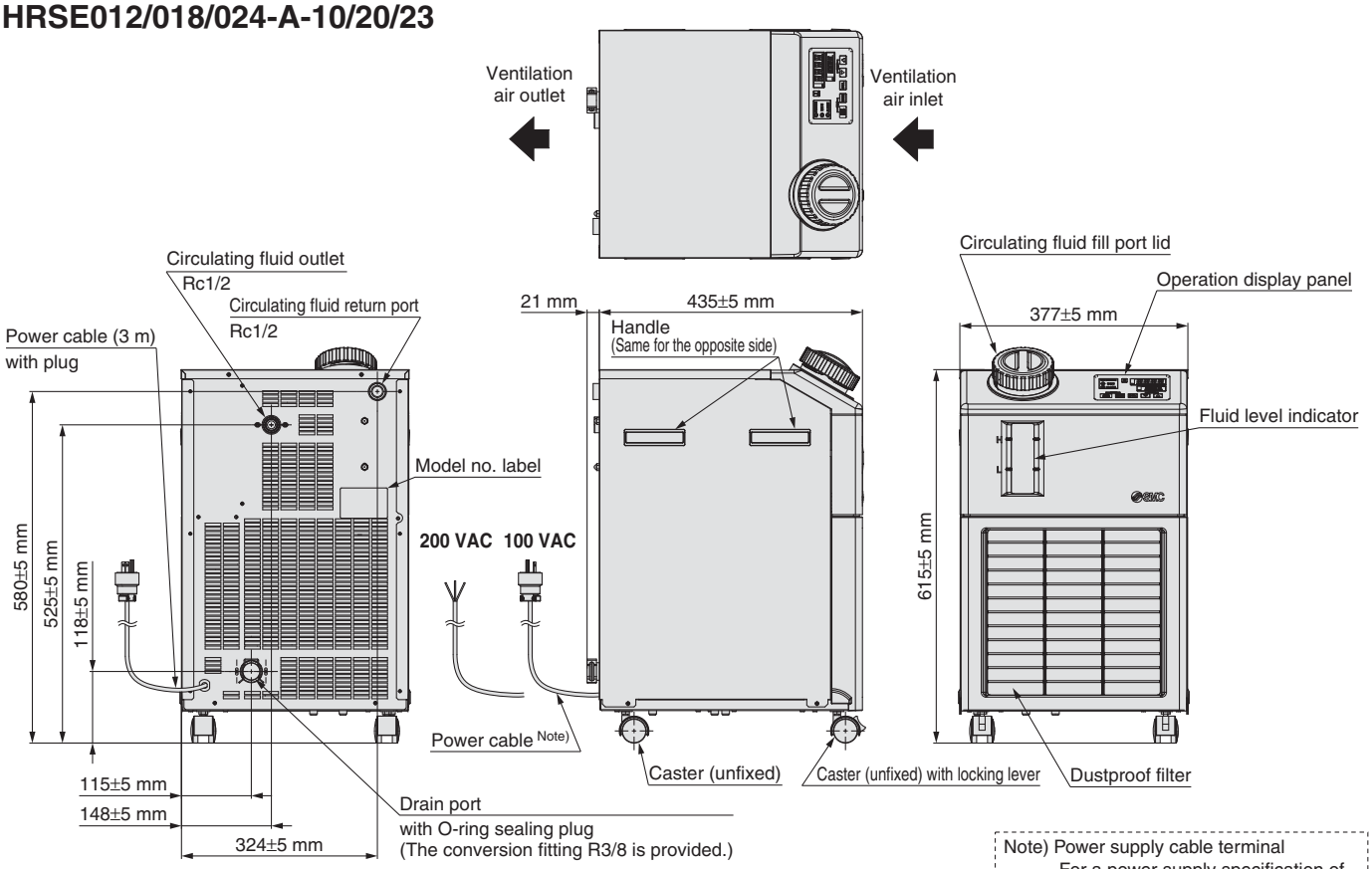


Option (-T): High Pressure Pump Mounted
HRSE $^{012}_{018}_{024}$-A-20/23-T



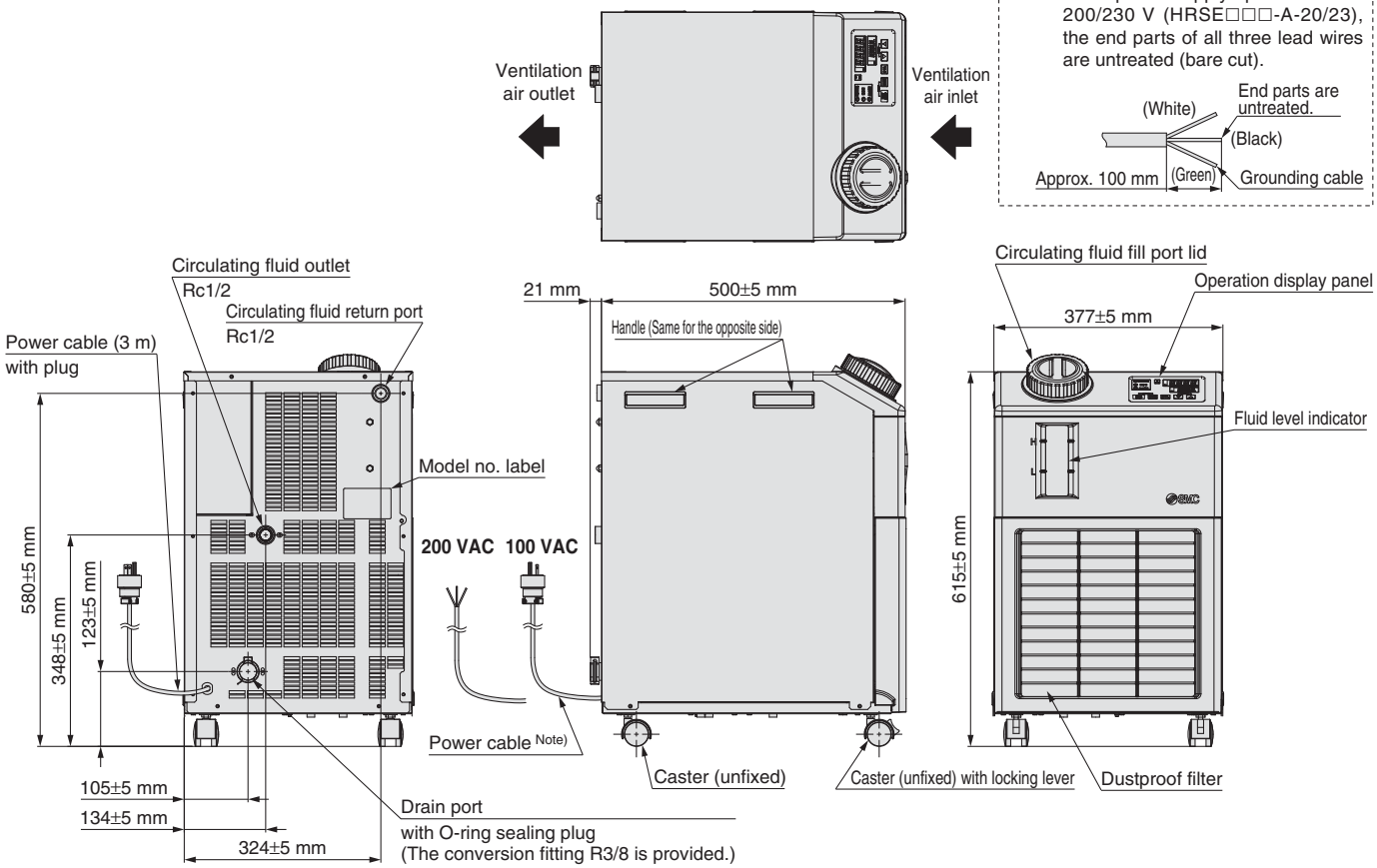
Dimensions

HRSE012/018/024-A-10/20/23

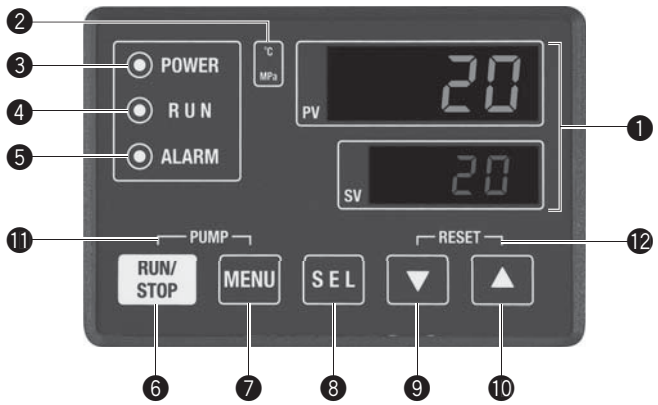


Note) Power supply cable terminal
- For a power supply specification of 100 V (HRSE□□□-A-10), a plug with ground terminal (JIS C 8303 Plug for the receptacle with dipoles grounding electrode) is included.
- For a power supply specification of 200/230 V (HRSE□□□-A-20/23), the end parts of all three lead wires are untreated (bare cut).

HRSE012/018/024-A-10/20/23-T (High pressure pump mounted)



● Operation Display Panel



No.	Description	Function	
❶	Digital display (7 segment, 4 digits)	PV	Displays the current circulating fluid temperature, pressure, alarm codes and other menu items (codes).
		SV	Displays the set values of the circulating fluid discharge temperature and other menus.
❷	[°C] [MPa] lamp	[°C] lamp is turned on when temperature is displayed on the digital display. [MPa] lamp is turned on when pressure is displayed on the digital display.	
❸	[POWER] lamp	Lights up when the power is being supplied to the unit.	
❹	[RUN] lamp	Lights up during operation, and goes off when it is stopped. Flashes during stand-by for stop or independent operation of the pump.	
❺	[ALARM] lamp	Flashes with buzzer when alarm occurs.	
❻	[RUN/STOP] key	Makes the product run or stop.	
❼	[MENU] key	Shifts the main menu (display screen of circulating fluid discharge temperature and pressure, etc.) and other menus (for monitoring and entry of set values).	
❽	[SEL] key	Changes the item in menu and enters the set value.	
❾	[▼] key	Decreases the set value.	
❿	[▲] key	Increases the set value.	
⓫	[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).	
⓬	[RESET] key	Press the [▼] and [▲] keys simultaneously. The alarm buzzer is stopped and the [ALARM] lamp is reset.	

● Alarm

Code	Alarm message	Operation status
AL02	High circulating fluid discharge temp.	Stop
AL03	Circulating fluid discharge temp. rise	Continue*
AL04	Circulating fluid discharge temp. drop	Continue*
AL07	Abnormal pump operation	Stop
AL20	Memory error	Stop
AL22	Circulating fluid discharge temp. sensor failure	Stop
AL24	Compressor intake temp. 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	Continue
AL30	Compressor maintenance	Continue

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

Series HRSE
Option/Optional Accessories

Option

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

T Option symbol

High Pressure Pump Mounted

HRSE□□-A-□-T

T: High pressure pump mounted

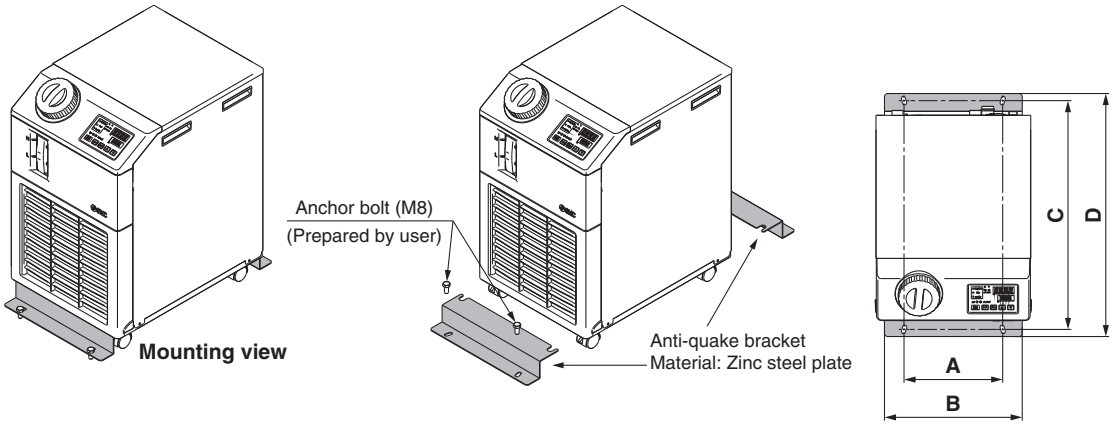
Possible to choose a high pressure pump in accordance with user's piping resistance.
Cooling capacity will decrease by heat generated in the pump.

Optional Accessories

① Anti-quake Bracket

Bracket for earthquakes. Anchor bolt (M8) suitable for the flooring material should be prepared separately by user.
(Anti-quake bracket thickness: 1.6 mm)

Part no. (per unit)	Applicable model	A	B	C	D
HRS-TK003	HRSE012-A-□ HRSE018-A-□ HRSE024-A-□	240	(335)	505	(540)
	HRSE012-A-□-T HRSE018-A-□-T HRSE024-A-□-T	240	(335)	555	(590)



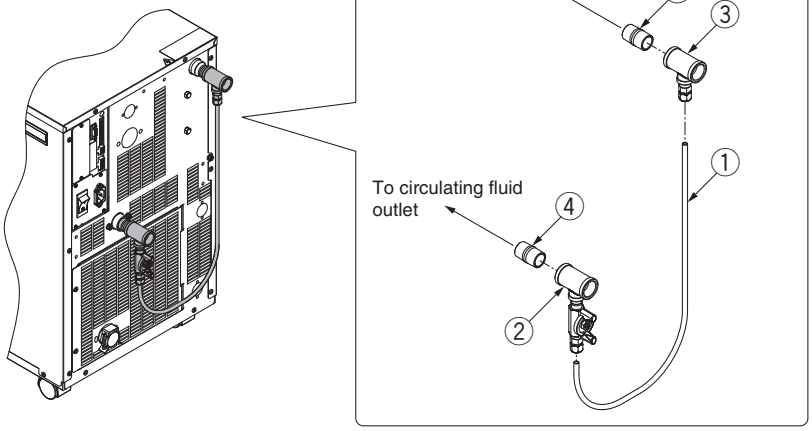
② Bypass Piping Set

When the circulating fluid goes below the rated flow (7 L/min), cooling capacity will be reduced and the temperature stability will be badly affected. In such a case, use the bypass piping set.
A high pressure pump is also available.

Part no.	Applicable model
HRS-BP001	HRSE012-A-□(-T) HRSE018-A-□(-T) HRSE024-A-□(-T)

Parts List

No.	Description
①	Bypass tube (700 mm) (Part no.: TL0806)
②	Outlet piping (with ball valve)
③	Return port piping
④	Nipple (Size: 1/2) (2 pcs.)

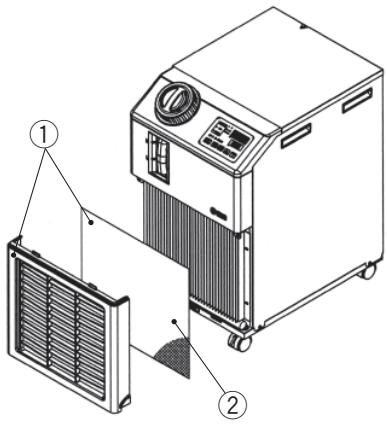


Optional Accessories

③ Replacement Type Dustproof Filter Set

A disposable dustproof filter is mounted instead of the dustproof net on the front panel.

Part no.	Applicable model
HRS-FL001	HRSE□-A-□-(T)



Parts List

No.	Description	Part no.	Note
①	Replacement type dustproof filter set	HRS-FL001	Front panel with hook-and-loop fastener for holding filter 5 filters are included. (No dustproof net is included.)
②	Replacement type dustproof filter	HRS-FL002	5 filters per set Size: 300 x 370

④ Particle Filter Set

Removes foreign objects in the circulating fluid.

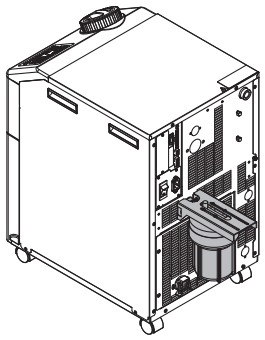
HRS−PF001−W075−H

Table 2

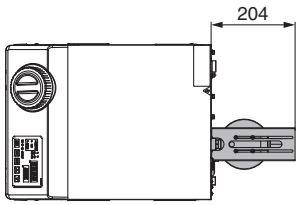
Symbol	Accessory
Nil	None
H	With handle

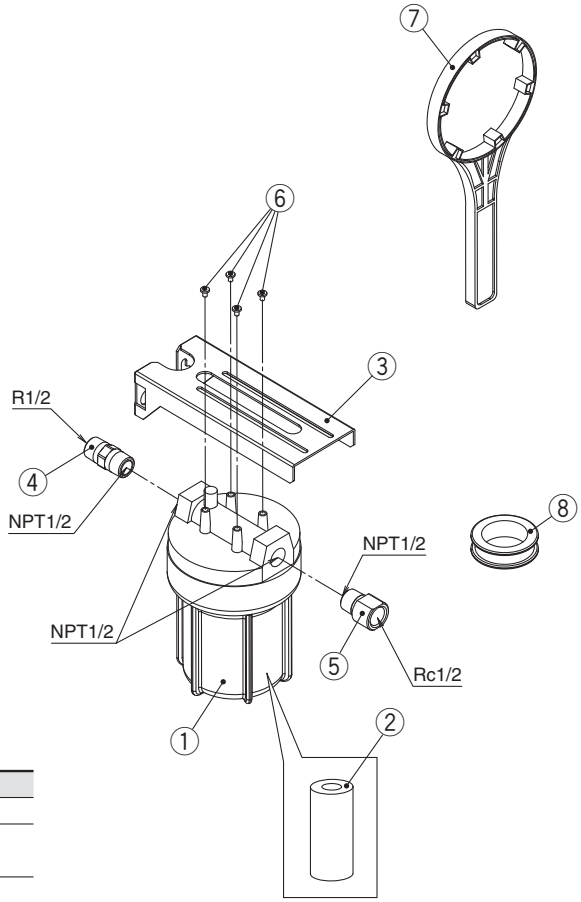
Table 1

Symbol	Nominal filtration accuracy (μm)	Replacement element part no. for L125 (individual part)
Nil	Without element	—
W005	5	EJ202S-005X11
W075	75	EJ202S-075X11



Mounting view





Parts List

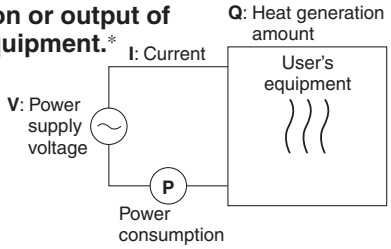
No.	Model	Description	Material	Q'ty	Note
①	—	Body	PP	1	—
②	EJ202S-005X11 EJ202S-075X11	Element	PP/PE	1	—
③	—	Particle filter bracket	SGCC	1	—
④	—	Nipple	Stainless steel	1	Conversion from R to NPT
⑤	—	Extension piece	Stainless steel	1	Conversion from NPT to Rc
⑥	—	Tapping screw	—	4	—
⑦	—	Handle	—	1	When -H is selected
⑧	—	Sealant tape	PTFE	1	—

Series HRSE
Cooling Capacity Calculation

Required Cooling Capacity Calculation

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

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



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

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

Q = P = 1000 [W]

Cooling capacity = Considering a safety factor of 20%,

1000 [W] x 1.2 = 1200 [W]

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

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

Q = P = V x I x Power factor

In this example, using a power factor of 0.85:

= 1.0 [kVA] x 0.85 = 0.85 [kW] = 850 [W]

Cooling capacity = Considering a safety factor of 20%,

850 [W] x 1.2 = 1020 [W]

③ **Derive the heat generation amount from the output.**

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

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

In this example, using an efficiency of 0.7:

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

Cooling capacity = Considering a safety factor of 20%,

1143 [W] x 1.2 = 1372 [W]

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

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

Obtain the temperature difference between inlet and outlet by circulating the circulating fluid inside the user's equipment.

Heat generation amount by user's equipment **Q**	: Unknown [W] ([J/s])
Circulating fluid	: Tap water*
Circulating fluid mass flow rate q_m	: (= ρ x q_v ÷ 60) [kg/s]
Circulating fluid density ρ	: 1 [kg/dm^3]
Circulating fluid (volume) flow rate q_v	: 10 [dm^3/min]
Circulating fluid specific heat **C**	: 4.2 x 10^3 [J/(kg·K)]
Circulating fluid outlet temperature T_1	: 293 [K] (20 [°C])
Circulating fluid return temperature T_2	: 295 [K] (22 [°C])
Circulating fluid temperature difference ΔT	: 2.0 [K] (= $T_2 - T_1$)
Conversion factor: minutes to seconds (SI units)	: 60 [s/min]

* Refer to page 177 for the typical physical property value of tap water or other circulating fluids.

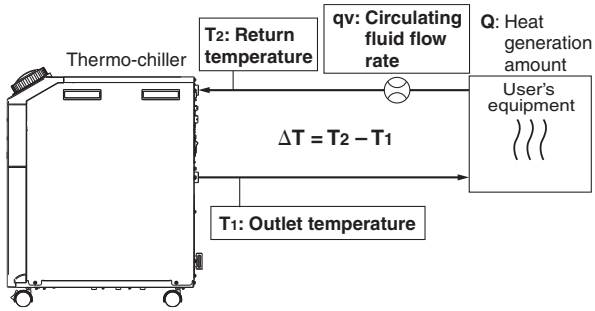
$$Q = q_m \times C \times (T_2 - T_1)$$

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

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

Cooling capacity = Considering a safety factor of 20%,

1400 [W] x 1.2 = 1680 [W]



Example of conventional measurement units (Reference)

Heat generation amount by user's equipment **Q**	: Unknown [cal/h] → [W]
Circulating fluid	: Tap water*
Circulating fluid weight flow rate q_m	: (= ρ x q_v x 60) [kgf/h]
Circulating fluid weight volume ratio γ	: 1 [kgf/L]
Circulating fluid (volume) flow rate q_v	: 10 [L/min]
Circulating fluid specific heat **C**	: 1.0 x 10^3 [cal/(kgf·°C)]
Circulating fluid outlet temperature T_1	: 20 [°C]
Circulating fluid return temperature T_2	: 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 [W] x 1.2 = 1680 [W]

Required Cooling Capacity Calculation

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

Heat quantity by cooled substance (per unit time) **Q** : Unknown [W] ([J/s])
Cooled substance : Water
Cooled substance mass **m** : (= ρ x **V**) [kg]
Cooled substance density ρ : 1 [kg/L]
Cooled substance total volume **V** : 20 [dm^3]
Cooled substance specific heat **C** : 4.2 x 10^3 [J/(kg·K)]
Cooled substance temperature when cooling begins T_0 : 305 [K] (32 [°C])
Cooled substance temperature after t hour T_t : 293 [K] (20 [°C])
Cooling temperature difference ΔT : 12 [K] (= $T_0 - T_t$)
Cooling time Δt : 900 [s] (= 15 [min])

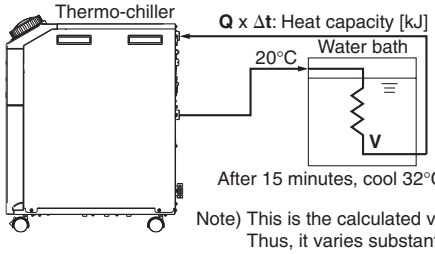
∗ Refer to the following for the typical physical property values by circulating fluid.

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

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

Cooling capacity = Considering a safety factor of 20%,

1120 [W] x 1.2 = 1344 [W]



After 15 minutes, cool 32°C down to 20°C.

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

Example of conventional measurement units (Reference)

Heat quantity by cooled substance (per unit time) **Q** : Unknown [cal/h] → [W]
Cooled substance : Water
Cooled substance weight **m** : (= ρ x **V**) [kgf]
Cooled substance weight volume ratio γ : 1 [kgf/L]
Cooled substance total volume **V** : 20 [L]
Cooled substance specific heat **C** : 1.0 x 10^3 [cal/(kgf·°C)]
Cooled substance temperature 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]

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

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

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

Cooling capacity = Considering a safety factor of 20%,

1120 [W] x 1.2 = 1344 [W]

Precautions on Cooling Capacity Calculation

1. Heating capacity

When the circulating fluid temperature is set above room temperature, it needs to be heated by the thermo-chiller. The heating capacity depends on the circulating fluid temperature. Consider the radiation rate and heat capacity of the user's equipment and check beforehand if the required heating capacity is provided.

2. Pump capacity

<Circulating fluid flow rate>

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

<Circulating fluid discharge pressure>

Circulating fluid discharge pressure has the possibility to increase up to the maximum pressure in the pump capacity curves. Check beforehand if the circulating fluid pipings or circulating fluid circuit of the user's equipment are fully durable against this pressure.

Circulating Fluid Typical Physical Property Values

1. This catalog uses the following values for density and specific heat in calculating the required cooling capacity.

Density ρ: 1 [kg/L] (or, using conventional unit system, weight volume ratio γ = 1 [kgf/L])
Specific heat **C**: 4.19 x 10^3 [J/(kg·K)] (or, using conventional unit system, 1 x 10^3 [cal/(kgf·°C)])

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

Water

Physical property value / Temperature	Density ρ [kg/L]	Specific heat C [J/(kg·K)]	Conventional unit system	
			Weight volume ratio γ [kgf/L]	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/L]	Specific heat C [J/(kg·K)]	Conventional unit system	
			Weight volume ratio γ [kgf/L]	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 shown are reference values. Contact circulating fluid supplier for details.

Series HRSE
Specific Product Precautions 1

Be sure to read this before handling. Refer to page 341 for Safety Instructions. For Temperature Control Equipment Precautions, refer to pages 342 to 345 and the Operation Manual on SMC website, http://www.smcworld.com

Design

⚠ Warning

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

1) Check the specifications 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.

3. Use non-corrosive material for fluid contact parts of circulating fluid.

Using corrosive materials such as aluminum or iron for fluid contact parts such as piping may cause clogging or leakage in the circulating fluid circuit. Provide protection against corrosion when you use the product.

Selection

⚠ Warning

1. Model selection

For selecting a model of thermo-chiller, it is required to know the heat generation amount of the user's equipment. Obtain the heat generation amount, referring to "Cooling Capacity Calculation" on pages 176 and 177 before selecting a model.

Handling

⚠ Warning

1. Thoroughly read the Operation Manual.

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

Transportation/Carriage/Movement

⚠ Warning

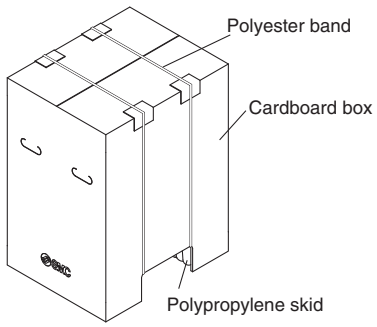
1. This product is heavy. Pay attention to safety and position of the product when it is transported, carried and moved.

2. Read the Operation Manual carefully to move the product after unpacking.

⚠ Caution

1. Never put the product down sideway as this may cause failure.

The product will be delivered in the packaging shown below.



Model	Weight [kg]	Dimensions [mm]
HRSE012-A-10 **HRSE018-A-10**	35	Height 745 x Width 465 x Depth 575
HRSE012-A-10-T **HRSE018-A-10-T**	42	Height 745 x Width 465 x Depth 620
HRSE012-A-20 **HRSE018-A-20** **HRSE024-A-20**	38	Height 745 x Width 465 x Depth 575
HRSE012-A-20-T **HRSE018-A-20-T** **HRSE024-A-20-T**	45	Height 745 x Width 465 x Depth 620
HRSE012-A-23 **HRSE018-A-23** **HRSE024-A-23**	41	Height 790 x Width 470 x Depth 580
HRSE012-A-23-T **HRSE018-A-23-T** **HRSE024-A-23-T**	48	Height 790 x Width 470 x Depth 580

Series HRSE
Specific Product Precautions 2

Be sure to read this before handling. Refer to page 341 for Safety Instructions. For Temperature Control Equipment Precautions, refer to pages 342 to 345 and the Operation Manual on SMC website, http://www.smcworld.com

Operating Environment/Storage Environment

⚠Warning

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

1) Outdoors
2) In locations where water, water vapor, salt water, and oil may splash on the product.
3) In locations where there are dust and particles.
4) In locations where corrosive gases, organic solvents, chemical fluids, or flammable gases are present. (This product is not explosion proof.)
5) In locations where the ambient temperature exceeds the limits as mentioned below.
   During transportation/storage: 0 to 50°C (But as long as water or circulating fluid are not left inside the pipings)
   During operation: • Power supply 100 V type: 5 to 35°C
   • Power supply 200/230 V type: 5 to 40°C
6) In locations where the ambient humidity is out of the following range or where condensation occurs.
   During transportation/storage: 15 to 85%
   During operation: 30 to 70%
7) In locations which receive direct sunlight or radiated heat.
8) In locations where there is a heat source nearby and the ventilation is poor.
9) In locations where temperature substantially changes.
10) In locations where strong magnetic noise occurs. (In locations where strong electric fields, strong magnetic fields and surge voltage occur.)
11) In locations where static electricity occurs, or conditions which make the product discharge static electricity.
12) In locations where high frequency occurs.
13) In locations where damage is likely to occur due to lightning.
14) In locations at altitude of 3000 m or higher (Except during storage and transportation)
   ∗ For altitude of 1000 m or higher
   Because of lower air density, the heat radiation efficiencies of the devices in the product will be lower in the location at altitude of 1000 m or higher.
   Therefore, the maximum ambient temperature to use and the cooling capacity will lower according to the descriptions in the table below.
   Select the thermo-chiller considering the descriptions.
   ① Upper limit of ambient temperature: Use the product in ambient temperature of the described value or lower at each altitude.
   ② Cooling capacity coefficient: The product's cooling capacity will lower to one that multiplied by the described value at each altitude.

Altitude [m]	① Upper limit of ambient temperature [°C]		② Cooling capacity coefficient
	Power supply 100 V type	Power supply 200/230 V type	
Less than 1000 m	35	40	1.00
Less than 1500 m	34	38	0.85
Less than 2000 m	33	36	0.80
Less than 2500 m	32	34	0.75
Less than 3000 m	32	32	0.70

⚠Warning

15) In locations where strong impacts or vibrations occur.
16) In locations where a massive force strong enough to deform the product is applied or a weight from a heavy object is applied.
17) In locations where there is not sufficient space for maintenance.

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.

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.

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. When you remove casters to install the product, lift the product at least 10 mm by using adjuster-foot etc.

This product cannot be directly installed on the floor as some screws come out from the bottom of the product.

Series HRSE
Specific Product Precautions 3

Be sure to read this before handling. Refer to page 341 for Safety Instructions. For Temperature Control Equipment Precautions, refer to pages 342 to 345 and the Operation Manual on SMC website, http://www.smcworld.com

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 inlet and outlet, drain port or overflow port of this product, use a pipe wrench to clamp the connection ports.

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 are constant-temperature fluid circulating machines 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

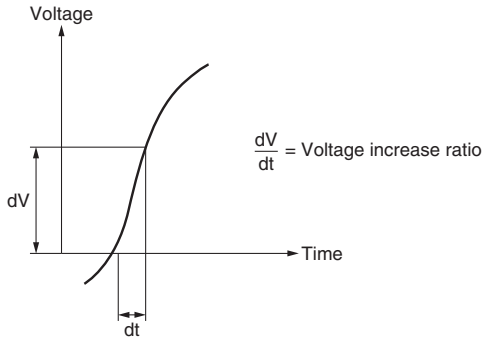
1. Grounding should never be connected to a water line, gas line or lightning rod.

⚠ Caution

1. Communication cable should be prepared by user.

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.



Circulating Fluid

⚠ Caution

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

2. When water is used as a circulating fluid, use tap water that conforms to the appropriate water quality standards.

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

Tap Water (as Circulating Fluid) Quality Standards

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

	Item	Unit	Standard value	Influence	
				Corrosion	Scale generation
Standard item	pH (at 25°C)	—	6.0 to 8.0	○	○
	Electric 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		○
	Ionic state silica (SiO_2)	[mg/L]	30 or less		○
Reference item	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.
- ○: Factors that have an effect on corrosion or scale generation.
- Even if the water quality standards are met, complete prevention of corrosion is not guaranteed.

3. Use an ethylene glycol that does not contain additives such as preservatives.

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

Overly high concentrations can cause a pump overload.

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 HRSE
Specific Product Precautions 4

Be sure to read this before handling. Refer to page 341 for Safety Instructions. For Temperature Control Equipment Precautions, refer to pages 342 to 345 and the Operation Manual on SMC website, http://www.smcworld.com

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 the 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.
Pump can be operated independently.

2. Confirmation during operation

• Check the circulating fluid temperature.
The operating temperature range of the circulating fluid is between 10 and 30°C.
When the amount of heat generated from the user's equipment is greater than the product's capability, the circulating fluid temperature may exceed this range. Use caution regarding this matter.

3. Emergency stop method

• When an abnormality is confirmed, stop the machine immediately. After stopping operation, disconnect the power supply from the user's equipment.

Operation Restart Time

⚠ Caution

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

Protection Circuit

⚠ Caution

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

• Power supply voltage is not within the rated voltage range of ±10%.
• 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 the user's equipment is too high.
• Ambient temperature is too high. (Check the ambient temperature in the specifications.)
• Ventilation hole is clogged with dust or dirt.

Maintenance

⚠ Caution

<Periodical inspection every one month>

1. Clean the ventilation hole.

If the dustproof filter becomes clogged with dust or debris, a decline in cooling performance can result.
In order to avoid deforming or damaging the dustproof filter, clean it with a long-haired brush or air gun.

<Periodical inspection every three months>

1. Inspect the circulating fluid.

1) When using tap water
• Replacement of tap water
Failure to replace the tap 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.

Circulating Fluid Temperature Controller

Refrigerated Thermo-chiller

Series HRZ

SEMATECH S2-93, S8-95

SEMI Standard S2-0703, S8-0701, F47-0200

- **Type of circulating fluid:** Fluorinated fluids/Ethylene glycol aqueous solution/ Tap water, Deionized water
- **Temperature range setting:** **–20** to **40**°C/**20** to **90**°C/**–20** to **90**°C
- **Cooling capacity:** **1** kW/**2** kW/**4** kW/**8** kW/**10** kW to Max.**15** kW
- **Temperature stability:** ±**0.1**°C
- **Refrigerant:** **R404A** (HFC)/**R134a** (HFC)

Inverter type

Power consumption **1.1** kWh/h

Facility water **2** L/min

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

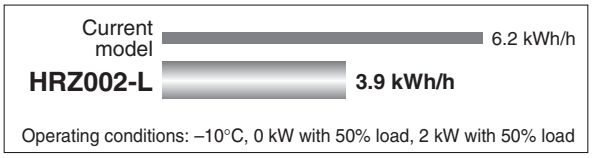


Energy-Saving

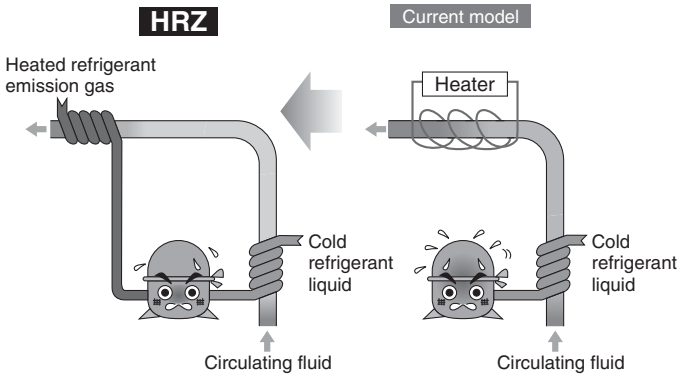
Power consumption:

Max. 40% reduction (SMC comparison)

In addition to the optimum control of the expansion valve by the original controller, by recycling the heat emitted from the facility water, power consumption is dramatically reduced.



- Reduced running cost
- Contribution to the environmental preservation

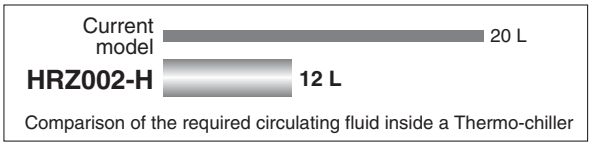


∗ This illustration is for an image only. For piping systems, refer to "Construction and Principles" on page 187.

Circulating fluid:

Max. 40% reduction (SMC comparison)

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

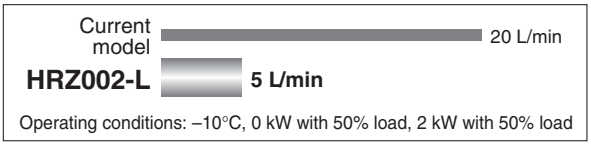


- Reduced initial cost
- Contribution to the environmental preservation

Facility water:

Max. 75% reduction (SMC comparison)

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



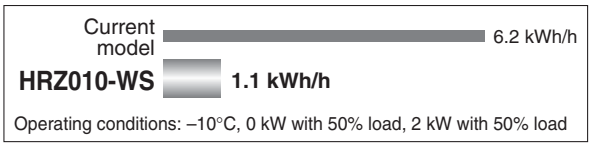
- Reduced facilities investment
- Space saved facility water equipment
- Reduced running cost

Double Inverter Type

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

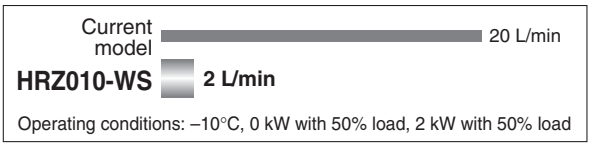
Power consumption:

Max. 82% reduction (SMC comparison)



Facility water:

Max. 90% reduction (SMC comparison)

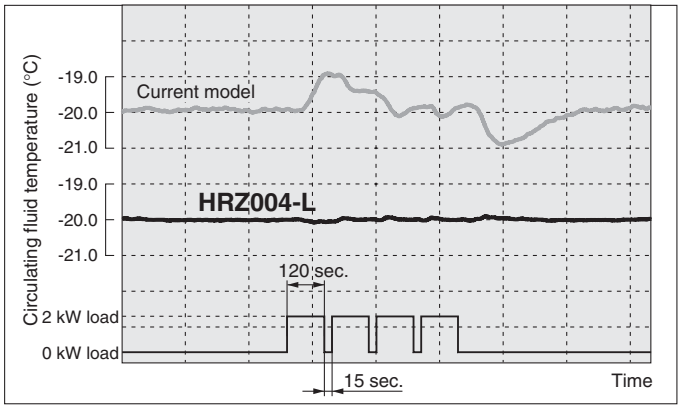


High Performance

Temperature stability: ±0.1°C

(when a load is stable)

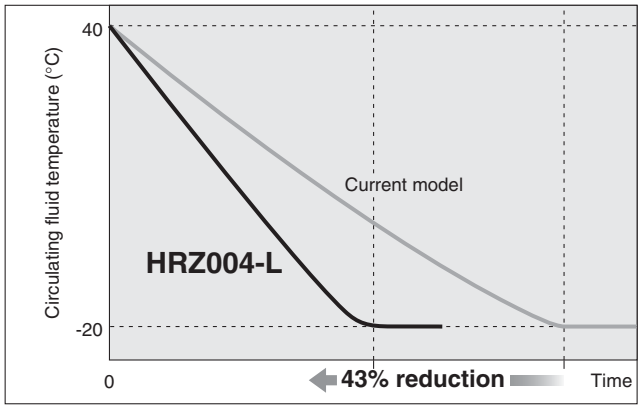
Enhanced temperature control technology achieved ±0.1°C temperature stabilities when a load is stable.



Cooling time: Max. 43% reduction

(SMC comparison)

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



Space-Saving

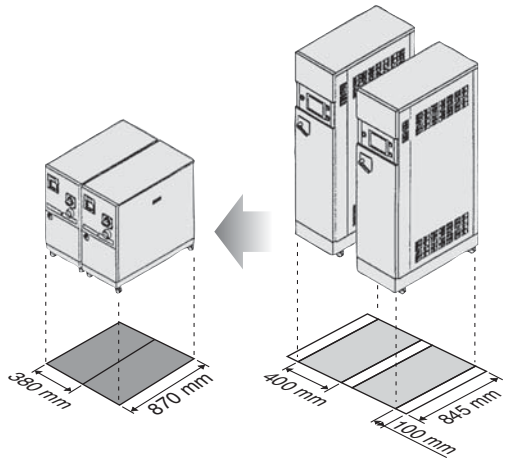
Installation area:

Max. 29% reduction (SMC comparison)

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

Current model: Body space: W400 mm x D845 mm
Ventilation space: 100 mm

HRZ008-H: Body space: W380 mm x D870 mm
Ventilation space: 0

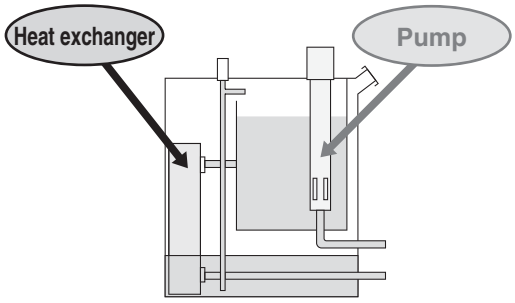


HRZ008-H **0.66 m²** Current model 0.93 m²

Leakless

All in tank

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



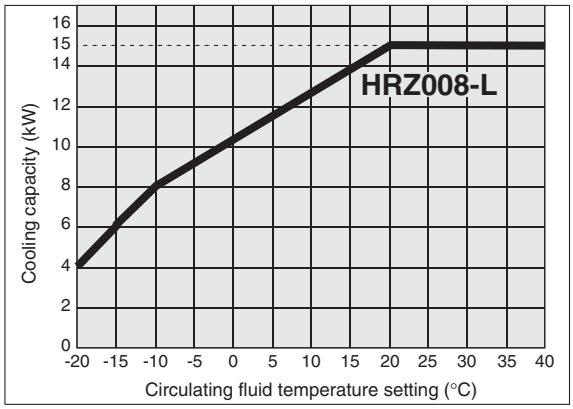
Communications

- Contact input/output signal
- Serial RS-485 communication
- Analog communication (Refer to "Options" on page 211.)
- DeviceNet communication (Refer to "Options" on page 211.)

DeviceNet™

Cooling capacity: Max. 15 kW

Up to 15 kW cooling capacity achieved.



Wetted parts adopt the materials compatible for various circulating fluids.

(Stainless steel, EPDM, etc.)

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

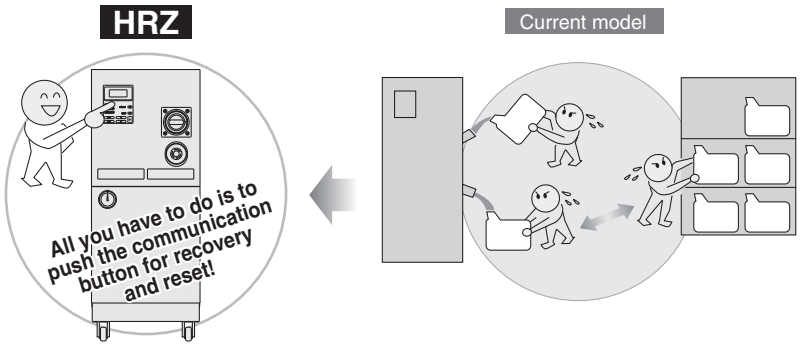
Regarding the fluid other than the above, please contact SMC.
Flourinert™ is a trademark of 3M. GALDEN® is a registered trademark of Solvay Solexis, Inc.

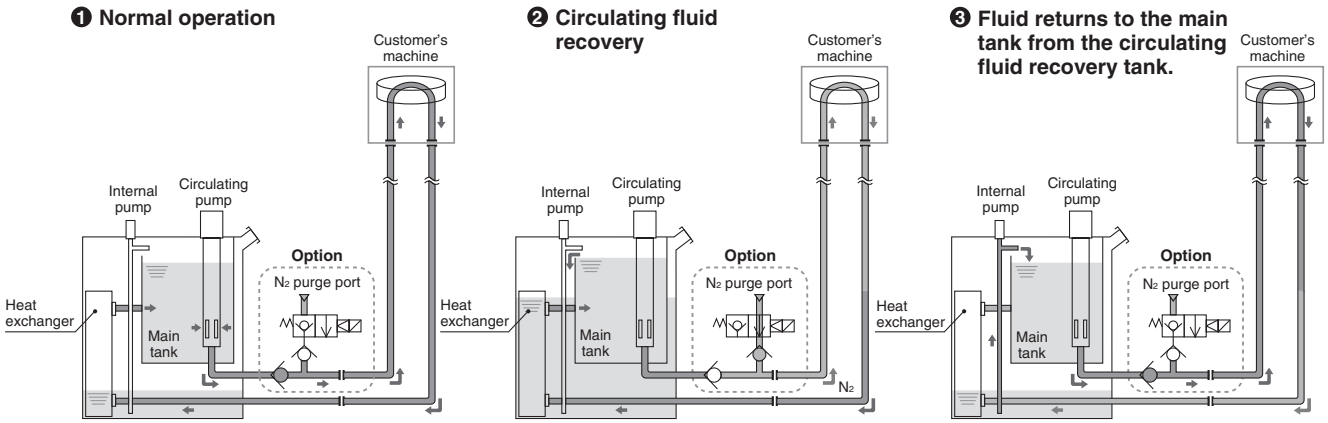
Easy Maintenance

Circulating fluid automatic recovery function (Refer to “Options” on page 212.)

Circulating fluid inside a thermo-chiller tank can be recovered automatically. (Recovery volume: 15 L to 17 L)

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



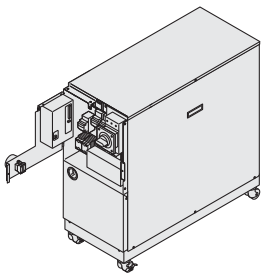


Circulating fluid electrical resistance ratio control function (Refer to “Options” on page 211.)

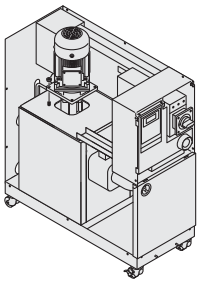
(DI control kit)

Easy maintenance

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



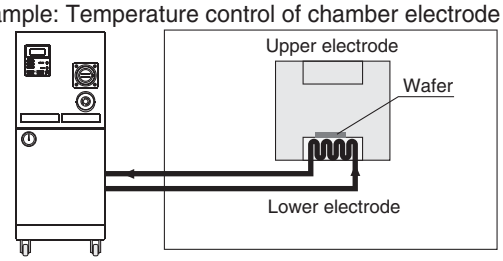
- Possible to replace the maintenance parts (such as a pump) without removing the pipings and discharging the circulating fluid.
- Various alarm displays (Refer to page 207.)



Application Examples

Semiconductor

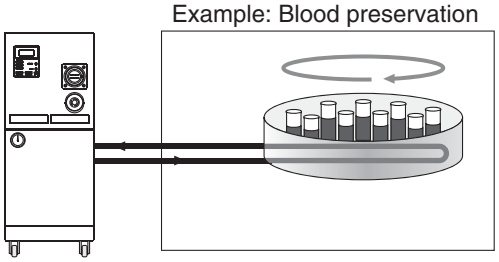
Example: Temperature control of chamber electrode



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

Medical

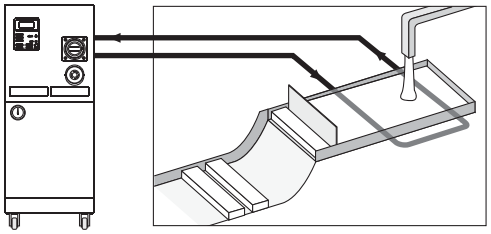
Example: Blood preservation



- **X-ray instrument**
- **MRI**
- **Blood preservation equipment**

Food

Example: Tofu (Bean curd) production

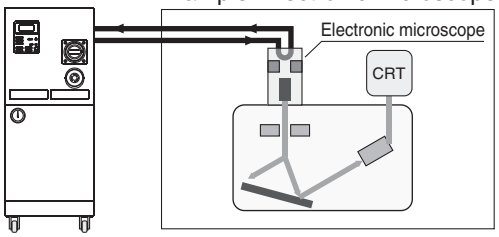


- **Bottle-cleaning machine**
- **Tofu (Bean curd) production equipment**
- **Noodle-making machine, etc.**

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

Analysis

Example: Electronic microscope

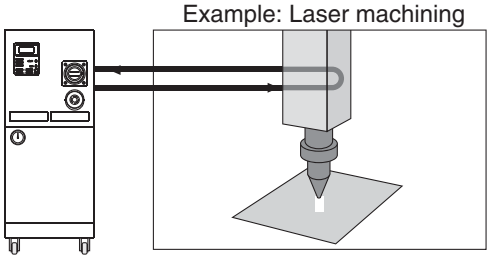


- **Electron microscope**
- **X-ray analytical instrument**
- **Gas chromatography**
- **Sugar level analytical instrument, etc.**

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

Machine tool

Example: Laser machining

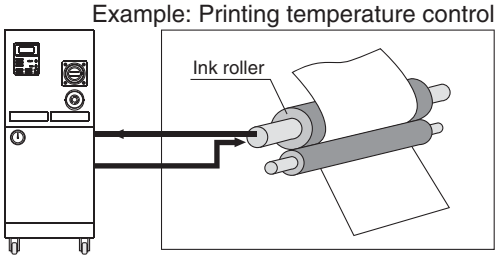


- **Wire cutting**
- **Grinder**
- **Spot welding**
- **Plasma welding**
- **Laser machining, etc.**

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

Printing

Example: Printing temperature control

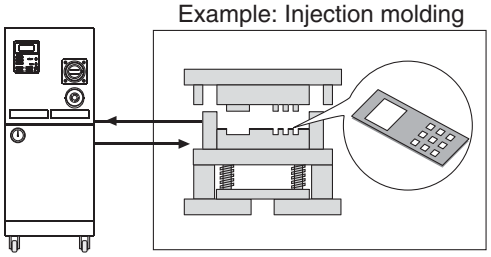


- **Offset printing machine**
- **Automatic developing machine**
- **UV equipment, etc.**

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

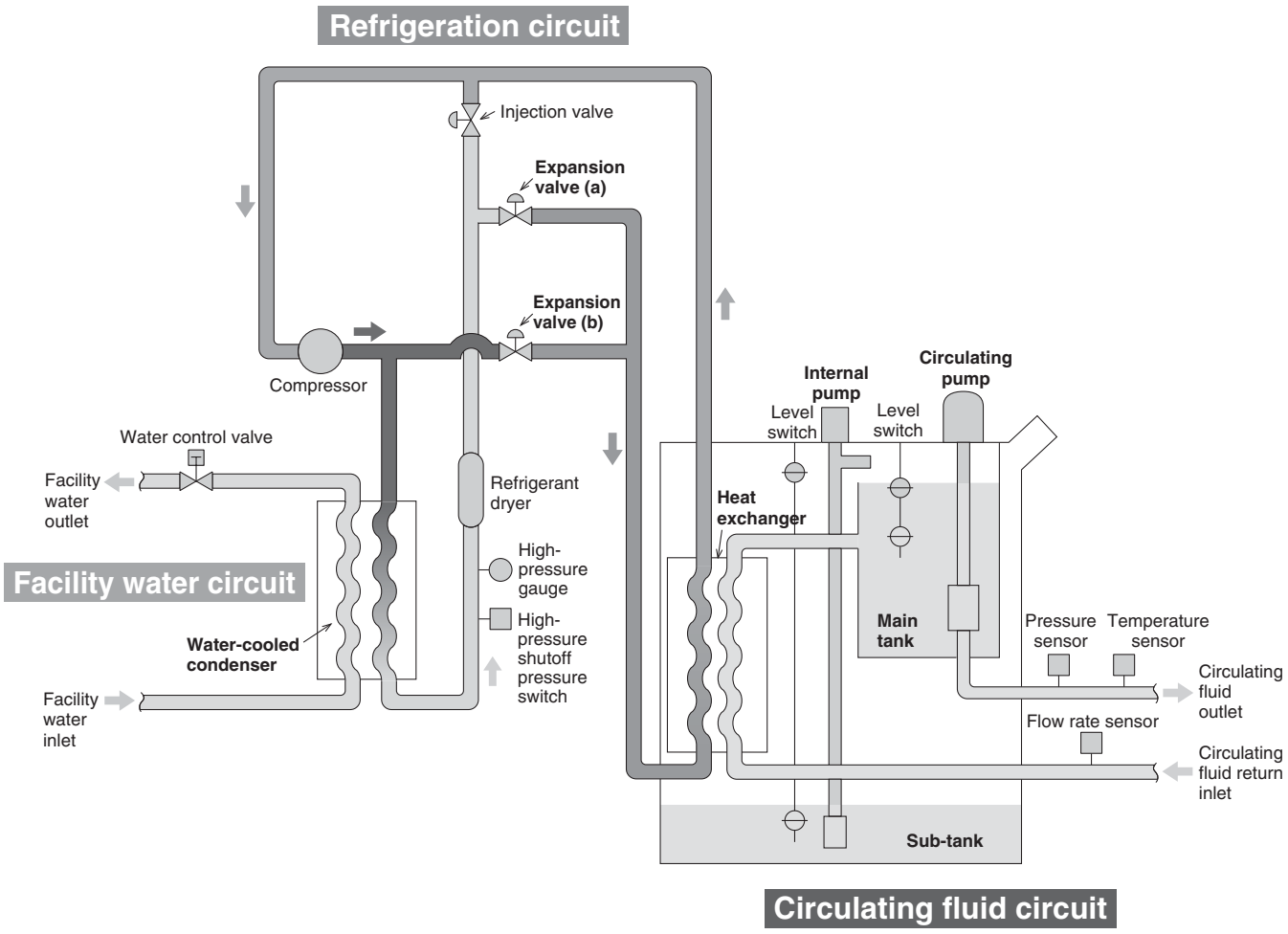
Molding

Example: Injection molding



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

Temperature-controlling the mold results in improved product quality.



Circulating fluid circuit

With the **circulating pump**, circulating fluid will be discharged to the customer's machine side. After the circulating fluid will heat or cool the customer's machine side, it will be returned to the **main tank** via the **heat exchanger**.
A **sub-tank** is not used under the normal operation. It will be used when a circulating fluid is recovered from the customer's machine side.
The **internal pump** is used to transfer a circulating fluid from the **sub-tank** to the **main tank**. (Refer to "Circulating fluid automatic recovery function" on page 185.)

Refrigeration circuit

When the circulating fluid temperature is rising higher than the set temperature, open the **expansion valve (a)** to introduce refrigerant gas at a lower temperature to the **heat exchanger**. With this, the circulating fluid will be cooled down.
Oppositely, when the circulating fluid is getting lower against the set temperature, open the **expansion valve (b)** and introduce refrigerant gas at a high temperature without going through the **water-cooled condenser** to the **heat exchanger**. With this heat, the circulating fluid will be heated.

CONTENTS

Series HRZ



Refrigerated Thermo-chiller Series HRZ

Model Selection

Guide to Model Selection ····· Page 189
Required Cooling Capacity Calculation ····· Page 190
Precautions on Model Selection ····· Page 191
Circulating Fluid Typical Physical Property Values ··· Page 192

Fluorinated Fluid Type

How to Order/Specifications ····· Page 193
Cooling Capacity/Heating Capacity ····· Page 194
Pump Capacity ····· Page 195

Ethylene Glycol Type

How to Order/Specifications ····· Page 196
Cooling Capacity/Heating Capacity ····· Page 197
Pump Capacity ····· Page 198

Tap/Deionized Water Type

How to Order/Specifications ····· Page 199
Cooling Capacity/Heating Capacity/Pump Capacity ··· Page 200

Double Inverter Type

How to Order/Specifications ····· Page 201
Cooling Capacity/Heating Capacity/Pump Capacity ··· Page 202

Common Specifications

Dimensions ····· Page 203
Communication Function ····· Page 205
· Contact Input/Output ····· Page 205
· Serial RS-485 ····· Page 206
· Connector Location ····· Page 206
Operation Display Panel ····· Page 207
Alarm ····· Page 207

Optional Accessories

① Bypass Piping Set ····· Page 208
② Anti-quake Bracket ····· Page 208
③ 4-Port Manifold ····· Page 209
④ DI Filter ····· Page 209
⑤ Insulating Material for DI Filter ····· Page 209
⑥ 60% Ethylene Glycol Aqueous Solution ····· Page 210
⑦ Concentration Meter ····· Page 210

Options

Analog Communication ····· Page 211
DeviceNet Communication ····· Page 211
NPT Fitting ····· Page 211
DI Control Kit ····· Page 211
Circulating Fluid Automatic Recovery ····· Page 212

Specific Product Precautions ····· Page 213

Series *HRZ*
Model Selection

Guide to Model Selection

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

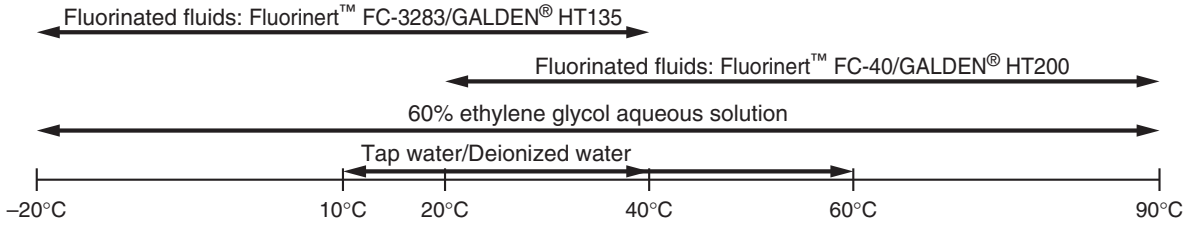
Temperature range which can be set with the thermo-chiller

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

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

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

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



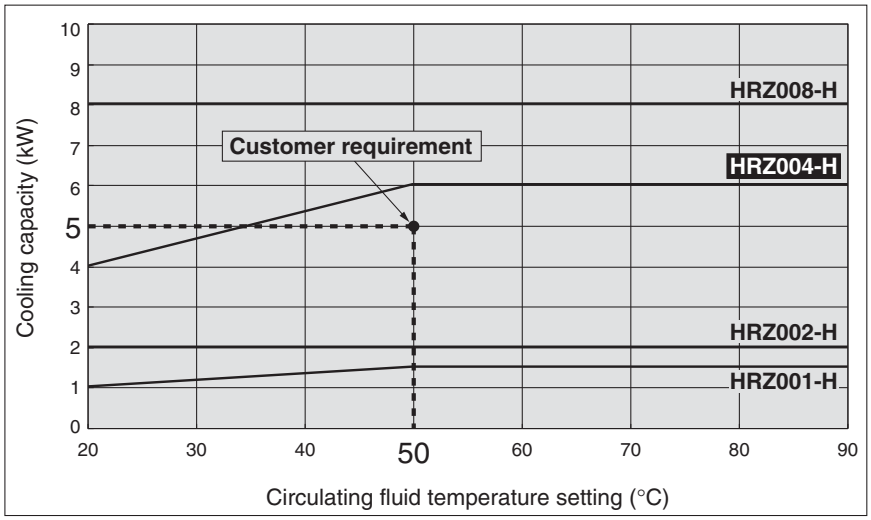
Example) Customer requirement: Fluorinated fluids

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

3. What is the kW for the required cooling capacity?
∗ To calculate the cooling capacity, referring to page 190.

Example) Customer requirement: 5 kW → **Plot the point of intersection between the operating temperature (50°C) and the cooling capacity (5 kW) in the cooling capacity graph.**

[Cooling Capacity Graph] Circulating Fluid: Fluorinated Fluids, Temperature Range: 20 to 90°C



The point plotted in the graph is the requirement from your customer. Select the thermo-chiller models exceeding this point. In this case, select the **HRZ004-H**.

Fluorinert™ is a trademark of 3M. GALDEN® is a registered trademark of Solvay Solexis, Inc.

Required Cooling Capacity Calculation

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

Heat generation amount Q: 3.5 kW

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

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

Obtain the temperature difference between inlet and outlet by circulating the circulating fluid inside the customer's machine.

Heat generation amount **Q**	: Unknown
Circulating fluid temperature difference Δ**T** (= **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)

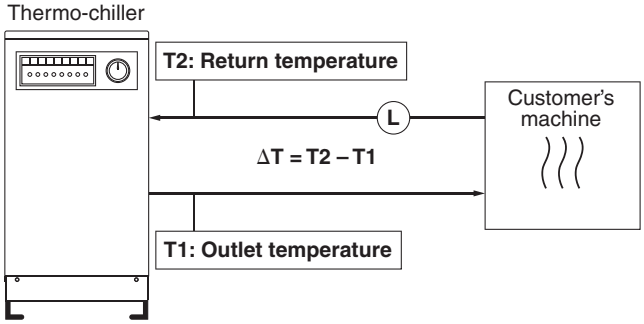
∗ Refer to page 192 for the typical physical property values by circulating fluid.

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

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

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

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



Example of 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 page 192 for the typical physical property values by circulating fluid.

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

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

$$= 3.5\ kW$$

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

Required Cooling Capacity Calculation

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

Cooled substance total volume **V** : 60 L
Cooling time **h** : 15 min
Cooling temperature difference Δ**T**: {20°C (20 K) / (40°C – 20°C → 20°C)
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 page 192 for the typical physical property values by circulating fluid.

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

$$= \frac{20 \times 60 \times 1.80 \times 10^3 \times 0.96 \times 10^3}{15 \times 60 \times 1000}$$

= 2304 W = 2.3 kW

Cooling capacity = Considering a safety factor of 20%,

2.3 x 1.2 = 2.8 kW (When the circulating fluid temperature is 20°C.)

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

Example of conventional measurement units (Reference)

0.06 m^3
0.25 h
20°C
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 page 192 for the typical physical property values by circulating fluid.

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

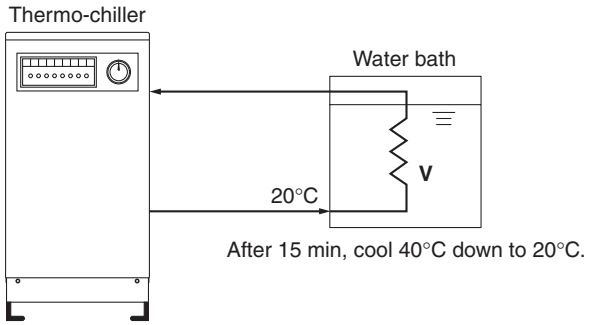
$$= \frac{20 \times 0.06 \times 1.80 \times 10^3 \times 0.23}{0.25 \times 860}$$

= 2.3 kW

Cooling capacity = Considering a safety factor of 20%,

2.3 x 1.2 = 2.8 kW (When the circulating fluid temperature is 20°C.)

(In this case, selected thermo-chiller model will be either HRZ002-L or HRZ004-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. Heating capacity

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

2. Pump capacity

<Circulating fluid flow rate>

Pump capacity varies depending on the model selected from the HRZ series. Also, circulating fluid flow varies depending on the circulating fluid discharge pressure. Consider the installation height difference between our thermo-chiller and a customer's machine, and the piping resistance such as circulating fluid pipings, or piping size, or piping curves in the machine. Check beforehand if the required flow is achieved using the pump capacity curves for each respective model.

<Circulating fluid discharge pressure>

Circulating fluid discharge pressure has the possibility to increase up to the maximum pressure in the pump capacity curves for the respective model. Check beforehand if the circulating fluid pipings or circulating fluid circuit of the customer's machine are fully durable against this pressure.

Circulating Fluid Typical Physical Property Values

∗ The below shown are reference values.
Please contact circulating fluid supplier for details.

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)

60% Ethylene Glycol Aqueous Solution

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 HRZ

SEMI

How to Order

Fluorinated Fluid Type **HRZ** **001** – **L** – □

Cooling capacity

Symbol	Cooling capacity
001	1 kW
002	2 kW
004	4 kW
008	8 kW

Temperature range setting

Symbol	Temperature range setting	1 kW	2 kW	4 kW	8 kW
L	–20 to 40°C	●	●	●	●
H	20 to 90°C	●	●	●	●
W	–20 to 90°C	—	●	—	●

Option (Refer to pages 211 and 212.)

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

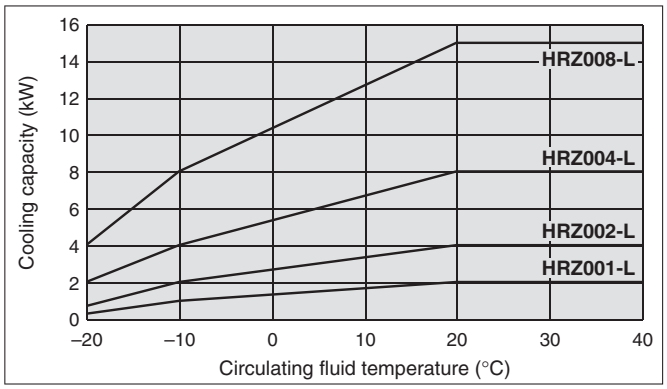
Specifications (For details, please consult our "Product Specifications" information.)

Model		HRZ001-L	HRZ002-L	HRZ004-L	HRZ008-L	HRZ001-H	HRZ002-H	HRZ004-H	HRZ008-H	HRZ002-W	HRZ008-W
Cooling method		Water-cooled refrigeration									
Refrigerant		R404A (HFC)									
Control system		PID control									
Ambient temp./humidity Note 1)		Temperature: 10 to 35°C, Humidity: 30 to 70%RH									
Circulating fluid system	Circulating fluid Note 2)	Fluorinert™ FC-3283/GALDEN® HT135				Fluorinert™ FC-40/GALDEN® HT200				• –20 to 40°C: Fluorinert™ FC-3283/GALDEN® HT135 • 20 to 90°C: Fluorinert™ FC-40/GALDEN® HT200	
	Temp. range setting Note 1) °C	–20 to 40				20 to 90				–20 to 90	
	Cooling capacity Note 3) kW	1.0 (at –10°C)	2.0 (at –10°C)	4.0 (at –10°C)	8.0 (at –10°C)	1.0 (at 20°C)	2.0 (at 20°C)	4.0 (at 20°C)	8.0 (at 20°C)	2.0 (at 20°C)	8.0 (at 20°C)
	Heating capacity Note 3) kW	2.8 (at –10°C)	3.2 (at –10°C)	3.6 (at –10°C)	5.9 (at –10°C)	2.3 (at 20°C)	2.6 (at 20°C)	2.8 (at 20°C)	3.0 (at 20°C)	2.3 (at 20°C)	3.3 (at 20°C)
	Temp. stability Note 4) °C	±0.1									
	Pump capacity (50/60 Hz) Note 5) MPa	0.45/0.65 (at 20 L/min)			0.65/0.95 (at 30 L/min)	0.40/0.60 (at 20 L/min)	0.45/0.65 (at 20 L/min)				
	Rated flow Note 6) L/min	20			30	20					
	Main tank capacity Note 7) L	Approx. 15			Approx. 22	Approx. 12	Approx. 15				
	Sub-tank capacity Note 8) L	Approx. 16			Approx. 17	Approx. 15	Approx. 16				
	Port size	Rc3/4									
	Wetted parts material	Stainless steel, EPDM, Copper brazing (Heat exchanger), PPS, Silicone, Fluororesin									
Cooling water system	Temperature range °C	10 to 25									
	Pressure range MPa	0.3 to 0.7									
	Required flow rate (50/60 Hz) Note 9) L/min	5/5	6/6	15/22	18/23	3/4	5/6	9/10	13/14	6/7	13/14
	Port size	Rc1/2									
	Wetted parts material	Stainless steel, EPDM, Copper brazing (Heat exchanger), Silicone, Brass									
Electrical system	Power supply	3-phase 200 VAC 50 Hz, 3-phase 200 to 208 VAC 60 Hz Allowable voltage fluctuation ±10%									
	Breaker capacity A	30			60	20		30			
	Rated current A	20		25	46	14		23			
	Alarm	Refer to page 207.									
	Communications	Contact input/output (D-sub 25 pin) and Serial RS-485 (D-sub 9 pin) (Refer to pages 205 and 206.)									
Weight Note 10) kg		170		175	275	145		170			
Safety standards		UL, CE marking, SEMI (S2-0703, S8-0701, F47-0200), SEMATECH (S2-93, S8-95)									

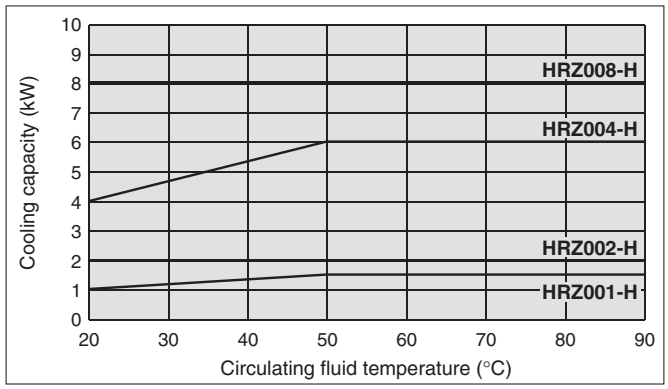
Note 1) It should have no condensation.
Note 2) Fluorinert™ is a trademark of 3M and GALDEN® is a registered trademark of Solvay Solexis, Inc. Regarding the fluid other than the above, please contact SMC.
Note 3) ① Facility water temperature: 25°C, ② Circulating fluid flow rate: Values at rated circulating fluid flow rate. Values common for 50/60 Hz.
Note 4) Value with a stable load without turbulence in the operating conditions. It may be out of this range depending on operating conditions.
Note 5) The capacity at the thermo-chiller outlet when the circulating fluid temperature is 20°C.
Note 6) Required flow rate for cooling capacity or maintaining the temperature stability. When used below the rated flow, use the individually sold, "By-pass Piping Set" (Refer to page 208).
Note 7) 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 8) Preliminary space volume without main tank capacity. Available for collecting the circulating fluid inside an external piping or for preliminary injection.
Note 9) Required flow rate when a load for the cooling capacity is applied at a facility water temperature of 25°C.
Note 10) Weight in the dry state without circulating fluids

Cooling Capacity

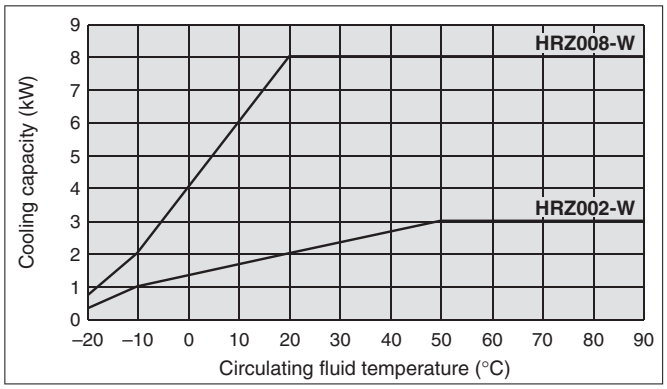
HRZ001-L/002-L/004-L/008-L



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

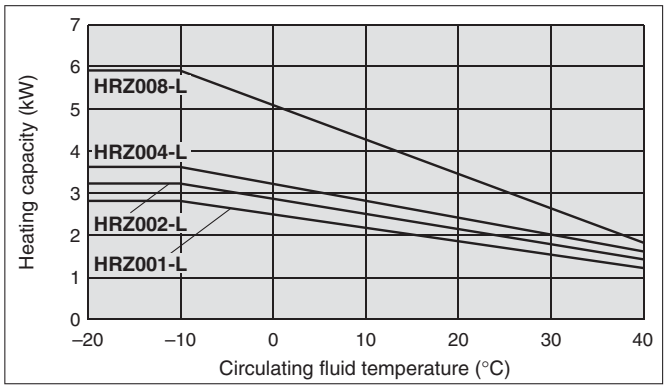


HRZ002-W/008-W

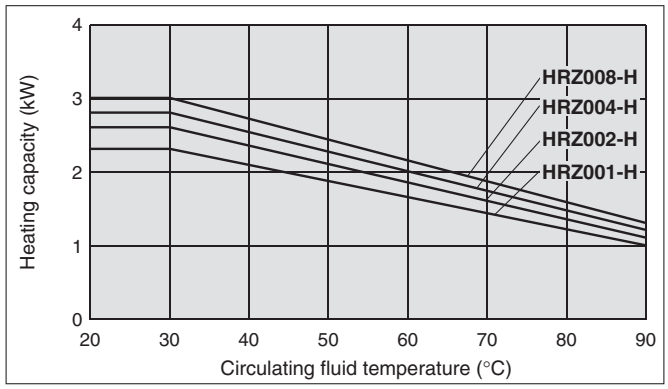


Heating Capacity

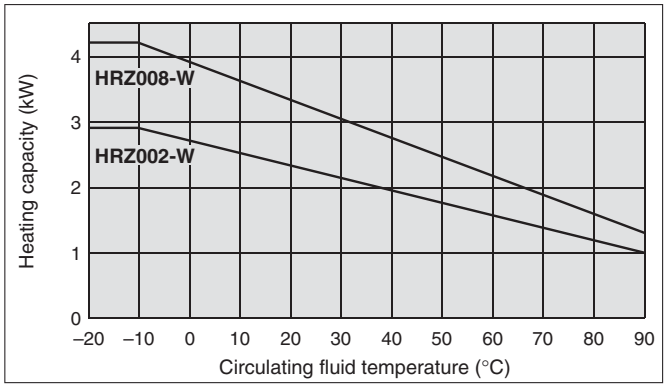
HRZ001-L/002-L/004-L/008-L



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

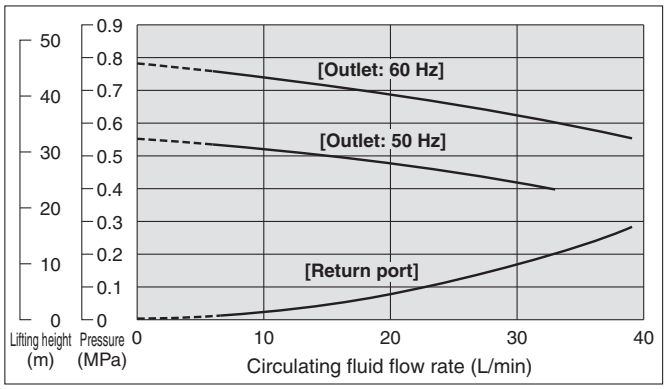


HRZ002-W/008-W

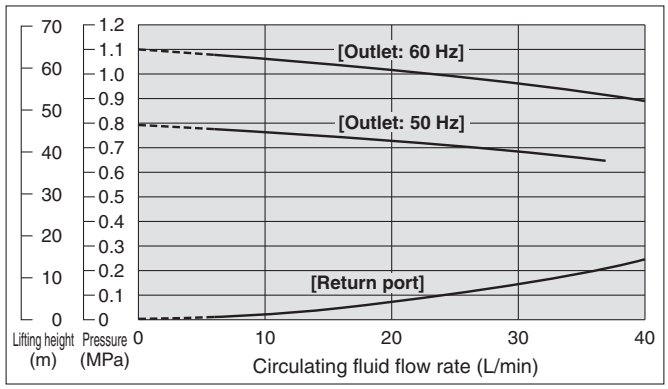


Pump Capacity (Thermo-chiller Outlet)

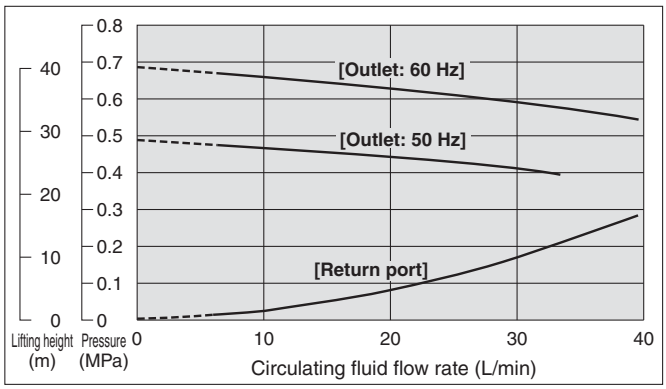
HRZ001-L/002-L/004-L



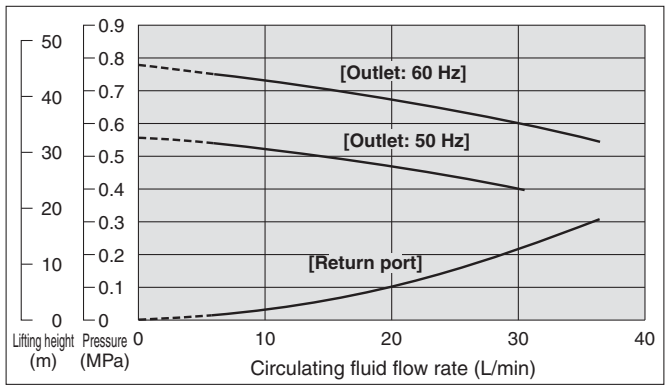
HRZ008-L



HRZ001-H/002-H



HRZ004-H/008-H
HRZ002-W/008-W



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

Thermo-chiller Ethylene Glycol Type
Series HRZ

SEMI

How to Order

Ethylene Glycol Type **HRZ 001 – L 1 – □**

Cooling capacity

Symbol	Cooling capacity
001	1 kW
002	2 kW
004	4 kW
008	8 kW

Temperature range setting

Symbol	Temperature range setting	1 kW	2 kW	4 kW	8 kW
L	–20 to 40°C	●	●	●	●
H	20 to 90°C	●	●	●	●
W	–20 to 90°C	—	●	—	●

Ethylene glycol type

Option (Refer to pages 211 and 212.)

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

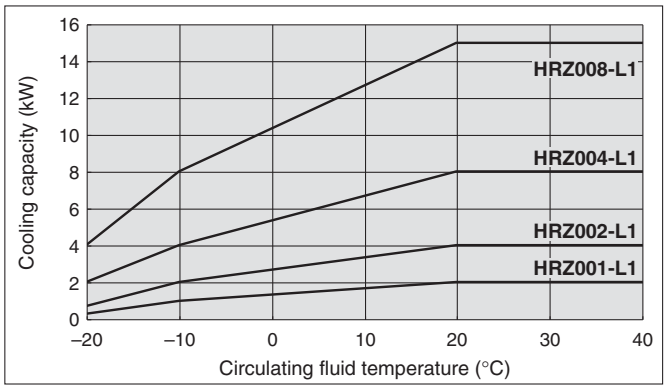
Specifications (For details, please consult our "Product Specifications" information.)

Model		HRZ001-L1	HRZ002-L1	HRZ004-L1	HRZ008-L1	HRZ001-H1	HRZ002-H1	HRZ004-H1	HRZ008-H1	HRZ002-W1	HRZ008-W1
Cooling method		Water-cooled refrigeration									
Refrigerant		R404A (HFC)									
Control system		PID control									
Ambient temp./humidity Note 1)		Temperature: 10 to 35°C, Humidity: 30 to 70%RH									
Circulating fluid system	Circulating fluid Note 2)	60% ethylene glycol aqueous solution									
	Temp. range setting Note 1) °C	–20 to 40				20 to 90				–20 to 90	
	Cooling capacity Note 3) kW	1.0 (at –10°C)	2.0 (at –10°C)	4.0 (at –10°C)	8.0 (at –10°C)	1.0 (at 20°C)	2.0 (at 20°C)	4.0 (at 20°C)	8.0 (at 20°C)	2.0 (at 20°C)	8.0 (at 20°C)
	Heating capacity Note 3) kW	2.5 (at –10°C)	2.9 (at –10°C)	3.4 (at –10°C)	6.1 (at –10°C)	1.8 (at 20°C)	2.1 (at 20°C)	2.5 (at 20°C)	3.0 (at 20°C)	2.2 (at 20°C)	3.3 (at 20°C)
	Temp. stability Note 4) °C	±0.1									
	Pump capacity (50/60 Hz) Note 5) MPa	0.25/0.40 (at 20 L/min)				0.25/0.35 (at 20 L/min)		0.25/0.40 (at 20 L/min)			
	Rated flow Note 6) L/min	20									
	Main tank capacity Note 7) L	Approx. 15			Approx. 22	Approx. 12		Approx. 15			
	Sub-tank capacity Note 8) L	Approx. 16			Approx. 17	Approx. 15		Approx. 16			
	Port size	Rc3/4									
	Wetted parts material	Stainless steel, EPDM, Copper brazing (Heat exchanger), PPS, Silicone, Fluororesin									
Cooling water system	Temperature range °C	10 to 25									
	Pressure range MPa	0.3 to 0.7									
	Required flow rate (50/60 Hz) Note 9) L/min	5/5	6/6	15/22	18/23	3/4	5/6	9/10	13/14	5/7	13/14
	Port size	Rc1/2									
	Wetted parts material	Stainless steel, EPDM, Copper brazing (Heat exchanger), Silicone, Brass									
Electrical system	Power supply	3-phase 200 VAC 50 Hz, 3-phase 200 to 208 VAC 60 Hz Allowable voltage fluctuation ±10%									
	Breaker capacity A	30			60	20		30			
	Rated current A	19		26	46	14		23			
	Alarm	Refer to page 207.									
	Communications	Contact input/output (D-sub 25 pin) and Serial RS-485 (D-sub 9 pin) (Refer to pages 205 and 206.)									
Weight Note 10) kg		170		175	275	145		170			
Safety standards		UL, CE marking, SEMI (S2-0703, S8-0701, F47-0200), SEMATECH (S2-93, S8-95)									

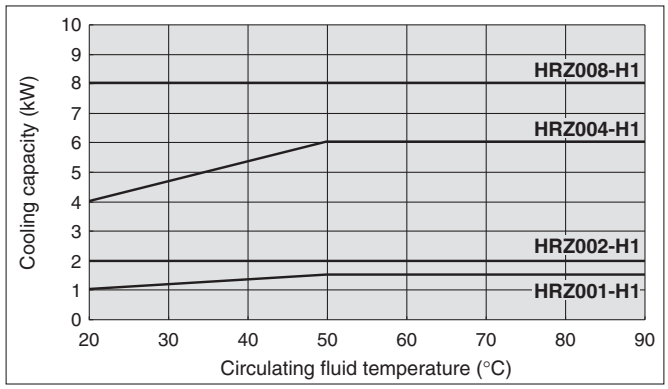
Note 1) It should have no condensation.
Note 2) Dilute pure ethylene glycol with tap water. Additives such as preservatives cannot be used.
Note 3) ① Facility water temperature: 25°C, ② Circulating fluid flow rate: Values at rated circulating fluid flow rate. Values common for 50/60 Hz.
Note 4) Value with a stable load without turbulence in the operating conditions. It may be out of this range when a DI control kit (option Y) is used or in some other operating conditions.
Note 5) The capacity at the thermo-chiller outlet when the circulating temperature is 20°C.
Note 6) Required flow rate for cooling capacity or maintaining the temperature stability. When used below the rated flow, use the individually sold, "By-pass Piping Set" (Refer to page 208).
Note 7) 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 8) Preliminary space volume without main tank capacity. Available for collecting the circulating fluid inside an external piping or for preliminary injection.
Note 9) Required flow rate when a load for the cooling capacity is applied at a facility water temperature of 25°C.
Note 10) Weight in the dry state without circulating fluids

Cooling Capacity

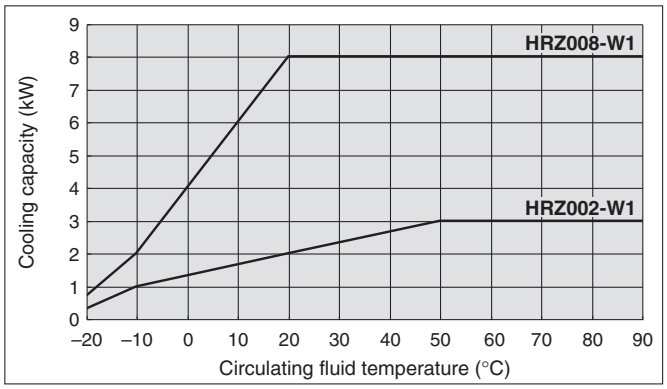
HRZ001-L1/002-L1/004-L1/008-L1



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

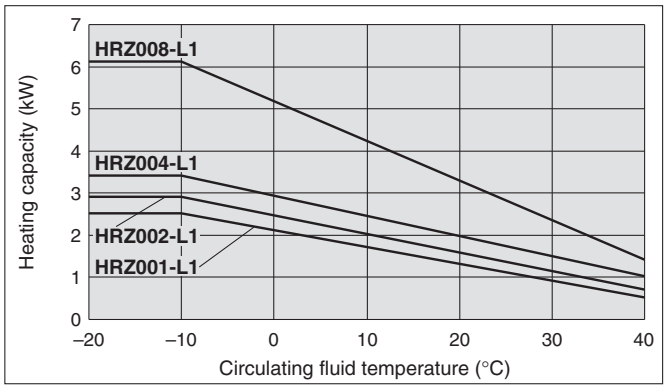


HRZ002-W1/008-W1

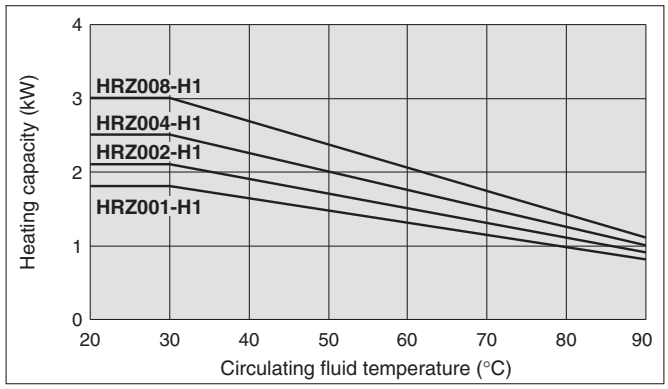


Heating Capacity

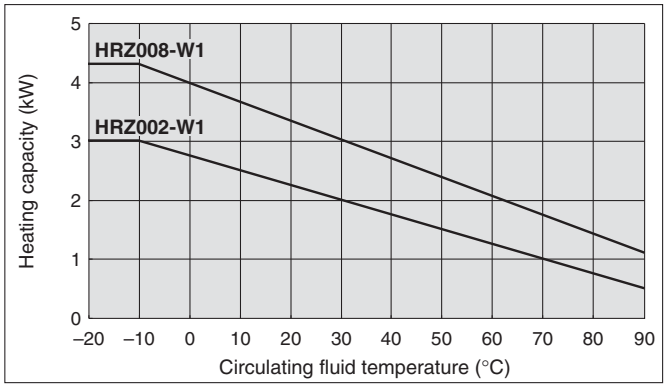
HRZ001-L1/002-L1/004-L1/008-L1



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

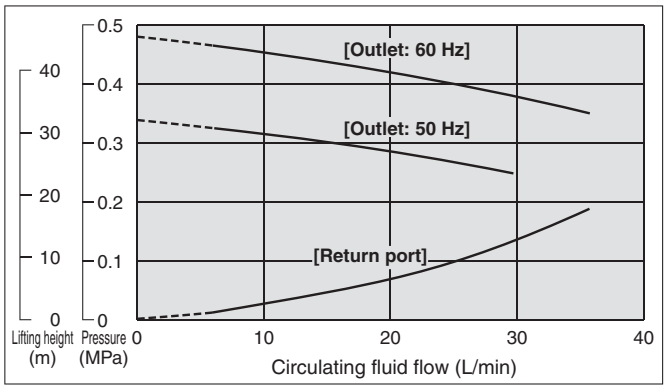


HRZ002-W1/008-W1

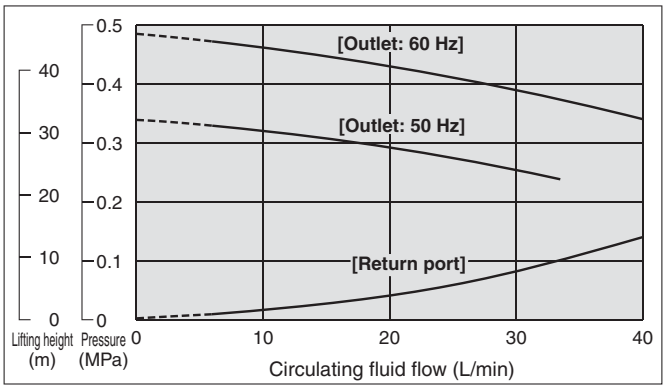


Pump Capacity (Thermo-chiller Outlet)

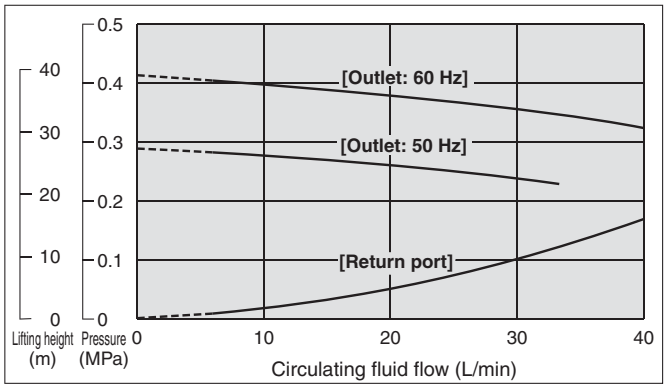
HRZ001-L1/002-L1/004-L1
HRZ004-H1/008-H1
HRZ002-W1/008-W1



HRZ008-L1



HRZ001-H1/002-H1



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

Thermo-chiller Tap/Deionized Water Type

Series HRZ

SEMI

How to Order

Tap/Deionized Water Type **HRZ 001 – L 2 – ☐**

Cooling capacity

Symbol	Cooling capacity
001	1 kW
002	2 kW
004	4 kW
008	8 kW

Option (Refer to pages 211 and 212.)

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

Temperature range setting

Symbol	Temperature range setting	1 kW	2 kW	4 kW	8 kW
L	10 to 40°C	●	●	●	●

Tap/Deionized water type

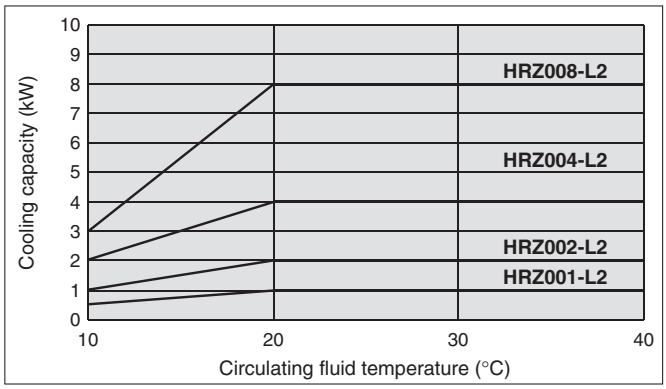
Specifications (For details, please consult our "Product Specifications" information.)

Model			HRZ001-L2	HRZ002-L2	HRZ004-L2	HRZ008-L2
Cooling method			Water-cooled refrigeration			
Refrigerant			R134a (HFC)			
Control system			PID control			
Ambient temperature/humidity Note 1)			Temperature: 10 to 35°C, Humidity: 30 to 70%RH			
Circulating fluid system	**Circulating fluid** Note 2)		Tap water, Deionized water			
	Temperature range setting Note 1)	°C	10 to 40			
	Cooling capacity Note 3)	kW	1.0 (at 20°C)	2.0 (at 20°C)	4.0 (at 20°C)	8.0 (at 20°C)
	Heating capacity Note 3)	kW	0.90 (at 20°C)	0.98 (at 20°C)	1.15 (at 20°C)	1.25 (at 20°C)
	Temperature stability Note 4)	°C	±0.1			
	Pump capacity (50/60 Hz) Note 5)	MPa	0.25/0.38 (at 20 L/min)			
	Rated flow Note 6)	L/min	20			
	Main tank capacity Note 7)	L	Approx. 15			
	Sub-tank capacity Note 8)	L	Approx. 16			
	Port size		Rc3/4			
	Wetted parts material		Stainless steel, EPDM, Copper brazing (Heat exchanger), PPS, Silicone, Fluororesin			
Cooling water system	**Temperature range**	°C	10 to 25			
	Pressure range	MPa	0.3 to 0.7			
	Required flow rate (50/60 Hz) Note 9)	L/min	5/5	6/6	15/22	18/23
	Port size		Rc1/2			
	Wetted parts material		Stainless steel, EPDM, Copper brazing (Heat exchanger), Silicone, Brass			
Electrical system	**Power supply**		3-phase 200 VAC 50 Hz, 3-phase 200 to 208 VAC 60 Hz Allowable voltage fluctuation ±10%			
	Breaker capacity	A	30			
	Rated current	A	19			
	Alarm		Refer to page 207.			
	Communications		Contact input/output (D-sub 25 pin) and Serial RS-485 (D-sub 9 pin) (Refer to pages 205 and 206.)			
Weight Note 10)		kg	170			
Safety standards			UL, CE marking, SEMI (S2-0703, S8-0701, F47-0200), SEMATECH (S2-93, S8-95)			

Note 1) It should have no condensation.
Note 2) If tap water or deionized water is used, please use water that conforms to Water Quality Standards of the Japan Refrigeration and Air Conditioning Industry Association (JRA GL-02-1994/cooling water system - circulation type - make-up water). The minimum electrical conductivity of the deionized water used as the fluid should be 0.5 μS/cm (or electrical resistivity 2 MΩ•cm at maximum).
Note 3) ① Facility water temperature: 25°C, ② Circulating fluid flow rate: Values at rated circulating fluid flow rate. Values common for 50/60 Hz.
Note 4) Value with a stable load without turbulence in the operating conditions. It may be out of this range when a DI control kit (option Y) is used or in some other operating conditions.
Note 5) The capacity at the thermo-chiller outlet when the circulating fluid temperature is 20°C.
Note 6) Required flow rate for cooling capacity or maintaining the temperature stability. When used below the rated flow, use the individually sold, "By-pass Piping Set" (Refer to page 208).
Note 7) 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 8) Preliminary space volume without main tank capacity. Available for collecting the circulating fluid inside an external piping or for preliminary injection.
Note 9) Required flow rate when a load for the cooling capacity is applied at a facility water temperature of 25°C.
Note 10) Weight in the dry state without circulating fluids

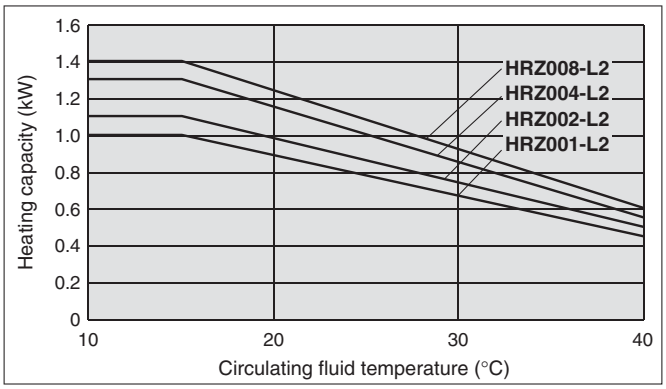
Cooling Capacity

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



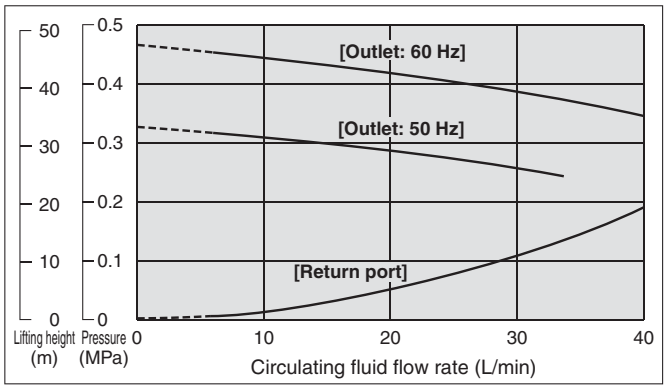
Heating Capacity

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



Pump Capacity (Thermo-chiller Outlet)

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



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

Thermo-chiller Double Inverter Type
Series HRZ

SEMI

How to Order

Double Inverter Type **HRZ 010 – W ☐ S – ☐**

Cooling capacity

Symbol	Cooling capacity
010	10 kW

Circulating fluid type

Symbol	Circulating fluid type	Temperature range setting
Nil	Fluorinated fluids	–20 to 90°C
1	Ethylene glycol aqueous solution	–20 to 90°C
2	Tap water/Deionized water	10 to 60°C

Double inverter type

Option (Refer to pages 211 and 212.)

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

* Not equipped to the fluorinated fluid type.

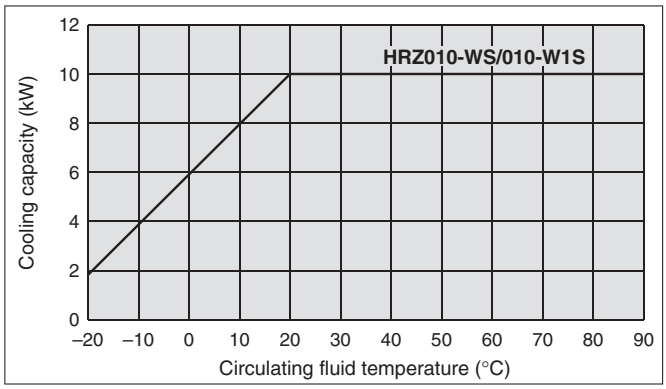
Specifications

Model			HRZ010-WS	HRZ010-W1S	HRZ010-W2S
Cooling method			Water-cooled refrigeration		
Refrigerant			R404A (HFC)		
Control system			PID control		
Ambient temperature/humidity Note 1)			Temperature: 10 to 35°C, Humidity: 30 to 70%RH		
Circulating fluid system	**Circulating fluid** Note 2)		• –20 to 40°C: Fluorinert™ FC-3283/GALDEN® HT135 • 20 to 90°C: Fluorinert™ FC-40/GALDEN® HT200	60% ethylene glycol aqueous solution	Tap water, Deionized water
	Temperature range setting Note 1)	°C	–20 to 90		10 to 60
	Cooling capacity Note 3)	kW	10 (at 20°C)	10 (at 20°C)	9 (at 20°C)
	Heating capacity Note 3)	kW	5.0 (at 20°C)	4.5 (at 20°C)	2.5 (at 20°C)
	Temperature stability Note 4)	°C	±0.1 (In cases when the circulating fluid discharge port and the return port are directly connected)		
	Pump capacity Note 5)	MPa	Max. 0.72 (at 20 L/min)	Max. 0.40 (at 20 L/min)	Max. 0.38 (at 20 L/min)
	Rated flow Note 6)	L/min	20		
	Flow range Note 7)	L/min	10 to 40 (With flow control function by inverter)		
	Main tank capacity Note 8)	L	Approx. 15		
	Sub-tank capacity Note 9)	L	Approx. 16		
	Port size		Rc3/4		
	Wetted parts material		Stainless steel, EPDM, Copper brazing (Heat exchanger), PPS, Silicone, Fluororesin		
Cooling water system	**Temperature range**	°C	10 to 30		10 to 25
	Pressure range	MPa	0.3 to 0.7		
	Required flow rate (50/60 Hz) Note 10)	L/min	15/15		
	Port size		Rc1/2		
	Wetted parts material		Stainless steel, EPDM, Copper brazing (Heat exchanger), PPS, Silicone, Brass		
Electrical system	**Power supply**		3-phase 200 VAC 50 Hz, 3-phase 200 to 208 VAC 60 Hz Allowable voltage fluctuation ±10%		
	Breaker capacity	A	30		
	Rated current	A	26	25	25
	Alarm		Refer to page 207.		
	Communications		Contact input/output (D-sub 25 pin) and Serial RS-485 (D-sub 25 pin) (Refer to pages 205 and 206.)		
Weight Note 11)		kg	165		
Safety standards			UL, CE marking, SEMI (S2-0703, S8-0701, F47-0200), SEMATECH (S2-93, S8-95)		

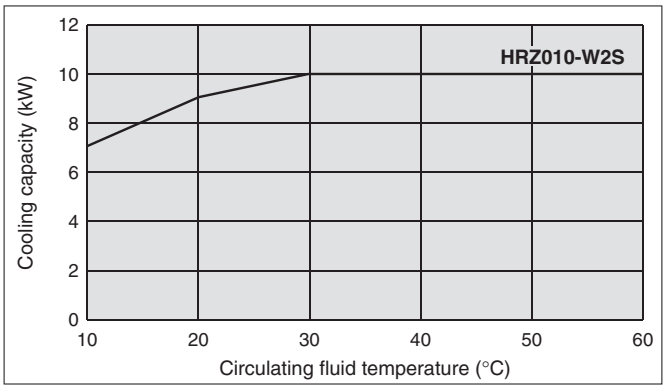
Note 1) It should have no condensation.
Note 2) Fluorinert™ is a trademark of 3M and GALDEN® is a registered trademark of Solvay Solexis, Inc. Dilute pure ethylene glycol with tap water. Additives such as preservatives cannot be used. If tap water or deionized water is used, please use water that conforms to Water Quality Standards of the Japan Refrigeration and Air Conditioning Industry Association (JRA GL-02-1994/cooling water system - circulation type - make-up water). The minimum electrical conductivity of the deionized water used as the fluid should be 0.5 μS/cm (or electrical resistivity 2 MΩ•cm at maximum).
Note 3) ① Facility water temperature: 25°C, ② Circulating fluid flow rate: Values at rated circulating fluid flow rate. Values common for 50/60 Hz.
Note 4) Value with a stable load without turbulence in the operating conditions. It may be out of this range when a DI control kit (option Y) is used or in some other operating conditions.
Note 5) The capacity at the thermo-chiller outlet when the circulating fluid temperature is 20°C.
Note 6) Required flow rate for cooling capacity or maintaining the temperature stability. When used below the rated flow, use the individually sold, "By-pass Piping Set" (Refer to page 208).
Note 7) May not be able to control with the set value depending on the piping specification in the customer side.
Note 8) Minimum volume required for operating only the thermo-chiller. (Circulating fluid temperature: 20°C, including the thermo-chiller's internal pipings or heat exchanger)
Note 9) Preliminary space volume without main tank capacity. Available for collecting the circulating fluid inside an external piping or for preliminary injection.
Note 10) Required flow rate when a load for the cooling capacity is applied at a facility water temperature of 25°C.
Note 11) Weight in the dry state without circulating fluids

Cooling Capacity

HRZ010-WS/010-W1S

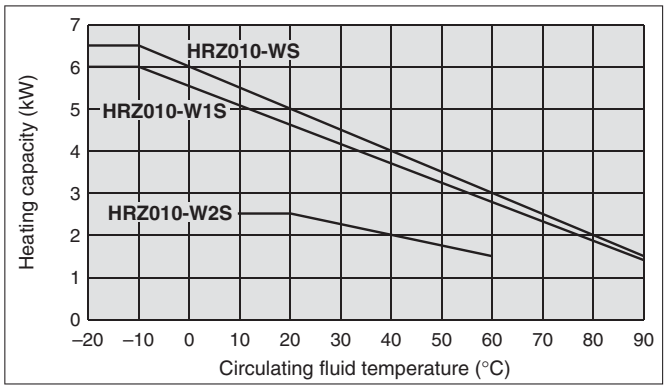


HRZ010-W2S



Heating Capacity

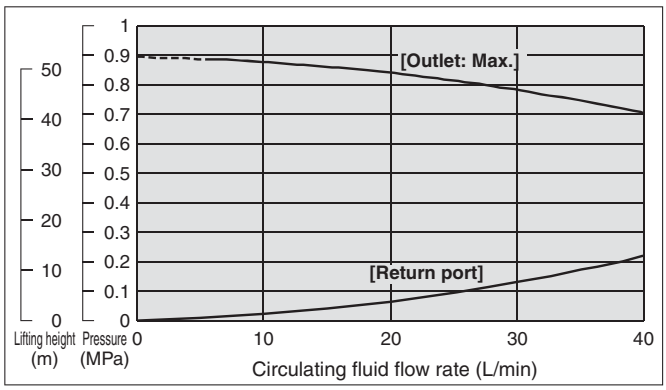
HRZ010-WS/010-W1S/010-W2S



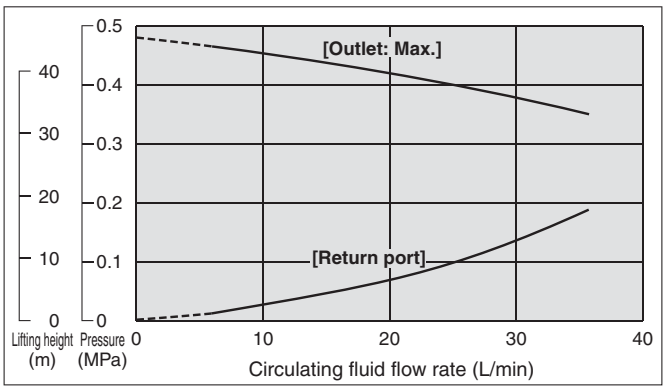
∗ When pump inverter is operating at frequency of 60 Hz (maximum).

Pump Capacity (Thermo-chiller Outlet)

HRZ010-WS

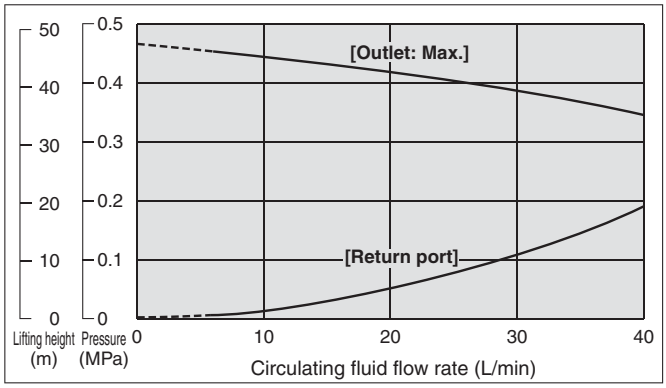


HRZ010-W1S



∗ The pump capacity of the HRZ010-W1S is same as that of the HRZ001-L1 group on page 198.
∗ The pump capacity of the HRZ010-W2S is same as on page 200.

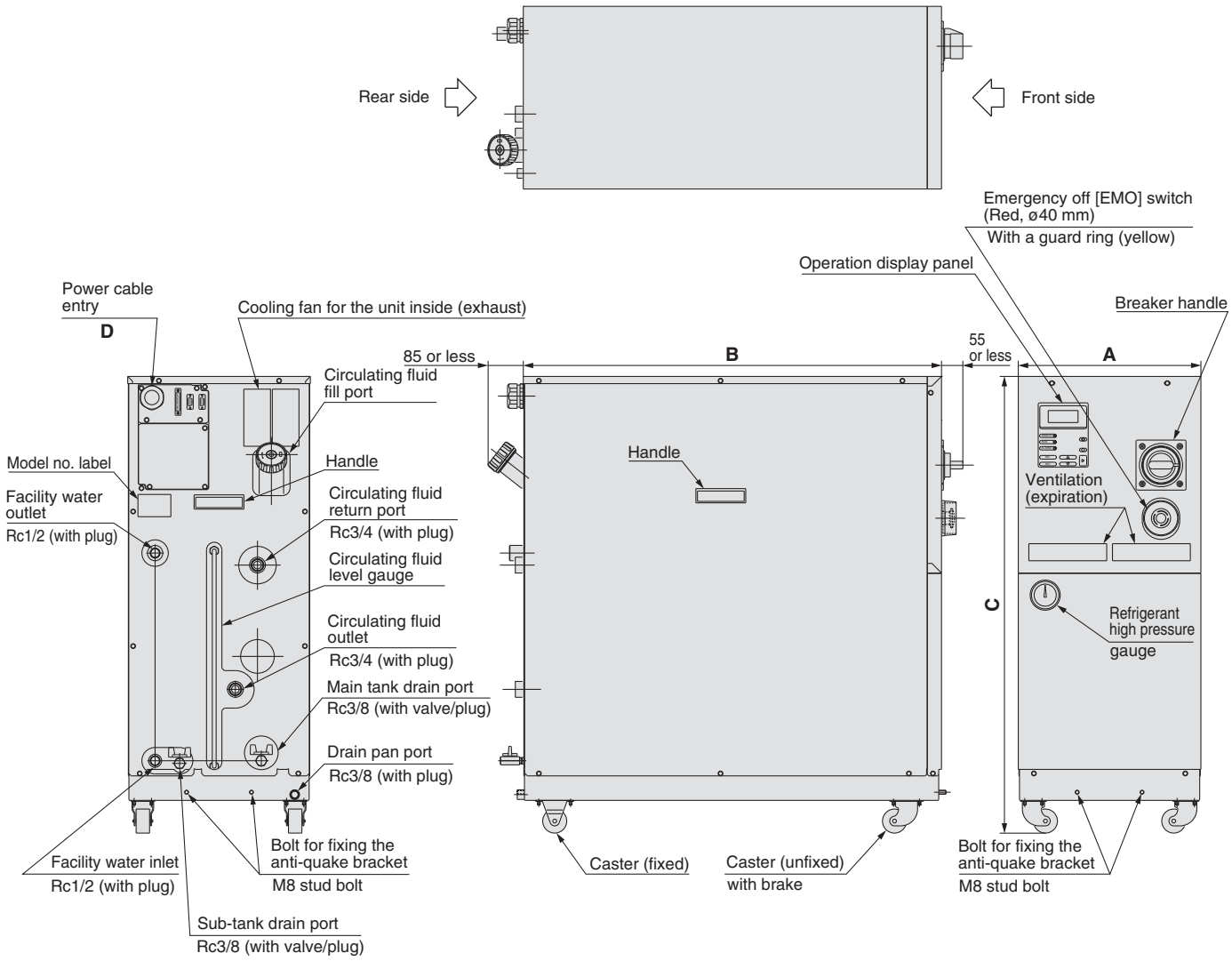
HRZ010-W2S



∗ When the circulating fluid flow is below 6 L/min, the in-built operation stop alarm will be activated. It is not possible to run the equipment. (common for all models)
∗ With flow control function by inverter

Series HRZ
Common Specifications

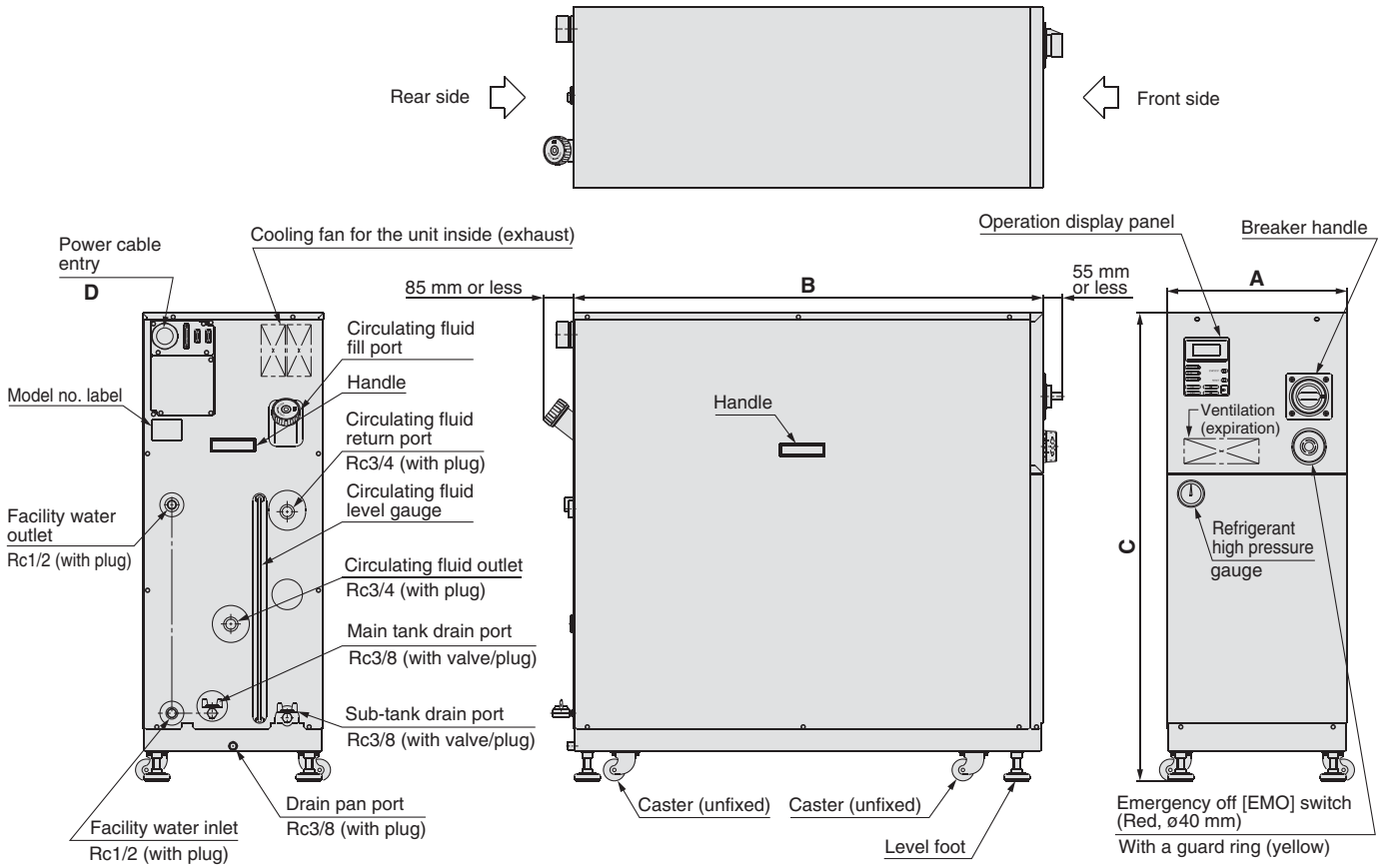
Dimensions

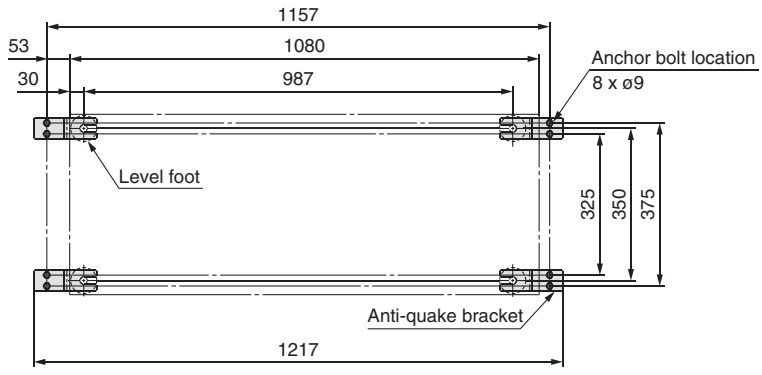


(mm)

Model			A	B	C	D
Fluorinated fluid type	Ethylene glycol type	Tap/Deionized water type				
HRZ001-H **HRZ002-H**	**HRZ001-H1** **HRZ002-H1**	—	380	870	860	ø18.5 to 20.5
HRZ001-L **HRZ002-L, W** **HRZ004-L, H** **HRZ008-H, W** **HRZ010-WS**	**HRZ001-L1** **HRZ002-L1, W1** **HRZ004-L1, H1** **HRZ008-H1, W1** **HRZ010-W1S**	**HRZ001-L2** **HRZ002-L2** **HRZ004-L2** **HRZ008-L2** **HRZ010-W2S**	380	870	950	ø18.5 to 20.5

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





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

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

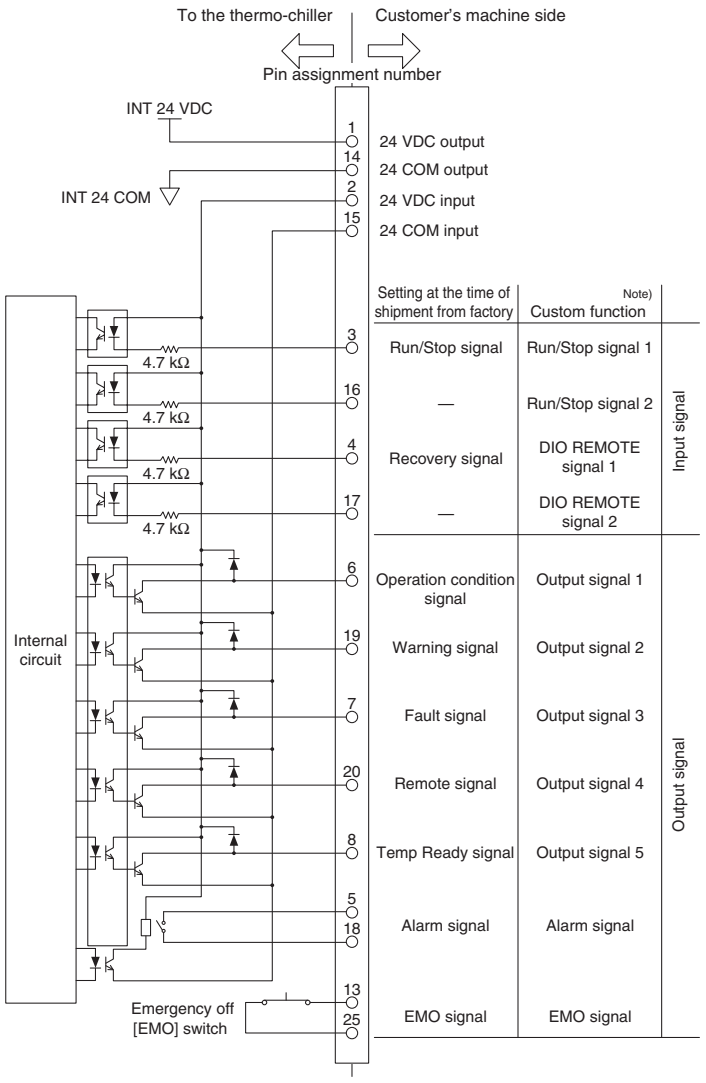
(mm)

Model		A	B	C	D
Fluorinated fluid type	Ethylene glycol type				
HRZ008-L	**HRZ008-L1**	415	1080	1075	ø35.0 to 38.0

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

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

Contact Input/Output

Item		Specifications
Connector no.		P1 (Refer to page 206 for connector location)
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 VDC to 26.4 VDC
	Rated input current	5 mA TYP
	Input impedance	4.7 kΩ
Open collector output signal	Insulation method	Photocoupler
	Rated load voltage	24 VDC
	Operating load voltage range	21.6 VDC to 26.4 VDC
	Maximum load current	80 mA
	Leakage current	0.1 mA or less
	Surge protection	Diode
Contact output signal (Alarm signal)	Rated load voltage	48 VAC or less/24 VDC or less
	Maximum load current	500 mA AC/DC (resistance load)
Contact output signal (EMO signal)	Rated load voltage	48 VAC or less/24 VDC or less
	Maximum load current	800 mA AC/DC (resistance load/inductive load)
Circuit diagram		

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

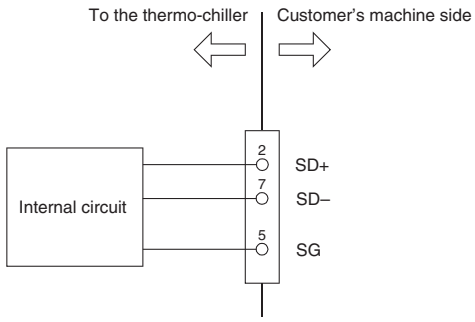
Serial RS-485

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

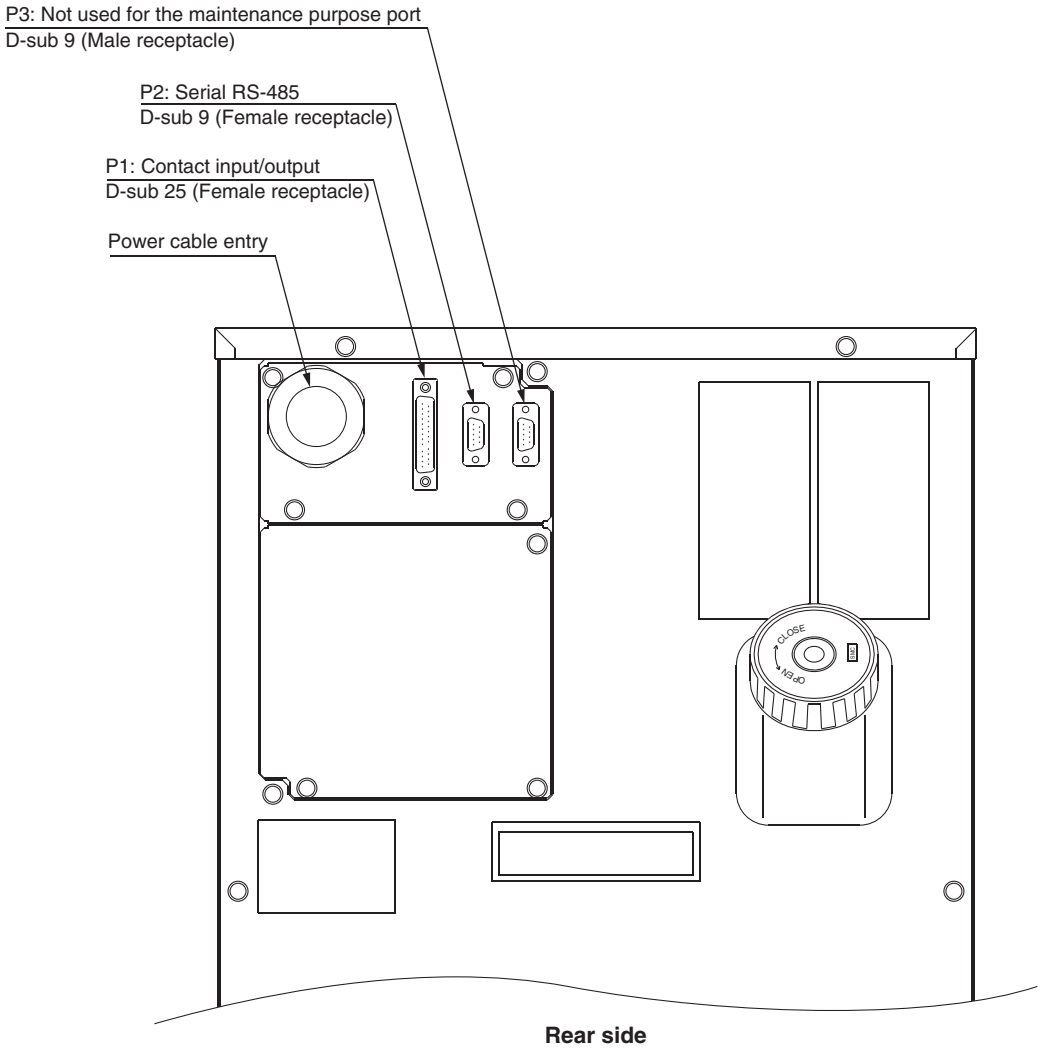
<Writing>
Run/Stop
Circulating fluid temperature setting
Circulating fluid automatic recovery start/stop*1

<Readout>
Circulating fluid present temperature
Circulating fluid flow
Circulating fluid discharge pressure
Circulating fluid electrical 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.

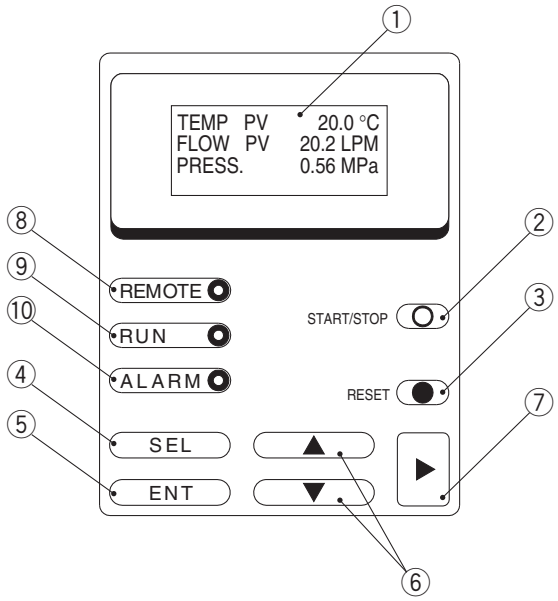
Item	Specifications
Connector no.	P2
Connector type (on this product side)	D-sub 9 P type, Female connector
Fixing bolt size	M2.6 x 0.45
Standards	EIA RS485
Protocol	Modicon Modbus
Circuit diagram	

Connector Location



Rear side

Operation Display Panel



No.	Description	Function
①	**LCD**	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] lamp**	Lights up when the unit is in the remote status.
⑨	**[RUN] lamp**	Lights up when the unit is in the operating status.
⑩	**[ALARM] lamp**	Lights up when the unit is alarming.

Alarm

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

Alarm code	Alarm message	Operation status	Main reason
01	Water Leak Detect FLT	Stop	Liquid deposits in the base of this unit.
02	Incorrect Phase Error FLT	Stop	The power supply to this unit is incorrect.
03	RFGT High Press FLT	Stop	Pressure in the refrigeration circuit has exceeded the limitation.
04	CPRSR Overheat FLT	Stop	Temperature inside the compressor has increased.
05	Reservoir Low Level FLT	Stop	The amount of circulating fluid is running low.
06	Reservoir Low Level WRN	Continue	The amount of circulating fluid is running low.
07	Reservoir High Level WRN	Continue	Filling the circulating fluid too much.
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.
11	Reservoir High Temp. WRN	Continue	Temperature of the circulating fluid has exceeded the limitation set by the customer.
12	Return Low Flow FLT	Stop	The circulating fluid flow has gone below 6 L/min.
13	Return Low Flow WRN	Continue	The circulating fluid flow has gone below the limitation set by the customer.
14	Heater Breaker Trip FLT	Stop	Protection device for the electric circuit of the heater is activated.
15	Pump Breaker Trip FLT	Stop	Protection device for the electric circuit of the circulating pump is activated.
16	CPRSR Breaker Trip FLT	Stop	Protection device for the electric circuit of the compressor is activated.
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.
19	FAN Motor Stop WRN	Continue	Cooling fan inside the compressor has stopped.
20	Internal Pump Time Out WRN	Continue	The internal pump continuously run for more than a certain period of time.
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 the customer. (Option)
25	Pump Inverter Error FLT	Stop	An error has occurred in the inverter for the circulating pump. The alarm is only for the HRZ010-W□S.
26	DNET Comm. Error WRN	Continue	The DeviceNet communications between this unit and customer's system has been suspended. (Only for DeviceNet communication specification - option D)
27	DNET Comm. Error FLT	Stop	An error has occurred in the DeviceNet communication system of this unit. (Only for DeviceNet communication specification - option D)
28	CPRSR INV Error FLT	Stop	An error has occurred in the inverter for the compressor. The alarm is only for the HRZ010-W□S.

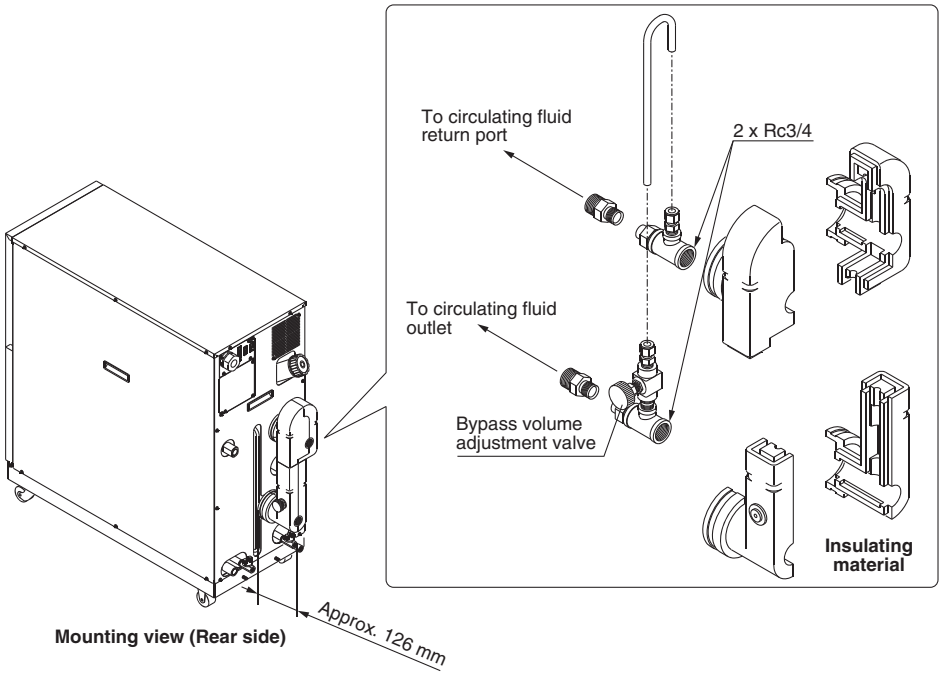
Optional Accessories

Bypass Piping Set

Note) Necessary to be fitted by the customer.

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 model
HRZ-BP001	HRZ001-H/HRZ001-H1 HRZ002-H/HRZ002-H1
HRZ-BP002	HRZ001-L/HRZ001-L1 HRZ001-L2 HRZ002-L/HRZ002-L1 HRZ002-L2 HRZ004-L/HRZ004-L1 HRZ004-L2 HRZ008-L2 HRZ004-H/HRZ004-H1 HRZ008-H/HRZ008-H1 HRZ002-W/HRZ002-W1 HRZ008-W/HRZ008-W1 HRZ010-WS HRZ010-W1S HRZ010-W2S
HRZ-BP008	HRZ008-L/HRZ008-L1

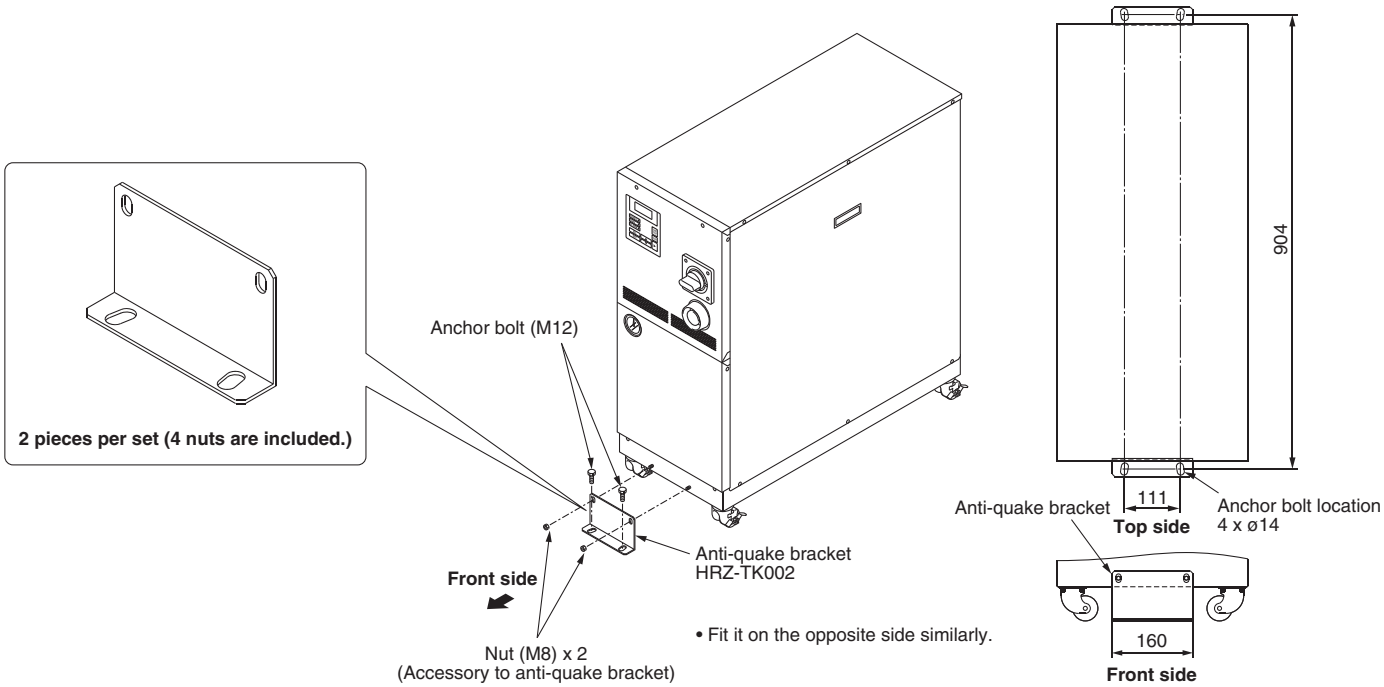


Anti-quake Bracket

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

Part no.	Applicable model
HRZ-TK002	HRZ001-L□/HRZ002-L□/HRZ004-L□/HRZ008-L2 HRZ001-H□/HRZ002-H□ HRZ004-H□/HRZ008-H□ HRZ002-W□/HRZ008-W□/HRZ010-W□S

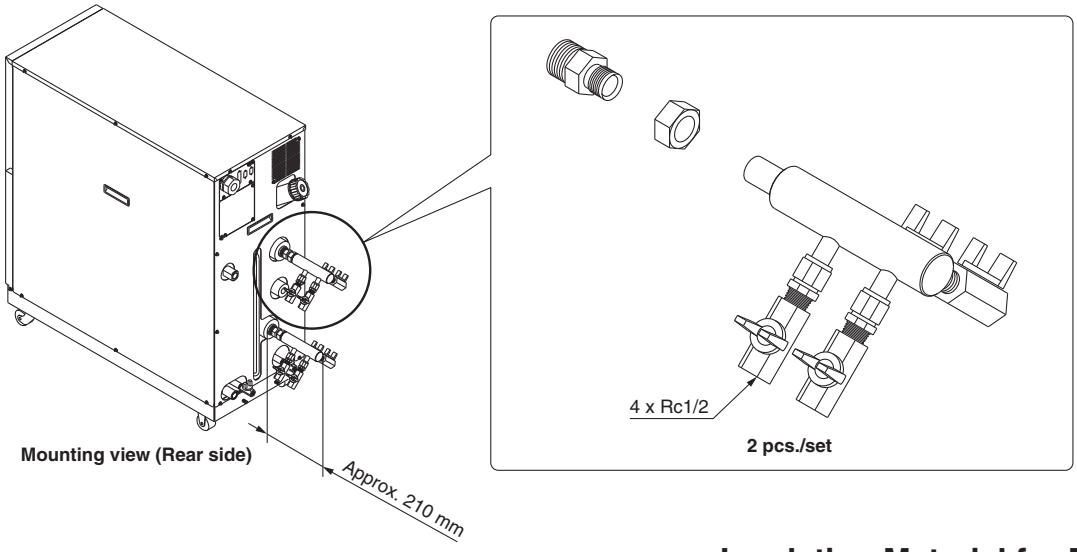
Note 1) 2 pieces per set (for 1 unit) (HRZ-TK002)
Note 2) Anti-quake bracket is attached as standard. (HRZ008-L, HRZ008-L1)



4-Port Manifold

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

Part no.	Applicable model
HRZ-MA001	Common for all models

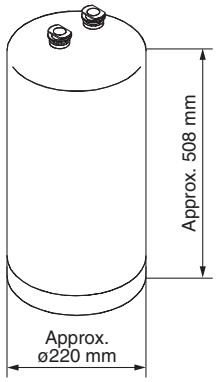


DI Filter

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

Part no.	Applicable model
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 (electrical resistivity set value, circulating fluid temperature, piping volume, etc.), product life cycles will vary accordingly.

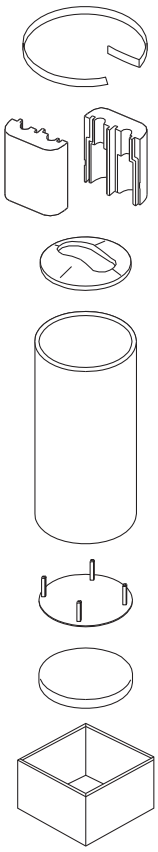


Weight: Approx. 20 kg

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. When the DI filter is used at a low-temperature, we also recommend that you use this to prevent heat absorption from the DI filter and to avoid forming condensation.

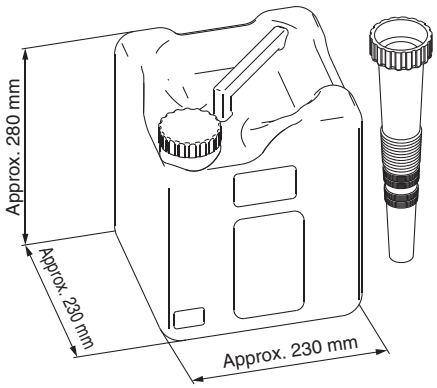
Part no.	Applicable model
HRZ-DF002	Common for all models which can select the DI control kit. (option Y)



60% Ethylene Glycol Aqueous Solution

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

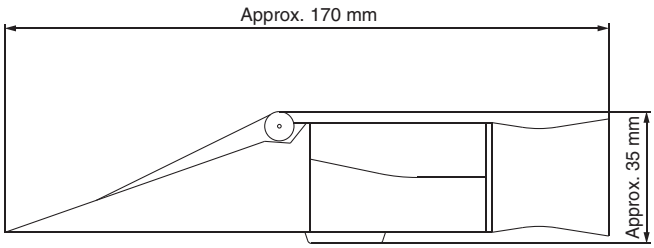
Part no.	Applicable model
HRZ-BR001	Common for all ethylene glycol-type models



Concentration Meter

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

Part no.	Applicable model
HRZ-BR002	Common for all ethylene glycol-type models



Series HRZ
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

HRZ□□□-□□-C

Analog communication

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

<Writing>
Circulating fluid temperature setting

<Readout>
Circulating fluid present temperature
Electrical resistivity*

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

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

D Option symbol
DeviceNet Communication

HRZ□□□-□□-D

DeviceNet communication

DeviceNet™

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

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

<Readout>
Circulating fluid present temperature
Circulating fluid flow
Circulating fluid discharge pressure
Electrical resistivity*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

HRZ□□□-□□-N

NPT fitting

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

Y Option symbol
DI Control Kit

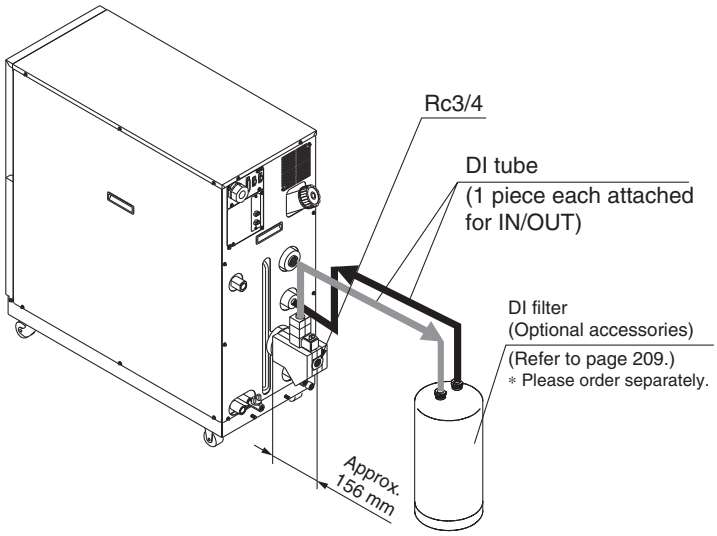
HRZ□□□-□□-Y

DI control kit

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

Applicable model		HRZ00□-L1-Y HRZ00□-H1-Y HRZ00□-W1-Y HRZ010-W1S-Y	HRZ00□-L2-Y HRZ010-W2S-Y
Allowable circulating fluid	—	60% ethylene glycol aqueous solution	Deionized water
DI level display range	MΩ·cm	0 to 20	
DI level set range	MΩ·cm	0 to 2.0 Note)	
DI level reduction alarm set range	MΩ·cm	0 to 2.0	

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



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

Z Option symbol

Circulating Fluid Automatic Recovery

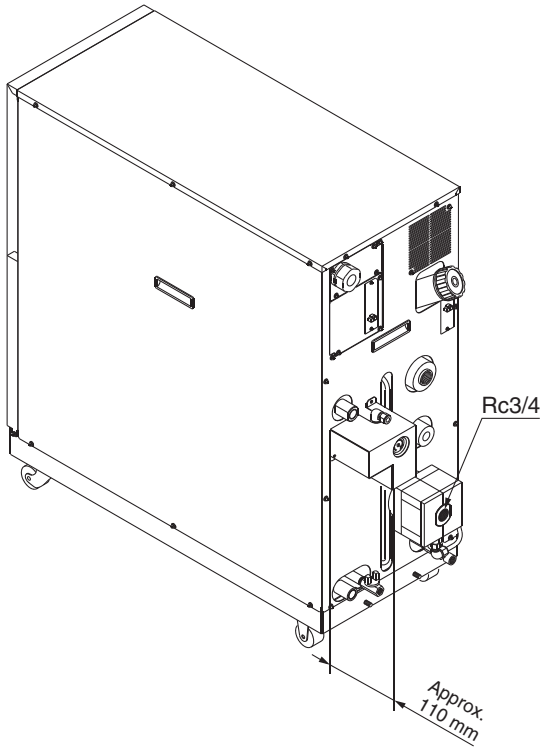
HRZ□□□-□□-Z

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, please consult "Product Specifications" information for these options.

Applicable model		**HRZ001-H-Z HRZ001-H1-Z HRZ002-H-Z HRZ002-H1-Z**	**HRZ001-L-Z HRZ002-L-Z HRZ004-L-Z HRZ004-H-Z HRZ008-H-Z HRZ001-L2-Z HRZ004-L2-Z HRZ002-W-Z HRZ008-W-Z HRZ010-WS-Z HRZ010-W2S-Z** **HRZ001-L1-Z HRZ002-L1-Z HRZ004-L1-Z HRZ004-H1-Z HRZ008-H1-Z HRZ002-L2-Z HRZ008-L2-Z HRZ002-W1-Z HRZ008-W1-Z HRZ010-W1S-Z**	**HRZ008-L-Z HRZ008-L1-Z**
Circulating fluid recoverable volume Note 1)	L	15	16	17
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 30		
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 tube, where necessary, use insert fittings, etc. in order not to deform the tubings when connecting to self-align fittings.
Note 3) At the time of shipping from factory, it is set to 0.2 MPa.
Note 4) For details, please consult our "Communication Specifications" information.



Series HRZ
Specific Product Precautions 1

Be sure to read this before handling. Refer to page 341 for Safety Instructions. For Temperature Control Equipment Precautions, refer to pages 342 to 345 and the Operation Manual on SMC website, http://www.smcworld.com

Design

⚠ Warning

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

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

Selection

⚠ Caution

1. Model selection

In order to select the correct thermo-chiller model, the amount of thermal generation from the customer's system, the operating circulating fluid, and its circulating flow are required. Select a model, by referring to the guideline to model selection on page 189.

2. Option selection

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

Handling

⚠ Warning

1. Thoroughly read the Operation Manual.

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

Operating Environment/Storage Environment

⚠ Caution

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

1. Environment like written in "Temperature Control Equipment Precautions."
2. Locations where spatter will adhere to when welding.
3. Locations where it is likely that the leakage of flammable gas may occur.
4. Locations where the ambient temperature exceeds the limits as mentioned below.
   During operation 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 for the unit inside.

Circulating Fluid

⚠ Caution

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

Circulating Fluid

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

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

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

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

Tap Water (as Circulating Water) Quality Standards

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

	Item	Unit	Standard value	Influence	
				Corrosion	Scale generation
Standard item	pH (at 25°C)	—	6.0 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		○
	Ionic state silica (SiO_2)	[mg/L]	30 or less		○
Reference item	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.
- ○: Factors that have an effect on corrosion or scale generation.
- Even if the water quality standards are met, complete prevention of corrosion is not guaranteed.

Transportation/Carriage/Movement

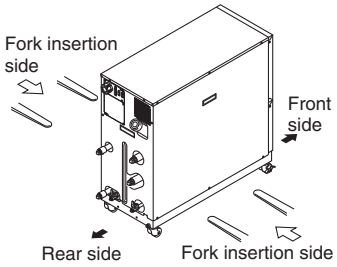
⚠ Warning

1. Transportation by forklift

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

2. Transportation by casters

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



Series HRZ
Specific Product Precautions 2

Be sure to read this before handling. Refer to page 341 for Safety Instructions. For Temperature Control Equipment Precautions, refer to pages 342 to 345 and the Operation Manual on SMC website, http://www.smcworld.com

Mounting/Installation

⚠ Caution

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

Piping

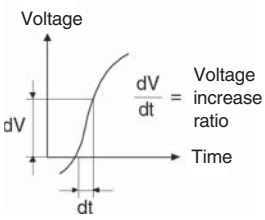
⚠ Caution

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

Electrical Wiring

⚠ Caution

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

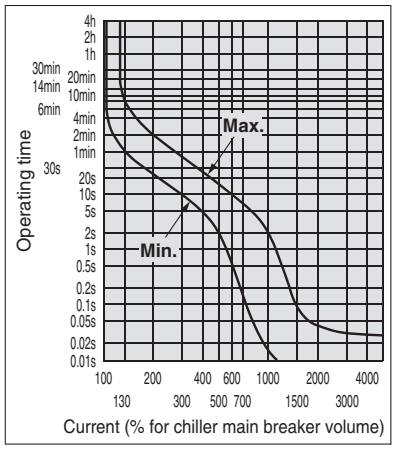


3. **This product is installed with a breaker with the following operating characteristics.**
   For the customer's machine (inlet side), use a breaker whose operating time is equal to or longer than the breaker of this product. If a breaker with shorter operating time is connected, the customer's machine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

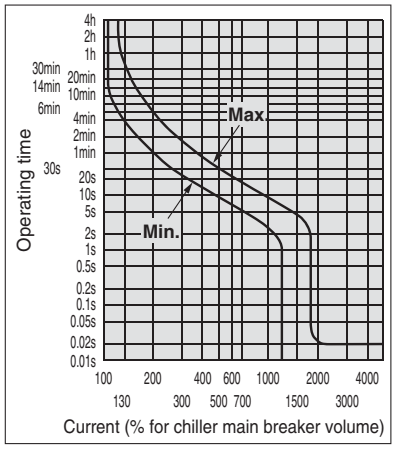
Breaker Operating Characteristics

Applicable model

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



HRZ008-L
HRZ008-L1
HRZ010-WS
HRZ010-W1S
HRZ010-W2S



Series HRZ
Specific Product Precautions 3

Be sure to read this before handling. Refer to page 341 for Safety Instructions. For Temperature Control Equipment Precautions, refer to pages 342 to 345 and the Operation Manual on SMC website, http://www.smcworld.com

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.

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.

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

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

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

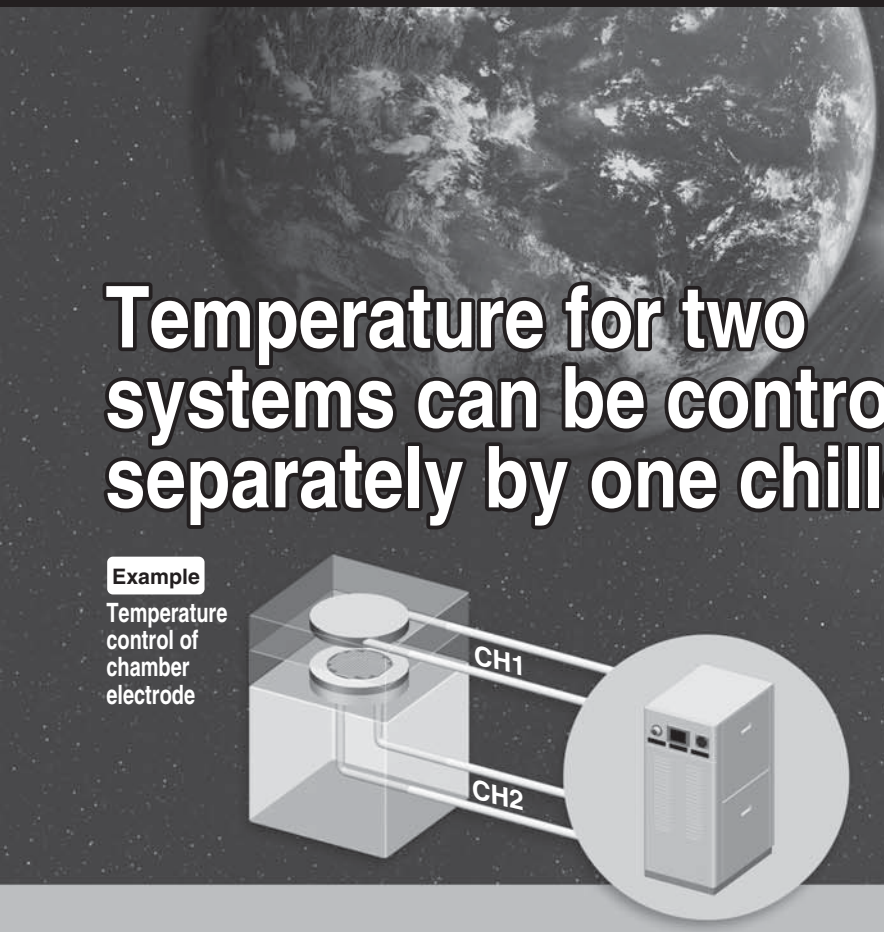
Circulating Fluid Temperature Controller

Refrigerated Dual Thermo-chiller

Series HRZD

(Double inverter type)

CE SEMI Standard S2-0706, S8-0308, F47-0706





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

Example
Temperature control of chamber electrode

Energy-saving

Double inverter type

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

Power consumption:

Reduced by 84%
2.2 kWh/h
(Current model: 13.8 kWh/h)

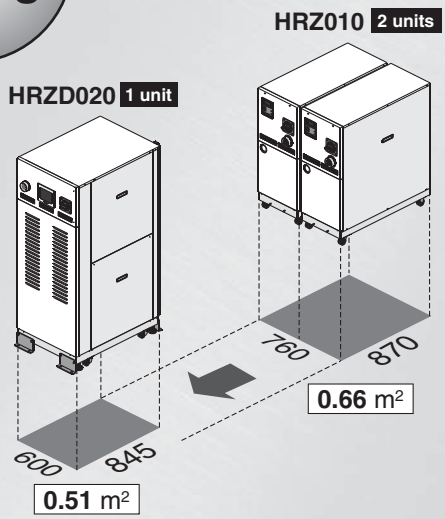
Facility water consumption:

Reduced by 90%
4 L/min (Current model: 40 L/min)

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

Space-saving

Footprint reduced by 23%



Reduced wiring, piping and labor

Single power cable, single facility water piping system

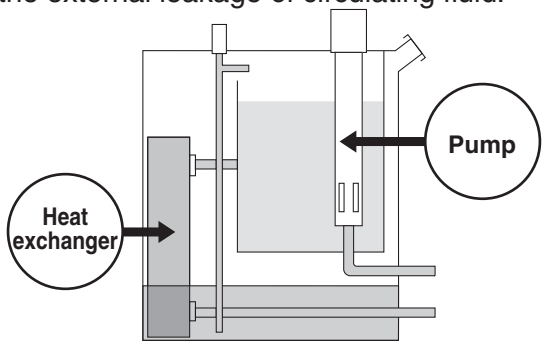
Switchover from the current model is also possible.

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

Leakless

All in Tank

Accommodation of a pump and a heat exchanger inside the tank can eliminate the external leakage of circulating fluid.

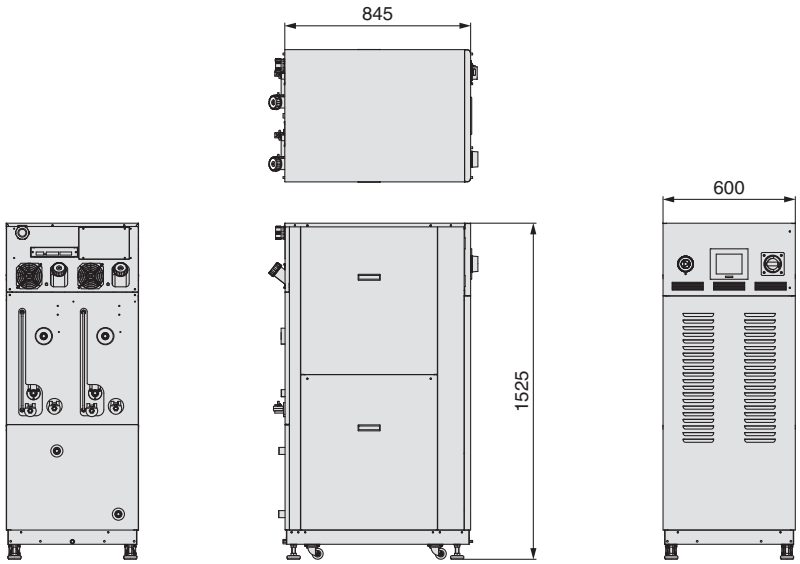


Specifications (Fluorinated Fluid Type)

Model		HRZD020-WS-WS	
Channel		1	2
Cooling method		Water-cooled refrigeration	
Cooling capacity Note 1)	kW	9.5 (Circulating fluid temperature at 20°C)	9.5 (Circulating fluid temperature at 20°C)
Temperature range setting	°C	–30 to 90	–30 to 90
Temperature stability	°C	±0.1 Note 2)	±0.1 Note 2)
Circulating fluid flow range Note 3)	L/min	10 to 40	10 to 40
Circulating fluid		–30 to 40°C: Galden® HT135 Note 4) Fluorinert™ FC-3283 Note 4) 20 to 90°C: Galden® HT200 Note 4) Fluorinert™ FC-40 Note 4)	
Refrigerant		R404A (HFC)	R404A (HFC)
Pump capacity Note 5)	MPa	Max. 0.72 (at 20 L/min) With flow control function by inverter	Max. 0.72 (at 20 L/min) With flow control function by inverter
Main tank capacity Note 6)	L	Approx.15	Approx.15
Sub-tank capacity Note 7)	L	Approx.16	Approx.16
Circulating fluid connection port size (Outlet/Return port)		Rc3/4	Rc3/4
Facility water	°C/MPa	10 to 35/0.3 to 0.7	
Facility water required flow rate Note 8)	L/min	15 (Facility water temperature at 25°C)	15 (Facility water temperature at 25°C)
Facility water connection port size (Inlet/Outlet)		Rc1/2 (Single system for Channel 1, 2)	
Power supply		3-phase, 50/60 Hz, 200/200 to 208 VAC ±10%	
Main breaker capacity	A	60	
Dimensions Note 9)	mm	W600 x D845 x H1525	
Weight Note 10)	kg	380	
Communications		Serial RS-485/RS-232C (D-sub 9 pin), Contact input/output, Analog input/output (D-sub 25 pin)	

Note 1) Values of facility water at 25°C, circulating fluid flow rate 20 L/min. Values when the heat generation source is directly connected to the circulating fluid circuit in this product. Common for 50/60 Hz.
Note 2) Values may go beyond the specified range depending on the operating condition.
Note 3) Depending on the piping specifications of the customer system, it may not be controlled by the set value.
Note 4) Galden® is a registered trademark of Solvay Solexis, Inc. Fluorinert™ is a trademark of 3M.
Note 5) Circulating fluid temperature at 20°C, Capacity at the outlet on this product. Common for 50/60 Hz.
Note 6) Minimum volume required for operating this product only. (Circulating fluid temperature at 20°C, including volume for the piping and the heat exchanger inside this product)
Note 7) Preliminary space volume without main tank capacity. Use for collecting circulating fluid inside the external piping or for preliminary injection.
Note 8) Required flow rate during the temperature drop. Possible to operate this product at approx. 1 to 2 L/min when there is no load.
Note 9) Dimensions between panels, not including the dimensions of protrusion such as a breaker handle.
Note 10) Weight in the dry state without circulating fluids

Dimensions



Circulating Fluid Temperature Controller

Water-cooled Thermo-chiller

Series HRW

SEMATECH S2-93, S8-95

SEMI Standard S2-0703, S8-1103, F47-0200

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

- Type of circulating fluid: **Fluorinated fluids/Ethylene glycol aqueous solution/Tap water, Deionized water**
- Temperature range setting: **20 to 90°C**
- Cooling capacity: **2 kW/8 kW/15 kW/30 kW**
- Temperature stability: **±0.3°C**

More effective energy-saving through use of an inverter pump



Inverter type

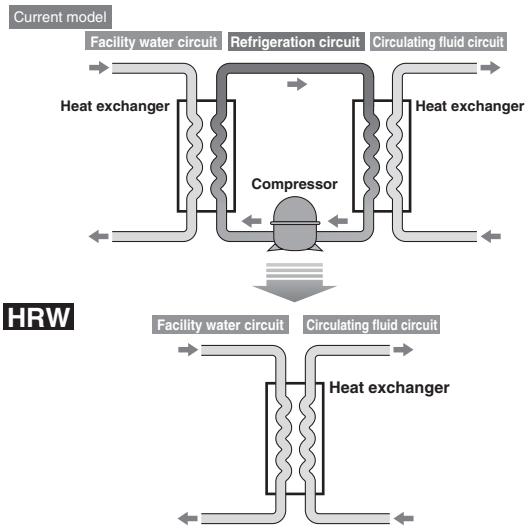
Power consumption **0.5 kWh/h**

Facility water **1.2 L/min**

Energy-Saving and Refrigerant-free

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

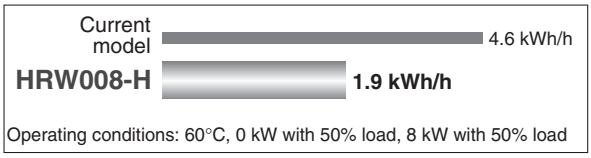
The water-cooled thermo-chiller which does not use a compressor (refrigerant-free) is suitable for processes operating from ordinary temperature to 90°C. The energy-savings shown below can be achieved in comparison with current models (depending on the conditions).



● 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.

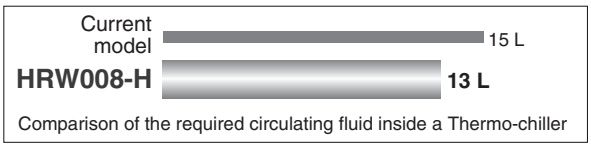


- Reduced running cost
- Contribution to the environmental preservation

● 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.

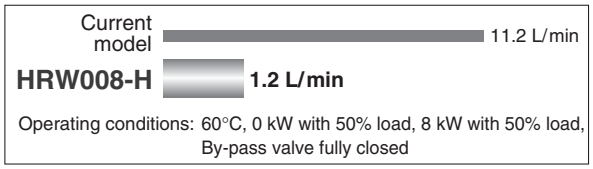


- Reduced initial cost
- Contribution to the environmental preservation

● Facility water: Max. 89% reduction

(SMC comparison)

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



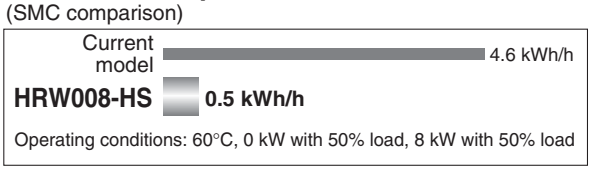
- Reduced facilities investment
- Space saved facility water equipment
- Reduced running cost

Pump Inverter Type

More effective energy-saving is achieved through use of an *inverter pump*.

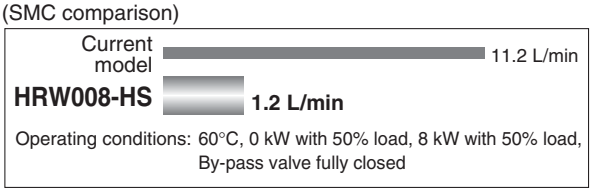
● Power consumption: Max. 89% reduction

(SMC comparison)



● Facility water: Max. 89% reduction

(SMC comparison)



Space-Saving

Installation area: Max. 45% reduction

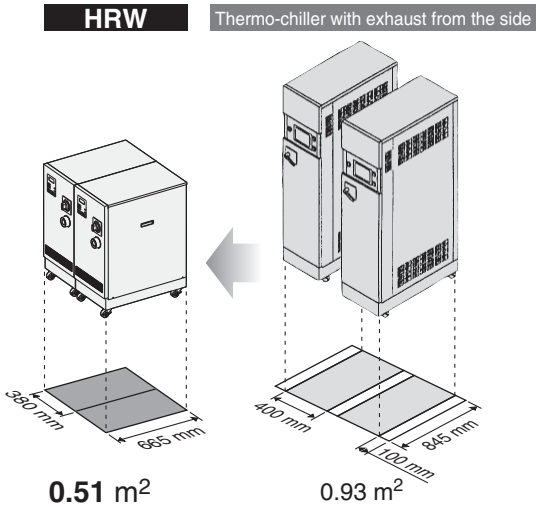
(SMC comparison)

(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

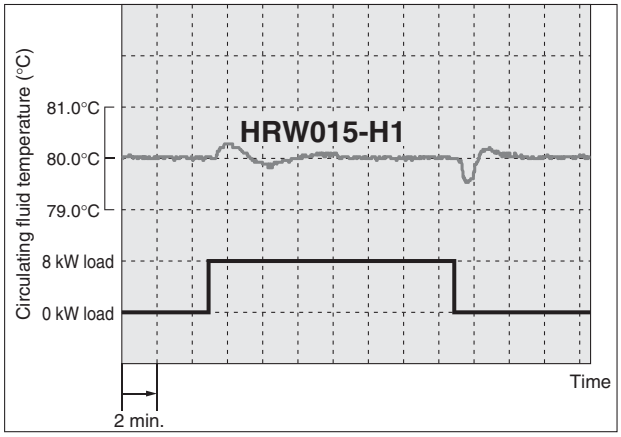


High Performance

Temperature stability: ±0.3°C

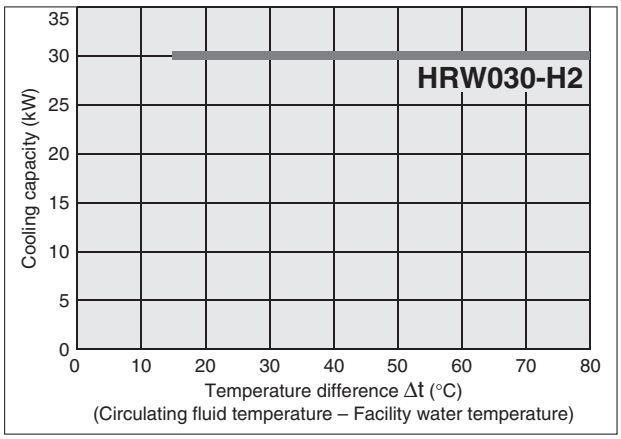
(when a load is stable)

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



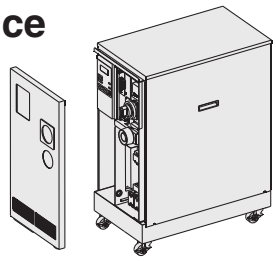
Cooling capacity: Max. 30 kW

Up to 30 kW cooling capacity achieved.

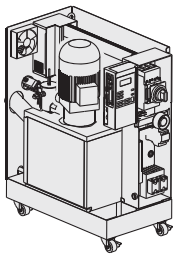


Easy maintenance

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



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



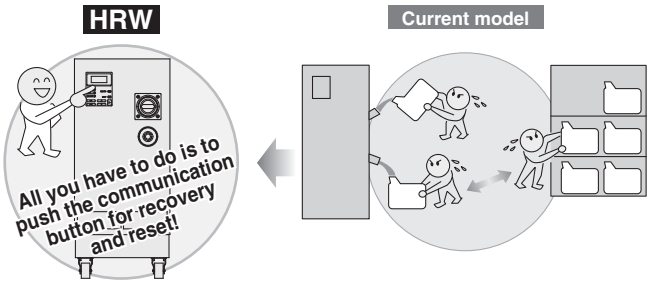
- Various alarm displays (Refer to page 238.)

Easy Maintenance

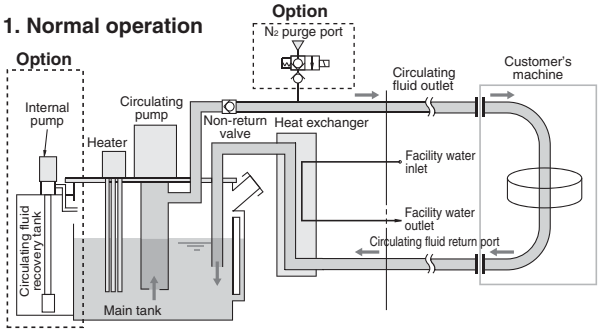
Circulating fluid automatic recovery function (Refer to "Options" on page 240.)

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

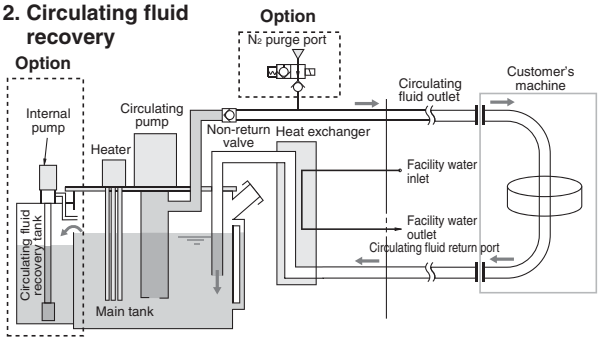
- Reduced maintenance time
- Faster operation
- Reduced circulating liquid loss by evaporation or spill



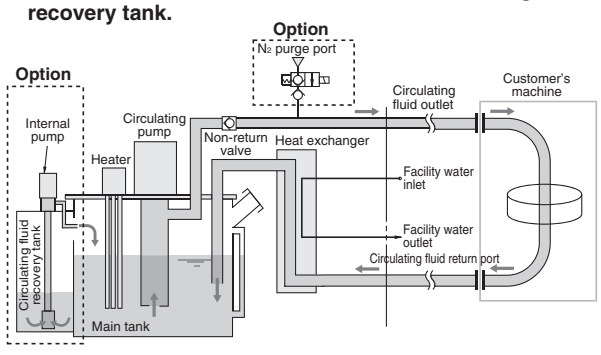
1. Normal operation



2. Circulating fluid recovery



3. Fluid returns to the main tank from the circulating fluid recovery tank.



Circulating fluid electrical resistivity control function

(Refer to "Options" on page 239.)

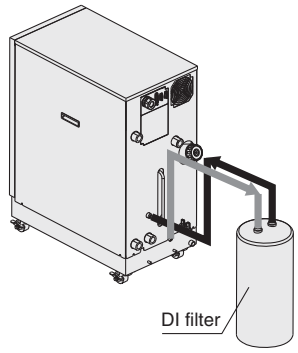
(DI control kit)

Electrical Resistivity Control

DI control kit

(Refer to “Options” on page 239.)

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



Communications

- Contact input/output signal
- Serial RS-485 communication
- Analog communication (Refer to “Options” on page 239.)
- DeviceNet communication (Refer to “Options” on page 239.)

DeviceNet™

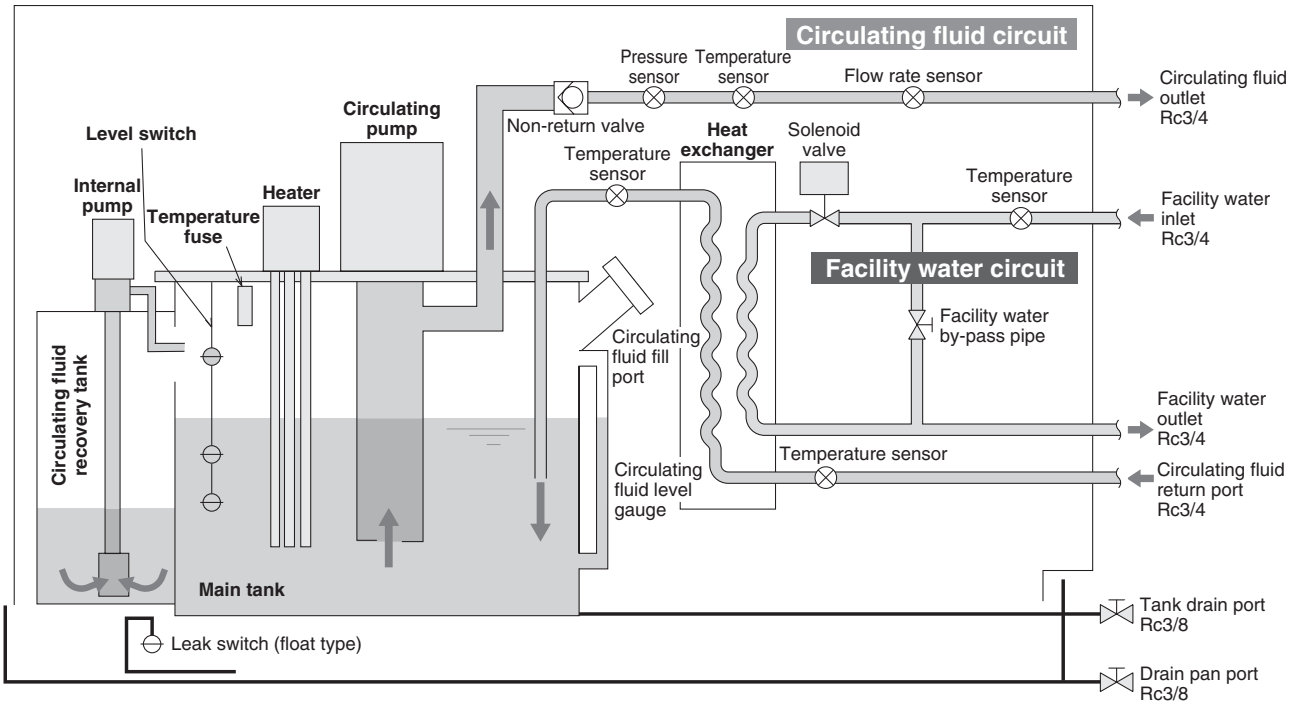
Wetted parts adopt the materials compatible for various circulating fluids.

(Stainless steel, EPDM, etc.)

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

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

Construction and Principles



Circulating fluid circuit

With the **circulating pump**, circulating fluid will be discharged to the customer’s machine side. After the circulating fluid will heat or cool the customer’s machine side, it will be returned to the **main tank** via the **heat exchanger**.
When the automatic circulating fluid recovery function, which recovers the circulating fluid from the customer's machine, is selected (refer to page 220), a **sub-tank** for recovery is installed. The **internal pump** is used to transfer a circulating fluid from the **sub-tank** to the **main tank**.

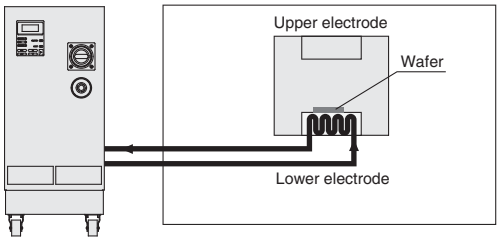
Facility water circuit

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

Application Examples

Semiconductor

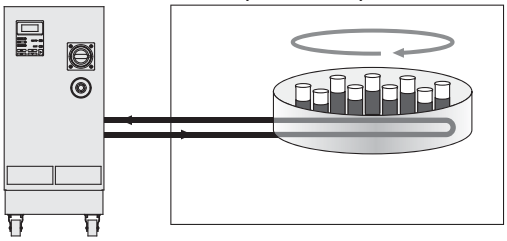
Example: Temperature control of chamber electrode



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

Medical

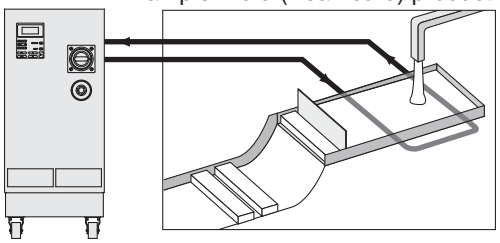
Example: Blood preservation



- **X-ray instrument**
- **MRI**
- **Blood preservation equipment**

Food

Example: Tofu (Bean curd) production

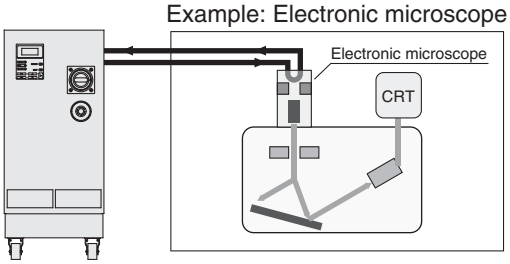


- **Bottle-cleaning machine**
- **Tofu (Bean curd) production equipment**
- **Noodle-making machine, etc.**

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

Analysis

Example: Electronic microscope

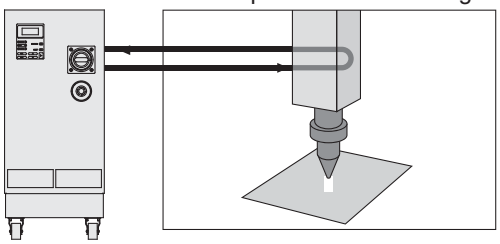


- **Electron microscope**
- **X-ray analytical instrument**
- **Gas chromatography**
- **Sugar level analytical instrument, etc.**

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

Machine tool

Example: Laser machining

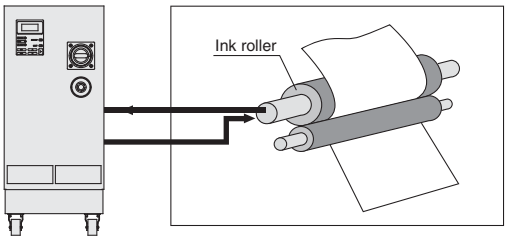


- **Wire cutting**
- **Grinder**
- **Spot welding**
- **Plasma welding**
- **Laser machining, etc.**

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

Printing

Example: Printing temperature control

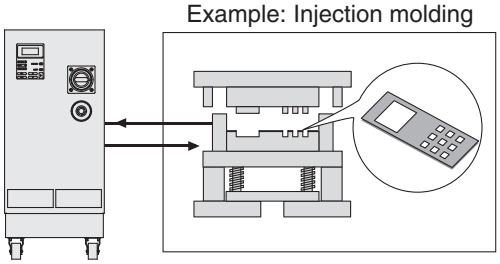


- **Offset printing machine**
- **Automatic developing machine**
- **UV equipment, etc.**

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



Water-cooled Thermo-chiller Series HRW

Model Selection

Guide to Model Selection ····· Page 225
Required Cooling Capacity Calculation ····· Page 226
Precautions on Model Selection ····· Page 227
Circulating Fluid Typical Physical Property Values ··· Page 228

Fluorinated Fluid Type

How to Order/Specifications ····· Page 229
Cooling Capacity/Heating Capacity/Pump Capacity ··· Page 230

Ethylene Glycol Type

How to Order/Specifications ····· Page 231
Cooling Capacity/Heating Capacity/Pump Capacity ··· Page 232

Tap/Deionized Water Type

How to Order/Specifications ····· Page 233
Cooling Capacity/Heating Capacity/Pump Capacity ··· Page 234

Common Specifications

Dimensions ····· Page 235
Communication Function ····· Page 236
· Contact Input/Output ····· Page 236
· Serial RS-485 ····· Page 237
· Connector Location ····· Page 237
Operation Display Panel ····· Page 238
Alarm ····· Page 238

Options

Analog Communication ····· Page 239
DeviceNet Communication ····· Page 239
NPT Fitting ····· Page 239
DI Control Kit ····· Page 239
Circulating Fluid Automatic Recovery ····· Page 240

Optional Accessories

① Bypass Piping Set ····· Page 241
② Anti-quake Bracket ····· Page 241
③ 4-Port Manifold ····· Page 242
④ DI Filter ····· Page 242
⑤ Insulating Material for DI Filter ····· Page 242
⑥ Contaminant Filter ····· Page 243
⑦ 60% Ethylene Glycol Aqueous Solution ····· Page 243
⑧ Concentration Meter ····· Page 243

Specific Product Precautions ····· Page 244

Series HRW
Model Selection

Guide to Model Selection

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

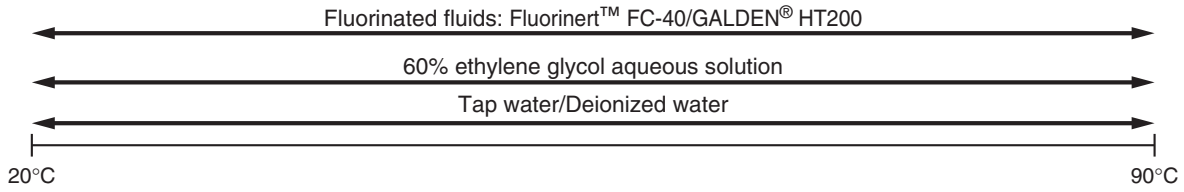
Temperature range which can be set with the thermo-chiller

H: 20°C to 90°C

Example) Customer requirement: 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) Customer requirement: Tap water

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

Temperature range which can be set with the thermo-chiller

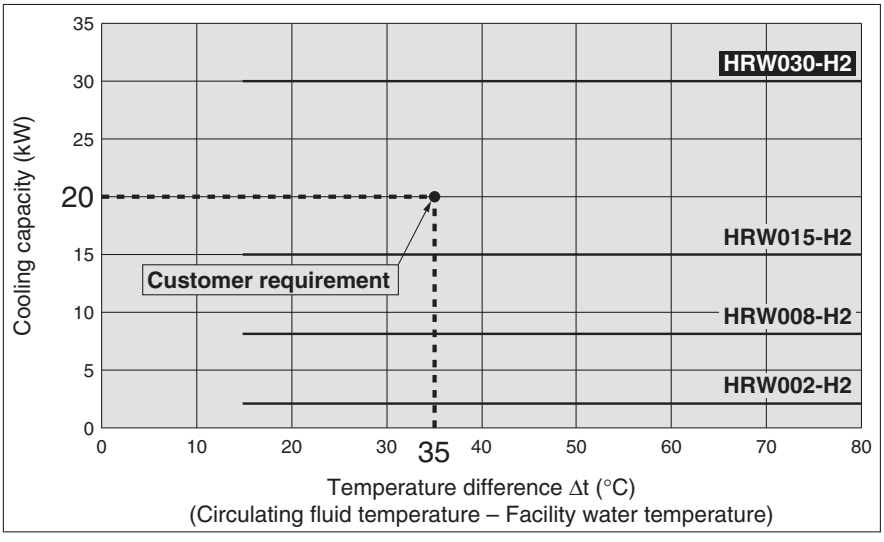
10°C to 35°C

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

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

Example) Customer requirement: 20 kW → **Plot the point where the temperature difference between the circulating fluid and facility water (35°C) intersects the cooling capacity (20 kW) in the cooling capacity graph.**

[Cooling Capacity Graph] Circulating Fluid: Tap Water/Deionized 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**.

Fluorinert™ is a trademark of 3M. GALDEN® is a registered trademark of Solvay Solexis, Inc.

Required Cooling Capacity Calculation

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

Heat generation amount Q: 3.5 kW

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

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

Obtain the temperature difference between inlet and outlet by circulating the circulating fluid inside the customer's machine.

Heat generation amount **Q**	: Unknown
Circulating fluid temperature difference Δ**T** (= **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 page 228 for the typical physical property values by circulating fluid.

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

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

= 3456 W = 3.5 kW

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

Example of 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)

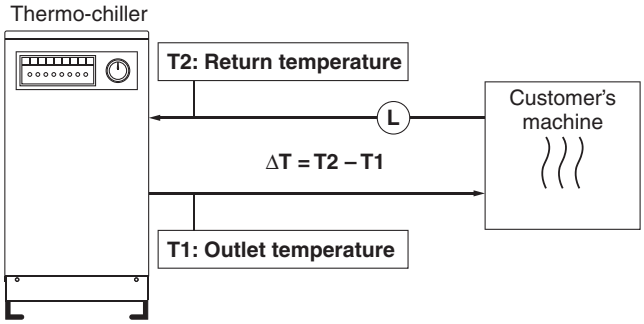
∗ Refer to page 228 for the typical physical property values by circulating fluid.

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

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

= 3.5 kW

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



Required Cooling Capacity Calculation

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

Cooled substance total volume **V** : 60 L
Cooling time **h** : 15 min
Cooling temperature difference Δ**T**: 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 page 228 for the typical physical property values by circulating fluid.

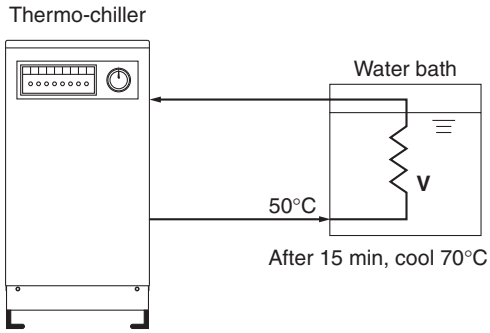
$$Q = \frac{\Delta T \times V \times \gamma \times C}{h \times 60 \times 1000}$$

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

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.

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.

Example of 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 page 228 for the typical physical property values by circulating fluid.

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

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

$$= 2.4\ kW$$

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.)

Precautions on Model Selection

1. Temperature difference between the circulating fluid and facility water

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

2. Heating capacity

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

3. Pump capacity

<Circulating fluid flow rate>

Pump capacity varies depending on the model selected from the HRW series. Also, circulating fluid flow varies depending on the circulating fluid discharge pressure. Consider the installation height difference between our thermo-chiller and a customer's machine, and the piping resistance such as circulating fluid pipings, or piping size, or piping curves in the machine. Check beforehand if the required flow rate is achieved, using the pump capacity curves for each respective model.

<Circulating fluid discharge pressure>

Circulating fluid discharge pressure has the possibility to increase up to the maximum pressure in the pump capacity curves for the respective model. Check beforehand if the circulating fluid pipings or circulating fluid circuit of the customer's machine are fully durable against this pressure.

Circulating Fluid Typical Physical Property Values

∗ The below shown are reference values.
Please contact circulating fluid supplier for details.

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

60% Ethylene Glycol Aqueous Solution

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

SEMI

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

Temperature range setting

Symbol	Temperature range setting
H	20 to 90°C

Pump inverter control

Symbol	Pump inverter control
Nil	None
S	Applicable (Pump inverter type)

Option

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

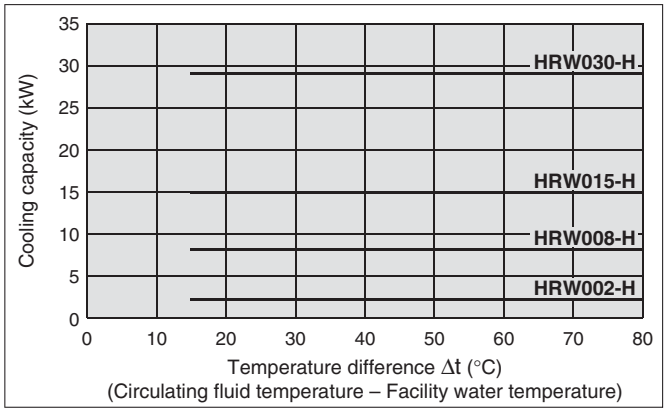
Specifications (For details, please consult our "Product Specifications" information.)

Model			HRW002-H HRW002-HS	HRW008-H HRW008-HS	HRW015-H HRW015-HS	HRW030-H HRW030-HS
Cooling method			Water-cooled			
Ambient temperature/humidity Note 1)			Temperature: 10 to 35°C, Humidity: 30 to 70%RH			
Circulating fluid system	**Circulating fluid** Note 2)		Fluorinert™ FC-40/GALDEN® HT200			
	Temperature 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 rate	L/min	10	20	25	40
	Temperature stability Note 3)	°C	±0.3			
	Pump capacity (50/60 Hz) Note 4)	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)
	Circulating fluid flow range Note 5)	L/min	3 to 16	9 to 50		
	Tank capacity Note 6)	L	Approx. 13		Approx. 14	
	Circulating fluid recovery tank volume Note 7)	L	12			
	Port size		Rc3/4			
	Wetted parts material		Copper brazing (Heat exchanger), Stainless steel, EPDM, Silicone, PPS, Fluororesin			
Facility water system	**Temperature range**	°C	10 to 35			
	Required flow rate Note 8)	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, Silicone, Bronze, Brass			
Electrical system	**Power supply**		3-phase 200/200 to 208 VAC ±10%			
	Max. operating current	A	26			
	Breaker capacity	A	30			
	Communications		Serial RS-485 (D-sub 9 pin) and Contact input/output (D-sub 25 pin)			
Dimensions Note 9)		mm	W380 x D665 x H860			
Weight Note 10)		kg	Approx. 90		Approx. 100	
Safety standards			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 SMC.
Note 3) Outlet temperature when the circulating fluid and facility water are rated flow, and the circulating fluid outlet and return port are directly connected. Installation environment, power supply, and facility water are within specification range and stable. Value obtained 10 minutes after the external load is stabilized. It may be out of ±0.3°C in some other operating conditions.
Note 4) The capacity at the circulating fluid outlet when the circulating fluid temperature is 20°C. Pump capacity at 60 Hz indicates the maximum capacity of the HRW□□□-HS (pump inverter type).
Note 5) Applicable to the HRW□□□-HS (pump inverter type) only.
Note 6) 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 7) The automatic circulating fluid recovering function will be provided by selecting option Z for collecting the circulating fluid inside an external piping.
Note 8) Required flow rate for cooling capacity or maintaining the temperature stability.
Note 9) Panel dimensions. These dimensions do not include possible protrusions such as a breaker handle.
Note 10) Weight in the dry state without circulating fluids

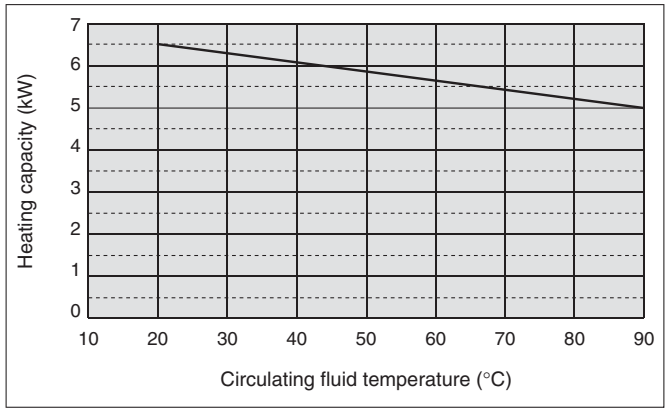
Cooling Capacity

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



Heating Capacity

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

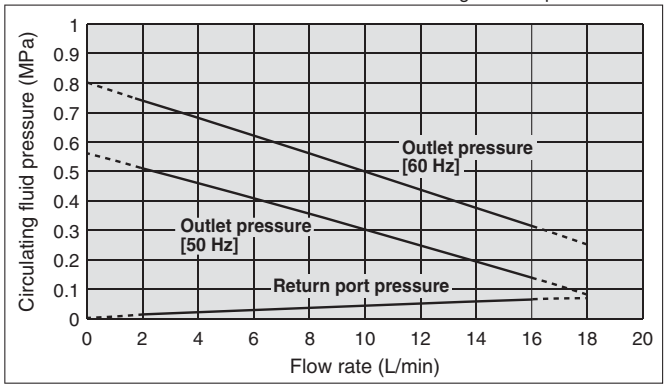


∗ When pump inverter is operating at frequency of 60 Hz (maximum).

Pump Capacity

HRW002-H
HRW002-HS

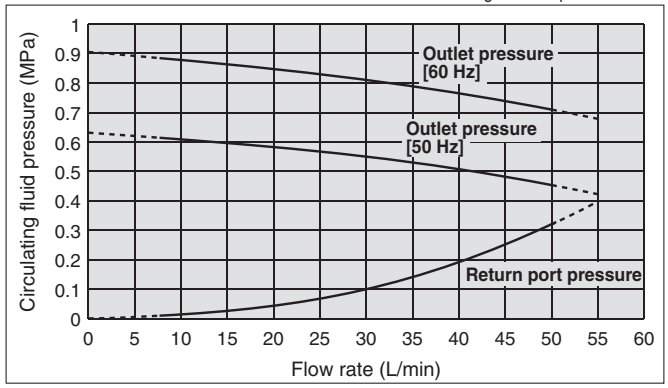
Circulating fluid: Fluorinated fluids
Circulating fluid temperature: 20°C



∗ If the circulating fluid flow drops below 2 L/min., the shutdown alarm activates and operation stops. Do not use the product when the flow exceeds 16 L/min., since the flow cannot be displayed accurately.
∗ Pump capacity at 60 Hz indicates the maximum capacity of the HRW002-HS (pump inverter type).

HRW008-H/015-H/030-H
HRW008-HS/015-HS/030-HS

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



∗ If the circulating fluid flow drops below 8 L/min., the shutdown alarm activates and operation stops. Do not use the product when the flow exceeds 50 L/min., since the flow cannot be displayed accurately.
∗ Pump capacity at 60 Hz indicates the maximum capacity of the HRW008-HS/015-HS/030-HS (pump inverter type).

Thermo-chiller Ethylene Glycol Type
Series HRW

SEMI

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

Pump inverter control

Symbol	Pump inverter control
Nil	None
S	Applicable (Pump inverter type)

Option

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

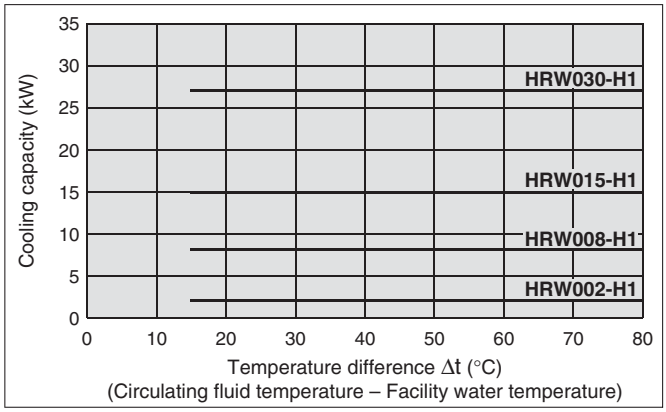
Specifications (For details, please consult our "Product Specifications" information.)

Model			HRW002-H1 HRW002-H1S	HRW008-H1 HRW008-H1S	HRW015-H1 HRW015-H1S	HRW030-H1 HRW030-H1S
Cooling method			Water-cooled			
Ambient temperature/humidity Note 1)			Temperature: 10 to 35°C, Humidity: 30 to 70%RH			
Circulating fluid system	Circulating fluid Note 2)		60% ethylene glycol aqueous solution			
	Temperature 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 rate	L/min	10	15	25	40
	Temperature stability Note 3)	°C	±0.3			
	Pump capacity (50/60 Hz) Note 4)	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)
	Circulating fluid flow range Note 5)	L/min	3 to 16	9 to 50		
	Tank capacity Note 6)	L	Approx. 13			
	Circulating fluid recovery tank volume Note 7)	L	12			
	Port size		Rc3/4			
	Wetted parts material		Nickel brazing (Heat exchanger), Stainless steel, EPDM, Silicone, PPS, Fluororesin			
Facility water system	Temperature range	°C	10 to 35			
	Required flow rate Note 8)	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, Silicone, Bronze, Brass			
Electrical system	Power supply		3-phase 200/200 to 208 VAC ±10%			
	Max. operating current	A	26			
	Breaker capacity	A	30			
	Communications		Serial RS-485 (D-sub 9 pin) and Contact input/output (D-sub 25 pin)			
Dimensions Note 9)		mm	W380 x D665 x H860			
Weight Note 10)		kg	Approx. 90			
Safety standards			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 tap water. Additives invading wetting parts material such as preservatives cannot be used.
Note 3) Outlet temperature when the circulating fluid and facility water are rated flow, and the circulating fluid outlet and return port are directly connected. Installation environment, power supply, and facility water are within specification range and stable. Value obtained 10 minutes after the external load is stabilized (after stabilization with no load for HRW030-H1). It may be out of this range when a DI control kit (option Y) is used or in some other operating conditions.
Note 4) The capacity at the circulating fluid outlet when the circulating fluid temperature is 20°C. Pump capacity at 60 Hz indicates the maximum capacity of the HRW□□□-H1S (pump inverter type).
Note 5) Applicable to the HRW□□□-H1S (pump inverter type) only.
Note 6) 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 7) The automatic circulating fluid recovering function will be provided by selecting option Z for collecting the circulating fluid inside an external piping.
Note 8) Required flow rate for cooling capacity or maintaining the temperature stability.
Note 9) Panel dimensions. These dimensions do not include possible protrusions such as a breaker handle.
Note 10) Weight in the dry state without circulating fluids

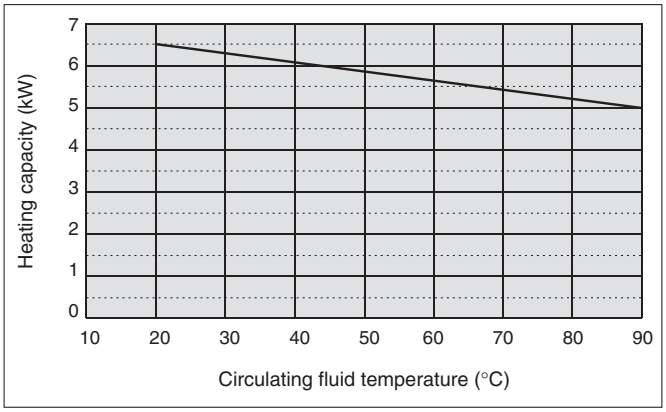
Cooling Capacity

HRW002-H1/008-H1/015-H1/030-H1
HRW002-H1S/008-H1S/015-H1S/030-H1S



Heating Capacity

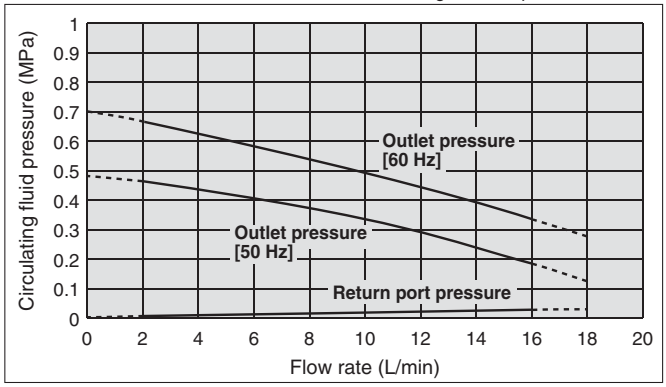
HRW002-H1/008-H1/015-H1/030-H1
HRW002-H1S/008-H1S/015-H1S/030-H1S



Pump Capacity

HRW002-H1
HRW002-H1S

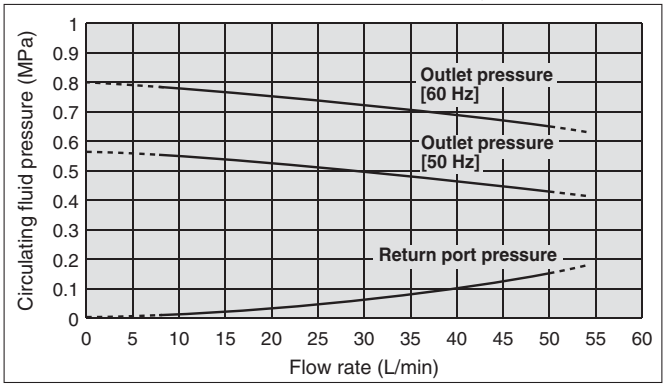
Circulating fluid: 60% ethylene glycol
Circulating fluid temperature: 20°C



∗ If the circulating fluid flow drops below 2 L/min., the shutdown alarm activates and operation stops. Do not use the product when the flow exceeds 16 L/min., since the flow cannot be displayed accurately.
∗ Pump capacity at 60 Hz indicates the maximum capacity of the HRW002-H1S (pump inverter type).

HRW008-H1/015-H1/030-H1
HRW008-H1S/015-H1S/030-H1S

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



∗ If the circulating fluid flow drops below 8 L/min., the shutdown alarm activates and operation stops. Do not use the product when the flow exceeds 50 L/min., since the flow cannot be displayed accurately.
∗ Pump capacity at 60 Hz indicates the maximum capacity of the HRW008-H1S/015-H1S/030-H1S (pump inverter type).

Thermo-chiller Tap/Deionized Water Type

Series HRW

SEMI

How to Order

Tap/Deionized 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

Tap/Deionized water type

Pump inverter control

Symbol	Pump inverter control
Nil	None
S	Applicable (Pump inverter type)

Option

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

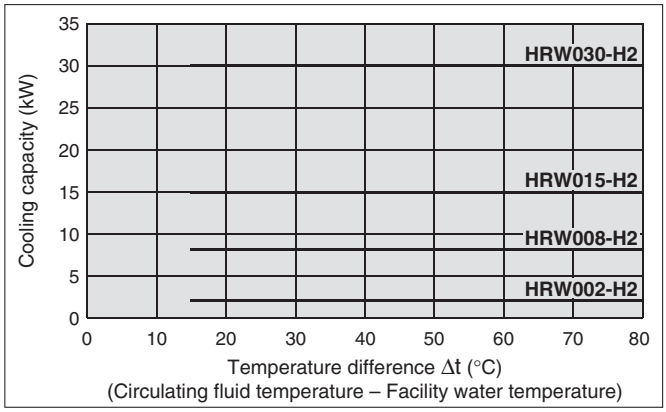
Specifications (For details, please consult our "Product Specifications" information.)

Model			HRW002-H2 HRW002-H2S	HRW008-H2 HRW008-H2S	HRW015-H2 HRW015-H2S	HRW030-H2 HRW030-H2S
Cooling method			Water-cooled			
Ambient temperature/humidity Note 1)			Temperature: 10 to 35°C, Humidity: 30 to 70%RH			
Circulating fluid system	Circulating fluid Note 2)		Tap water, Deionized water			
	Temperature 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 rate	L/min	10	15	25	40
	Temperature stability Note 3)	°C	±0.3			
	Pump capacity (50/60 Hz) Note 4)	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)
	Circulating fluid flow range Note 5)	L/min	3 to 16	9 to 50		
	Tank capacity Note 6)	L	Approx. 13			
	Circulating fluid recovery tank volume Note 7)	L	12			
	Port size		Rc3/4			
	Wetted parts material		Nickel brazing (Heat exchanger), Stainless steel, EPDM, Silicone, PPS, Fluororesin			
Facility water system	Temperature range	°C	10 to 35			
	Required flow rate Note 8)	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, Silicone, Bronze, Brass			
Electrical system	Power supply		3-phase 200/200 to 208 VAC ±10%			
	Max. operating current	A	26			
	Breaker capacity	A	30			
	Communications		Serial RS-485 (D-sub 9 pin) and Contact input/output (D-sub 25 pin)			
Dimensions Note 9)		mm	W380 x D665 x H860			
Weight Note 10)		kg	Approx. 90			
Safety standards			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 tap water or deionized water is used, please use water that conforms to Water Quality Standards of the Japan Refrigeration and Air Conditioning Industry Association (JRA GL-02-1994/cooling water system - circulation type - make-up water). The electrical conductivity of the deionized water used as the fluid varies depending on the operating conditions.
Note 3) Outlet temperature when the circulating fluid and facility water are rated flow, and the circulating fluid outlet and return port are directly connected. Installation environment, power supply, and facility water are within specification range and stable. Value obtained 10 minutes after the external load is stabilized (after stabilization with no load for HRW030-H2). It may be out of this range when a DI control kit (option Y) is used or in some other operating conditions.
Note 4) The capacity at the circulating fluid outlet when the circulating fluid temperature is 20°C. Pump capacity at 60 Hz indicates the maximum capacity of the HRW□□□-H2S (pump inverter type).
Note 5) Applicable to the HRW□□□-H2S (pump inverter type) only.
Note 6) 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 7) The automatic circulating fluid recovering function will be provided by selecting option Z for collecting the circulating fluid inside an external piping.
Note 8) Required flow rate for cooling capacity or maintaining the temperature stability.
Note 9) Panel dimensions. These dimensions do not include possible protrusions such as a breaker handle.
Note 10) Weight in the dry state without circulating fluids

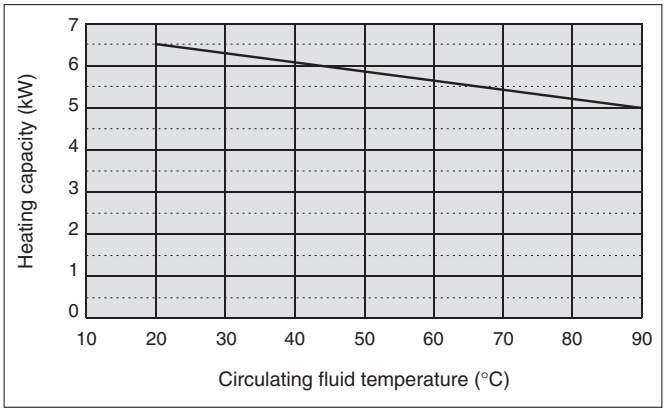
Cooling Capacity

HRW002-H2/008-H2/015-H2/030-H2
HRW002-H2S/008-H2S/015-H2S/030-H2S



Heating Capacity

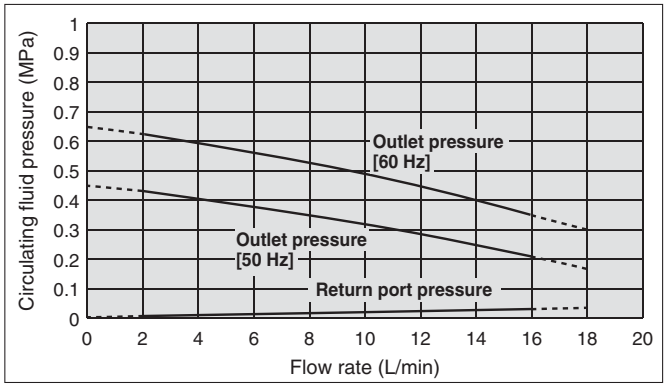
HRW002-H2/008-H2/015-H2/030-H2
HRW002-H2S/008-H2S/015-H2S/030-H2S



Pump Capacity

HRW002-H2
HRW002-H2S

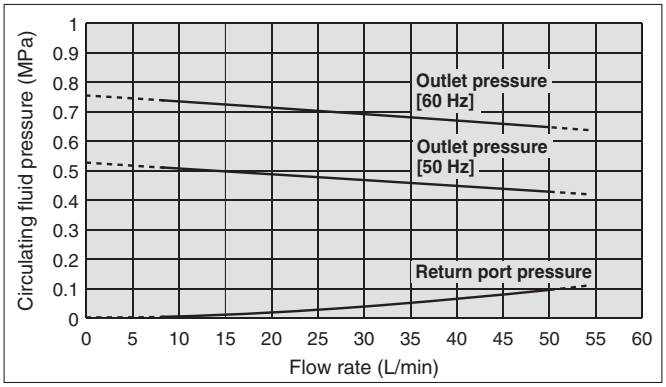
Circulating fluid: Tap water
Circulating fluid temperature: 20°C



∗ If the circulating fluid flow drops below 2 L/min., the shutdown alarm activates and operation stops. Do not use the product when the flow exceeds 16 L/min., since the flow cannot be displayed accurately.
∗ Pump capacity at 60 Hz indicates the maximum capacity of the HRW002-H2S (pump inverter type).

HRW008-H2/015-H2/030-H2
HRW008-H2S/015-H2S/030-H2S

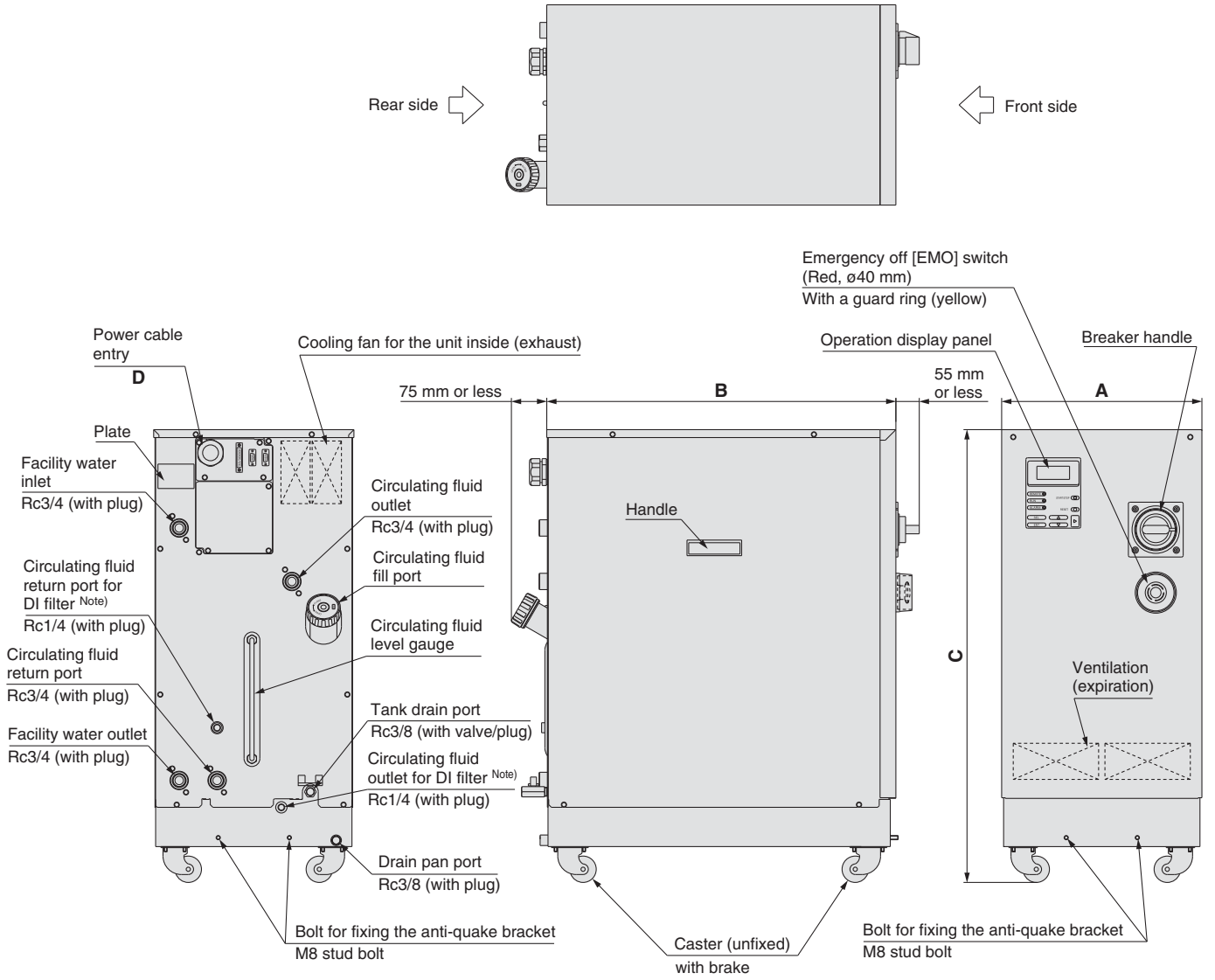
Circulating fluid: Tap water
Circulating fluid temperature: 20°C



∗ If the circulating fluid flow drops below 8 L/min., the shutdown alarm activates and operation stops. Do not use the product when the flow exceeds 50 L/min., since the flow cannot be displayed accurately.
∗ Pump capacity at 60 Hz indicates the maximum capacity of the HRW008-H2S/015-H2S/030-H2S (pump inverter type).

Common Specifications

Dimensions



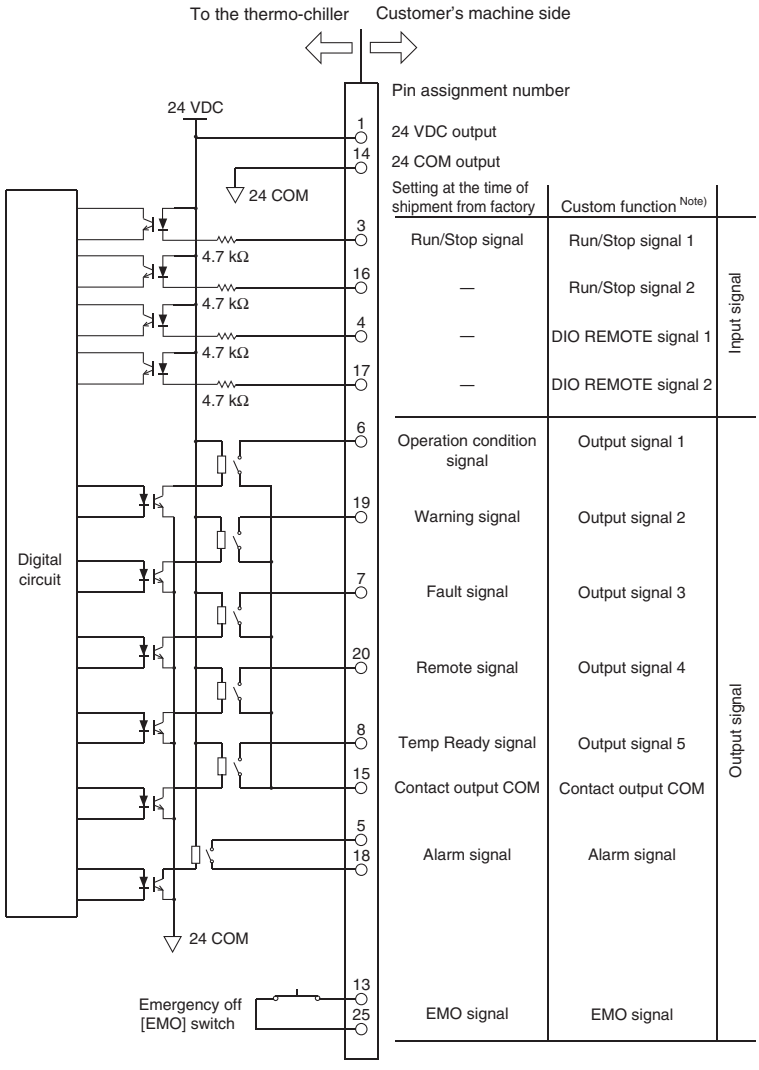
Note) Only when the DI control kit (option Y) is selected.

(mm)

Model			A	B	C	D
Fluorinated fluid type	Ethylene glycol type	Tap/Deionized 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

Communication Function (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: 200 mA DC (resistance load/inductive load) When using the power supply of the customer's machine: 800 mA AC/DC (resistance load/inductive load)
Alarm signal	**Rated load voltage**	48 VAC or less/30 VDC or less
	Maximum load current	800 mA AC/DC (resistance load/inductive load)
EMO signal	**Rated load voltage**	48 VAC or less/30 VDC or less
	Maximum load current	800 mA AC/DC (resistance load/inductive load)
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.

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

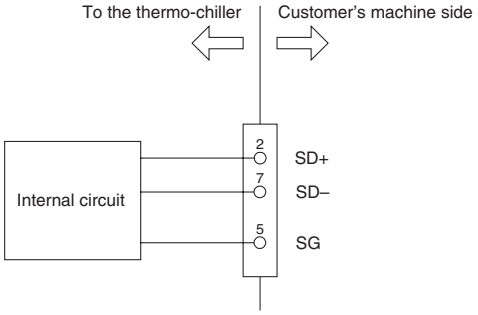
Serial RS-485

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

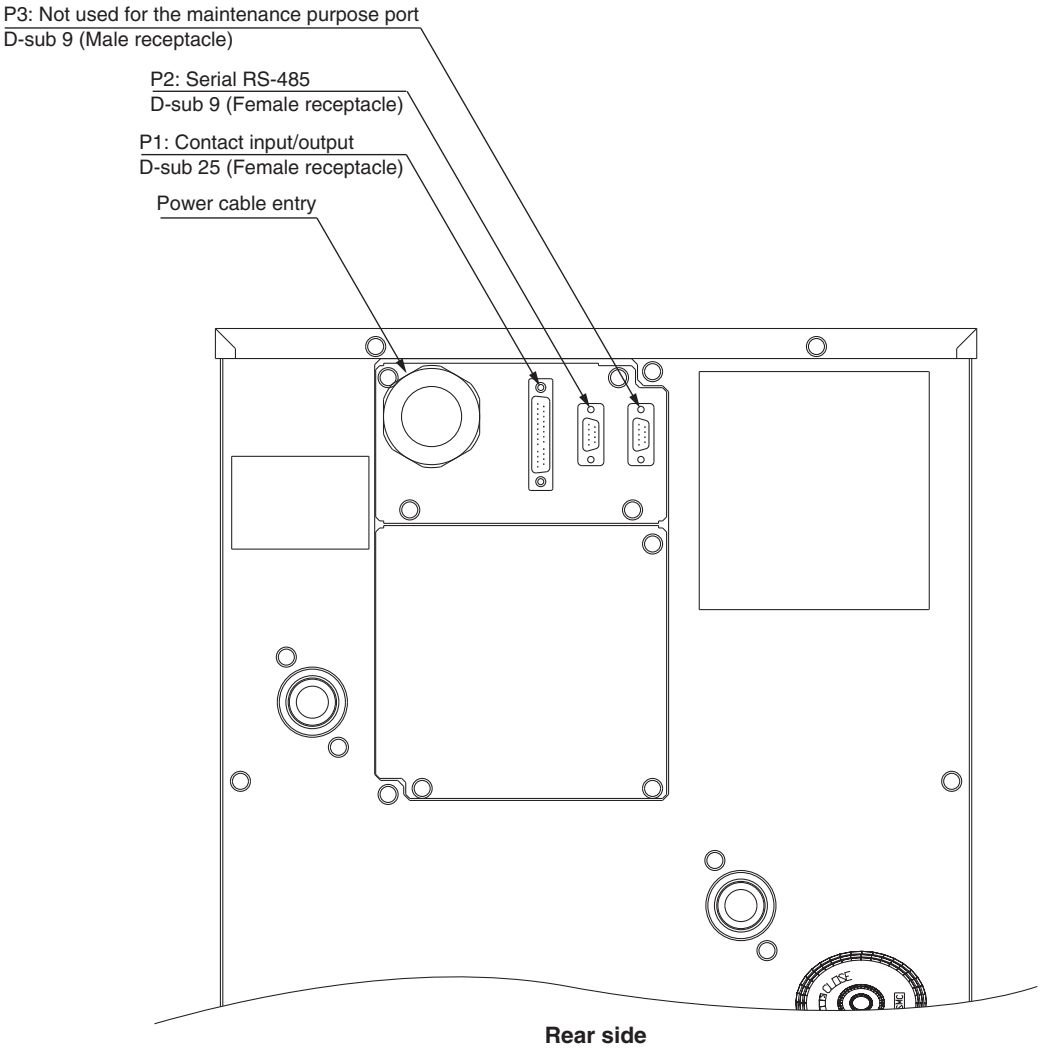
<Writing>
Run/Stop
Circulating fluid temperature setting
Circulating fluid automatic recovery start/stop*1

<Readout>
Circulating fluid present temperature
Circulating fluid flow
Circulating fluid discharge pressure
Circulating fluid electrical 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.

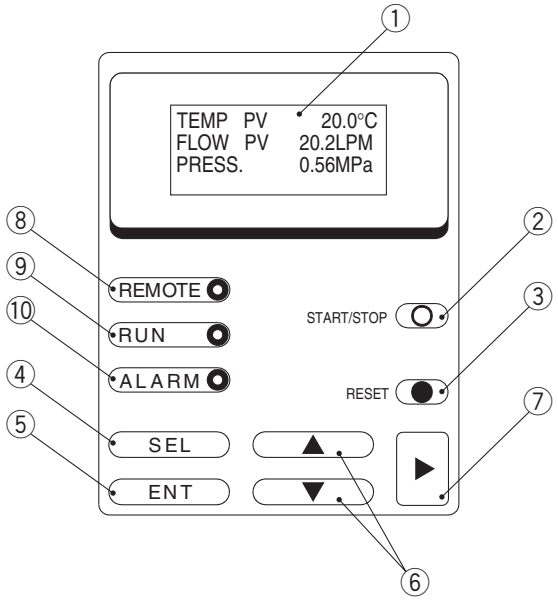
Item	Specifications
Connector no.	P2
Connector type (on this product side)	D-sub 9 P type, Female connector
Fixing bolt size	M2.6 x 0.45
Standards	EIA RS485
Protocol	Modicon Modbus
Circuit diagram	

Connector Location



Rear side

Operation Display Panel



No.	Description	Function
①	**LCD**	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] lamp**	Lights up when the unit is in the remote status.
⑨	**[RUN] lamp**	Lights up when the unit is in the operating status.
⑩	**[ALARM] lamp**	Lights up 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 code	Alarm message	Operation status	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 the 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 compressor 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 the customer. (Only for DI control kit - option Y)
25	Pump Inverter Error FLT	Stop	The error occurred in the circulating pump inverter. This alarm is applicable to the HRW□□□-H□S only.
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
	Electrical resistivity*

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

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

D Option symbol: DeviceNet Communication

HRW□□□ – □□ – D

DeviceNet communication

DeviceNet™

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	Electrical 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

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

Y Option symbol: DI Control Kit

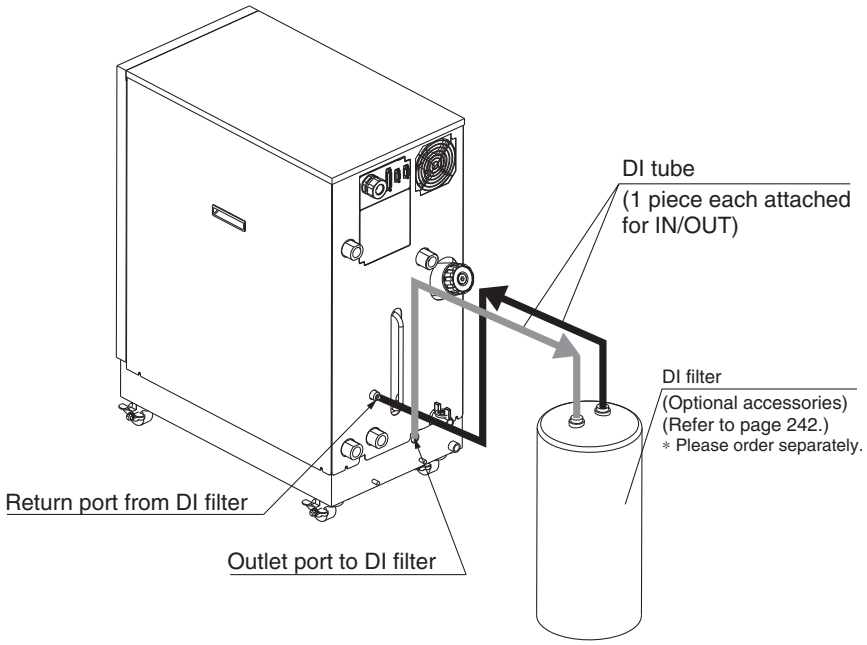
HRW□□□ – □□ – Y

DI control kit

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

Applicable model		HRW0□□-H1-Y	HRW0□□-H2-Y
Allowable circulating fluid	—	60% ethylene glycol aqueous solution	Deionized 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 rear side of the thermo-chiller.
* It may go outside of the temperature stability range of ±0.3°C when this option is used in some operating conditions.

Z Option symbol

Circulating Fluid Automatic Recovery

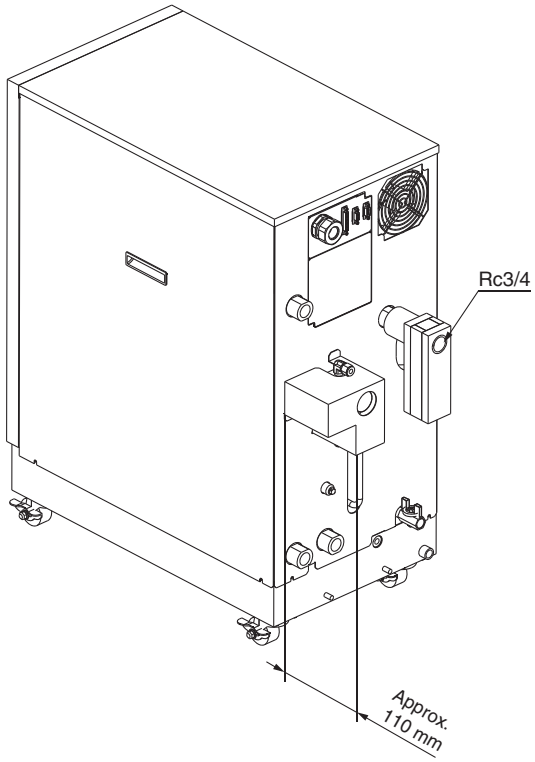
HRW□□-□□-Z

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 operation display panel.
Some components need to be fitted by the customer. For details, consult "Product Specifications" information for these options.

Applicable model		Common for all models
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 tube, where necessary, use insert fittings, etc. in order not to deform the tubings when connecting to self-align fittings.
Note 3) At the time of shipping from factory, it is set to 0.2 MPa.
Note 4) For details, please consult our "Communication Specifications" information.



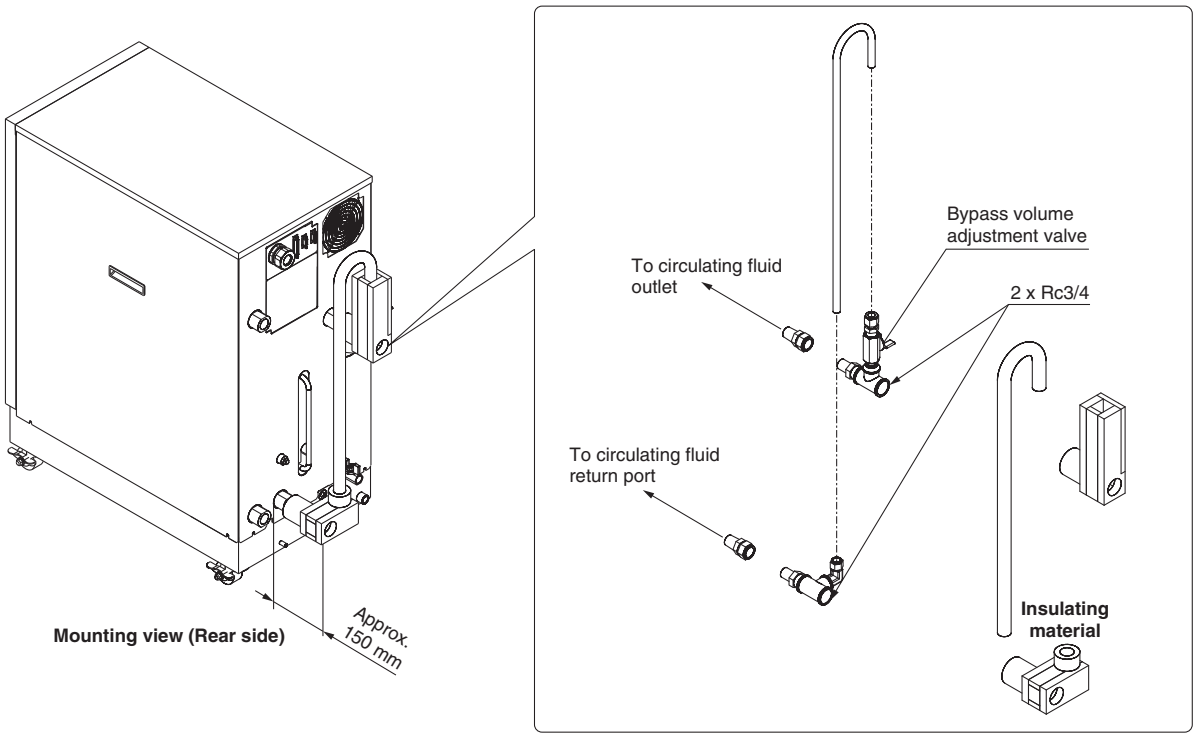
Optional Accessories

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 model
HRW-BP001	Common for all models

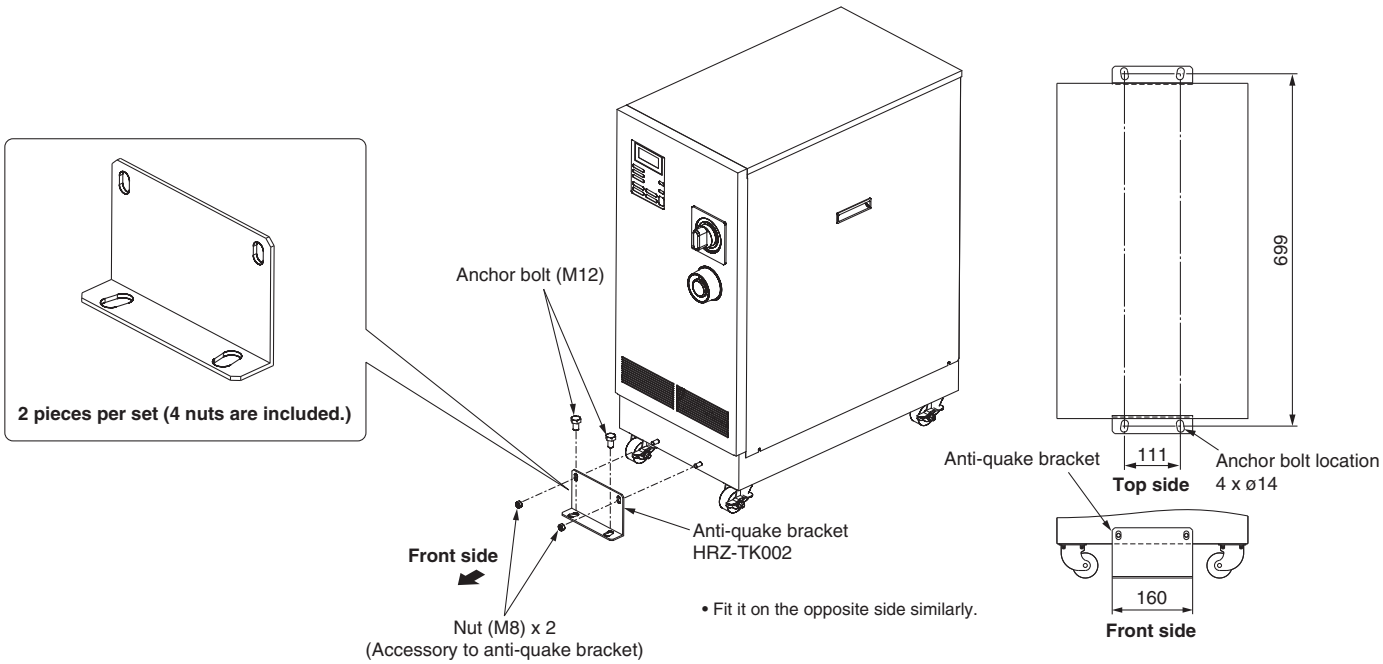


Anti-quake Bracket

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

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

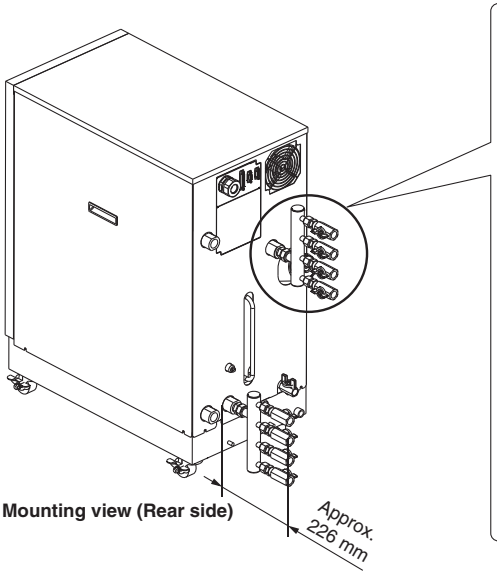
Note) 2 pieces per set (for 1 unit) (HRZ-TK002)



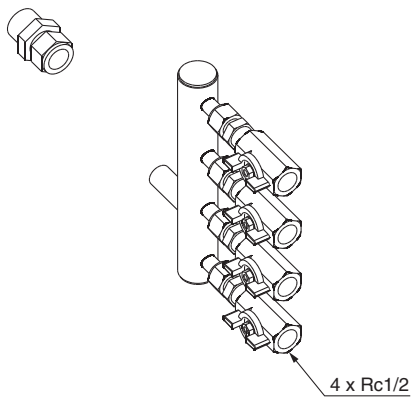
4-Port Manifold

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.

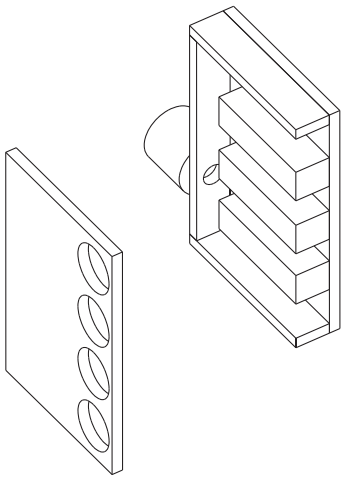
Part no.	Applicable model
HRW-MA001	Common for all models
HRW-MA002	



Mounting view (Rear side)



HRW-MA001 (2 pcs./set)



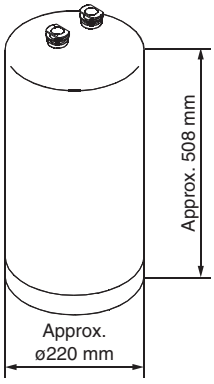
HRW-MA002 (2 pcs./set)

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 model
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 (electrical resistivity set value, circulating fluid temperature, piping volume, etc.), product life cycles will vary accordingly.

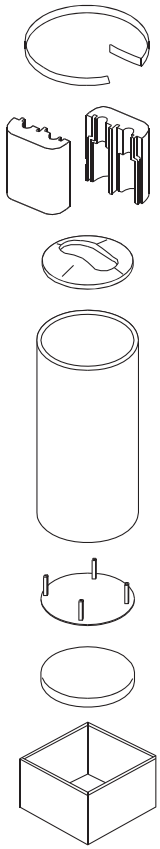


Weight: Approx. 20 kg

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 model
HRZ-DF002	Common for all models which can select the DI control kit. (option Y)

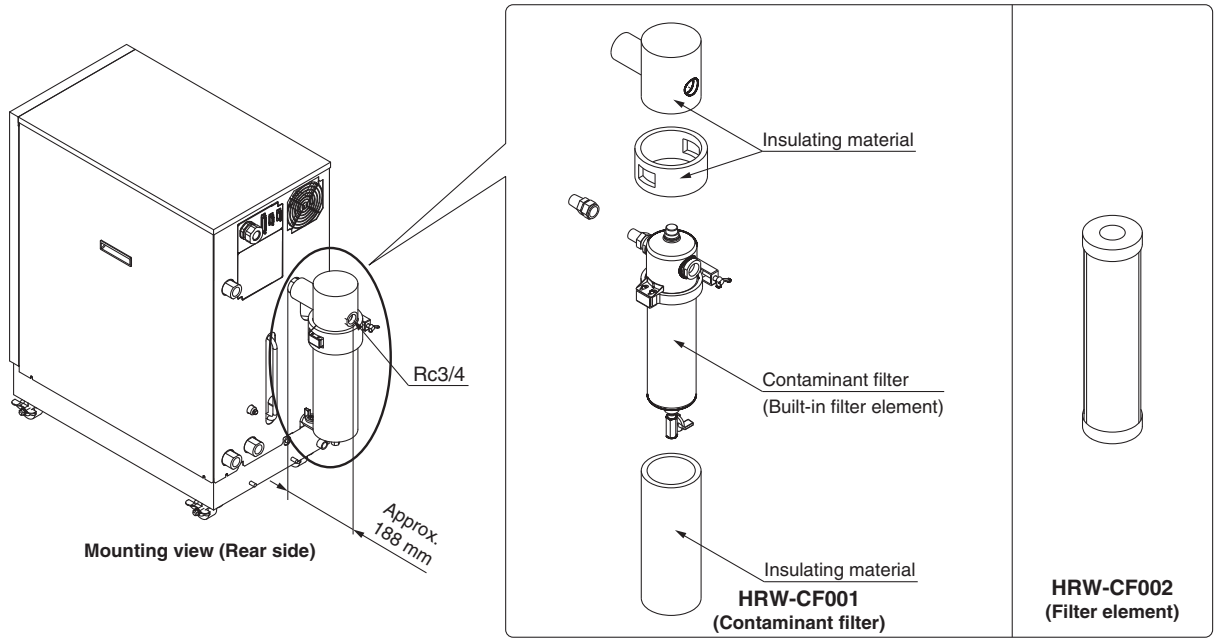


Contaminant Filter

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 model
HRW-CF001	Common for all models
HRW-CF002	

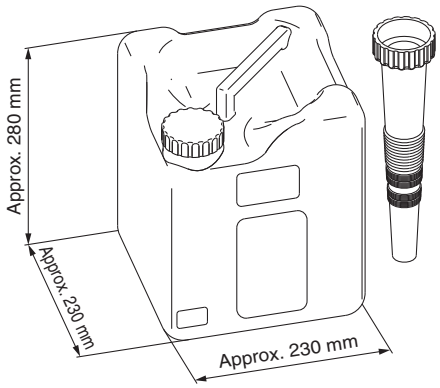
Note) The internal element of the contaminant filter (Part no.: HRW-CF002) is a replacement part. The period in service depends on the operating conditions.



60% Ethylene Glycol Aqueous Solution

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

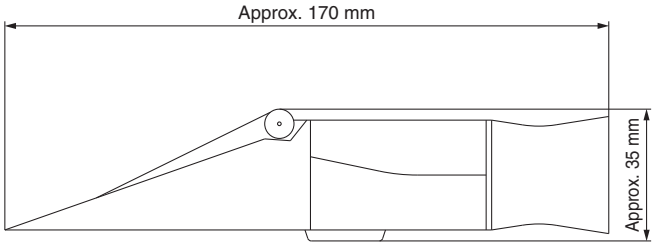
Part no.	Applicable model
HRZ-BR001	Common for all ethylene glycol-type models



Concentration Meter

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

Part no.	Applicable model
HRZ-BR002	Common for all ethylene glycol-type models



Series HRW
Specific Product Precautions 1

Be sure to read this before handling. Refer to page 341 for Safety Instructions. For Temperature Control Equipment Precautions, refer to pages 342 to 345 and the Operation Manual on SMC website, http://www.smcworld.com

Design

⚠ Warning

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

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

Selection

⚠ Caution

1. Model selection

In order to select the correct thermo-chiller model, the amount of thermal generation from the customer's system, the operating circulating fluid, and its circulating flow are required. Select a model, by referring to the guideline to model selection on page 225.

2. Option selection

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

Handling

⚠ Warning

1. Thoroughly read the Operation Manual.

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

Operating Environment/Storage Environment

⚠ Caution

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

1. Environment like written in "Temperature Control Equipment Precautions."
2. Locations where spatter will adhere to when welding.
3. Locations where it is likely that the leakage of flammable gas may occur.
4. Locations where the ambient temperature exceeds the limits as mentioned below.
   During operation 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 for the unit inside.

Circulating Fluid

⚠ Caution

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

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

3. The condensation of ethylene glycol aqueous solution must be 60% or less. If the condensation is too high, the pump will be overloaded, resulting in occurrence of "Pump Breaker Trip FLT".

4. Avoid water moisture entering the fluorinated fluid.

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

Tap Water (as Circulating Fluid) Quality Standards

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

	Item	Unit	Standard value	Influence	
				Corrosion	Scale generation
Standard item	pH (at 25°C)	—	6.0 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		○
	Ionic state silica (SiO_2)	[mg/L]	30 or less		○
Reference item	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.
• ○: Factors that have an effect on corrosion or scale generation.
• Even if the water quality standards are met, complete prevention of corrosion is not guaranteed.

Transportation/Carriage/Movement

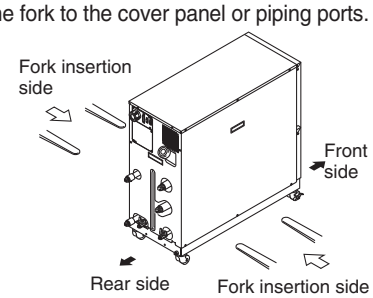
⚠ Warning

1. Transportation by forklift

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

2. Transportation by casters

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



Series HRW
Specific Product Precautions 2

Be sure to read this before handling. Refer to page 341 for Safety Instructions. For Temperature Control Equipment Precautions, refer to pages 342 to 345 and the Operation Manual on SMC website, http://www.smcworld.com

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 (Silicone sealant)

4. **For the circulating fluid pipings, use clean pipings which have no dust, oil or water moisture inside the pipings, and blow with air prior to undertaking any piping works.**

   If any dust, oil or water moisture enters the circulating fluid circuit, inferior cooling performance or equipment failure due to frozen water may occur, resulting in bubbles in the circulating fluid inside the tank.

5. **Select the circulating fluid pipings which can exceed the required rated flow.**

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

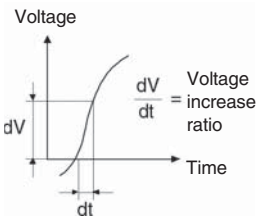
6. **For the circulating fluid piping connection, install a drain pan just in case the circulating fluid may leak.**
7. **Do not return the circulating fluid to the unit by installing a pump in the customer system.**

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 a malfunction.

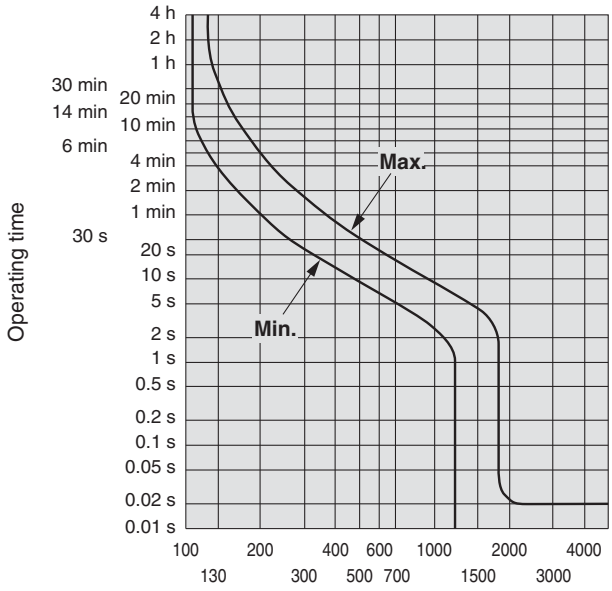


3. **This product is installed with a breaker with the following operating characteristics.**

   For the customer's machine (inlet side), use a breaker whose operating time is equal to or longer than the breaker of this product. If a breaker with shorter operating time is connected, the customer's machine could be cut off due to the inrush current of the motor of this product.

Breaker Operating Characteristics

Common for all models



Series HRW
Specific Product Precautions 3

Be sure to read this before handling. Refer to page 341 for Safety Instructions. For Temperature Control Equipment Precautions, refer to pages 342 to 345 and the Operation Manual on SMC website, http://www.smcworld.com

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 the case of fluorinated fluids:
   Discharge the circulating liquid and avoid any dirty objects, or water moisture, or foreign objects entering the system.
2. In the case of ethylene glycol aqueous solution:
   Maintain the condensation at 60%.
3. In case of tap water, deionized 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 page 344.

Peltier-Type Chiller/Thermo-con

Series HECR

Air-cooled **Rack Mount Type**



Good space utilization

Mountable in a 19-inch rack

Saves space by mounting multiple equipment together in a rack.

Temperature stability ±0.01°C to 0.03°C

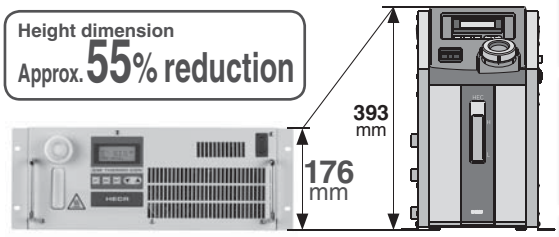
Set temperature range 10°C to 60°C

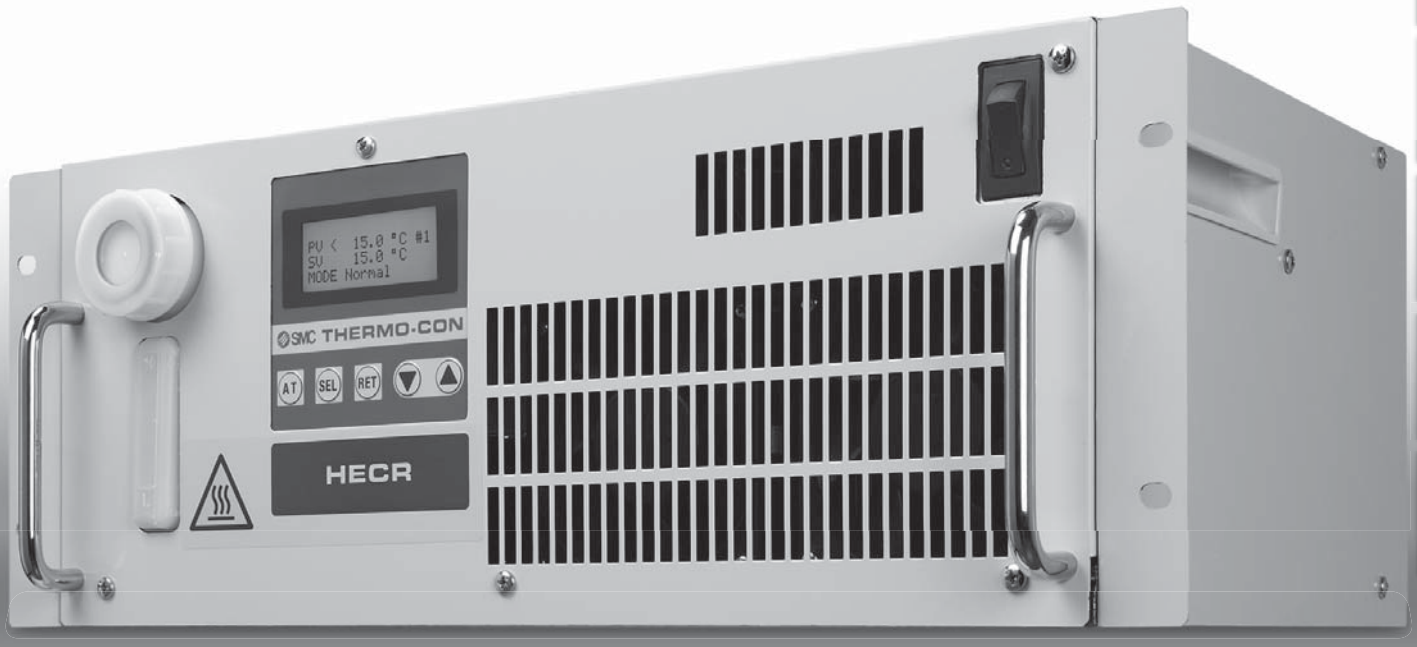
Cooling capacity 200 W

Power consumption Energy saving 440 W (100 V input, 4.6 A)

Space saving design with reduced height

Height dimension Approx. 55% reduction





Can precisely control the temperature of a heat source or process fluid.

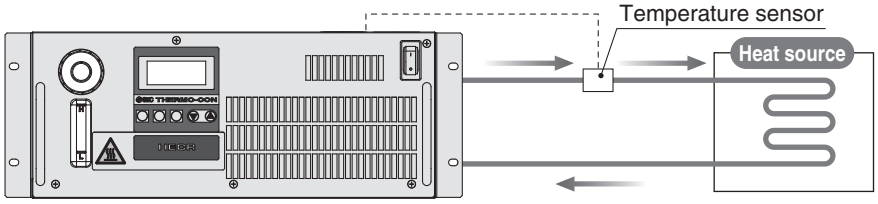
Precisely control the temperature of the circulating fluid by using the Peltier device.
Refrigerant-free and environmentally friendly.

Radiating method Air-cooled **Cooling capacity** 200 W **Heating capacity** 600 W

Power supply Single-phase 100 to 240 VAC (Globally compatible power supplies)

Learning control function (Temperature control by external temperature sensor)

This function adjusts the fluid temperature to the set value with an automatic offset setting. Set the external temperature sensor at the circulating fluid inlet located just in front of the heat source, which allows the thermo-con to sample the fluid temperature. This function is effective when automatically adjusting for heat exhaust from piping etc.



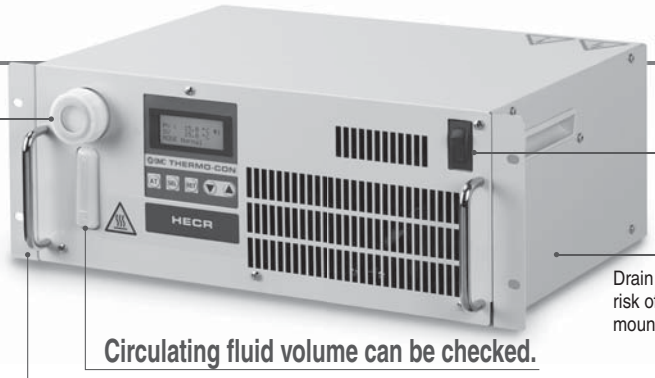
If the external temperature sensor is installed directly on the heat source, the learning control function may not work property due to large heat volume or large temperature difference. Be sure to install the sensor at the circulating fluid inlet.

Simple operation



❶ Turn the power ON.
❷ Press the (SEL) key, and adjust the temperature setting with the ▼▲ keys.
❸ Press the (RET) key to complete.

Fluid fill port
Fluid can be supplied without removing the product from the rack.



Power switch

Drain pan
Drain pan is equipped to avoid any risk of fluid leakage over equipment mounted in a lower rack.

Circulating fluid volume can be checked.

Rack mounting bracket

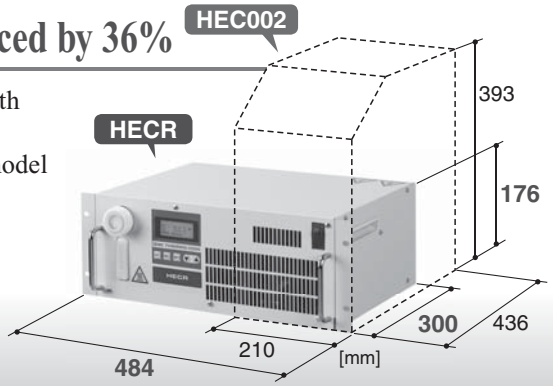
Floor type is also available. (Option)
The rack mounting brackets and the handles can be removed and rubber feet can be mounted instead. (Refer to page 259 for details.)

Low vibration, Low noise (49 dBA)

Less vibration and noise with no moving parts such as a compressor.

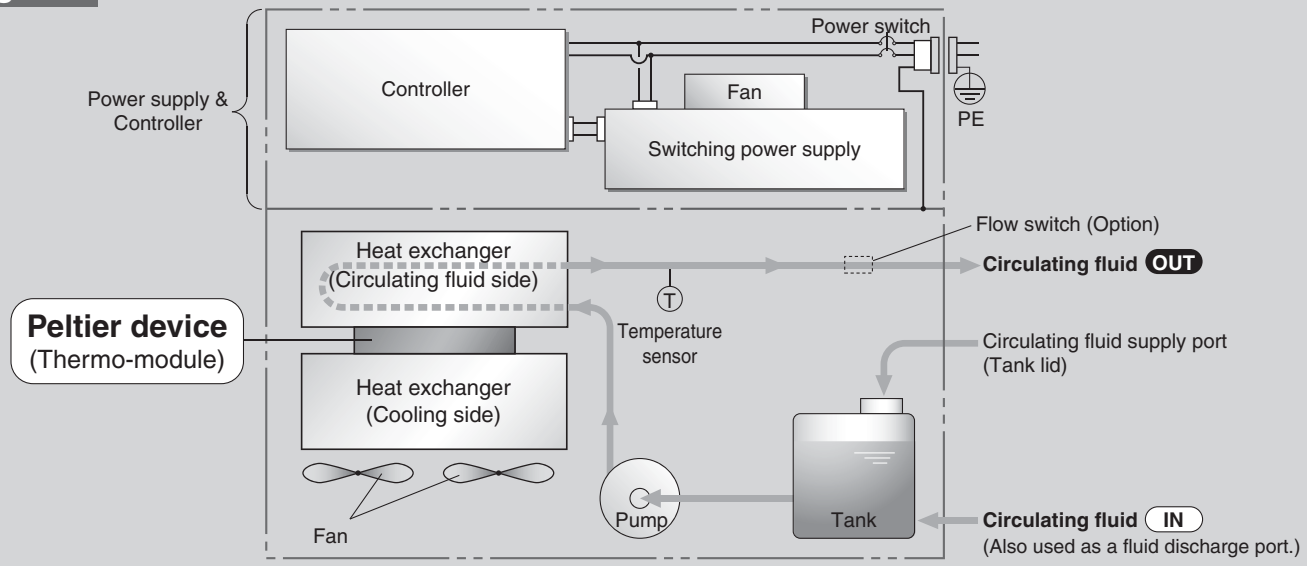
Volume ratio reduced by 36%

Better space utilization with reduced height and depth compared to the current model (HEC002).



Construction and Principles

Figure 1



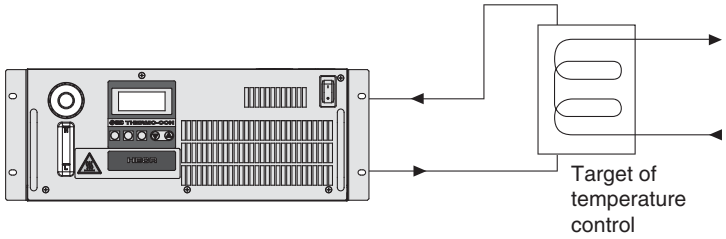
For the rack type, a flow switch (option) is mounted on the circulating fluid OUT side.

The thermo-con is constructed as shown in Figure 1. It interposes a Peltier device (thermo-module) between the heat exchangers for the circulating fluid and facility water and controls the DC power supply to achieve the target outlet temperature of circulating fluid precisely.

The circulating fluid returns to the tank, and is transferred by the pump which is built in the thermo-con, and goes through the heat exchangers and temperature sensor and out from the circulating fluid outlet.

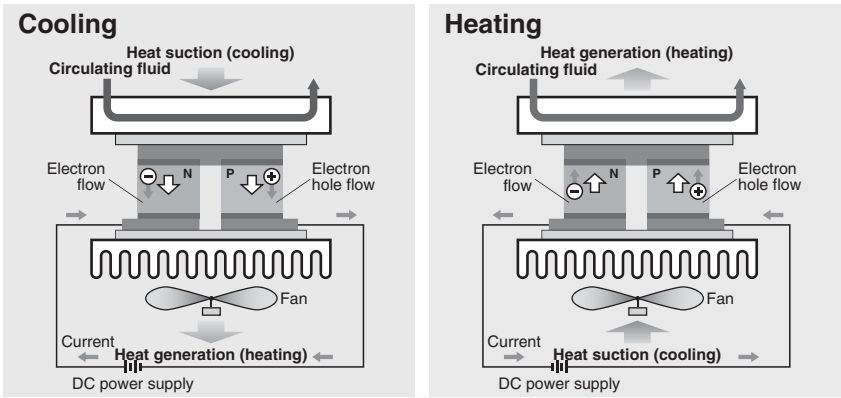
Figure 2 shows an example of circulating fluid piping. The circulating fluid is transferred at a constant temperature by the pump.

Figure 2 **Example of circulating fluid piping**



Principle of Peltier Device (Thermo-module)

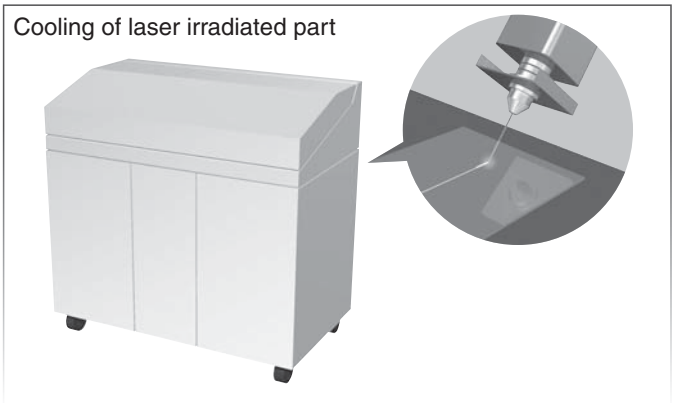
A Peltier device (thermo-module) is a plate type element, inside which P-type semiconductors and N-type semiconductors are located alternately. If direct current is supplied to the Peltier device (thermo-module), heat is transferred inside the device, and one face generates heat and increases temperature while the other face absorbs heat and decreases temperature. Therefore, changing the direction of the current supplied to the Peltier device (thermo-module) can achieve heating and cooling operation. This method has a fast response and can shift quickly between heating and cooling, so temperature can be controlled very precisely.



Application Examples

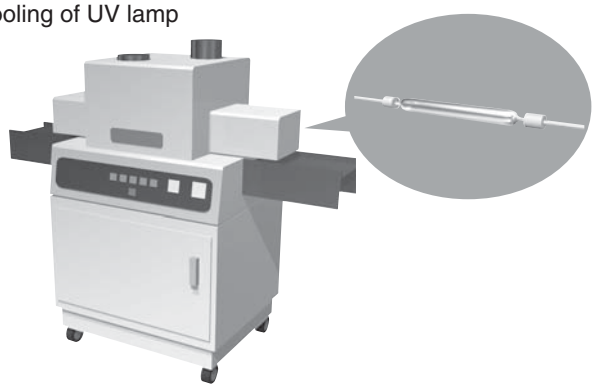
Laser machining

Cooling of laser irradiated part



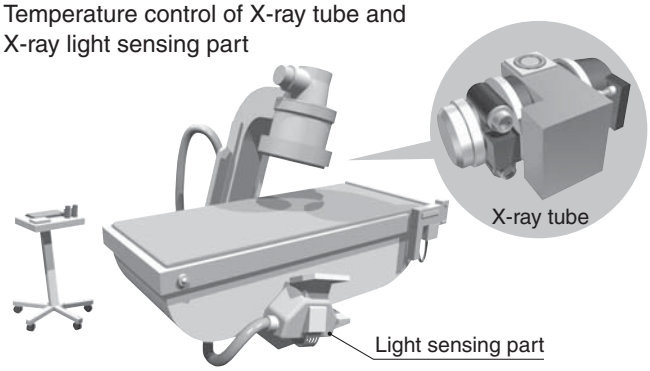
UV curing device (printing, painting, bonding and sealing)

Cooling of UV lamp



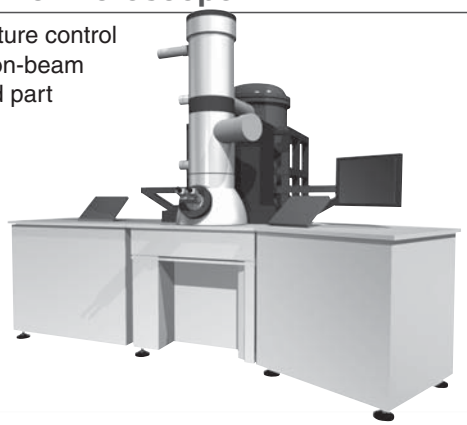
X-ray (digital) instrument

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



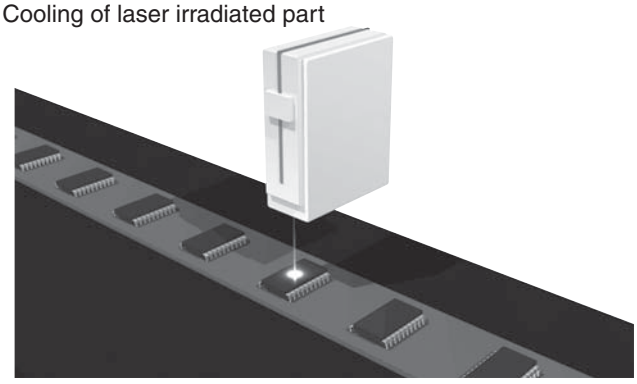
Electronic microscope

Temperature control of electron-beam irradiated part



Laser marker

Cooling of laser irradiated part



Ultra sonic wave inspection machine

Temperature control of ultrasonic wave laser part



CONTENTS

Series HECR/HECR010





Thermo-con/Rack Mount Type
Series HECR

Model Selection ····· Page 253
How to Order/Specifications **Air-cooled** ····· Page 255
Cooling Capacity ····· Page 256
Heating Capacity ····· Page 256
Pump Capacity (Thermo-con Outlet) ····· Page 256
Dimensions ····· Page 257
Operation Display Panel ····· Page 258
Alarm ····· Page 258
Maintenance ····· Page 258

● Options

With Feet and No Rack Mounting Brackets ····· Page 259
With Flow Switch ····· Page 259

● Optional accessories

Power Supply Cable ····· Page 260

Specific Product Precautions ····· Page 261

Thermo-con/Rack Mount Type
Series HECR010

How to Order/Specifications **Air-cooled** ····· Page 263
Cooling Capacity ····· Page 264
Heating Capacity ····· Page 264
Pump Capacity (Thermo-con Outlet) ····· Page 264
Dimensions ····· Page 265

● Options

With Feet and No Rack Mounting Brackets ····· Page 266
With Flow Switch ····· Page 266
High-pressure Pump Mounted ····· Page 266

Series HECR
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-con: 10 to 60°C

If a lower temperature (down to –20°C) or higher temperature (up to 90°C) than this range is necessary, select the thermo-chiller HRZ series.

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

Circulating fluids that can be used in the thermo-con: Tap water, Ethylene glycol 20%

When using fluorinated fluids, select the water-cooled thermo-con HEC series.

3. How much cooling capacity required?

Allows a safety factor of 20% over the capacity that is actually required, taking into account the changes in the operating conditions. If a larger capacity than this thermo-con is necessary, select the Peltier-type thermo-con HEC series (refer to the following.) or the refrigerated thermo-chiller HRS/HRZ series.

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

Heat generation amount: 400 W

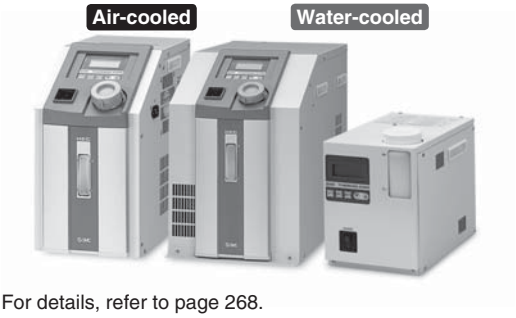
Cooling capacity = Considering a safety factor of 20%,

400 W x 1.2 = 480 W

Thermo-con/*Series HEC*

High-precision temperature control type for semi-conductor manufacturing equipment, medical equipment, etc.

- **Cooling capacity: 140 W to 1200 W**
- **Temperature stability: ±0.01°C to 0.03°C**



For details, refer to page 268.

Guide to Model Selection

Example 2 | When the heat generation amount in the user's equipment is not known.

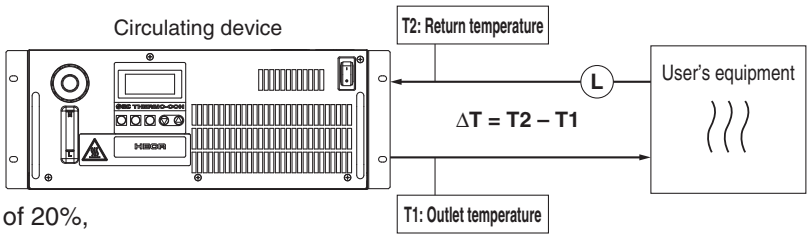
Obtain the temperature difference between inlet and outlet by circulating the fluid inside the user's equipment.

Heat generation amount **Q** : Unknown
Circulating fluid temperature difference ΔT (= **T2** – **T1**) : 0.8°C (0.8 K)
Circulating fluid outlet temperature **T1** : 25°C (298.15 K)
Circulating fluid return temperature **T2** : 25.8°C (298.95 K)
Circulating fluid flow rate **L** : 3 L/min
Circulating fluid : Water
Density γ: 1 x 10^3 kg/m^3
Specific heat **C**: 4.2 x 10^3 J/(kg·K)

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

$$= \frac{0.8 \times 3 \times 1 \times 10^3 \times 4.2 \times 10^3}{60 \times 1000}$$

$$= 167\ W$$



Cooling capacity = Considering a safety factor of 20%,

167 W x 1.2 = 200 W

Example 3 | When cooling the object below a certain temperature in certain period of time.

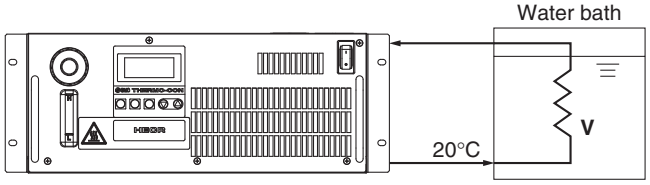
Cooled substance total volume **V** : 2 L
Cooling time **h** : 15 min
Cooling temperature difference ΔT : Temperature difference: 10°C (10 K). Cool from 30°C (303 K) to 20°C (293 K).
Circulating fluid : Tap water
Density γ: 1 x 10^3 kg/m^3
Specific heat **C**: 4.2 x 10^3 J/(kg·K)

∗ Refer to the information shown below for the typical physical property values by circulating fluid.

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

$$= \frac{10 \times 2 \times 1 \times 10^3 \times 4.2 \times 10^3}{15 \times 60 \times 1000}$$

$$= 93.3\ W$$



After 15 min, cool 30°C down to 20°C.

Cooling capacity = Considering a safety factor of 20%,

93.3 W x 1.2 = 112 W

Precautions on Model Selection

The flow rate of the circulating fluid depends on the pressure loss of the user's equipment and the length, diameter and resistance created by bends in the circulating fluid piping etc. Check if the required flow rate of circulating fluid can be obtained before selecting.

Circulating Fluid Typical Physical Property Values

Ethylene Glycol Solution 20%

Temperature [°C]	Density ρ [kg/L]	Specific heat C [J/(kg·K)]
10	1.03	3.93 x 10^3
20	1.03	3.95 x 10^3
30	1.02	3.97 x 10^3
40	1.02	3.98 x 10^3
50	1.01	4.00 x 10^3
60	1.01	4.02 x 10^3

Water

Density γ: 1 x 10^3 [kg/m^3] **Specific heat C: 4.2 x 10^3 [J/(kg·K)]**

Thermo-con/ Rack Mount Type

Series HECR Air-cooled



How to Order

HECR 002 – A 5 □ – □

Cooling capacity

002	200 W

Radiating method

A	Air-cooled

Power supply

5	100 to 240 VAC

Pipe thread type

Nil	Rc
N	NPT thread

Option

Nil	None
E	With feet and no rack mounting brackets
F	With flow switch

Specifications

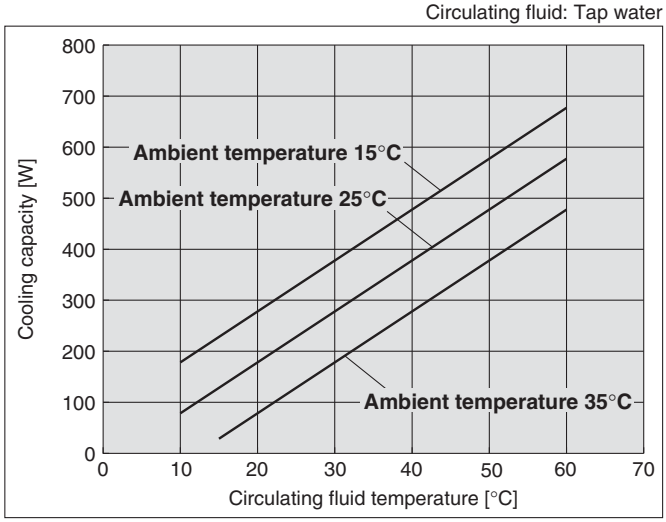
Model		HECR002-A
Cooling method		Thermoelectric device (Thermo-module)
Radiating method		Forced air cooling
Control method		Cooling/Heating automatic shift PID control
Ambient temperature/humidity		10 to 35°C, 35 to 80%RH (No condensation)
Circulating fluid system	Circulating fluid	Tap water, Ethylene glycol 20%
	Set temperature range	10.0 to 60.0°C (No condensation)
	Cooling capacity	200 W (Tap water) Note 1)
	Heating capacity	600 W (Tap water) Note 1)
	Temperature stability Note 2)	±0.01 to 0.03°C
	Pump capacity	Refer to the performance charts. (Page 256)
	Tank capacity	Approx. 1.3 L
	Port size	Rc1/4
	Wetted parts material	Stainless steel, EPDM, Ceramics, PPE, Carbon, PP, PE
Electrical system	Power supply	Single-phase 100 to 240 VAC ±10%, 50/60 Hz
	Overcurrent protector	10 A
	Current consumption	5 A (100 V) to 2.5 A (240 V)
	Power consumption	440 W Note 1)
	Alarm	Refer to “Alarm.” (Page 258)
	Communications	RS232C/RS-485
Weight		Approx. 14 kg
Accessories		Power supply connector, Operation Manual Power supply cable should be ordered as an option (sold separately) or prepared by the user.
Safety standards		CE marking, UL (NRTL) standards

Note 1) Conditions: Set temperature 25°C, Ambient temperature 25°C, Circulating flow rate 3 L/min

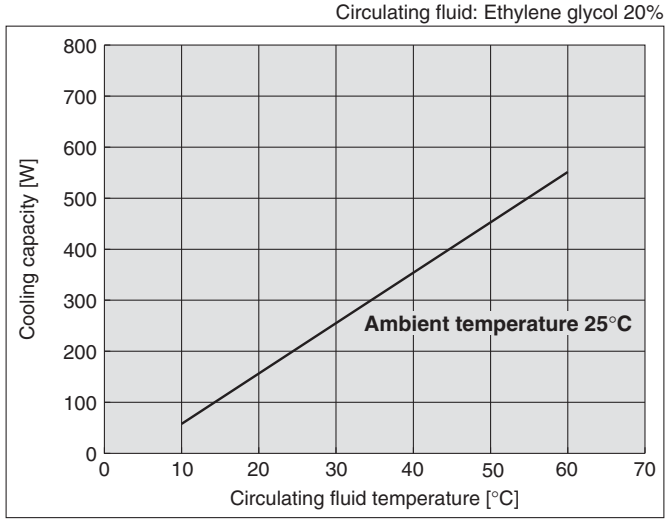
Note 2) The indicated values are with a stable load without turbulence in the operating conditions. It may be out of this range in some other operating conditions.

Cooling Capacity

Circulating fluid: Tap water

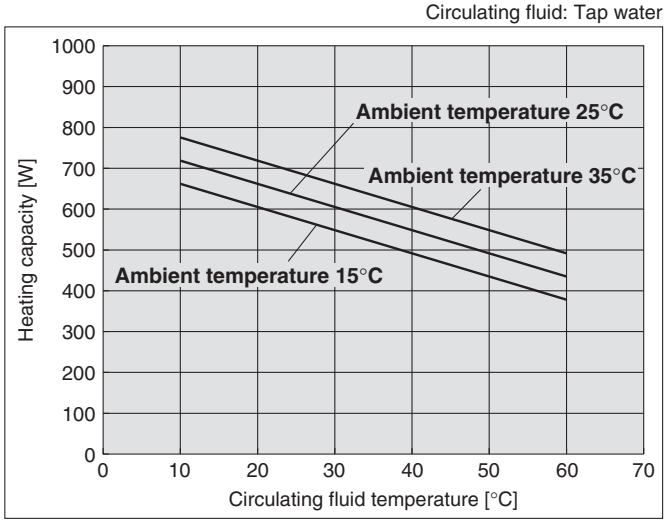


Circulating fluid: Ethylene glycol 20%

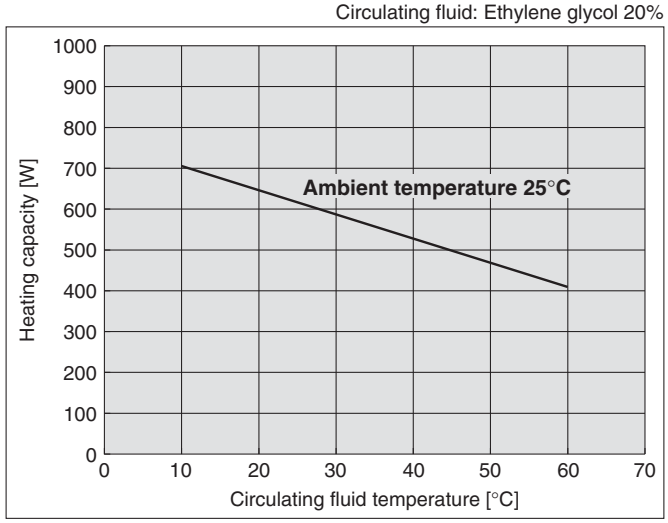


Heating Capacity

Circulating fluid: Tap water

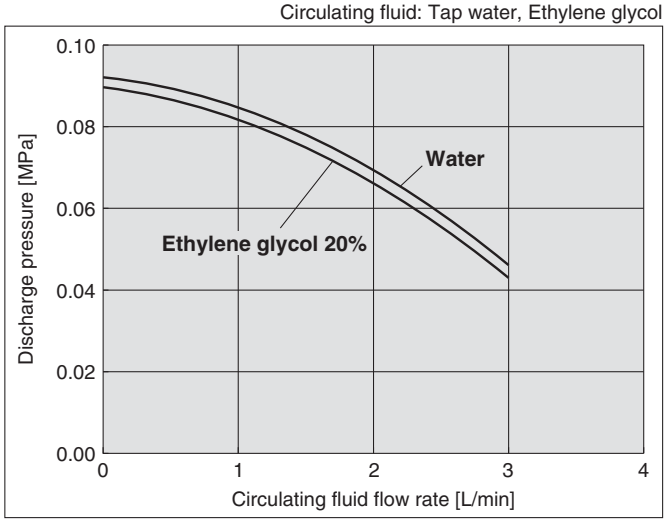


Circulating fluid: Ethylene glycol 20%



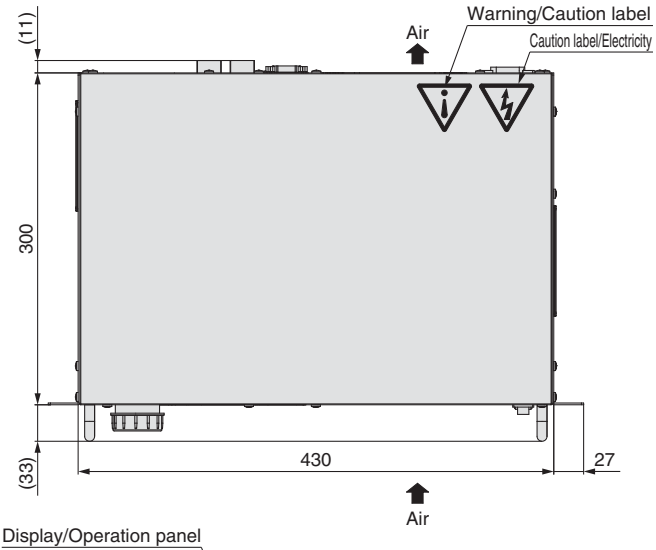
Pump Capacity (Thermo-con Outlet)

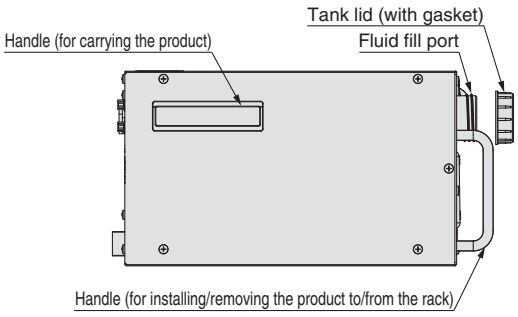
Circulating fluid: Tap water, Ethylene glycol

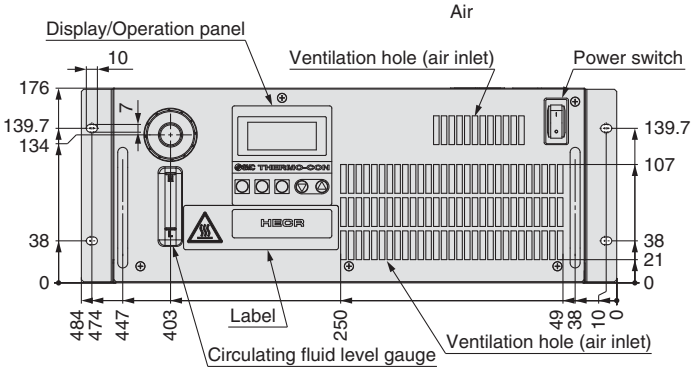


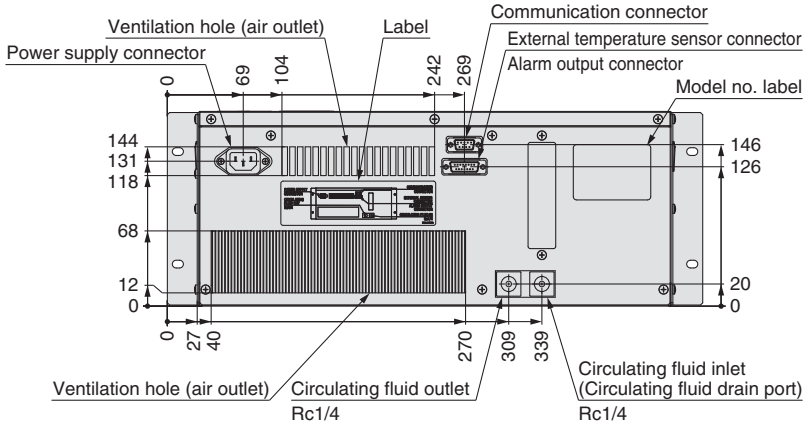
Dimensions

HECR002-A5



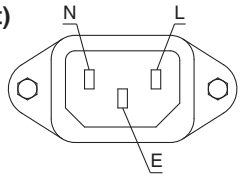






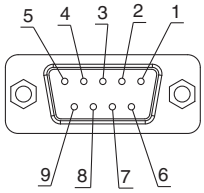
1. Power supply connector
IEC60320 C14 (or equivalent)

Pin no.	Signal contents
N	100-240 VAC
L	100-240 VAC
E	PE



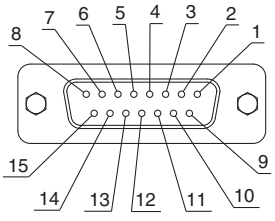
2. Communication connector
D-sub 9 pin (socket)
Holding screw: M2.6

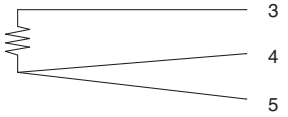
Pin no.	Signal contents	
	RS-232C	RS-485
1	Unused	BUS+
2	RD	Unused
3	SD	Unused
4	Unused	Unused
5	SG	SG
6-8	Unused	Unused
9	Unused	BUS–



3. External temperature sensor connector/Alarm output connector
D-sub 15 pin (socket)
Holding screw: M2.6

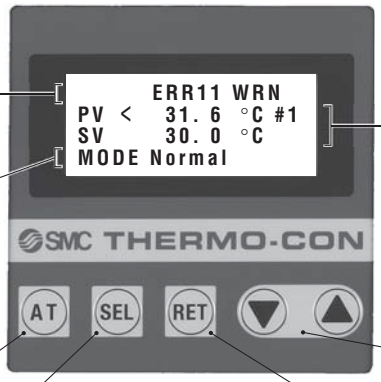
Pin no.	Signal contents
1-2	Unused
3	Terminal A of resistance temperature detector
4	Terminal B of resistance temperature detector
5	Terminal B of resistance temperature detector
6	Contact a for output cutoff alarm (open when alarm occurs)
7	Common for output cutoff alarm
8	Contact b for output cutoff alarm (closed when alarm occurs)
9	Contact a for upper/lower temp. limit alarm (open when alarm occurs)
10	Common for upper/lower temp. limit alarm
11	Contact b for upper/lower temp. limit alarm (closed when alarm occurs)
12-14	Unused
15	FG





Connection diagram of resistance temperature sensor

Operation Display Panel



1st line
Indicates No. corresponding to the alarm which arises and [WRN] comes to light up when the upper or lower temperature limit warning occurs.

4th line
Indicates control operation mode during normal operation and set values during setting mode selection.

AT key
Used to start and stop auto tuning.

SEL key
Used to change setting mode.

2nd, 3rd line
Indicates present temperature [PV] and target temperature [SV] during normal operation. When the alarm arises, the error is indicated instead and during setting mode selection, the selected setting mode is indicated.

▽△ key
Used to change set value in each setting mode.

RET key
Used to fix set value or return to present temperature status indication.

Alarm

This unit is equipped as standard with a function allowing 14 kinds of alarms to display on the LCD and can be read out by serial communication. Also, it can generate relay output for upper/lower temperature limit alarm and output cutoff alarm.

Alarm

Alarm code	Alarm description	Operation status	Main reason
WRN	Upper/Lower temp. limit alarm	Continue	The temperature has become out of upper/lower limit range for the target temperature.
ERR01	System error 1	Stop	The internal cable of the Thermo-con has been broken due to abnormal vibration or dropping the product.
ERR02	System error 2	Stop	EEPROM data has been lost due to high level noise.
ERR03	Back-up data error	Stop	EEPROM data of the controller has been destroyed due to high level noise.
ERR11	DC power supply failure	Stop	The DC power supply has failed (due to fan stop or abnormal high temperature) or the thermo-module has been short-circuited.
ERR12	Internal temp. sensor high temp. error	Stop	The internal temperature sensor has become higher than high temp. cutoff setting.
ERR13	Internal temp. sensor low temp. error	Stop	The internal temperature sensor has become lower than low temp. cutoff setting.
ERR14	Thermostat alarm	Stop	The thermostat has been activated due to filter clog or fan/pump failure, etc.
ERR15	Abnormal output alarm	Continue	The temperature cannot be changed even at 100% output due to overload or disconnection of the thermo-module.
ERR16	Low flow rate alarm (Option)	Stop	The flow rate of the circulating fluid has dropped.
ERR17	Internal temp. sensor disconnection alarm	Stop	The internal temperature sensor has been disconnected or short-circuited.
ERR18	External temp. sensor disconnection alarm	Continue	The external temperature sensor has been disconnected or short-circuited. (Only detected when in learning control or external tune control)
ERR19	Abnormal auto tuning alarm	Stop	Auto tuning has not been completed within 20 minutes.
ERR20	Low fluid level alarm	Stop	The amount of circulating fluid in the tank has dropped.

Maintenance

Maintenance of this unit is performed only in the form of return to and repair at SMC's site. As a rule, SMC will not conduct on-site maintenance.

Series HECR
Options

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

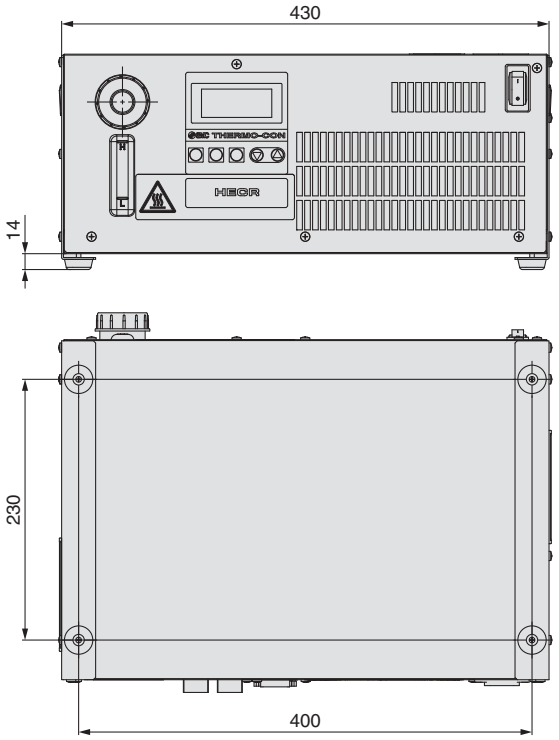
E Option symbol

With Feet and No Rack Mounting Brackets

HECR002-A5□-E

With feet and no rack mounting brackets

Rack mounting brackets and handles on the front side are removed as they are not necessary when the product is not mounted in a rack. This option has rubber feet for installing the product on the floor.



F Option symbol

With Flow Switch

HECR002-A5□-F

With flow switch

This is an ON/OFF switch detecting low levels of the circulating fluid. When the fluid volume is 1 L/min or less, “ERR16” is displayed and the thermo-con stops. The flow switch is built into the thermo-con.
Refer to page 250.

Applicable model
HECR002-A5□-F

Optional Accessories

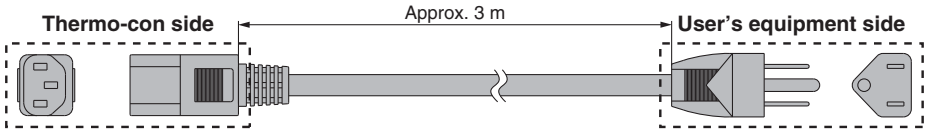
① Power Supply Cable

■ For single-phase 100/115 VAC type

∗ Not applicable for the 200 V type.

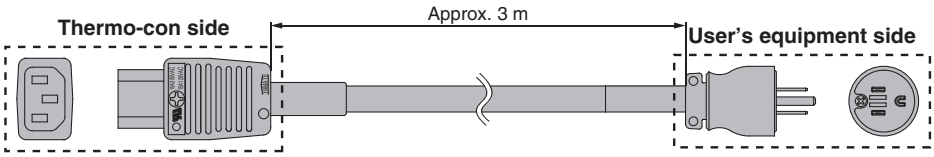
Part no.	Applicable model
HRS-CA001	HECR002

∗ Not applicable to the retaining clip.



Part no.	Applicable model
HRS-CA003	HECR002

∗ Applicable to the retaining clip.

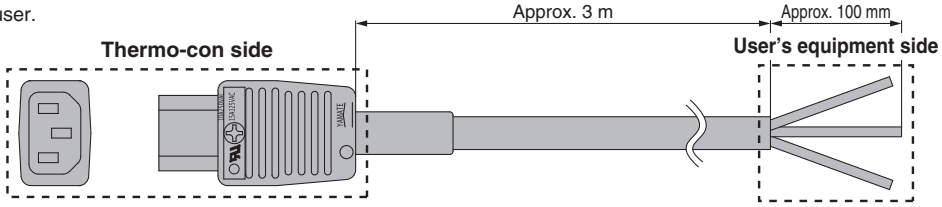


■ For single-phase 200 VAC type

∗ Also applicable for the 100 VAC type, but the connector for the user's equipment needs to be prepared by the user.

Part no.	Applicable model
HRS-CA002	HECR002

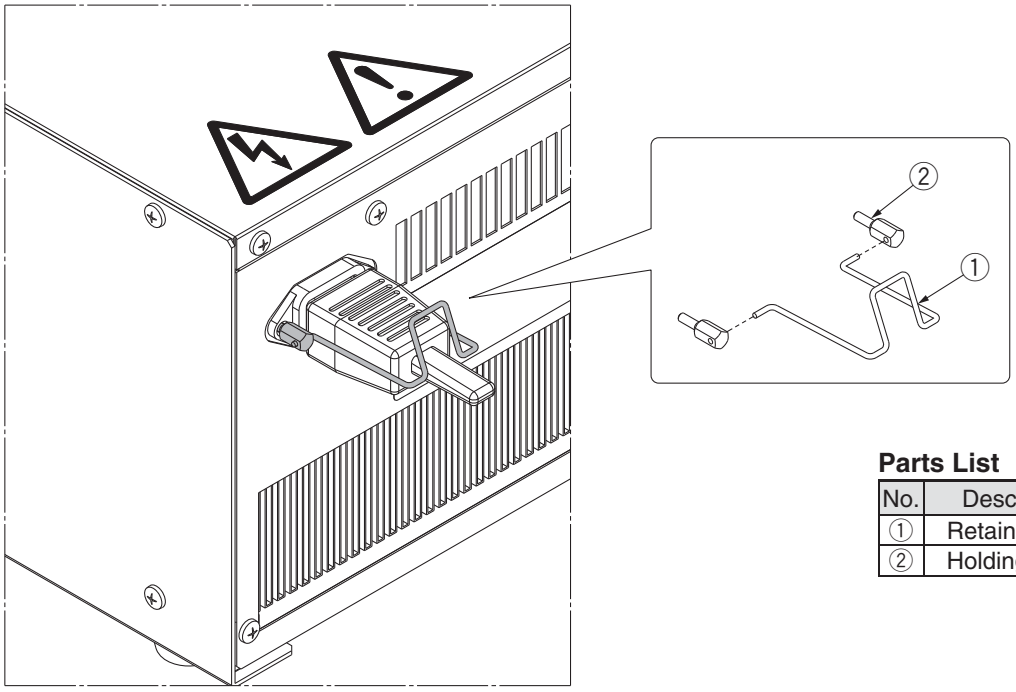
∗ Applicable to the retaining clip.



■ Retaining clip

Holds the connector on the thermo-con side in position.

Part no.	Applicable power supply cable model
HRS-S0074	HRS-CA002 HRS-CA003 Power supply connector for accessory



Parts List

No.	Description
①	Retaining clip
②	Holding screw

Series HECR
Specific Product Precautions 1

Be sure to read this before handling. Refer to page 341 for Safety Instructions. For Temperature Control Equipment Precautions, refer to pages 342 to 345 and the Operation Manual on SMC website, http://www.smcworld.com

System Design

⚠Warning

1. This catalog shows the specifications of the thermo-con.

1. Check the detailed specifications in the separate "Product Specifications", and evaluate the compatibility of the thermo-con with user's system.
2. Although the protection circuit as a single unit is installed, the user is requested to carry out the safety design for the whole system.

Handling

⚠Warning

1. Thoroughly read the Operation Manual.

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

2. If the set temperature is repeatedly changed by 10°C or more, the thermo-con may fail in short periods of time.

Operating Environment/Storage Environment

⚠Warning

1. Keep within the specified ambient temperature and humidity range.

Also, if the set temperature is too low, condensation may form on the inside of the thermo-con or the surface of piping even within the specified ambient temperature range. Dew condensation can cause failure, and so must be avoided by considering operating conditions.

2. The thermo-con is not designed for clean room usage.

The pump and fan generate dust.

3. Low molecular siloxane can damage the contact of the relay.

Use the thermo-con in a place free from low molecular siloxane.

Transportation/Movement/Installation

⚠Caution

1. Avoid strong vibration and/or impact.

The product is precision equipment. Do not apply vibration or impact during transportation.

2. Caution when moving a heavy object.

This product is heavy. Use adequate caution to avoid injury when picking up and setting down the product, and dropping accidents should be avoided.

3. Installation

When installing the product into a rack, it should be designed that the product weight is held with the bottom surface of the product. Use the handles on the front side of the product when installing/removing the product to/from the rack.

Radiation Air

⚠Caution

1. The inlet for radiation air must not be exposed to particles and dust as far as possible.

2. Do not let the inlet and outlet for radiation air get closed.

3. If more than one thermo-con is used, consider their arrangement so that the downstream sides of the Thermo-cons suck radiation air from the upstream sides.

Otherwise, the performance at the downstream sides may deteriorate. Also, the set temperature may not be achieved depending on the value of the set temperature and the load. In such a case, take countermeasures such as changing the direction of the thermo-cons to prevent the deterioration of performance.

4. Filters are not built-in. Mount them as necessary.

5. Flow rate of the heat dissipation air is approximately 2 m^3/min. The heat generation is approximately 600 W at maximum.

Circulating Fluid

⚠Caution

1. Use a fluid that is listed in the specifications.

2. Deionized water (with an electrical conductivity of approximately 1 μS/cm) can be used, but may lose its electrical conductivity.

Also, if a facility supplying deionized water is used, the thermo-con may be damaged by static electricity.

3. If deionized water is used, bacteria and algae may grow in a short period.

If the thermo-con is operated with bacteria and algae, its cooling capacity or the capacity of the pump may deteriorate.
Exchange all deionized water regularly depending on the conditions (once a month as a guide).

4. If using a fluid other than those listed in the specifications, please contact SMC beforehand.

5. The maximum operating pressure of circulating fluid circuit is 0.1 MPa.

If this pressure is exceeded, leakage from the tank in the thermo-con can result.

6. Select a pipe with a length and diameter which allow a flow rate of 0.5 L/min or more for the circulating fluid.

If the flow rate is less than 0.5 L/min, the thermo-con cannot provide precise control, but also can fail because of the repeated cooling and heating operation.

7. A magnet driven pump is used as a circulating pump.

A fluid which contains metal powders such as iron powder cannot be used.

Series HECR
Specific Product Precautions 2

Be sure to read this before handling. Refer to page 341 for Safety Instructions. For Temperature Control Equipment Precautions, refer to pages 342 to 345 and the Operation Manual on SMC website, http://www.smcworld.com

Circulating Fluid

⚠Caution

8. The thermo-con must not be operated without circulating fluid.

The pump can break due to idling.

9. If the tank lid is opened after the supply of circulating fluid, the circulating fluid may spill out depending on the condition of external piping.

10. If an external tank is used, the circulating fluid may spill out from the internal tank lid depending on where the external tank is installed.

Confirm that the internal tank has no leakage if using an external tank.

11. If there is a point where fluid is released to atmosphere externally (tank or piping), minimize the piping resistance at the circulating fluid return side.

If the piping resistance is too large, the piping may be crushed, or the built-in circulator tank may be deformed or cracked because the pressure in the piping for return will become negative. The built-in circulator tank is made of resin (PE). Therefore, the tank may be crushed if the pressure is negative. Special attention must be paid if the flow rate of the circulating fluid is high. To avoid getting negative pressure –0.02 MPa or less, the piping for return should be as thick and short as possible to minimize the piping resistance. It is also effective to restrict the flow rate of circulating fluid or remove the gasket of internal tank for the release to atmosphere.

12. Fluorinated fluid is outside of the specifications.

If it is used in the thermo-con, static electricity will be generated by the flow of fluid. This static electricity may be discharged to the board of the thermo-con, causing damage or operation failure and loss of data of such as set temperature.
Also, as the specific gravity of the fluorinated fluid is 1.5 to 1.8 times of water, the pump will be overloaded, which also causes fluorinated fluid to be outside the specifications. Therefore, if fluorinated fluid is used, please contact SMC and we will introduce a suitable special product (water-cooled type).

13. Avoid operation with cavitation or bubbles due to low fluid level in the tank. This may shorten the pump life.

Circulating Fluid

⚠Caution

14. If tap water is used, it should satisfy the quality standards shown below.

Tap Water (as Circulating Fluid) Quality Standards

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

	Item	Unit	Standard value	Influence	
				Corrosion	Scale generation
Standard item	pH (at 25°C)	—	6.0 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		○
	Ionic state silica (SiO_2)	[mg/L]	30 or less		○
Reference item	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.
- ○: Factors that have an effect on corrosion or scale generation.
- Even if the water quality standards are met, complete prevention of corrosion is not guaranteed.

15. The tank capacity is approximately 1 liter at the High level, and approximately 0.4 liters at the Low level. When the fluid level goes below the Low level, "ERR20" (Low fluid level alarm) will be generated.

Maintenance

⚠Warning

1. Prevention of electric shock and fire

Do not operate the switch with wet hands. Also, do not operate the thermo-con with water left on it.

2. Action in the case of error

If any error such as abnormal sounds, smoke, or bad smell occurs, cut off the power at once, and stop supplying and conveying fluid. Please contact SMC or a sales distributor to repair the thermo-con.

3. Regular inspection

Check the following items at least once a month. The inspection must be done by an operator who has sufficient knowledge and experience.

a) Check of displayed contents.
b) Check of temperature, vibration and abnormal sounds in the body of the thermo-con.
c) Check of the voltage and current of the power supply system.
d) Check for leakage and contamination of the circulating fluid and intrusion of foreign objects to it, and subsequent replacement of fluid.
e) Check for flow condition and temperature of radiation air.

Peltier-Type Chiller

Thermo-con/ Rack Mount Type Air-cooled

Series HECR010



■ Cooling capacity 1 kW

■ Mountable in a 19-inch rack

Saves space by mounting multiple equipment together in a rack.

■ Temperature stability

±0.01°C to 0.03°C

■ Set temperature range

10°C to 60°C

■ Power consumption Energy saving 400 W (with load factor 50%)

■ Low-noise design 54 dB (with load factor 50% or less)

Controls the number of fan rotations depending on the load, reducing noise when the cooling load is low.

How to Order

HECR 010 − A 2 □ − □

Cooling capacity

010	1 kW

Radiating method

A	Air-cooled

Power supply

2	200 to 240 VAC

Pipe thread type

Nil	Rc
N	NPT thread

Option

Nil	None
E	With feet and no rack mounting brackets
F	With flow switch
P	High-pressure pump mounted

Specifications

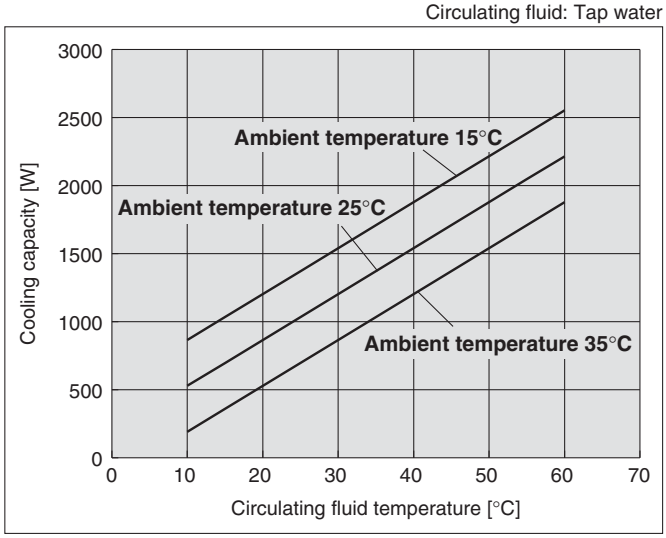
Model		HECR010-A
Cooling method		Thermoelectric device (Thermo-module)
Radiating method		Forced air cooling
Control method		Cooling/Heating automatic shift PID control
Ambient temperature/humidity		10 to 35°C, 35 to 80%RH (No condensation)
Circulating fluid system	Circulating fluid	Tap water, 20% ethylene glycol
	Set temperature range	10.0 to 60.0°C (No condensation)
	Cooling capacity	1 kW (Tap water) Note 1)
	Heating capacity	2 kW (Tap water) Note 1)
	Temperature stability Note 2)	±0.01 to 0.03°C
	Pump capacity	Refer to the performance charts.
	Tank capacity	Approx. 1.3 L
	Port size	IN/OUT: Rc3/8, Drain: PLCD 16004
	Wetted parts material	Stainless steel, EPDM, NBR, Ceramics, PPE, Carbon, Polyethylene, Polypropylene
Electrical system	Power supply	Single-phase 200 to 240 VAC ±10%, 50/60 Hz
	Overcurrent protector	14 A
	Current consumption	Max. 8 A (200 V)
	Communications	RS-232C/RS-485
Weight		Approx. 33 kg
Accessories		Power supply connector, Operation Manual Power supply cable should be ordered as an option (sold separately) or prepared by the user.
Safety standards		CE marking, UL (NRTL) standards

Note 1) Conditions: Set temperature 25°C, Ambient temperature 25°C, Circulating flow rate 4 L/min

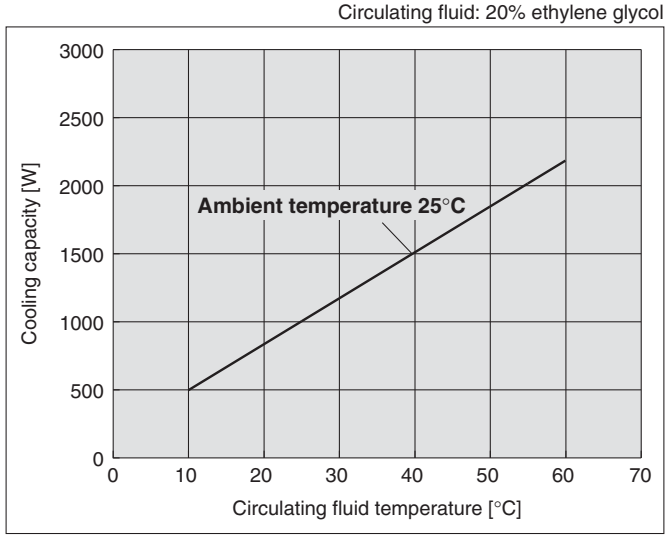
Note 2) The indicated values are with a stable load without turbulence in the operating conditions. It may be out of this range in some other operating conditions.

Cooling Capacity

Circulating fluid: Tap water

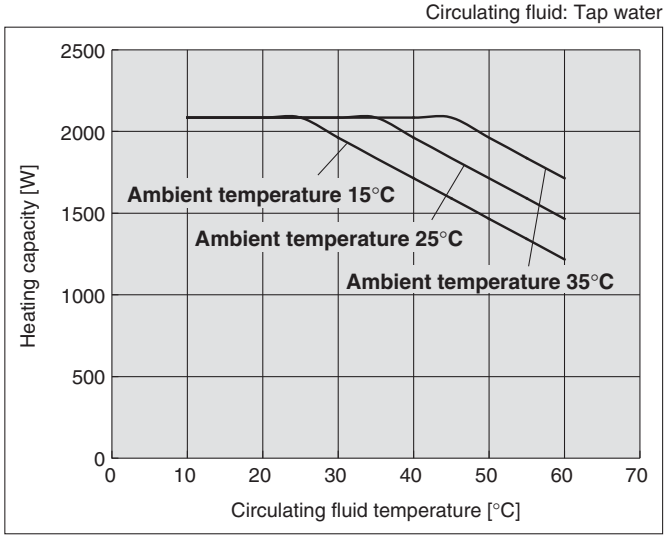


Circulating fluid: 20% ethylene glycol

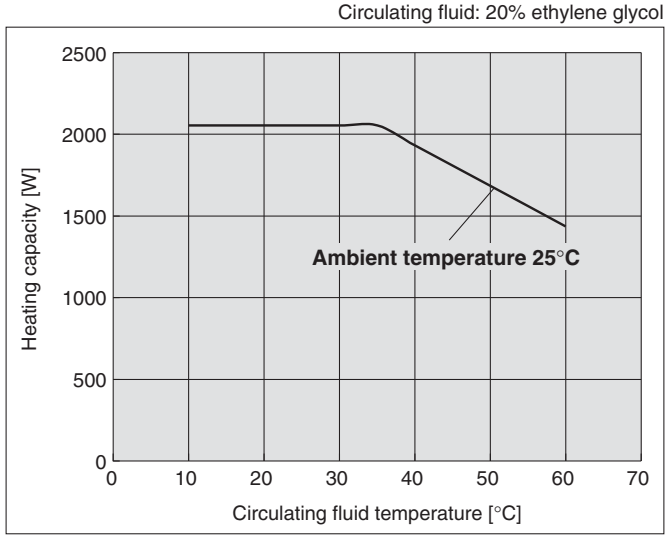


Heating Capacity

Circulating fluid: Tap water

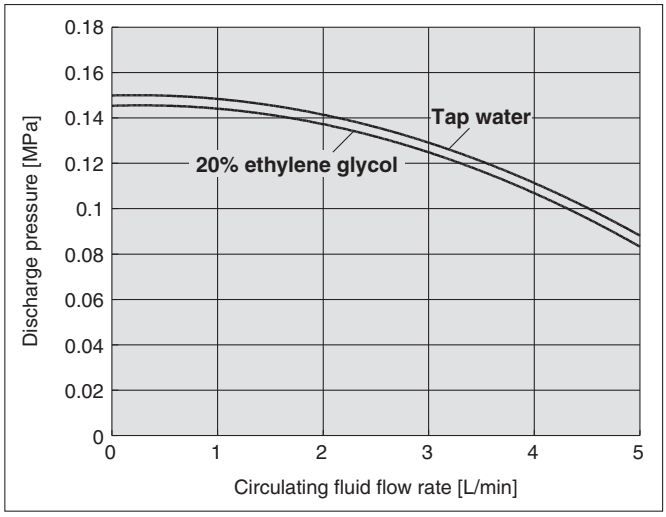


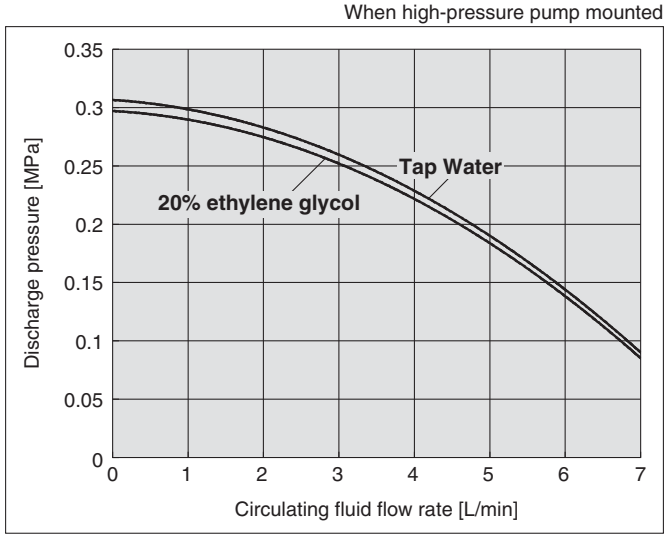
Circulating fluid: 20% ethylene glycol



Pump Capacity (Thermo-con Outlet)

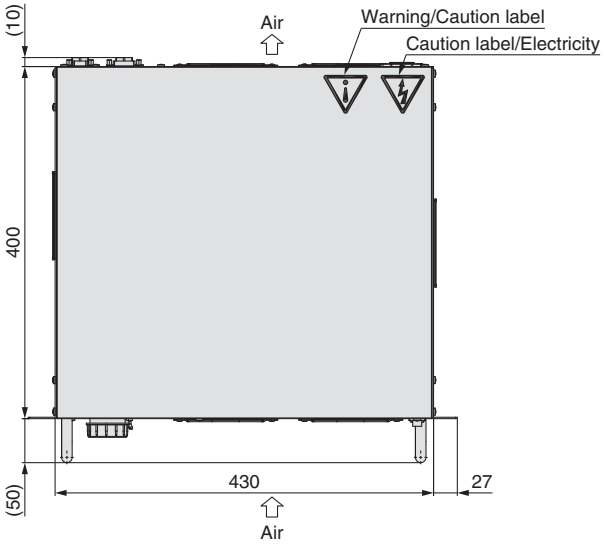
When high-pressure pump mounted

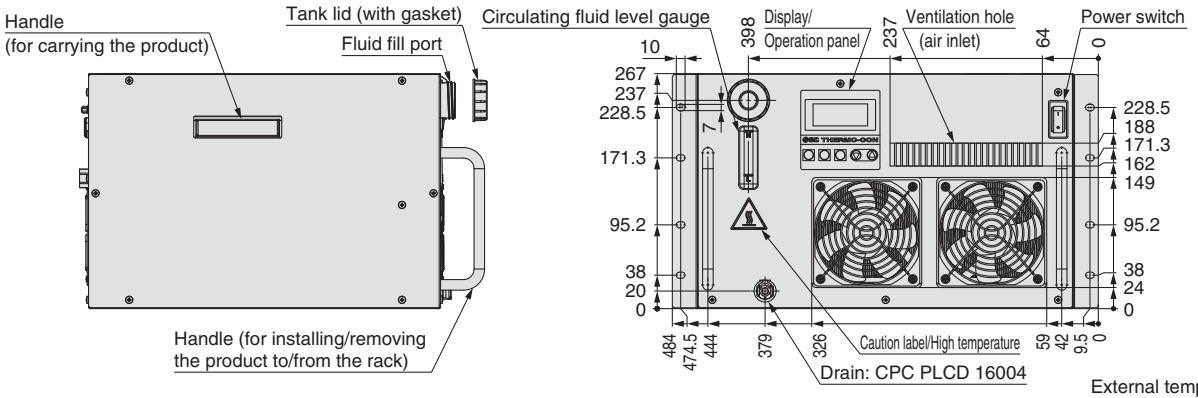


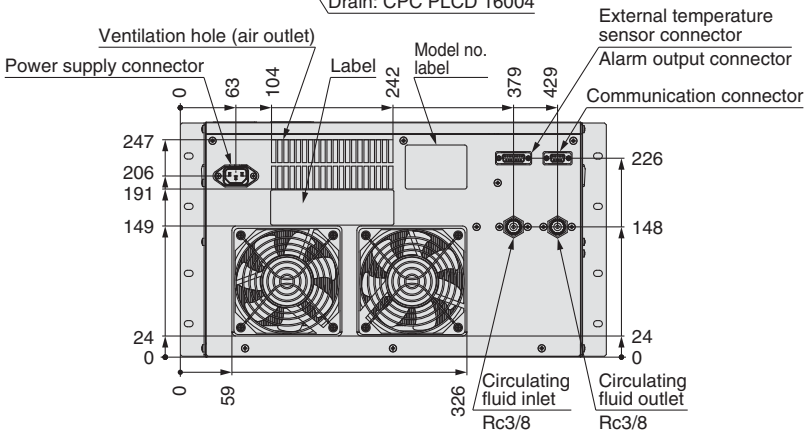


Dimensions

HECR010-A2

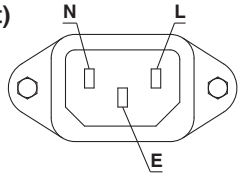






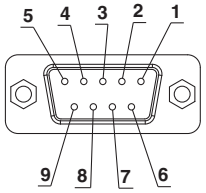
1. Power supply connector
IEC60320 C14 (or equivalent)

Pin no.	Signal contents
N	200-240 VAC
L	200-240 VAC
E	PE



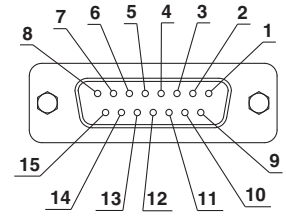
2. Communication connector
D-sub 9 pin (socket)
Holding screw: M2.6

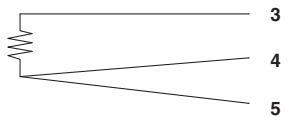
Pin no.	Signal contents	
	RS-232C	RS-485
1	Unused	BUS+
2	RD	Unused
3	SD	Unused
4	Unused	Unused
5	SG	SG
6-8	Unused	Unused
9	Unused	BUS–



3. External temperature sensor connector/Alarm output connector
D-sub 15 pin (socket)
Holding screw: M2.6

Pin no.	Signal contents
1-2	Unused
3	Terminal A of resistance temperature detector
4	Terminal B of resistance temperature detector
5	Terminal B of resistance temperature detector
6	Contact a for output cutoff alarm (open when alarm occurs)
7	Common for output cutoff alarm
8	Contact b for output cutoff alarm (closed when alarm occurs)
9	Contact a for upper/lower temp. limit alarm (open when alarm occurs)
10	Common for upper/lower temp. limit alarm
11	Contact b for upper/lower temp. limit alarm (closed when alarm occurs)
12-14	Unused
15	FG





Connection diagram of resistance temperature detector

Options

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

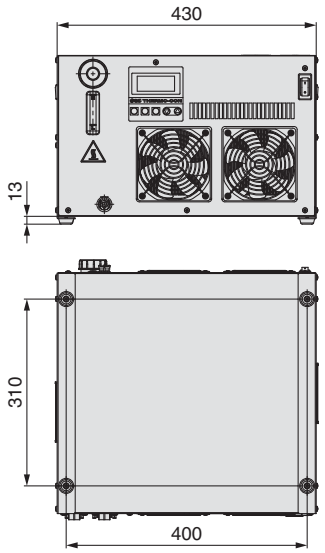
E Option symbol

With Feet and No Rack Mounting Brackets

HECR010-A2□-E

With feet and no rack mounting brackets

Rack mounting brackets and handles on the front side are removed as they are not necessary when the product is not mounted in a rack. This option has rubber feet for installing the product on the floor.



F Option symbol

With Flow Switch

HECR010-A2□-F

With flow switch

This is an ON/OFF switch detecting low levels of the circulating fluid.
When the fluid volume is 1 L/min or less, “ERR16” is displayed and the thermo-con stops.
The flow switch is built into the thermo-con.

P Option symbol

High-pressure Pump Mounted

HECR010-A2□-P

High-pressure pump mounted

Possible to choose a high-pressure pump in accordance with user’s piping resistance.
Cooling capacity will decrease by approx. 50 W by heat generated in the pump.

Peltier-Type Chiller/Thermo-con

Series HEC

Air-cooled | Water-cooled

Can precisely control the temperature of a heat source or process fluid.

Precisely control the temperature of the circulating fluid by using the Peltier device. Generates little vibration, and is refrigerant-free and environmentally friendly.
Can control the temperature of the heat source by using the external temperature sensor (sold separately). (Automatically adjusts to the effects of ambient temperature.)

- **Temperature range setting:**
  10°C to 60°C
- **Temperature stability:**
  ±0.01°C to 0.03°C

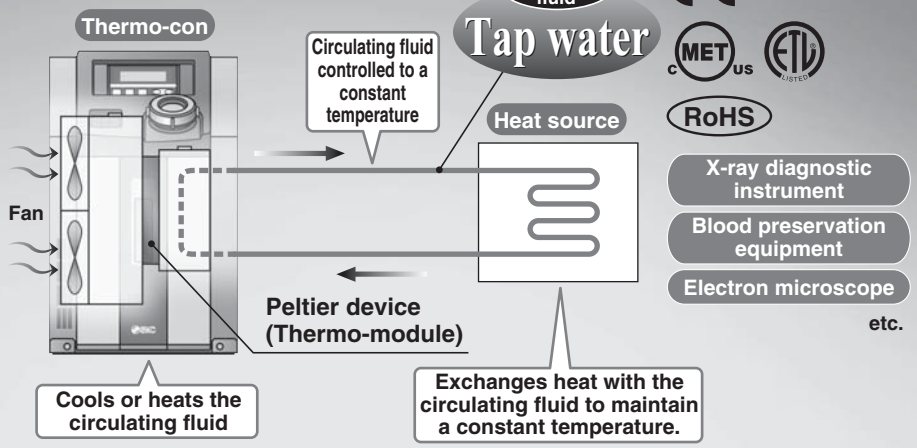
Added cooling capacity of 140 W and 320 W (water-cooled), and 600 W (air-cooled).



140W: W184 x H262 x D321
320W: W184 x H262 x D321
230W: W210 x H393 x D436
600W: W240 x H390 x D455,
600W: W240 x H390 x D455
1200W: W300 x H448 x D523

Air-cooled Series HEC-A

- **Air-cooled: Can be used in the environments with no cooling equipment.**
- **Cooling capacity: 230 W, 600 W**



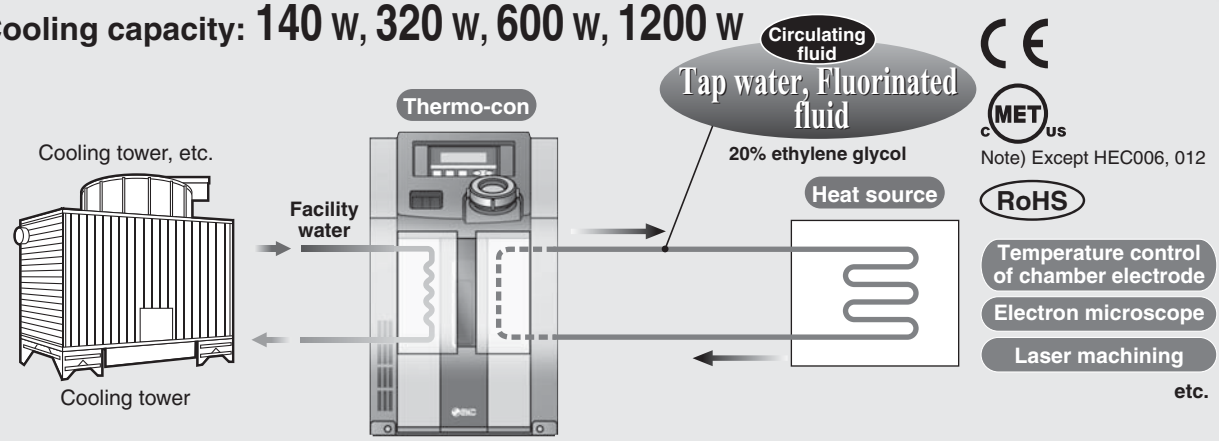
CE
cMETus
RoHS

- X-ray diagnostic instrument
- Blood preservation equipment
- Electron microscope

etc.

Water-cooled Series HEC-W

- **Water-cooled: Can be used in the environments with facility water equipment.**
- **Cooling capacity: 140 W, 320 W, 600 W, 1200 W**



CE
cMETus
Note) Except HEC006, 012
RoHS

- Temperature control of chamber electrode
- Electron microscope
- Laser machining

etc.

- **Compliant with safety standard for medical equipment IEC 60601-1 (Air-cooled/HEC002-A series)**
- **Power supply: Applicable to 100 V to 240 V (Air-cooled/HEC-A series, Water-cooled/HEC001-W, HEC003-W)**
- **Suitable to fluorinated fluids (Fluorinert™ FC-3283, GALDEN® HT135) (Water-cooled/HEC006-W, HEC012-W)**
- **Compatible with ethylene glycol 20% (Water-cooled/HEC001-W, HEC003-W)**

Learning Control Function (Temp. control by external temperature sensor)

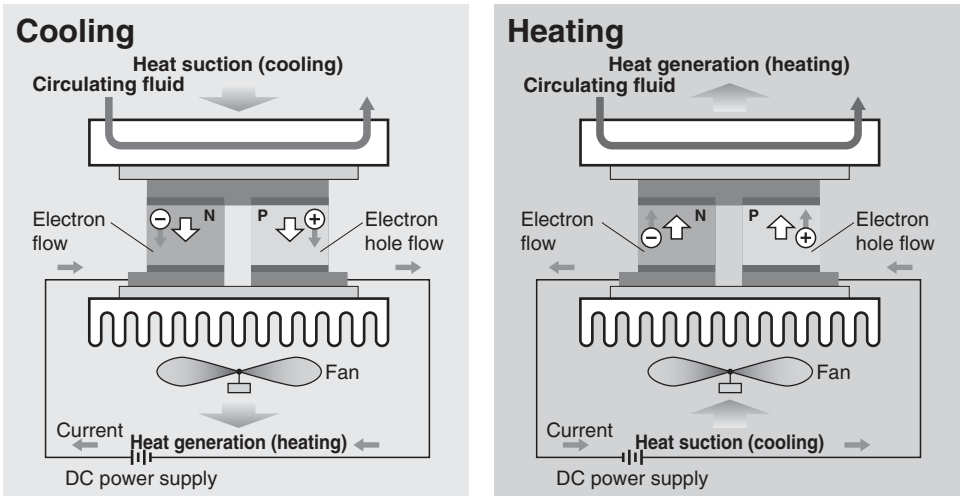
This function adjusts the fluid temperature to the set value with an automatic offset setting. Set the external temperature sensor at the circulating fluid inlet located just in front of the heat source, which allows the Thermo-con to sample the fluid temperature. This function is effective when automatically adjusting for heat exhaust from piping, etc. If the external temperature sensor is installed directly on the heat source, the learning control function may not work property due to large heat volume or large temperature difference. Be sure to install the sensor at the circulating fluid inlet.

Principle of Peltier Device (Thermo-module)

A Peltier device (thermo-module) is a plate type element, inside which P-type semiconductors and N-type semiconductors are located alternately. If direct current is supplied to the Peltier device (thermo-module), heat is transferred inside the device, and one face generates heat and increases temperature while the other face absorbs heat and decreases temperature. Therefore, changing the direction of the current supplied to the Peltier device (thermo-module) can achieve heating and cooling operation. This method has a fast response and can shift quickly between heating and cooling, so temperature can be controlled very precisely.

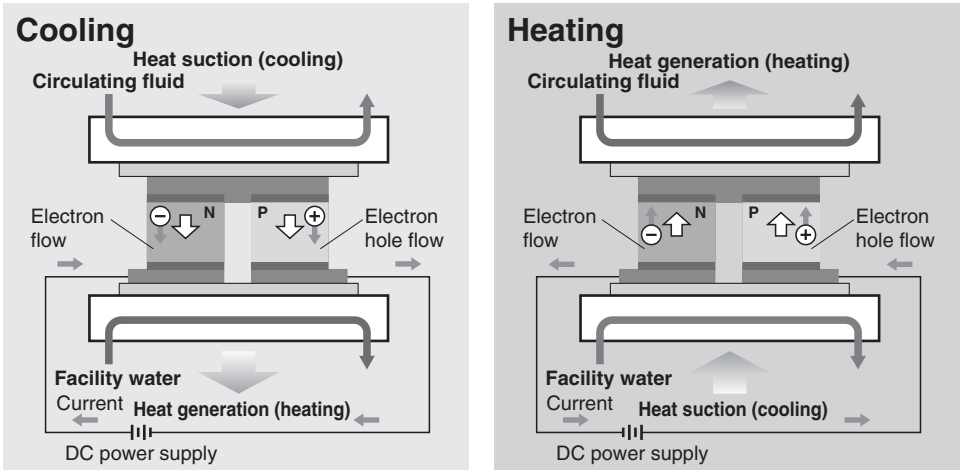
Air-cooled

Series HEC-A



Water-cooled

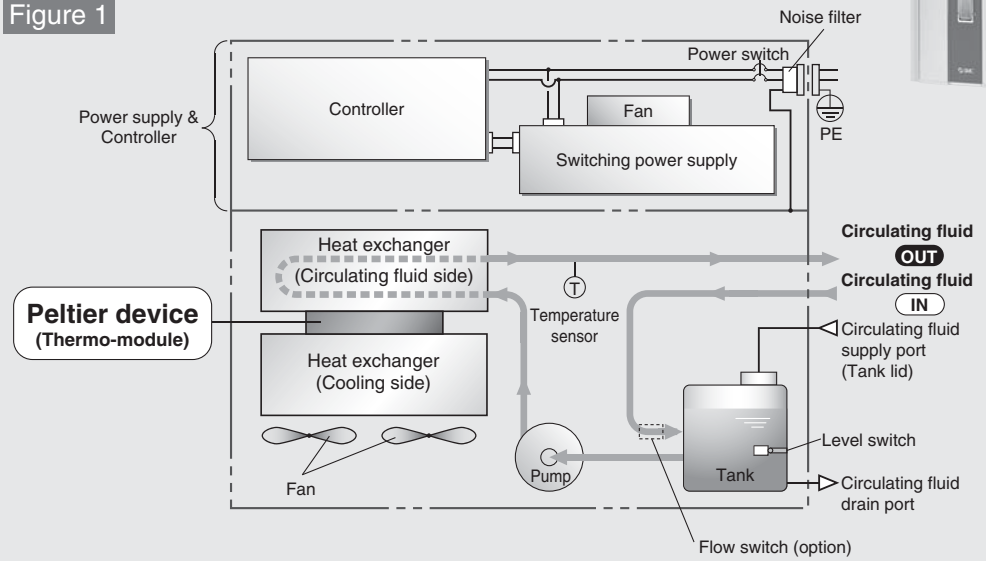
Series HEC-W



Air-cooled Series HEC-A



Figure 1



Water-cooled Series HEC-W



Figure 1

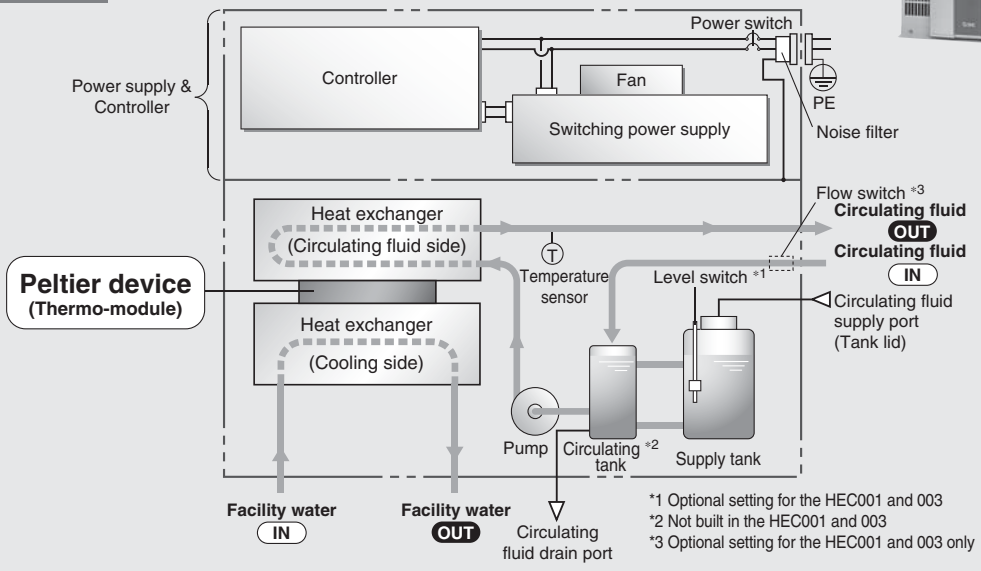
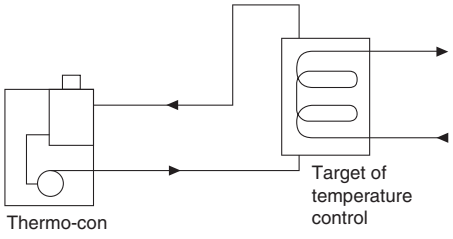


Figure 2 Example of circulating fluid piping



The thermo-con is constructed as shown in Figure 1. It interposes a Peltier device (thermo-module) between the heat exchangers for the circulating fluid and facility water and controls the pulse width of supply direct current to achieve the target outlet temperature of circulating fluid precisely.
The circulating fluid returns to the tank, and is transferred by the pump which is built in the thermo-con, and goes through the heat exchangers and internal sensors and out from the circulating fluid outlet.
Figure 2 shows an example of circulating fluid piping. The circulating fluid is transferred at a constant temperature by the pump.

When to Use Air-cooled and Water-cooled Thermo-con

Both air-cooled and water-cooled thermo-cons are available. Select a proper thermo-con by referring to the following.

Air-cooled

- No facility water equipment → Can install the unit easily without facility water equipment.
- Frequent piping changes → Can reduce the piping installation labor since facility water piping is not required.

Water-cooled

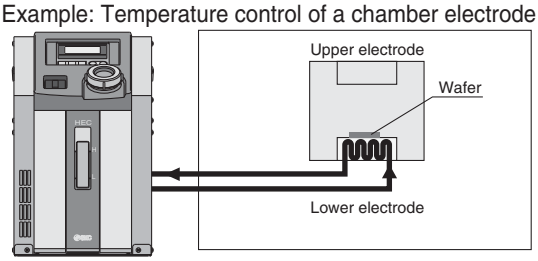
- Need to avoid effects of ambient temperature. → Since the unit is water-cooled, the ambient temperature will have little effect.
- Want to reduce the installation space. → Can reduce the space since the unit is compact.

Application Examples

Semiconductor

Air-cooled Water-cooled

Example: Temperature control of a chamber electrode

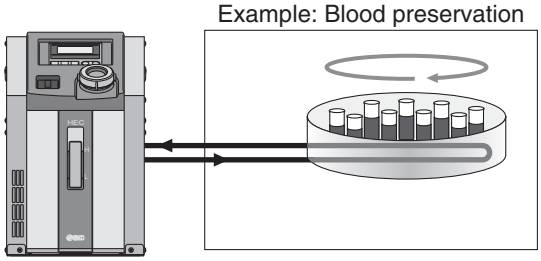


- **Etching equipment**
- **Spatter equipment**
- **Cleaning equipment**
- **Coating equipment**
- **Dicing equipment**
- **Tester, etc.**

Medical

Air-cooled

Example: Blood preservation

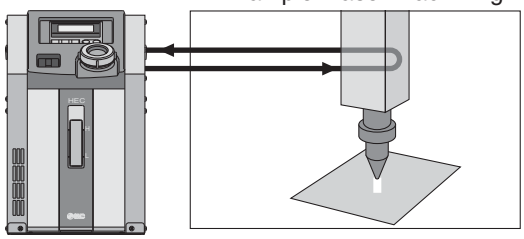


- **X-ray diagnostic instrument**
- **MRI**
- **Blood preservation equipment**

Machine tool

Air-cooled Water-cooled

Example: Laser machining



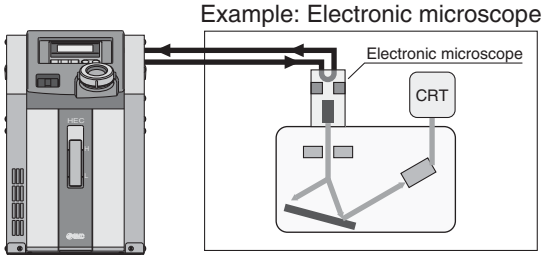
- **Wire cutting**
- **Grinder**
- **Spot welding**
- **Plasma welding**
- **Laser machining, etc.**

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

Analysis

Air-cooled Water-cooled

Example: Electronic microscope



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

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

Bonding of DVD including next generation Air-cooled Water-cooled

Cooling of semiconductor laser Air-cooled Water-cooled

Temperature control of die-cast mold Air-cooled Water-cooled

CONTENTS

Series HEC





Model Selection ····· Page 273

Thermo-con
Air-cooled Series **HEC-A**

How to Order/Specifications ····· Page 275
Cooling Capacity/Heating Capacity/
Pump Capacity (Thermo-con Outlet) ····· Page 276
Parts Description ····· Page 277
Dimensions ····· Page 278
Connectors ····· Page 280
Alarm/Maintenance ····· Page 281
Options ····· Page 282

Specific Product Precautions ····· Page 283

Thermo-con
Water-cooled Series **HEC-W**

How to Order/Specifications ····· Page 287
Cooling Capacity/Heating Capacity/Pump Capacity
(Thermo-con Outlet)/Pressure Loss in Facility Water Circuit ··· Page 289
Parts Description ····· Page 292
Dimensions ····· Page 293
Connectors ····· Page 296
Alarm/Maintenance ····· Page 297
Options ····· Page 298

Specific Product Precautions ····· Page 299

Series HEC
Model Selection

Guide to Model Selection

1. What radiation method will be used?

Without a cooling tower ····· Air-cooled HEC-A series
With a cooling tower ····· Water-cooled HEC-W series

When to Use Air-cooled and Water-cooled Thermo-con

<Air-cooled>

- No facility water equipment → Can install the unit easily without facility water equipment.
- Frequent piping changes → Can reduce the piping installation labor since facility water piping is not required.

<Water-cooled>

- Need to avoid effects of ambient temperature. → Since the unit is water-cooled, the ambient temperature will have little effect.
- Want to reduce installation space. → Can reduce the space since the unit is compact.

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

Temperature range which can be set with the thermo-con: 10 to 60°C

If a lower temperature (down to –20°C) or higher temperature (up to 90°C) than this range is necessary, select the thermo-chiller HRZ series.

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

Circulating fluids that can be used in the thermo-con

Model	Tap water	Fluorinert™ FC-3238 GALDEN® HT135	20% ethylene glycol
HEC001-W, HEC003-W	○	×	○
HEC006-W, HEC012-W	○	○	×
HEC002-A, HEC006-A	○	×	×

○ : Usable × : Unusable

4. How much cooling capacity required?

Allows a safety factor of 20% over the capacity that is actually required, taking into account the changes in the operating conditions. If a larger capacity than this thermo-con is necessary, select the thermo-cooler HRG series or thermo-chiller HRZ series.

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

Heat generation amount: 400 W

Cooling capacity = Considering a safety factor of 20%, **400 x 1.2 = 480 W**

Guide to Model Selection

Example 2 | **When the heat generation amount in the customer's machine is not known.**

Obtain the temperature difference between inlet and outlet by circulating the fluid inside the customer's machine.

Heat generation amount **Q** : Unknown
Circulating fluid temperature difference ΔT (= **T2** – **T1**) : 0.8°C (0.8 K)
Circulating fluid outlet temperature **T1** : 25°C (298.15 K)
Circulating fluid return temperature **T2** : 25.8°C (298.95 K)
Circulating fluid flow rate **L** : 3 L/min
Circulating fluid : Water
Density γ: 1 x 10^3 kg/m^3
Specific heat **C**: 4.2 x 10^3 J/(kg·K)

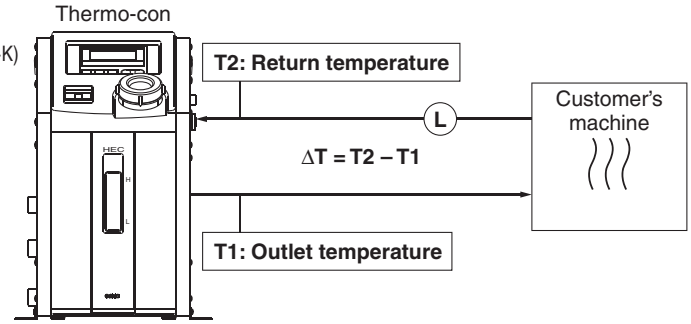
$$Q = \frac{\Delta T \times L \times \gamma \times C}{60 \times 1000}$$

$$= \frac{0.8 \times 3 \times 1 \times 10^3 \times 4.2 \times 10^3}{60 \times 1000}$$

$$= 167\ W$$

Cooling capacity = Considering a safety factor of 20%,

167 W x 1.2 = 200 W



Example 3 | **When cooling the object below a certain temperature in certain period of time.**

Cooled substance total volume **V** : 20 L
Cooling time **h** : 15 min
Cooling temperature difference ΔT : Temperature difference: 10°C (10 K). Cool from 30°C (303 K) to 20°C (293 K).
Circulating fluid : Tap water
Density γ: 1 x 10^3 kg/m^3
Specific heat **C**: 4.2 x 10^3 J/(kg·K)

∗ Refer to the information shown below for the typical physical property values by circulating fluid.

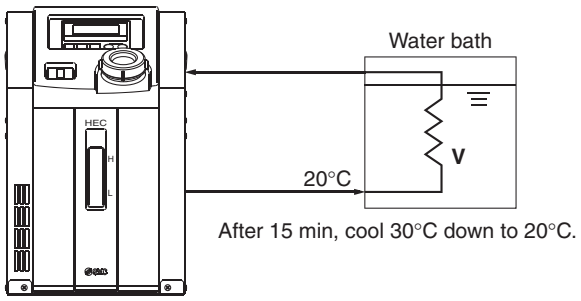
$$Q = \frac{\Delta T \times V \times \gamma \times C}{h \times 60 \times 1000}$$

$$= \frac{10 \times 20 \times 1 \times 10^3 \times 4.2 \times 10^3}{15 \times 60 \times 1000}$$

$$= 933\ W$$

Cooling capacity = Considering a safety factor of 20%,

933 W x 1.2 = 1120 W



Precautions on Model Selection

The flow rate of the circulating fluid depends on the pressure loss of the customer's machine and the length, diameter and resistance created by bends in the circulating fluid piping, etc. Check if the required flow rate of circulating fluid can be obtained before selecting.

Circulating Fluid Typical Physical Property Values

Fluorinated Fluids

Physical property value / Temperature	Density γ [kg/m^3]	Specific heat C [J/(kg·K)]
–10°C	1.87 x 10^3	0.87 x 10^3
20°C	1.80 x 10^3	0.96 x 10^3
50°C	1.74 x 10^3	1.05 x 10^3
80°C	1.67 x 10^3	1.14 x 10^3

Water

Density γ: 1 x 10^3 [kg/m^3] **Specific heat C: 4.2 x 10^3 [J/(kg·K)]**

Peltier-Type Chiller
Thermo-con (Air-cooled)
Series HEC-A



How to Order

HEC 002 – A 5 B – □

Cooling capacity

002	230 W
006	600 W

Radiating method

A	Air-cooled

Power supply

5	100 to 240 VAC

Communication

A	RS-485
B	RS-232C

∗ Select B when communication is not used.

Option

Nil	None
F	With flow switch
N	NPT thread

∗ The option should be specified when ordering.

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

Model			HEC002-A5A	HEC002-A5B	HEC006-A5A	HEC006-A5B
Cooling method			Thermoelectric device (Thermo-module)			
Radiating method			Forced air cooling			
Control method			Cooling/Heating automatic shift PID control			
Ambient temperature/humidity			10 to 35°C, 35 to 80%RH (no condensation)			
Circulating fluid system	**Circulating fluid**		Tap water			
	Operating temperature range		10.0 to 60.0°C (no condensation)			
	Cooling capacity		230 W Note 1)		600 W Note 2)	
	Heating capacity		600 W Note 1)		900 W Note 2)	
	Temperature stability Note 3)		±0.01 to ±0.03°C			
	Pump capacity		Refer to performance chart.			
	Tank capacity		Approx. 1.2 L			
	Port size	**IN/OUT**	Rc1/4		Rc3/8	
		Drain	Rc1/4 (with plug)			
	Wetted parts material		Stainless steel 303, Stainless steel 304, EPDM, Ceramics, PPS glass 30%, Carbon, PE, Polyurethane			
Electrical system	**Power supply**		Single-phase 100 to 240 VAC ±10%, 50/60 Hz			
	Overcurrent protector		15 A			
	Current consumption		8 A (100 VAC) to 3 A (240 VAC)		10 A (100 VAC) to 4 A (240 VAC)	
	Alarm		Refer to alarm function.			
	Communications		RS-485	RS-232C	RS-485	RS-232C
Weight			Approx. 17.5 kg (including foot for fixing)		Approx. 27.5 kg (including foot for fixing)	
Accessories			Power cable, Foot for fixing			
Safety standards			CE marking, UL (NRTL) standards, Safety standard for medical equipment (IEC 60601-1)		CE marking, UL (NRTL) standards	

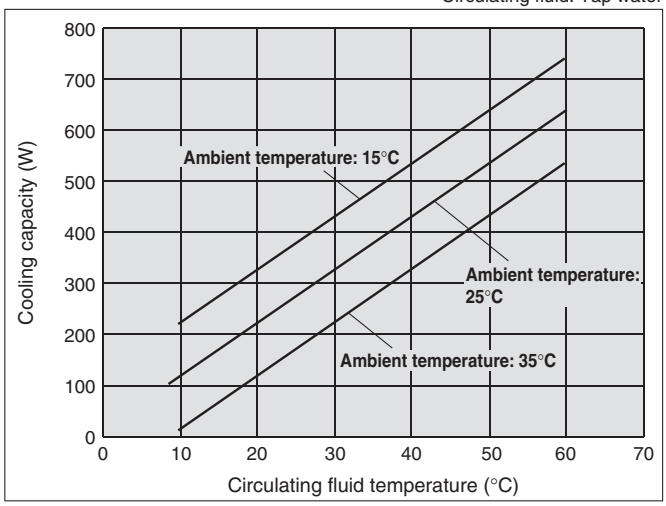
Note 1) Conditions: Set temperature 25°C, Ambient temperature 25°C, Circulating flow rate 3 L/min
Note 2) Conditions: Set temperature 25°C, Ambient temperature 20°C, Circulating flow rate 8 L/min
Note 3) The indicated values are with a stable load without turbulence in the operating conditions. It may be out of this range in some other operating conditions.

The values shown on the performance chart are not guaranteed, but typical. Allow margins for safety when selecting the model.

Cooling Capacity

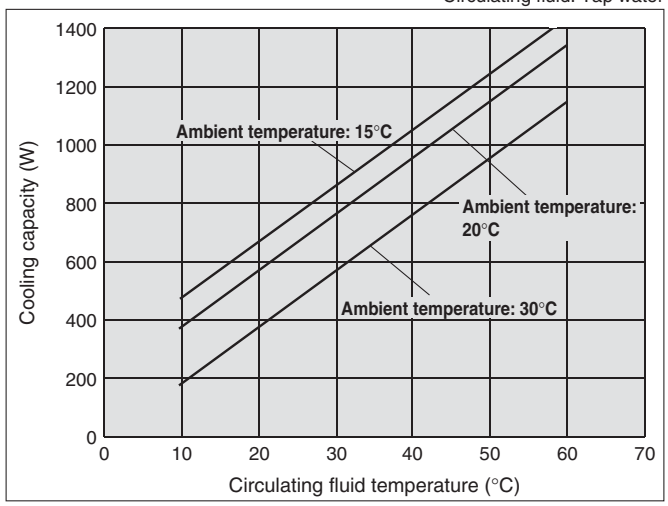
HEC002

Circulating fluid: Tap water



HEC006

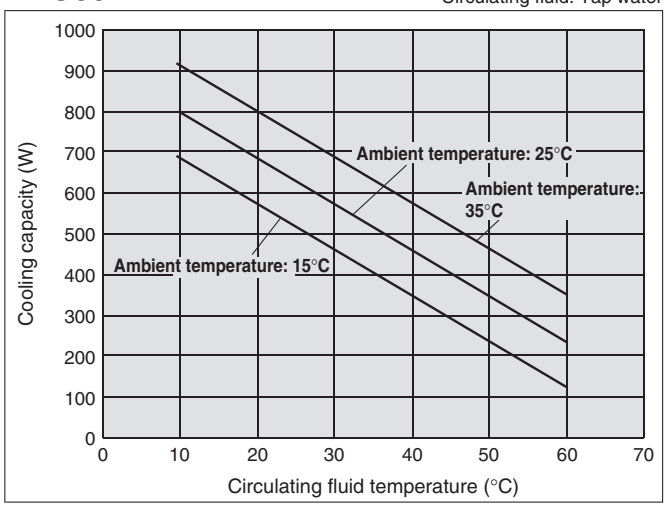
Circulating fluid: Tap water



Heating Capacity

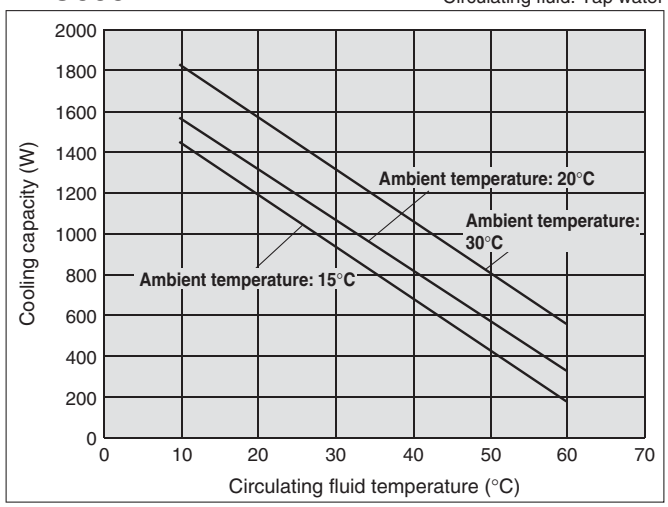
HEC002

Circulating fluid: Tap water



HEC006

Circulating fluid: Tap water

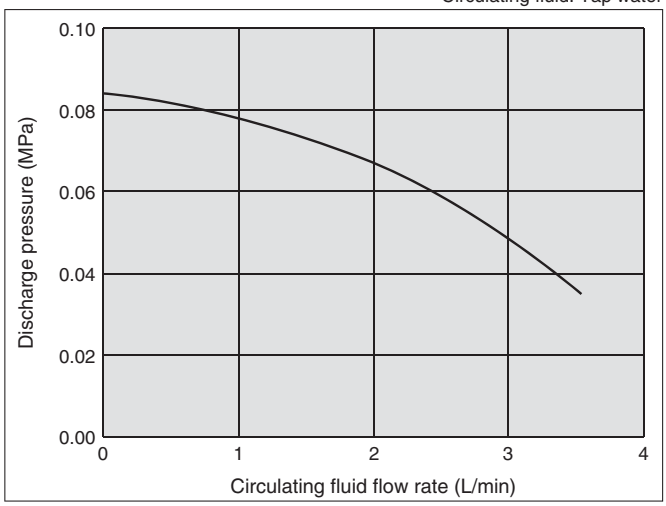


Pump Capacity (Thermo-con Outlet)

The pressure on the y-axis shows the discharge pressure of circulating fluid in the thermo-con.

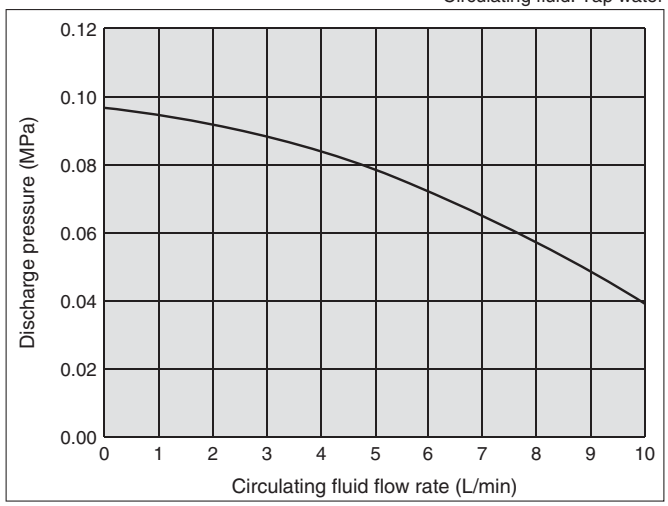
HEC002

Circulating fluid: Tap water



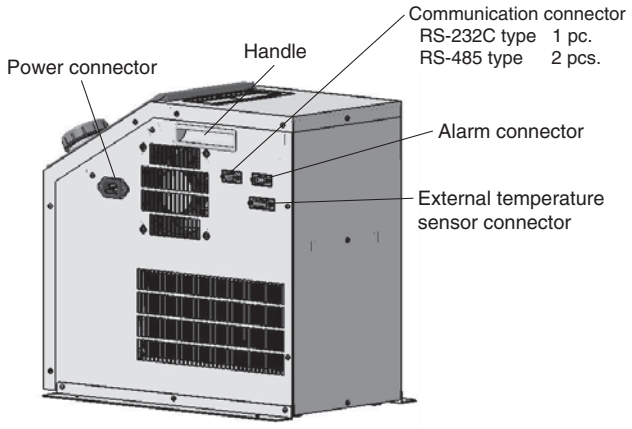
HEC006

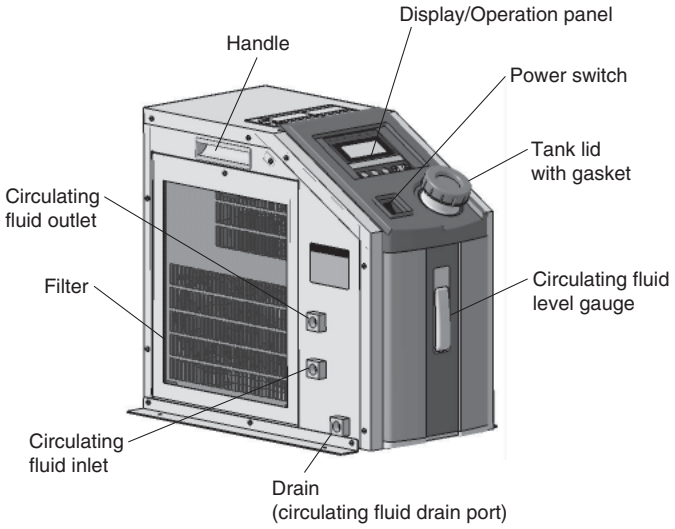
Circulating fluid: Tap water



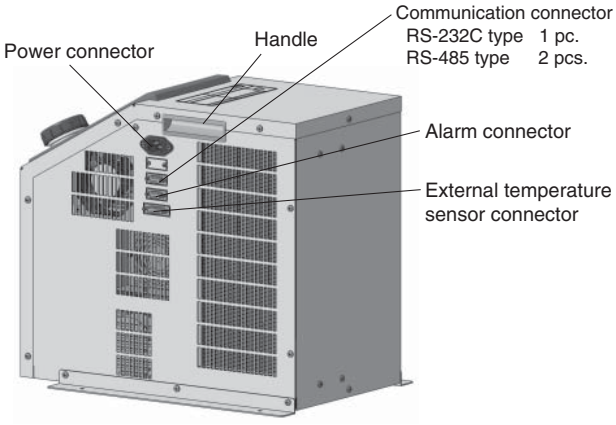
Parts Description

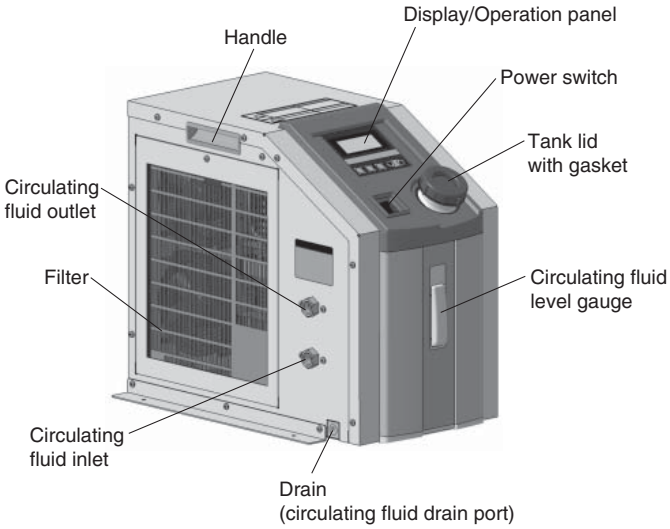
HEC002





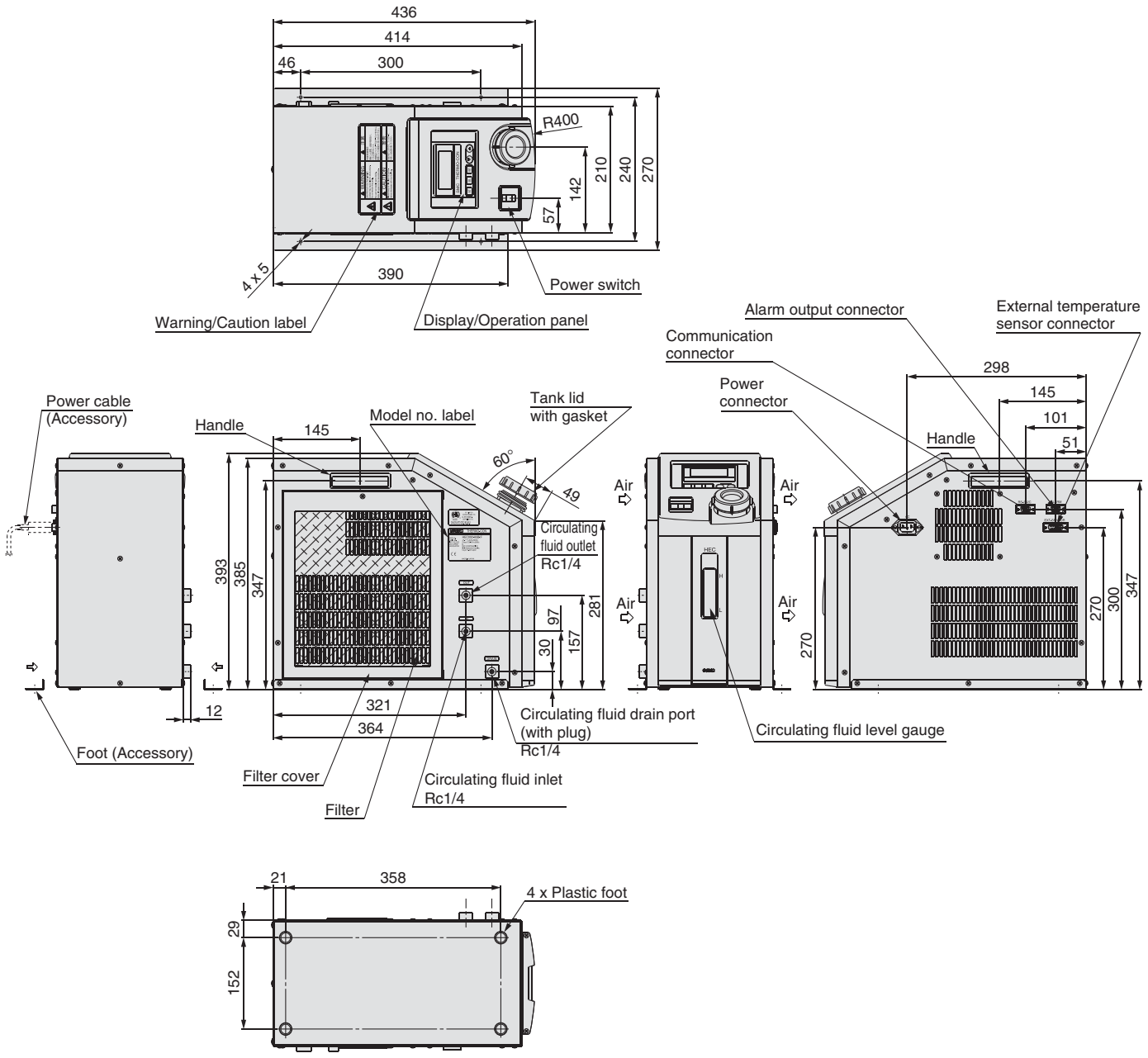
HEC006





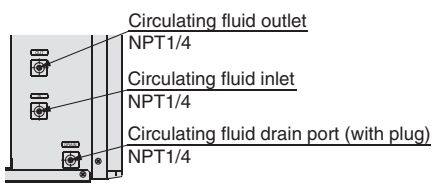
Dimensions

HEC002



Option (Fitting part)

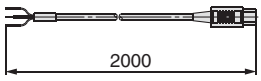
NPT fitting specification (-N, -FN)



Power Cable (Accessory)

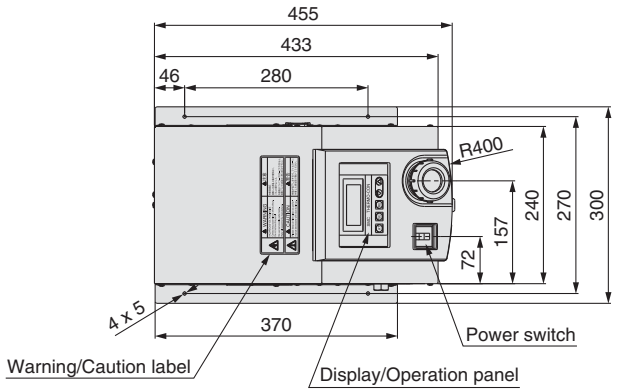
Connector: IEC 60320 C13 or equivalent
Cable: 14AWG, O.D. ø8.4

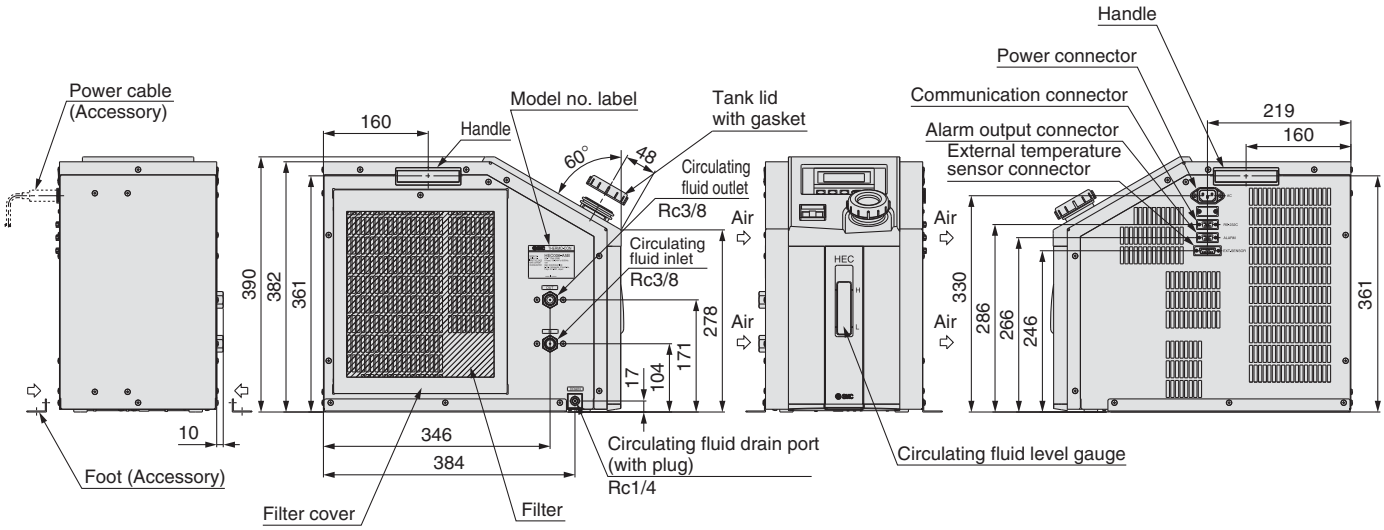
Wire color	Contents
Black	100 to 240 VAC
Black	100 to 240 VAC
Green/Yellow	PE

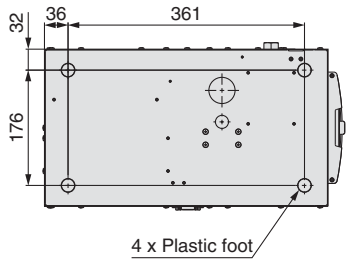


Dimensions

HEC006

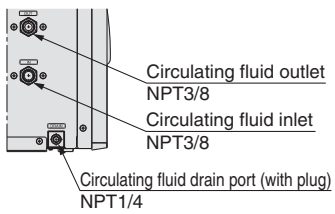






Option (Fitting part)

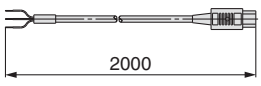
NPT fitting specification (-N, -FN)



Power Cable (Accessory)

Connector: IEC 60320 C13 or equivalent
Cable: 14AWG, O.D. ø8.4

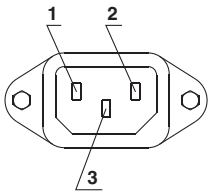
Wire color	Contents
Black	100 to 240 VAC
Black	100 to 240 VAC
Green/Yellow	PE



Connectors

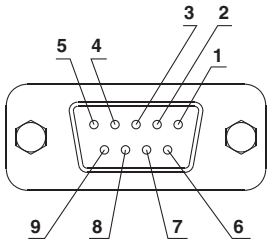
1. Power connector (AC)
IEC 60320 C14 or equivalent

Pin No.	Contents
1	100 to 240 VAC
2	100 to 240 VAC
3	PE



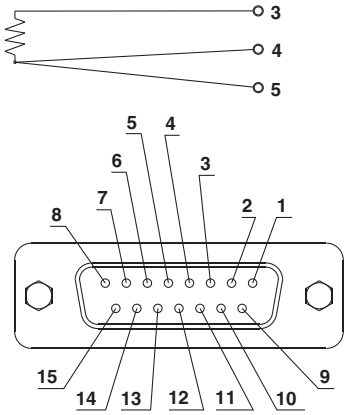
2. Communication connector (RS-232C or RS-485)
D-sub 9 pin (socket)
Holding screw: M2.6

Pin No.	Signal contents	
	RS-232C	RS-485
1	Unused	BUS+
2	RD	BUS–
3	SD	Unused
4	Unused	Unused
5	SG	SG
6-9	Unused	Unused



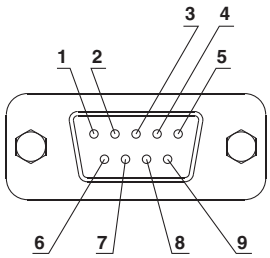
3. External sensor connector (EXT.SENSOR)
D-sub 15 pin (socket)
Holding screw: M2.6

Pin No.	Signal contents
1-2	Unused
3	Terminal A of resistance temperature detector
4	Terminal B of resistance temperature detector
5	Terminal B of resistance temperature detector
6-14	Unused
15	FG



4. Alarm output connector (ALARM)
D-sub 9 pin (pin)
Holding screw: M2.6

Pin No.	Signal contents
1	Contact a for output cut-off alarm (open when alarm occurs)
2	Common for output cut-off alarm
3	Contact b for output cut-off alarm (closed when alarm occurs)
4-5	Unused
6	Contact a for upper/lower temp. limit alarm (open when alarm occurs)
7	Common for upper/lower temp. limit alarm
8	Contact b for upper/lower temp. limit alarm (closed when alarm occurs)
9	Unused



Alarm

This unit is equipped as standard with a function allowing 15 kinds of alarms to display on the LCD and can be read out by serial communication. Also, it can generate relay output for upper/lower temperature limit alarm and output cut-off alarm.

Alarm

Alarm code	Alarm description	Operation status	Main reason
WRN	Upper/Lower temp. limit alarm	Continue	The temperature has exceeded the upper or lower limit of the target temperature.
ERR00	CPU hung-up	Stop	The CPU has crashed due to noise, etc.
ERR01	CPU check error	Stop	The contents of the CPU cannot be read out correctly when the power supply is turned on.
ERR03	Back-up data error	Stop	The contents of the back-up data cannot be read out correctly when the power supply is turned on.
ERR04	EEPROM writing error	Stop	The data cannot be written to EEPROM.
ERR11	DC power supply failure	Stop	The DC power supply has failed (due to fan stop or abnormal high temperature) or the thermo-module has been short-circuited.
ERR12	Internal temp. sensor high temp. error	Stop	The internal temperature sensor has exceeded the upper limit of cut-off temperature.
ERR13	Internal temp. sensor low temp. error	Stop	The internal temperature sensor has exceeded the lower limit of cut-off temperature.
ERR14	Thermostat alarm	Stop	The thermostat has been activated due to filter clog or fan/pump failure, etc.
ERR15	Abnormal output alarm	Continue	The temperature cannot be changed even at 100% output due to overload or disconnection of the thermo-module.
ERR16	Low flow rate alarm (option)	Stop	The flow rate of the circulating fluid has dropped.
ERR17	Internal temp. sensor disconnection alarm	Stop	The internal temperature sensor has been disconnected or short-circuited.
ERR18	External temp. sensor disconnection alarm	Continue	The external temperature sensor has been disconnected or short-circuited. (Only detected when in learning control or external tune control)
ERR19	Abnormal auto tuning alarm	Stop	Auto tuning has not been completed within 20 minutes.
ERR20	Low fluid level alarm	Stop	The amount of circulating fluid in the tank has dropped.

Maintenance

Maintenance of this unit is performed only in the form of return to and repair at SMC's site. As a rule, SMC will not conduct on-site maintenance. Separately, the following parts have a limited life and need to be replaced before the life ends.

Parts Life Expectation

Description	Expected life	Possible failure
Pump	3 to 5 years	The bearing is worn so the pump fails to transfer the circulating fluid, which results in temperature control failure.
Fan	5 to 10 years	The bearing uses up lubrication and makes the fan unable to supply enough air, which deteriorates the cooling and heating capacity.
DC power supply	5 to 10 years	The capacity of the electrolytic condenser decreases, and causes abnormal voltage which results in DC power supply failure and stops the thermo-con.
Display panel	50,000 hours (approx. 5 years)	The display turns off when the backlight of the LCD reaches the end of its life.

Series HEC-A
Options

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

F Option symbol

With Flow Switch

HEC□□□-□□□-F

F: With flow switch

This is an ON/OFF switch detecting low levels of the circulating fluid.
When the fluid volume is 1 L/min. or less, “ERR16” is displayed and the thermo-con stops. This switch is installed between the circulating fluid inlet and the tank, and built into the thermo-con.
Refer to page 270.

Type	Applicable model
Air-cooled	**HEC002-A5□-F**
	HEC006-A5□-F

N Option symbol

NPT Thread

HEC□□□-□□□-N

N: NPT thread

The connection parts of circulating fluid piping, facility water piping and circulating fluid drain port are NPT thread type.

Type	Applicable model
Air-cooled	**HEC002-A5□-N**
	HEC006-A5□-N

Series HEC-A
Specific Product Precautions 1

Be sure to read this before handling. Refer to page 341 for Safety Instructions. For Temperature Control Equipment Precautions, refer to pages 342 to 345 and the Operation Manual on SMC website, http://www.smcworld.com

System Design

⚠Warning

1. This catalog shows the specifications of the Thermo-con.

1. Check detailed specifications in the separate "Product Specifications", and evaluate the compatibility of the thermo-con with customer's system.
2. Although the protection circuit as a single unit is installed, the customer is requested to carry out the safety design for the whole system.

Handling

⚠Warning

1. Thoroughly read the Operation Manual.

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

2. If the set temperature is repeatedly changed by 10°C or more, the thermo-con may fail in short periods of time.

Operating Environment/Storage Environment

⚠Warning

1. Keep within the specified ambient temperature and humidity range.

Also, if the set temperature is too low, condensation may form on the inside of the thermo-con or the surface of piping even within the specified ambient temperature range. Dew condensation can cause failure, and so must be avoided by considering operating conditions.

2. The thermo-con is not designed for clean room usage.

It generates dust from the pump inside the unit and the cooling fan.

3. Low molecular siloxane can damage the contact of the relay.

Use the thermo-con in a place free from low molecular siloxane.

Radiation Air

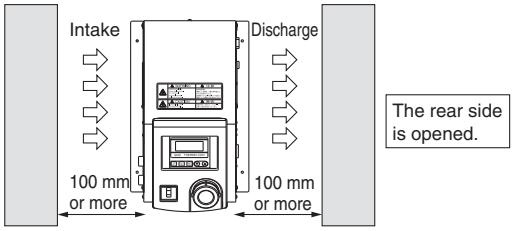
⚠Caution

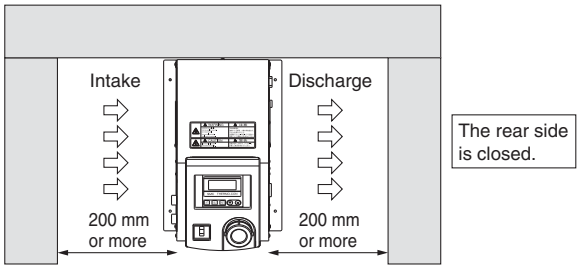
1. The inlet for radiation air must not be exposed to particles and dust as far as possible.

2. Do not let the inlet and outlet for radiation air get closed.

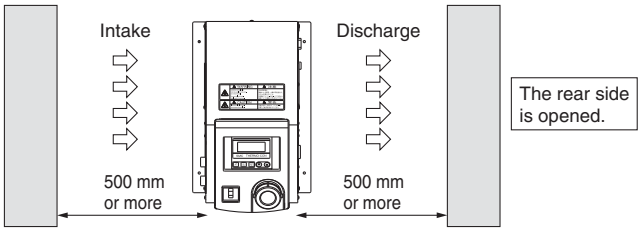
<HEC002>

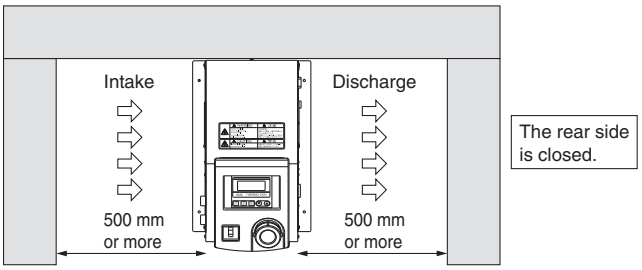
If radiation is prevented, the set temperature may not be achieved depending on the value of the set temperature and the load. Keep a space of 100 mm for opened rear side or 200 mm for closed rear side respectively.





<HEC006>





Note) The space must be 500 mm or more. Be sure that the ambient temperature is within the specification range.

Series HEC-A
Specific Product Precautions 2

Be sure to read this before handling. Refer to page 341 for Safety Instructions. For Temperature Control Equipment Precautions, refer to pages 342 to 345 and the Operation Manual on SMC website, http://www.smcworld.com

Radiation Air

⚠Caution

3. If more than one thermo-con is used, consider their arrangement so that the downstream sides of the thermo-cons suck radiation air from the upstream sides.

Otherwise, the performance at the downstream sides may deteriorate. Also, the set temperature may not be achieved depending on the value of the set temperature and the load. In such a case, take countermeasures such as changing the direction of the thermo-cons to prevent the deterioration of performance.

4. If dust adheres to the filter, remove dust with a vacuum cleaner or a dry cloth.

5. Do not operate without the filter.

Otherwise, dust may accumulate on the heat sink and electrical components, causing abnormal heating.

Circulating Fluid

⚠Caution

1. Use tap water or fluid which will not damage the wetted material.

(Stainless steel 303, Stainless steel 304, EPDM, Polypropylene, PE, PPE, Ceramics, Polyurethane)

2. Deionized water (with an electrical conductivity of approx. 1 μS/cm) can be used, but may lose its electrical conductivity.

Also, if a facility supplying deionized water is used, the thermo-con may be damaged by static electricity.

3. If deionized water is used, bacteria and algae may grow in short periods of time.

If the thermo-con is operated with bacteria and algae, its cooling capacity or the capacity of the pump may deteriorate. Exchange all deionized water regularly depending on the conditions (once a month as a guide).

4. If using a fluid other than water, please contact SMC beforehand.

5. The maximum operating pressure of circulating fluid circuit is 0.1 MPa.

If this pressure is exceeded, leakage from the tank in the thermo-con can result.

6. Select a pipe with a length and diameter which allow a flow rate of 1 L/min or more (HEC002) or 3 L/min or more (HEC006) for the circulating fluid.

If the flow rate is less than these values, the thermo-con cannot provide precise control, but also can fail because of the repeated cooling and heating operation.

7. A magnet driven pump is used as a circulating pump.

A fluid which contains metal powders such as iron powder cannot be used.

8. The thermo-con must not be operated without circulating fluid.

The pump can break due to idling.

Circulating Fluid

⚠Caution

9. If the tank lid is opened after the supply of circulating fluid, the circulating fluid may spill out depending on the condition of external piping.

10. If an external tank is used, the circulating fluid may spill out from the internal tank lid depending on where the external tank is installed.

Check that the internal tank has no leakage if using an external tank.

11. If there is a point where fluid is released to atmosphere externally (tank or piping), minimize the piping resistance at the circulating fluid return side.

If the piping resistance is too large, the piping may be crushed, or the built-in circulator tank may be deformed or cracked because the pressure in the piping for return will become negative. The built-in circulator tank is made of resin (PE). Therefore, the tank may be crushed if the pressure is negative. Special attention must be paid if the flow rate of the circulating fluid is high. To avoid getting negative pressure less than –0.02 MPa, the piping for return should be as thick and short as possible to minimize the piping resistance. It is also effective to restrict the flow rate of circulating fluid or remove the gasket of internal tank for the release to atmosphere.

12. Fluorinated fluid is outside of the specifications.

If it is used in the thermo-con, static electricity will be generated by the flow of fluid. This static electricity may be discharged to the board of the thermo-con, causing damage or operation failure and loss of data of such as set temperature. Also, as the specific gravity of the fluorinated fluid is 1.5 to 1.8 times of water, the pump will be overloaded, which also causes fluorinated fluid to be outside the specifications. Therefore, if fluorinated fluid is used, please contact SMC and we will introduce a suitable special product (water-cooled type).

13. Avoid operation with cavitation or bubbles due to low fluid level in the tank. This may shorten the pump life.

14. If tap water is used, it should satisfy the quality standards shown below.

Tap Water (as Circulating Water) Quality Standards

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

	Item	Unit	Standard value	Influence	
				Corrosion	Scale generation
Standard item	pH (at 25°C)	—	6.0 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		○
	Ionic state silica (SiO_2)	[mg/L]	30 or less		○
Reference item	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.
• ○: Factors that have an effect on corrosion or scale generation.
• Even if the water quality standards are met, complete prevention of corrosion is not guaranteed.

Specific Product Precautions 3

Be sure to read this before handling. Refer to page 341 for Safety Instructions. For Temperature Control Equipment Precautions, refer to pages 342 to 345 and the Operation Manual on SMC website, http://www.smcworld.com

Communication

⚠Caution

1. The set value can be written to EEPROM, but only up to approx. 1 million times.

In particular, pay attention to how many of times the writing is performed using the communication function.

Maintenance

⚠Warning

1. Prevention of electric shock and fire

Do not operate the switch with wet hands. Also, do not operate the thermo-con with water left on it.

2. Action in the case of error

If any error such as abnormal sounds, smoke, or bad smell occurs, cut off the power at once, and stop supplying and conveying fluid. Please contact SMC or a sales distributor to repair the thermo-con.

3. Regular inspection

Check the following items at least once a month. The inspection must be done by an operator who has sufficient knowledge and experience.

a) Check of displayed contents.
b) Check of temperature, vibration and abnormal sounds in the body of the thermo-con.
c) Check of the voltage and current of the power supply system.
d) Check for leakage and contamination of the circulating fluid and intrusion of foreign objects to it, and subsequent replacement of the fluid.
e) Check for flow condition, temperature and filter of radiation air.

Peltier-Type Chiller
Thermo-con (Water-cooled)
Series HEC-W

Note) Except HEC006, 012

How to Order



140 W, 320 W **HEC 003 – W 5 B –** ☐

Cooling capacity

001	140 W
003	320 W

Radiating method

W	Water-cooled

Power supply

5	100 to 240 VAC

Communication

A	RS-485
B	RS-232C

∗ Select B when communication is not used.

Option

Nil	None
F	With flow switch
N	NPT thread
L	With level switch

∗ The option should be specified when ordering.

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

Model		HEC001-W5A	HEC001-W5B	HEC003-W5A	HEC003-W5B
Cooling method		Thermoelectric device (Thermo-module)			
Radiating method		Water-cooled			
Control method		Cooling/Heating automatic shift PID control			
Ambient temperature/humidity		10 to 35°C, 35 to 80%RH (no condensation)			
Circulating fluid system	Circulating fluid	Tap water, 20% ethylene glycol			
	Operating temp. range	10.0 to 60.0°C (no condensation)			
	Cooling capacity	140 W Note 1)		320 W Note 1)	
	Heating capacity	400 W Note 1)		770 W Note 1)	
	Temperature stability Note 2)	±0.01 to 0.03°C			
	Pump capacity	Refer to performance chart.			
	Tank capacity	Approx. 1.2 L			
	Port size	IN/OUT: Rc3/8 Drain: Rc1/4 (with plug)			
	Wetted parts material	PPE, PP glass 10%, Alumina ceramics, Carbon, EPDM, Stainless steel 303, Stainless steel 304, PE, PP, NBR			
Facility water system	Temperature range	10 to 35°C (no condensation)			
	Pressure range	Within 1 MPa			
	Required flow rate Note 3)	3 to 7 L/min			
	Port size	IN/OUT: Rc3/8			
	Wetted parts material	Stainless steel 304			
Electrical system	Power supply	Single-phase 100 to 240 VAC ±10%, 50/60 Hz			
	Overcurrent protector	10 A			
	Current consumption	3.5 A (100 VAC) to 1.5 A (240 VAC)		5.5 A (100 VAC) to 2.5 A (240 VAC)	
	Alarm	Refer to alarm function.			
	Communications	RS-485	RS-232C	RS-485	RS-232C
Weight		Approx. 12 kg		Approx. 13 kg	
Accessories		Power cable, Foot for fixing, Splashproof cover			
Safety standards		CE marking, UL (NRTL) standards, SEMI			

Note 1) Circulating fluid/Tap water conditions: Circulating fluid set temperature 20°C, Flow rate 5 L/min., Facility water temperature 20°C, Flow rate 5 L/min., Ambient temperature 25°C
Note 2) The indicated values are with a stable load without turbulence in the operating conditions. It may be out of this range in some other operating conditions.
Note 3) The flow rate over or below the set range may deteriorate performance or generate noise.

How to Order



600 W, 1200 W **HEC 012 – W 2 B –** ☐

Cooling capacity

006	600 W
012	1200 W

Radiating method

W	Water-cooled

Power supply

2	200 to 220 VAC

Option

Nil	None
N	NPT thread

∗ The option should be specified when ordering.

Communication

A	RS-485
B	RS-232C

∗ Select B when communication is not used.

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

Model		HEC006-W2A	HEC006-W2B	HEC012-W2A	HEC012-W2B
Cooling method		Thermoelectric device (Thermo-module)			
Radiating method		Water-cooled			
Control method		Cooling/Heating automatic shift PID control			
Ambient temperature/humidity		10 to 35°C, 35 to 80%RH (no condensation)			
Circulating fluid system	**Circulating fluid** Note 1)	Tap water, Fluorinated fluid (Fluorinert™ FC-3283, GALDEN® HT135)			
	Operating temperature range	10.0 to 60.0°C (no condensation)			
	Cooling capacity	600 W (Tap water), 400 W (Fluorinert™ FC-3283) Note 2)		1200 W (Tap water), 800 W (Fluorinert™ FC-3283) Note 3)	
	Heating capacity	900 W (Tap water), 600 W (Fluorinert™ FC-3283) Note 2)		2200 W (Tap water), 1500 W (Fluorinert™ FC-3283) Note 3)	
	Temperature stability Note 4)	±0.01 to 0.03°C			
	Pump capacity	Refer to performance chart.			
	Tank capacity	Approx. 3 L		Approx. 5 L	
	Port size	IN/OUT: Rc3/8 Drain: Rc1/4 (with plug)		IN/OUT: Rc3/4 Drain: Rc1/4 (with plug)	
	Wetted parts material	Stainless steel 303, Stainless steel 304, EPDM, Ceramics, PPS glass 30%, Carbon, PE, Polyurethane		Stainless steel 303, Stainless steel 304, EPDM, Ceramics, PP, PE, Polyurethane, SiC, PPS	
Facility water system	**Temperature range**	10 to 35°C (no condensation)			
	Pressure range	Within 1 MPa			
	Required flow rate Note 5)	8 to 10 L/min		10 to 15 L/min	
	Port size	IN/OUT: Rc3/8		IN/OUT: Rc1/2	
	Wetted parts material	Stainless steel 303, Stainless steel 304			
Electrical system	**Power supply**	Single-phase 200 to 220 VAC ±10%, 50/60 Hz			
	Overcurrent protector	10 A		15 A	
	Current consumption	5 A		10 A	
	Alarm	Refer to alarm function.			
	Communications	RS-485	RS-232C	RS-485	RS-232C
Weight		Approx. 25 kg (including foot for fixing)		Approx. 40 kg (including foot for fixing)	
Accessories		Power cable, Foot for fixing			
Safety standards		CE marking			

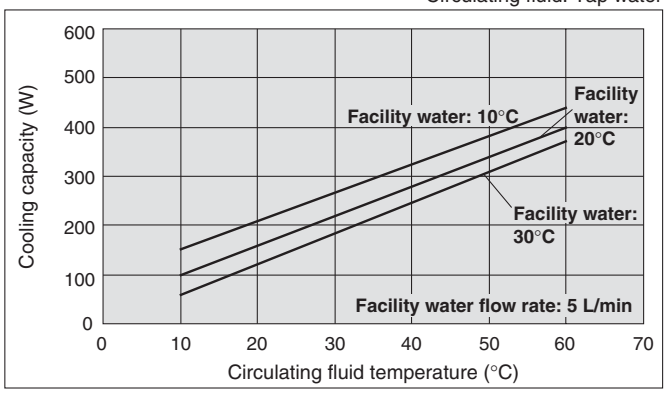
Note 1) Fluorinert™ is a trademark of 3M and GALDEN® is a registered trademark of Solvay Solexis, Inc. Regarding the fluid other than the above, please consult with SMC.
Note 2) Conditions: Set temperature 25°C, Facility water temperature 20°C, Facility water flow rate 8 L/min, Ambient temperature 25°C.
Note 3) Conditions: Set temperature 25°C, Facility water temperature 20°C, Facility water flow rate 10 L/min, Ambient temperature 25°C.
Note 4) The indicated values are with a stable load without turbulence in the operating conditions. It may be out of this range in some other operating conditions.
Note 5) The flow rate over or below the set range may deteriorate performance or generate noise.

The values shown on the performance chart are not guaranteed, but typical. Allow margins for safety when selecting the model.

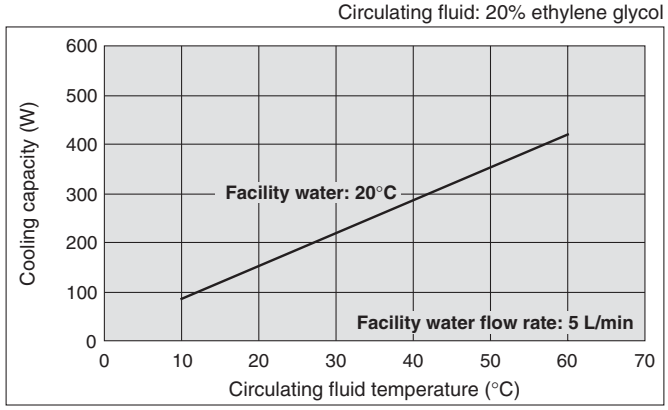
Cooling Capacity

HEC001

Circulating fluid: Tap water

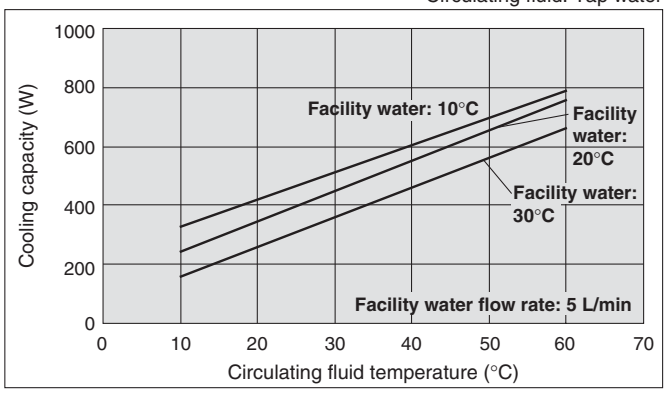


Circulating fluid: 20% ethylene glycol

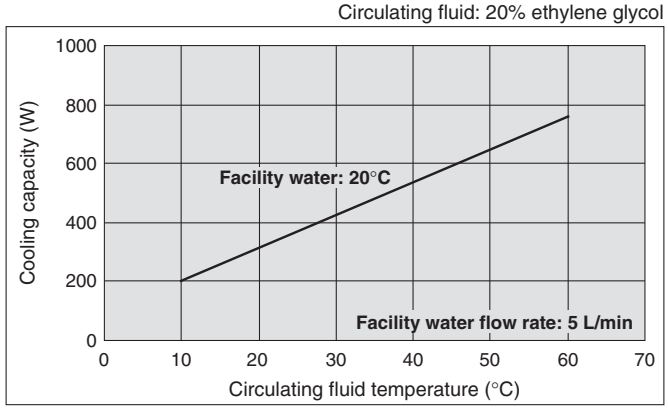


HEC003

Circulating fluid: Tap water

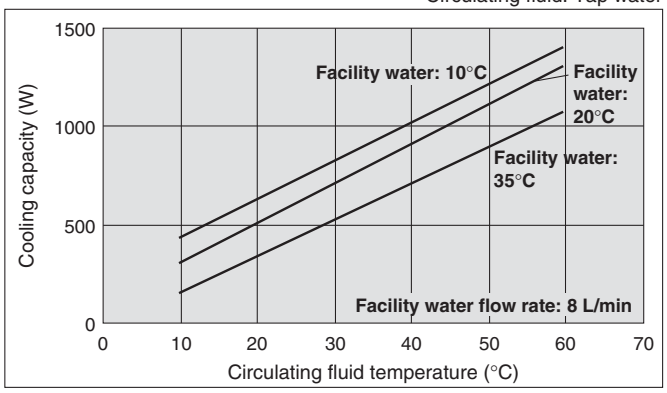


Circulating fluid: 20% ethylene glycol

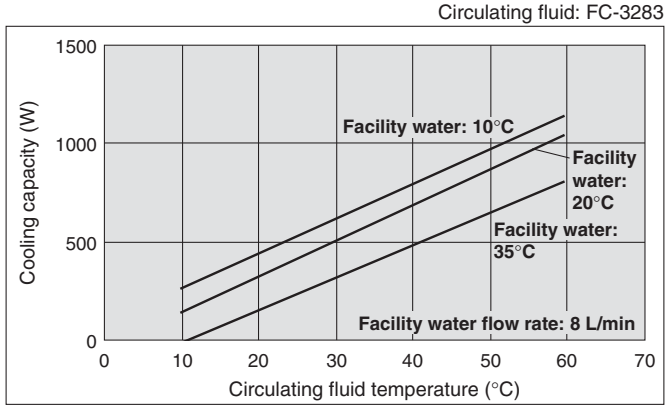


HEC006

Circulating fluid: Tap water

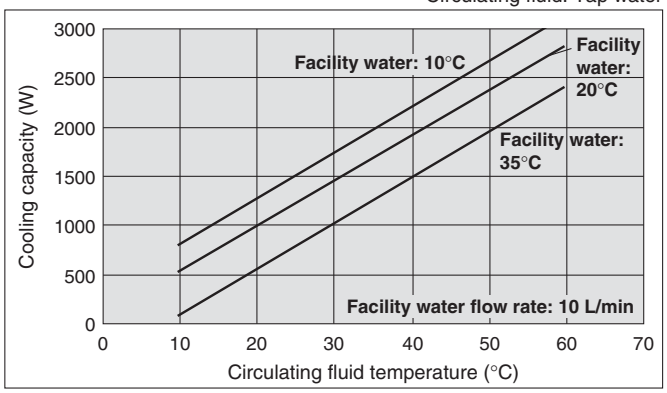


Circulating fluid: FC-3283

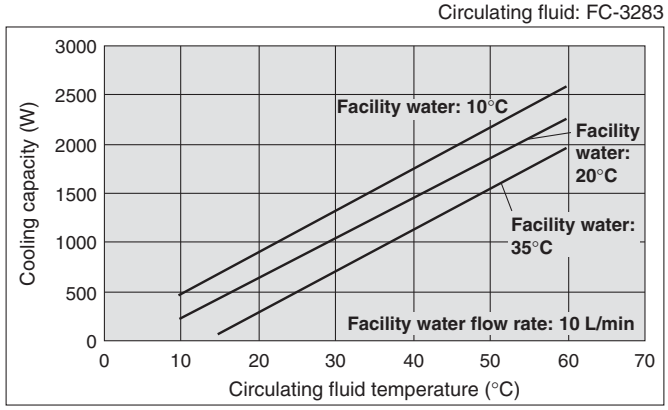


HEC012

Circulating fluid: Tap water



Circulating fluid: FC-3283

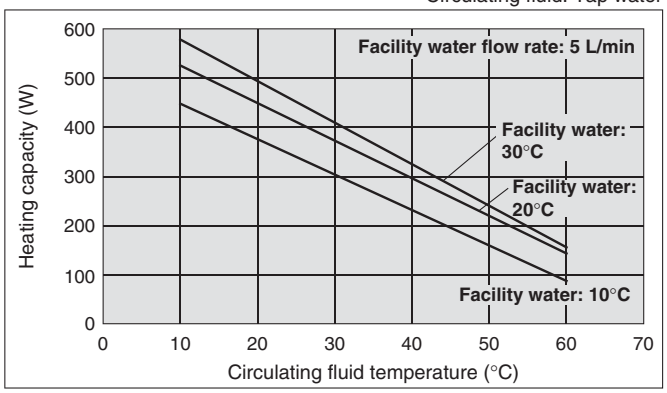


The values shown on the performance chart are not guaranteed, but typical. Allow margins for safety when selecting the model.

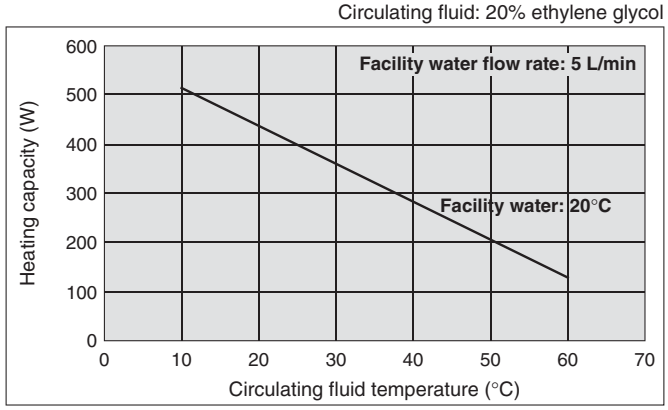
Heating Capacity

HEC001

Circulating fluid: Tap water

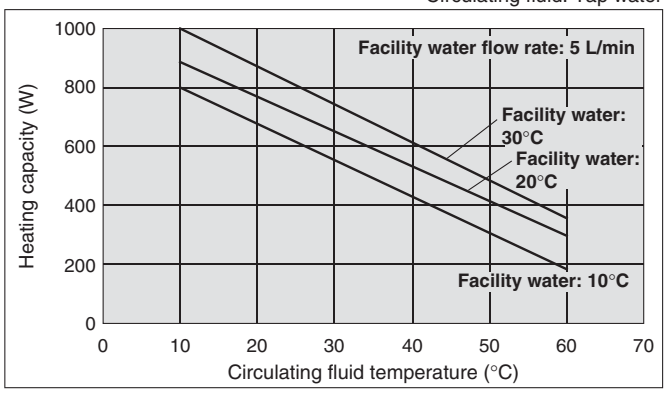


Circulating fluid: 20% ethylene glycol

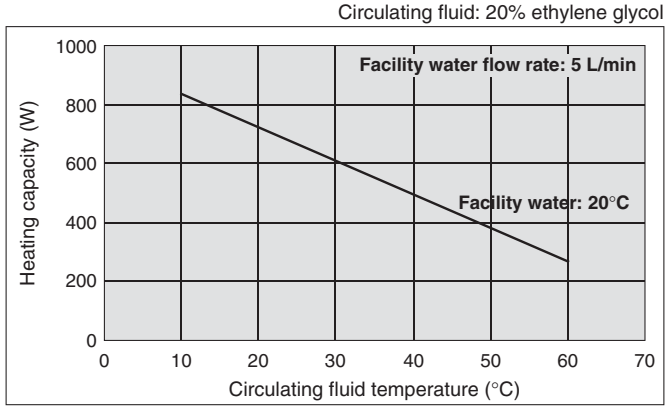


HEC003

Circulating fluid: Tap water

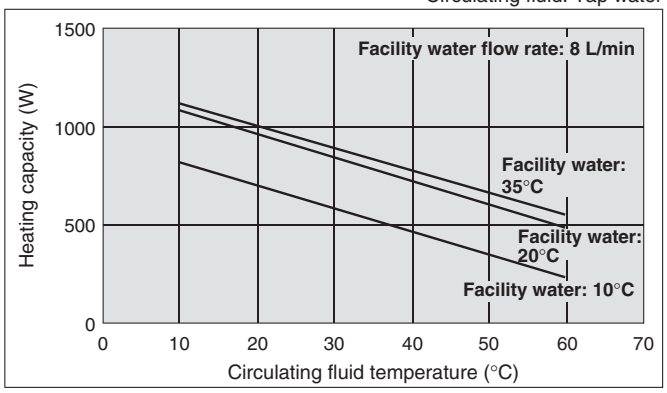


Circulating fluid: 20% ethylene glycol

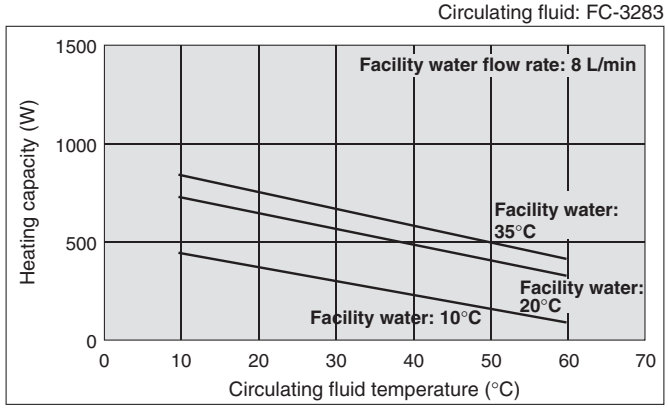


HEC006

Circulating fluid: Tap water

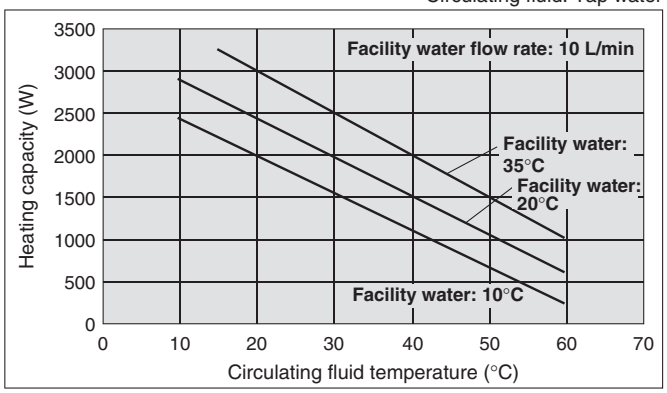


Circulating fluid: FC-3283

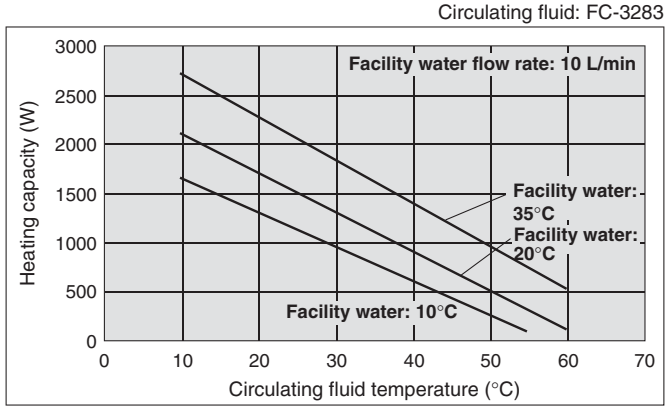


HEC012

Circulating fluid: Tap water

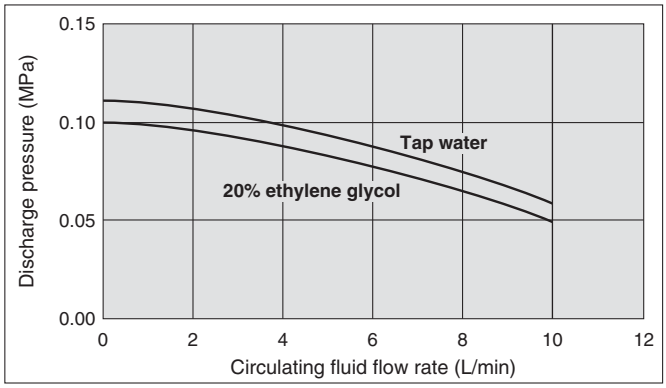


Circulating fluid: FC-3283

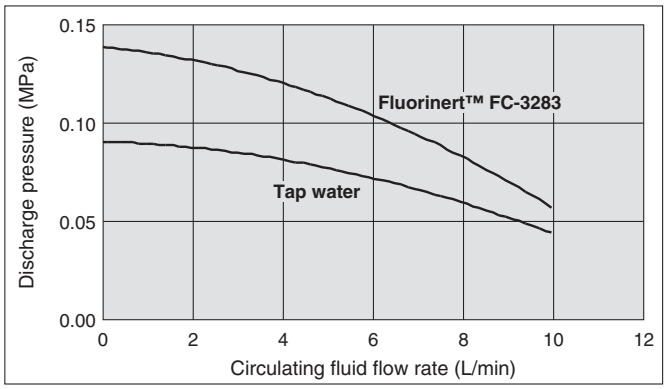


Pump Capacity (Thermo-con Outlet)

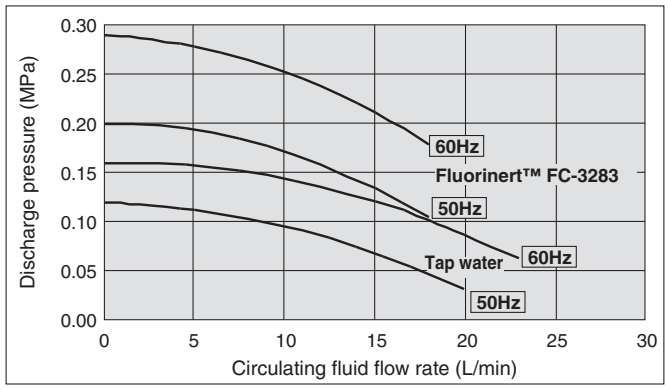
HEC001/003
Since a DC pump is used, the unit is not affected by power requirements.



HEC006
Since a DC pump is used, the unit is not affected by power requirements.

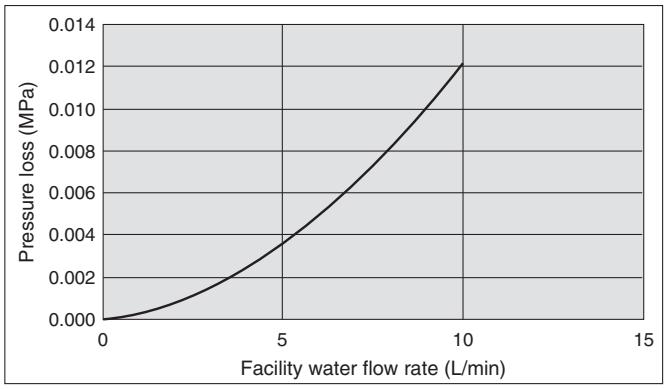


HEC012

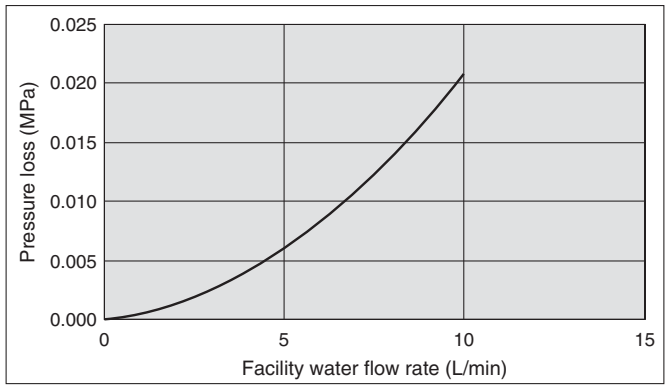


Pressure Loss in Facility Water Circuit

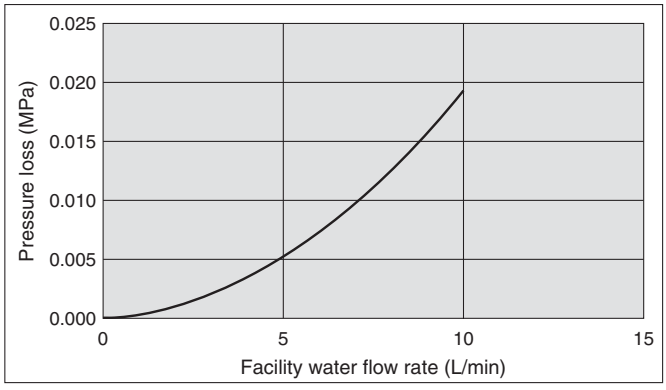
HEC001



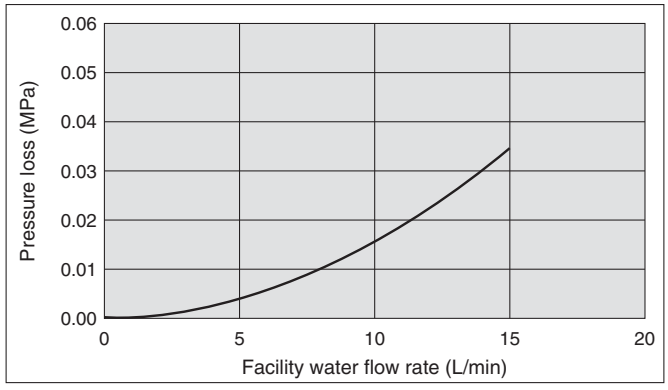
HEC003



HEC006

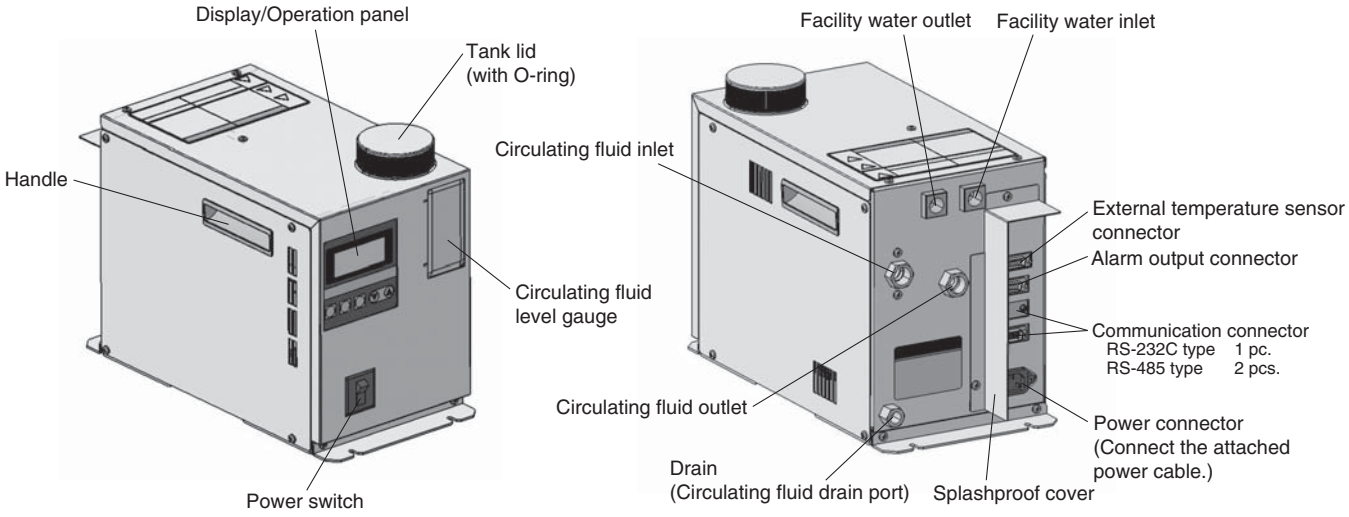


HEC012

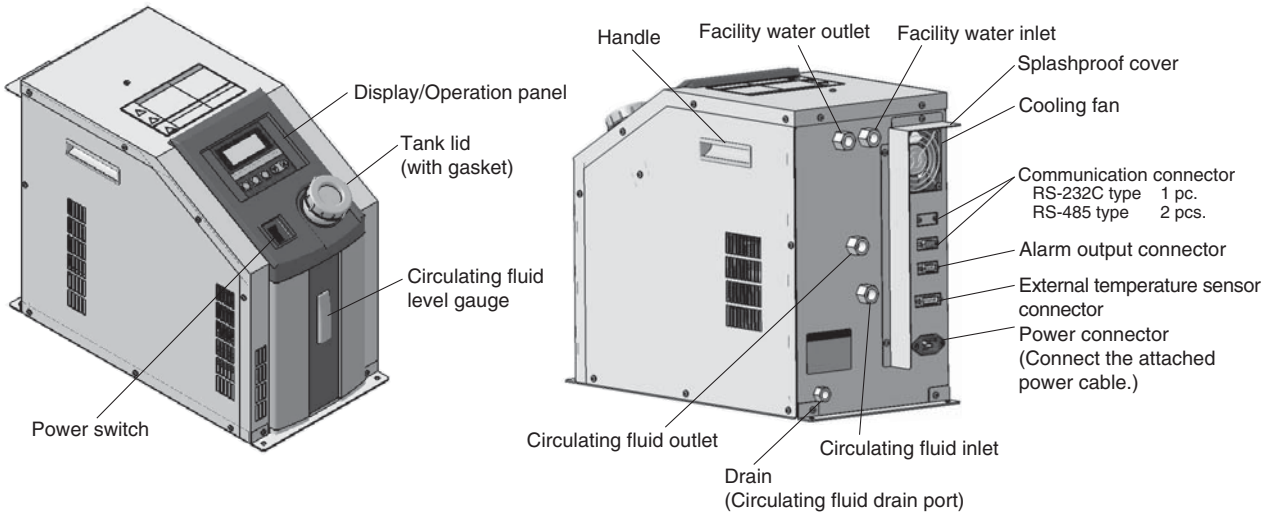


Parts Description

HEC001/003

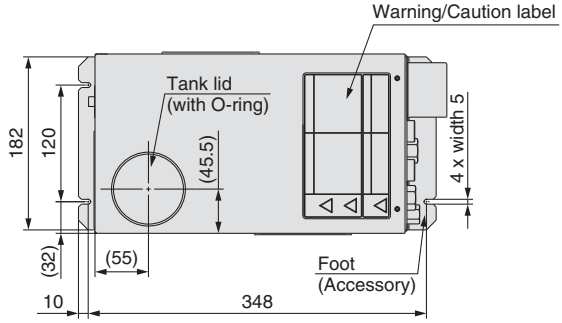


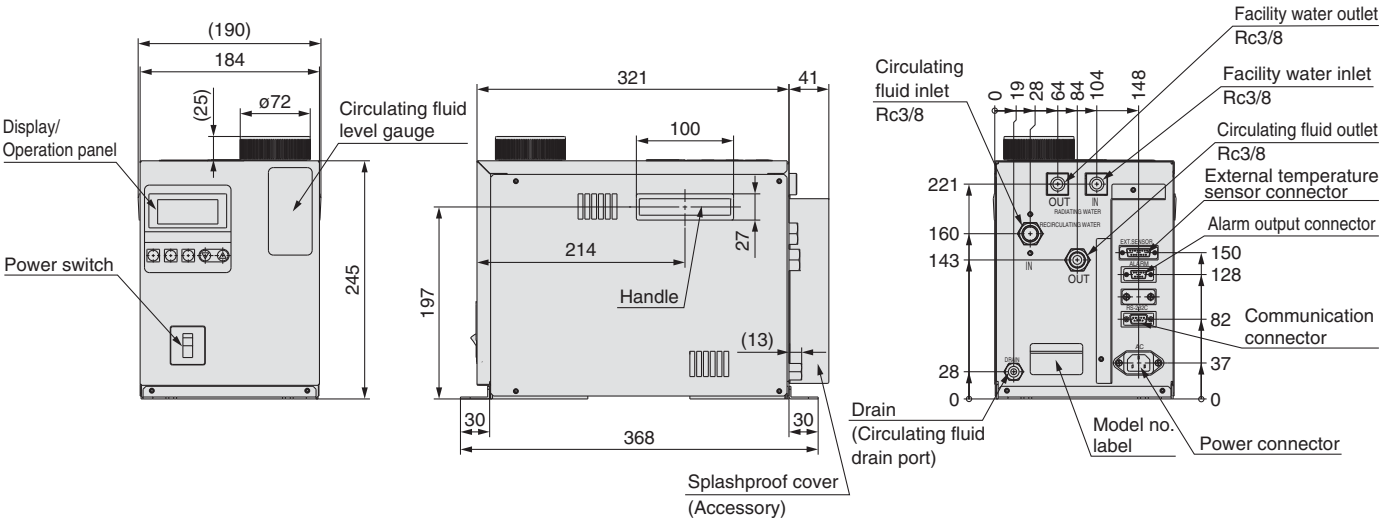
HEC006/012



Dimensions

HEC001-W5□
HEC003-W5□



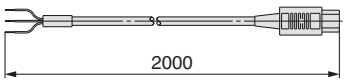


For NPT thread specification (-N), all fittings (including those at the circulating fluid drain port) are made of NPT.

Power Cable (Accessory)

Connector: IEC 60320 C13 or equivalent
Cable: 14AWG, O.D. ø8.4

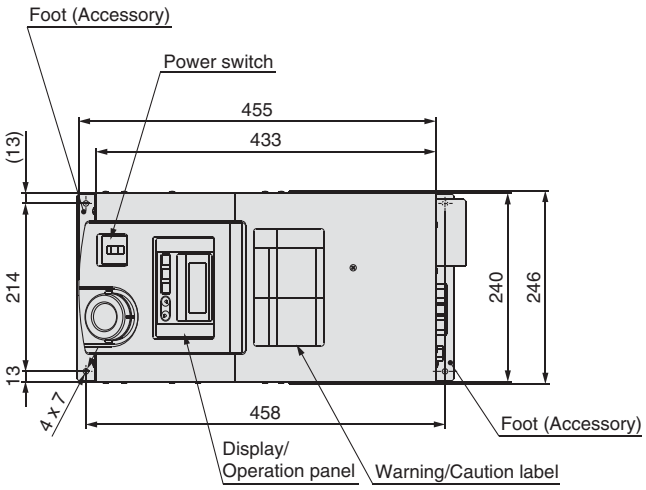
Wire color	Contents
Black	100 to 240 VAC
Black	100 to 240 VAC
Green/Yellow	PE

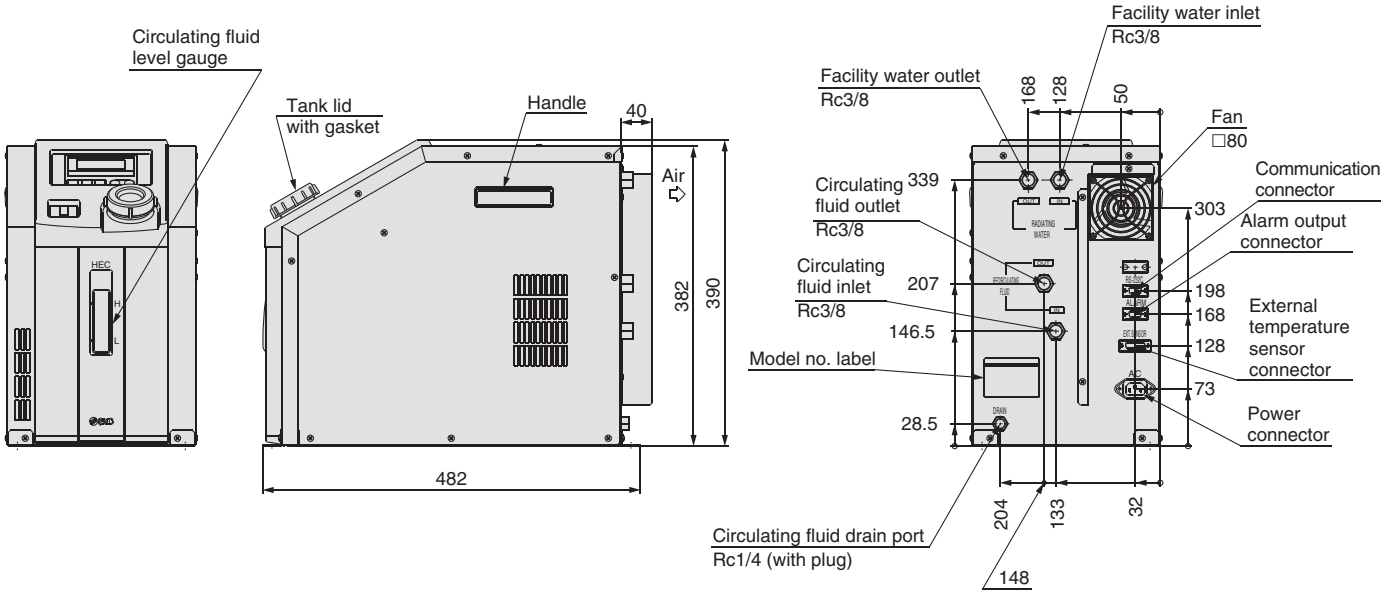


Power cable (Accessory)

Dimensions

HEC006-W2□



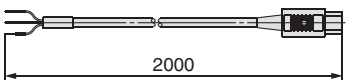


For NPT thread specification (-N), all fittings (including those at the circulating fluid drain port) are made of NPT.

Power Cable

Connector: IEC 60320 C13 or equivalent
Cable: 14AWG, O.D. ø8.4

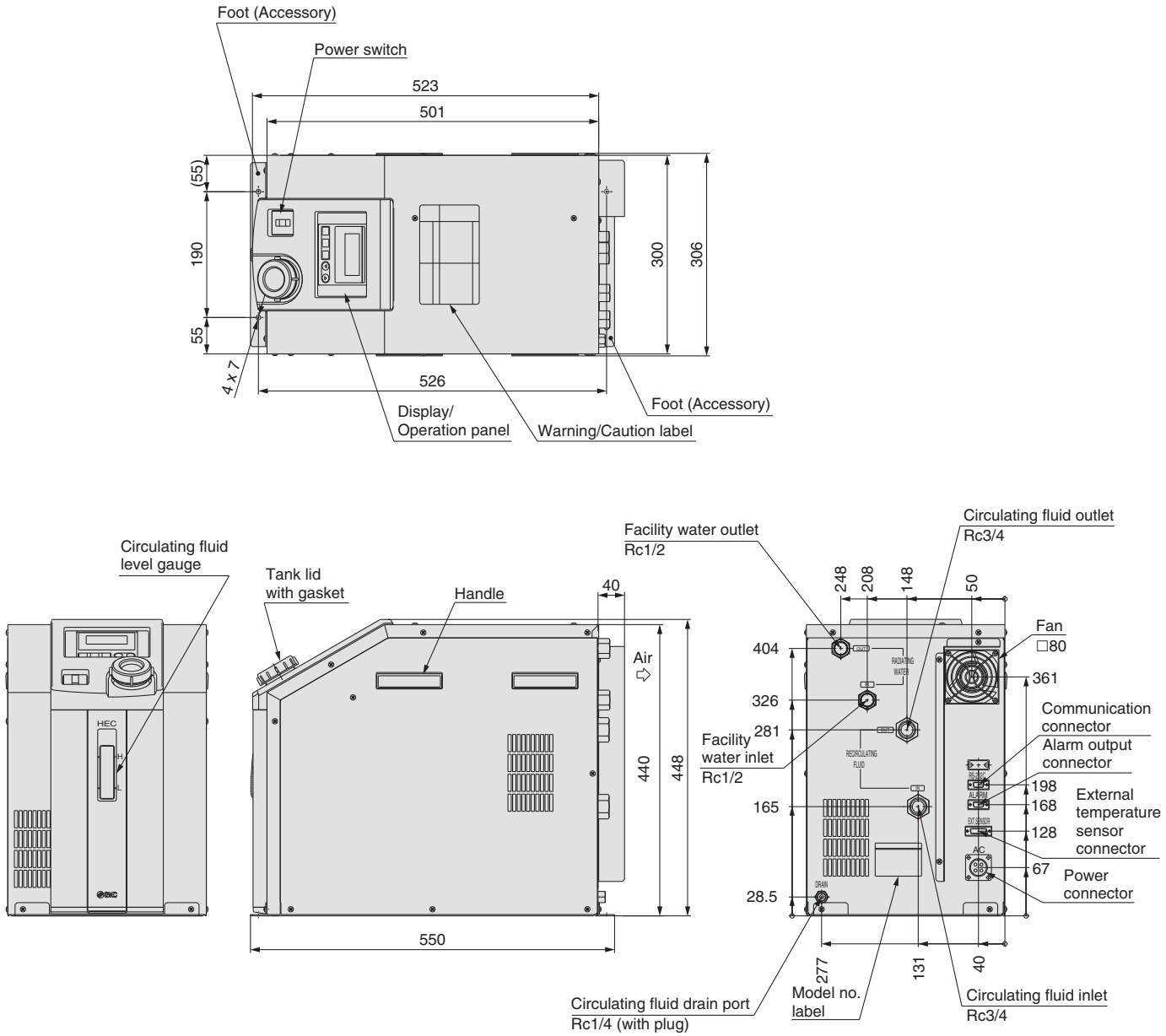
Wire color	Contents
Black	200 to 220 VAC
Black	200 to 220 VAC
Green/Yellow	PE



Power cable (Accessory)

Dimensions

HEC012-W2□

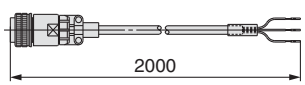


For NPT fitting specification (-N), all fittings (including those at the circulating fluid drain port) are made of NPT.

Power Cable

Connector: DDK CE05-6A18-10SD-D-BSS or equivalent
Cable: 14AWG, O.D. ø8.4

Wire color	Contents
Black	200 to 220 VAC
Black	200 to 220 VAC
Green/Yellow	PE



Power cable (Accessory)

Connectors

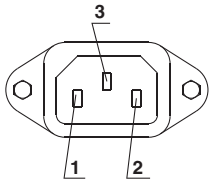
HEC006-W2□/001-W5□/003-W5□

1. Power connector (AC)
IEC 60320 C14 or equivalent
HEC006-W2□

Pin No.	Contents
1	200 to 220 VAC
2	200 to 220 VAC
3	PE

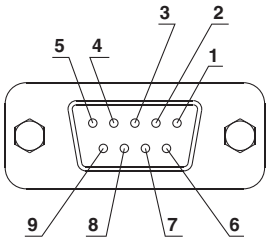
HEC001-W5□
HEC003-W5□

Pin No.	Contents
1	100 to 240 VAC
2	100 to 240 VAC
3	PE



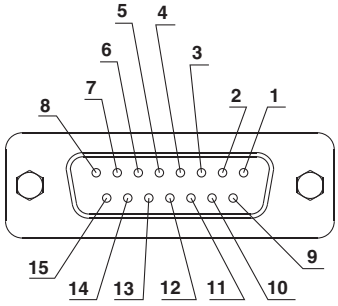
2. Communication connector (RS-232C or RS-485)
D-sub 9 pin (socket)
Holding screw: M2.6

Pin No.	Signal contents	
	RS-232C	RS-485
1	Unused	BUS+
2	RD	BUS–
3	SD	Unused
4	Unused	Unused
5	SG	SG
6-9	Unused	Unused



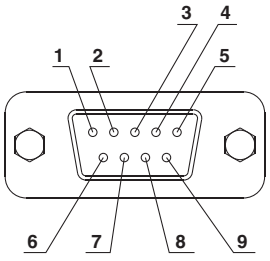
3. External sensor connector (EXT.SENSOR)
D-sub 15 pin (socket)
Holding screw: M2.6

Pin No.	Signal contents
1-2	Unused
3	Terminal A of resistance temperature detector
4	Terminal B of resistance temperature detector
5	Terminal B of resistance temperature detector
6-14	Unused
15	FG



4. Alarm output connector (ALARM)
D-sub 9 pin (pin)
Holding screw: M2.6

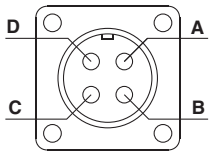
Pin No.	Signal contents
1	Contact a for output cut-off alarm (open when alarm occurs)
2	Common for output cut-off alarm
3	Contact b for output cut-off alarm (closed when alarm occurs)
4-5	Unused
6	Contact a for upper/lower temp. limit alarm (open when alarm occurs)
7	Common for upper/lower temp. limit alarm
8	Contact b for upper/lower temp. limit alarm (closed when alarm occurs)
9	Unused



HEC012-W2□

Power connector (AC)
DDK CE05-2A18-10PD-D or equivalent

Pin No.	Contents
A	200 to 220 VAC
B	200 to 220 VAC
C	Unused
D	PE



Other connectors are the same as those for the HEC006-W2□.

Alarm

This unit is equipped as standard with a function allowing 15 kinds of alarms to display on the LCD and can be read out by serial communication. Also, it can generate relay output for upper/lower temperature limit alarm and output cut-off alarm.

Alarm code	Alarm description	Operation status	Main reason
WRN	Upper/Lower temp. limit alarm	Continue	The temperature has exceeded the upper or lower limit of the target temperature.
ERR00	CPU hung-up	Stop	The CPU has crashed due to noise, etc.
ERR01	CPU check error	Stop	The contents of the CPU cannot be read out correctly when the power supply is turned on.
ERR03	Back-up data error	Stop	The contents of the back-up data cannot be read out correctly when the power supply is turned on.
ERR04	EEPROM writing error	Stop	The data cannot be written to EEPROM.
ERR11	DC power supply failure	Stop	The DC power supply has failed (due to abnormal high temperature) or an irregular voltage has occurred or the thermo-module has been short-circuited.
ERR12	Internal temp. sensor high temp. error	Stop	The internal temperature sensor has exceeded the upper limit of cut-off temperature.
ERR13	Internal temp. sensor low temp. error	Stop	The internal temperature sensor has exceeded the lower limit of cut-off temperature.
ERR14	Thermostat alarm	Stop	The thermostat has been activated due to insufficient of the facility water or high temperature.
ERR15	Abnormal output alarm	Continue	The temperature cannot be changed even at 100% output due to overload or disconnection of the thermo-module.
ERR16	Pump failure *1 or low circulating fluid level alarm *2	Stop	The pump has been overloaded *1 or the flow switch is activated *2.
ERR17	Internal temp. sensor disconnection alarm	Stop	The internal temperature sensor has been disconnected or short-circuited.
ERR18	External temp. sensor disconnection alarm	Continue	The external temperature sensor has been disconnected or short-circuited. (Only detected when in learning control or external tune control.)
ERR19	Abnormal auto tuning alarm	Stop	Auto tuning has not been completed within 20 minutes.
ERR20	Low fluid level alarm *3	Stop	The amount of circulating fluid in the tank has dropped and the level switch is activated.

*1 The HEC012 only
*2 Optional for the HEC001 and HEC003 only (Not available for the HEC006)
*3 Optional for the HEC001 and HEC003

Maintenance

Maintenance of this unit is performed only in the form of return to and repair at SMC's site. As a rule, SMC will not conduct on-site maintenance. Separately, the following parts have a limited life and need to be replaced before the life ends.

Parts Life Expectation

Description	Expected life	Possible failure
Pump	3 to 5 years	The bearing is worn so the pump fails to transfer the circulating fluid, which results in temperature control failure.
Fan	5 to 10 years	The bearing uses up lubrication and makes the fan unable to supply enough air, which increases the internal temperature of the thermo-con, and activates the overheat protection of the power supply and generates the alarm.
DC power supply	5 to 10 years	The capacity of the electrolytic condenser decreases, and causes abnormal voltage which results in DC power supply failure and stops the thermo-con.
Display panel	50,000 hours (approx. 5 years)	The display turns off when the backlight of the LCD reaches the end of its life.

Series HEC-W
Options

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

F Option symbol

With Flow Switch

HEC□□□-□□□-F

With flow switch

This is an ON/OFF switch detecting low levels of the circulating fluid.
When the fluid volume is 1 L/min. or less, “ERR16” is displayed and the thermo-con stops. This switch is installed between the circulating fluid inlet and the tank, and built into the Thermo-con.
Refer to page 270.

Type	Applicable model
Water-cooled	**HEC001-W5□-F**
	HEC003-W5□-F

N Option symbol

NPT Thread

HEC□□□-□□□-N

NPT thread

The connection parts of circulating fluid piping, facility water piping and circulating fluid drain port are NPT thread type.

Type	Applicable model
Water-cooled	**HEC001-W5□-N**
	HEC003-W5□-N
	HEC006-W2□-N
	HEC012-W2□-N

L Option symbol

With Level Switch

HEC□□□-□□□-L

With level switch

This switch is used to detect a LOW level of tank fluid. When the fluid level becomes below the LOW level, “ERR20” is displayed and the thermo-con stops. This switch is installed in the circulating fluid tank and built into the thermo-con.
Refer to page 270.

Type	Applicable model
Water-cooled	**HEC001-W5□-L**
	HEC003-W5□-L

Other models include a level switch as standard equipment.

Series HEC-W
Specific Product Precautions 1

Be sure to read this before handling. Refer to page 341 for Safety Instructions. For Temperature Control Equipment Precautions, refer to pages 342 to 345 and the Operation Manual on SMC website, http://www.smcworld.com

System Design

⚠Warning

1. This catalog shows the specifications of the thermo-con.

1. Check detailed specifications in the separate "Product Specifications", and evaluate the compatibility of the thermo-con with customer's system.
2. Although the protection circuit as a single unit is installed, the customer is requested to carry out the safety design for the whole system.

Handling

⚠Warning

1. Thoroughly read the Operation Manual.

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

2. If the set temperature is repeatedly changed by 10°C or more, the thermo-con may fail in short periods of time.

Operating Environment/Storage Environment

⚠Warning

1. Keep within the specified ambient temperature and humidity range.

Also, if the set temperature is too low, condensation may form on the inside of the thermo-con or the surface of piping even within the specified ambient temperature range. Dew condensation can cause failure, and so must be avoided by considering operating conditions.

2. The thermo-con is not designed for clean room usage.

The pump and fan generate dust.

3. Low molecular siloxane can damage the contact of the relay.

Use the thermo-con in a place free from low molecular siloxane.

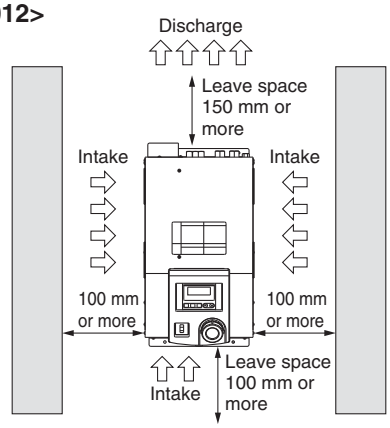
Operating Environment/Storage Environment

⚠Warning

4. Installation conditions

If the space for the intake and discharge of air is insufficient, the amount of transferred air will decrease, which can impair the performance and life of the product. Therefore, keep the conditions illustrated below for installation. Also, if ambient temperature is expected to be over 35°C, vent or exhaust air to prevent the increase of ambient temperature over 35°C.

<HEC006/012>



<HEC001/003>

It is not necessary to leave space for ventilation. Install the product while taking working space for installation and maintenance into account. However, ventilation must be also considered so that ambient temperature does not excessively rise.

Facility Water

⚠Caution

1. If the temperature of the facility water is too low, it can cause formation of dew condensation inside the heat exchanger.

Supply facility water with a temperature over the atmospheric dew point to avoid the formation of dew condensation.

2. If the facility water piping is connected to multiple machines, the facility water exchanges heat at the upstream side and its temperature will become higher as it goes downstream.

Limit the number of connected thermo-cons to two per facility water system, and if more than two thermo-cons are to be connected, increase the number of systems.

Circulating Fluid

⚠Caution

1. Use tap water or fluid which will not damage the wetted parts material as described in this catalog's specifications.

(PPE, PP glass 10%, Alumina ceramics, Carbon, EPDM, Stainless steel 303, Stainless steel 304, PE, PP, NBR)

2. Deionized water (with an electrical conductivity of approx. 1 μS/cm) can be used, but may lose its electrical conductivity.

Series HEC-W
Specific Product Precautions 2

Be sure to read this before handling. Refer to page 341 for Safety Instructions. For Temperature Control Equipment Precautions, refer to pages 342 to 345 and the Operation Manual on SMC website, http://www.smcworld.com

Circulating Fluid

⚠Caution

3. If deionized water is used, bacteria and algae may grow in a short period.

If the thermo-con is operated with bacteria and algae, its heat exchanging capacity or the capacity of the pump may deteriorate. Exchange all deionized water regularly depending on the conditions (once a month as a guide).

4. If using a fluid other than this catalog, please contact SMC beforehand.

5. The maximum operating pressure of circulating fluid circuit is 0.1 MPa.

If this pressure is exceeded, leakage from the tank in the thermo-con can result.

6. Select a pipe with a length and diameter which allow a flow rate of 3 L/min or more for the circulating fluid.

If the flow rate is less than 3 L/min, the thermo-con cannot provide precise control, but also can fail because of the repeated cooling and heating operation.

7. A magnet driven pump is used as a circulating pump.

A fluid which contains metal powders such as iron powder cannot be used.

8. The thermo-con must not be operated without circulating fluid.

The pump can break due to idling.

9. If the tank lid is opened after the supply of circulating fluid, the circulating fluid may spill out depending on the condition of external piping.

10. If an external tank is used, the circulating fluid may spill out from the internal tank lid depending on where the external tank is installed.

Check that the internal tank has no leakage if using an external tank.

11. If there is a point where fluid is released to atmosphere externally (tank or piping), minimize the piping resistance at the circulating fluid return side.

If the piping resistance is too large, the piping may be crushed, or the built-in circulator tank may be deformed or cracked because the pressure in the piping for return will become negative. The built-in circulator tank is made of resin (PE). Therefore, the tank may be crushed if the pressure is negative. Special attention must be paid if the flow rate of the circulating fluid is high. To avoid getting negative pressure less than –0.02 MPa, the piping for return should be as thick and short as possible to minimize the piping resistance. It is also effective to restrict the flow rate of circulating fluid or remove the gasket of internal tank for the release to atmosphere.

12. If fluorinated fluid is used in the thermo-con (HEC006/012), static electricity will be generated by the flow of fluid. This static electricity may be discharged to the board of the thermo-con, causing damage or operation failure and loss of data of such as set temperature.

Ground pipe in order to remove static electricity.

13. Avoid operation with cavitation or bubbles due to low fluid level in the tank. This may shorten the pump life.

Circulating Fluid

⚠Caution

14. If tap water is used, it should satisfy the quality standards shown below.

Tap Water (as Circulating Water) Quality Standards

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

	Item	Unit	Standard value	Influence	
				Corrosion	Scale generation
Standard item	pH (at 25°C)	—	6.0 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		○
	Ionic state silica (SiO_2)	[mg/L]	30 or less		○
Reference item	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.
• ○: Factors that have an effect on corrosion or scale generation.
• Even if the water quality standards are met, complete prevention of corrosion is not guaranteed.

Communication

⚠Caution

1. The set value can be written to EEPROM, but only up to approx. 1 million times.

In particular, pay attention to how many of times the writing is performed using the communication function.

Maintenance

⚠Warning

1. Prevention of electric shock and fire

Do not operate the switch with wet hands. Also, do not operate the thermo-con with water left on it.

2. Action in the case of error

If any error such as abnormal sounds, smoke, or bad smell occurs, cut off the power at once, and stop supplying and conveying fluid. Please contact SMC or a sales distributor to repair the thermo-con.

3. Regular inspection

Check the following items at least once a month. The inspection must be done by an operator who has sufficient knowledge and experience.

a) Check of displayed contents.
b) Check of temperature, vibration and abnormal sounds in the body of the thermo-con.
c) Check of the voltage and current of the power supply system.
d) Check for leakage and contamination of the circulating fluid and intrusion of foreign objects to it, and subsequent replacement of water.
e) Check for leakage, quality change, flow rate and temperature of facility water.

Peltier-Type

Thermoelectric Bath

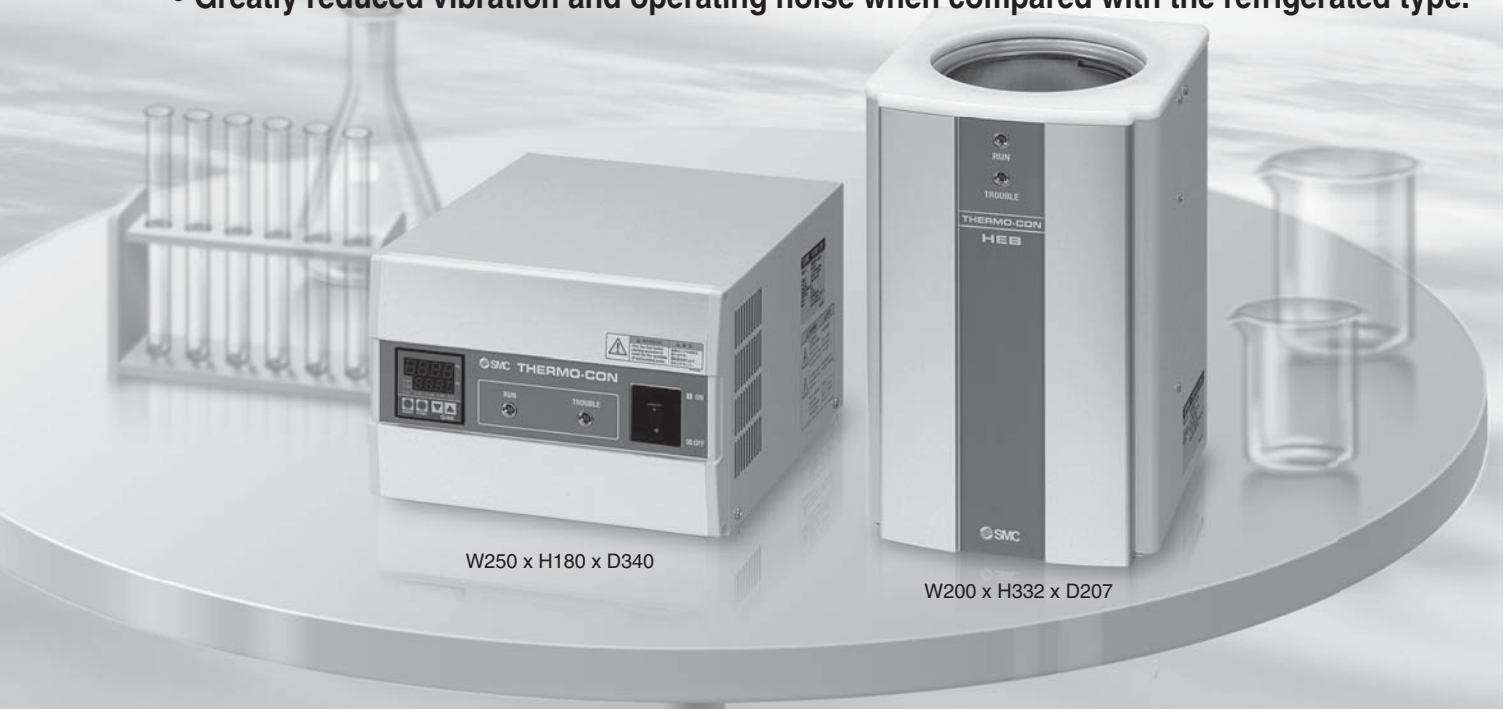
Series HEB

Accurately controls the temperature of liquid in the bath.

Temperature stability: ±0.01°C

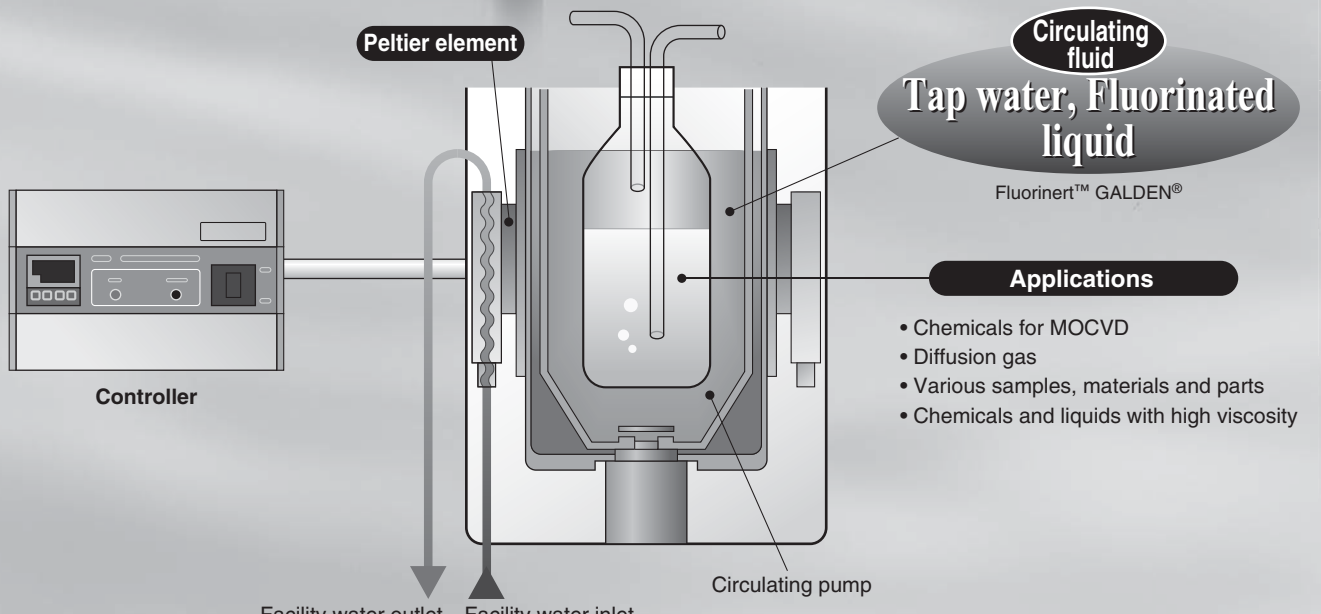
Temperature distribution: ±0.02°C in the bath

- Environmentally friendly and refrigerant-free
- Heaterless
- Function to detect abnormal heating and temperature sensor errors comes standard.
- Light and compact
- Greatly reduced vibration and operating noise when compared with the refrigerated type.



W250 x H180 x D340

W200 x H332 x D207



Circulating fluid

Tap water, Fluorinated liquid

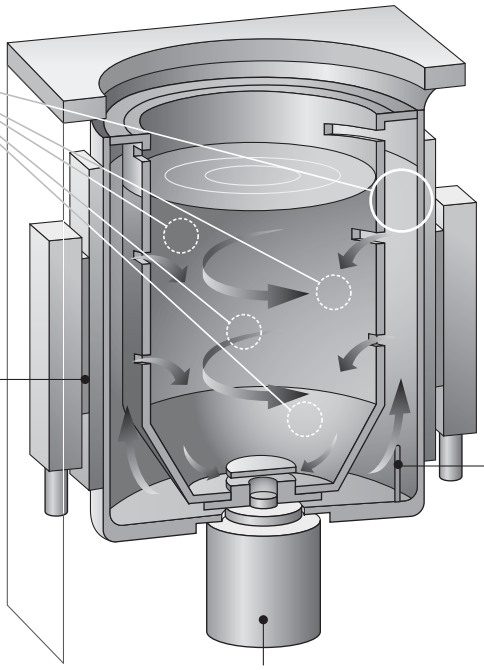
Fluorinert™ GALDEN®

Applications

- Chemicals for MOCVD
- Diffusion gas
- Various samples, materials and parts
- Chemicals and liquids with high viscosity

Features

Exclusively developed dual tank construction to provide consistent temperature at any position in the bath



Peltier element

(Thermo-module, Thermoelectric device)

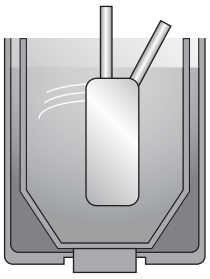
Temperature sensor

- Accurate display by measuring the circulating fluid with a temperature sensor directly

Circulating pump

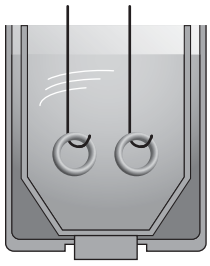
Application Examples

Semiconductor



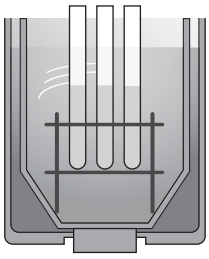
Evaporation of chemicals for MOCVD
Temperature control of diffusion gas

Various tests



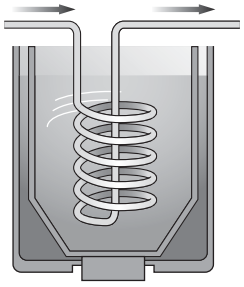
Thermal test with immersion

Physical and chemical analysis



Temperature control of various samples, materials and parts

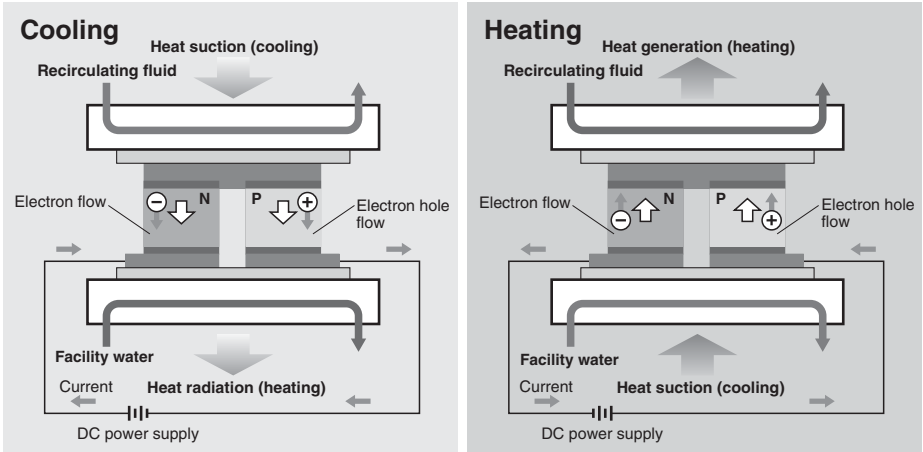
Various chemical processes



Indirect temperature control of chemicals and liquids with high viscosity

Principle of Peltier Device (Thermo-module, Thermoelectric device)

A Peltier device (thermo-module, thermoelectric device) is a plate type element, inside which P-type semiconductors and N-type semiconductors are located alternately. If direct current is supplied to the Peltier device, heat is transferred inside the device, and one face generates heat and increases temperature while the other face sucked heat and decreases temperature. Therefore, changing the direction of the current supplied to the Peltier device can achieve heating and cooling operation. This method has a fast response and can shift quickly between heating and cooling, so temperature can be controlled very precisely.



CONTENTS

Series HEB



Thermoelectric Bath Series HEB

How to Order ····· Page 305
Specifications ····· Page 306
Cooling Capacity ····· Page 307
Heating Capacity ····· Page 307
Pressure Loss in Facility Water Circuit ····· Page 307
Parts Description ····· Page 307
Dimensions ····· Page 308
Connectors ····· Page 309
Maintenance ····· Page 309

Specific Product Precautions ····· Page 310

Made to Order ····· Page 312



Peltier-Type Thermoelectric Bath

Series HEB



Controller

Liquid tank

How to Order

Combination (Controller + Liquid tank)

HEB C 002 – W A 10 – □

Shape of bath

C	Round

Cooling capacity

002	140 W

Radiating method

W	Water-cooled

Communication

A	RS-485
B	RS-232C

Liquid tank size

10	ø130 x H180

Option

Nil	Rc1/4
N	NPT1/4

∗ The option should be specified when ordering.

Liquid tank

HEB C 002 – H W 10 – □

Shape of bath

C	Round

Cooling capacity

002	140 W

Liquid tank

Radiating method

W	Water-cooled

Liquid tank size

10	ø130 x H180

Option

Nil	Rc1/4
N	NPT1/4

∗ The option should be specified when ordering.

Controller

HEBC002 – C A

Controller

Communication

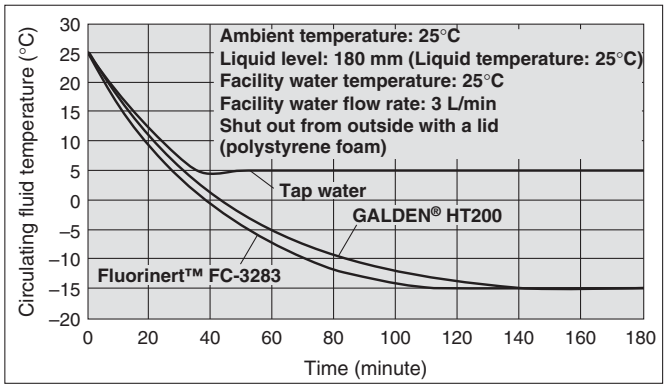
A	RS-485
B	RS-232C

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

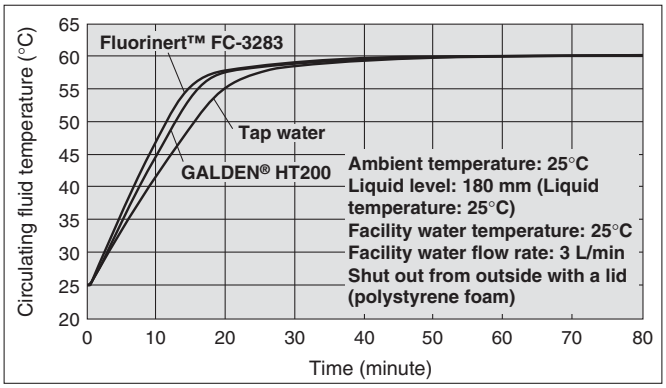
Model		HEBC002-WA10	HEBC002-WB10
Cooling method		Peltier device (Thermo-module, Thermoelectric device)	
Radiating method		Liquid tank: Water-cooled, Controller: Forcible air-cooled	
Control method		Cooling/Heating automatic shift PID control	
Ambient temperature/humidity		10 to 35°C, 35 to 80%RH	
Circulating fluid system	**Application fluid** Note 1)	Tap water, Fluorinated liquid (Fluorinert™ FC-3283, GALDEN® HT135, HT200)	
	Set temperature range Note 1) Note 5)	–15.0 to 60.0°C (5 to 60°C for water)	
	Cooling capacity Note 2)	140 W (Water)	
	Heating capacity Note 2)	300 W (Water)	
	Temperature stability Note 3)	±0.01°C	
	Temperature distribution Note 3)	±0.02°C	
	Tank dimensions	Internal diameter ø130 x Liquid level 188 mm	
Facility water system	**Temperature**	10 to 35°C (no condensation)	
	Pressure range	Within 0.5 MPa	
	Flow rate Note 4)	3 to 5 L/min	
	Port size	IN/OUT: Rc1/4	
	Wetted parts material	Stainless steel 303, Stainless steel 304, FEP, A6063 (anodized)	
Electrical system	**Power supply**	Single-phase 100 to 240 VAC, 50/60 Hz	
	Overcurrent protector	10 A	
	Current consumption	4 A (100 VAC) to 2 A (240 VAC)	
	Alarm (With alarm output connector)	1) Overheating of liquid tank (which activates the thermostat) 2) Controller output voltage reduction 3) Controller fan rotation stopped	
Communications		RS-485	RS-232C
Weight		Liquid tank: Approx. 8.5 kg Controller: Approx. 6.5 kg	
Accessories		Power cable (2 m), DC cable, Signal cable (3 m each)	
Safety standards		CE marking, UL (NRTL) standard	

Note 1) GALDEN® is a trademark of Solvay Solexis and Fluorinert™ is a trademark of 3M. For other fluids, please contact SMC.
Note 2) Determined under the following conditions: water as the recirculating fluid, set temperature 25°C, facility water temperature 25°C, flow rate 3 L/min, ambient temperature 25°C, and sealed from outside air with a lid.
Note 3) Differs depending on the operating conditions.
Note 4) An appropriate range is from 3 to 5 L/min. To prevent damage to the radiating system, do not supply a flow over the maximum flow rate of 8 L/min.
Note 5) When the temperature is set high, the liquid temperature inside of the liquid tank and the temperature inside of the thermostat could differ greatly depending on the heating mode at start-up, and the thermostat could then begin operating and stop the output. Confirm that there is no problem by carrying out an operating test beforehand.

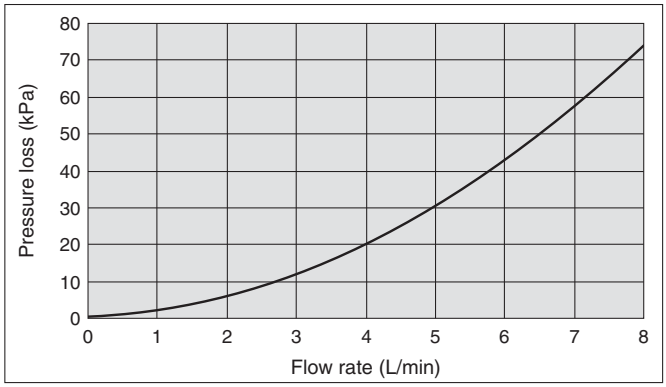
Cooling Capacity



Heating Capacity



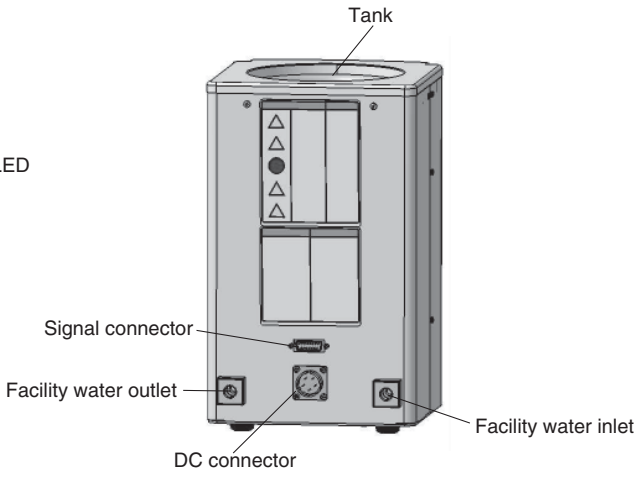
Pressure Loss in Facility Water Circuit

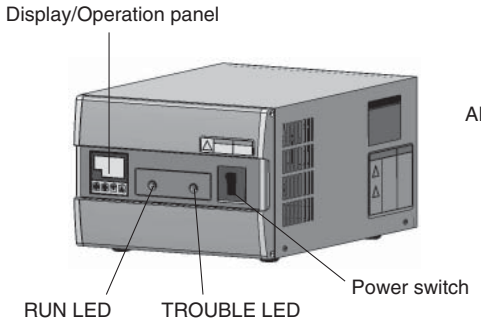


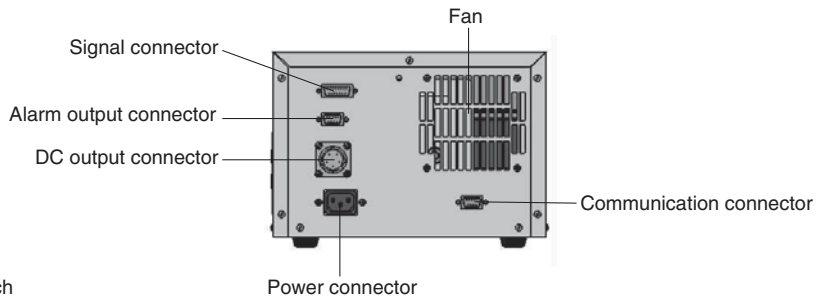
The values shown on the performance chart are not guaranteed, but typical. Allow margins for safety when selecting the model.

Parts Description



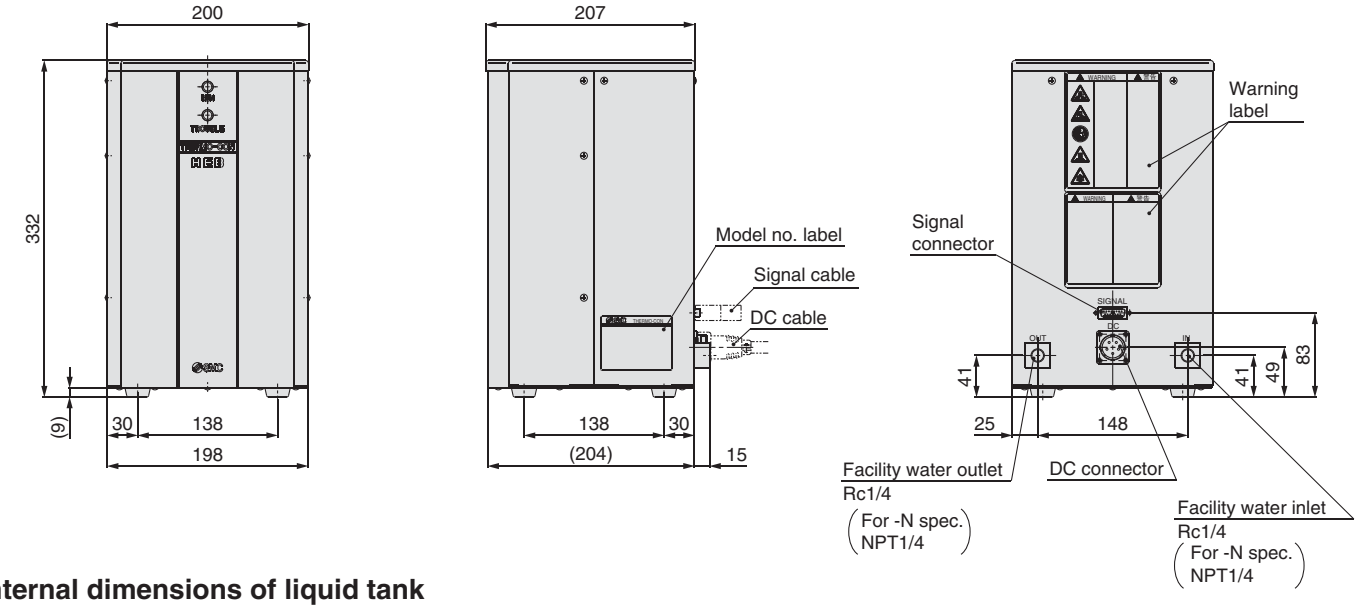




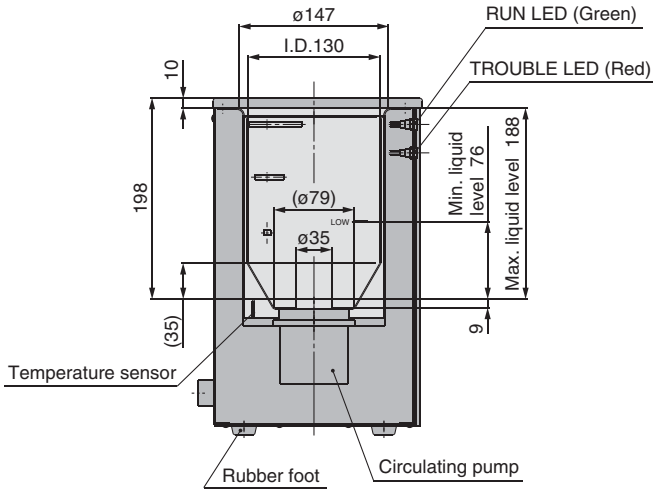


Dimensions

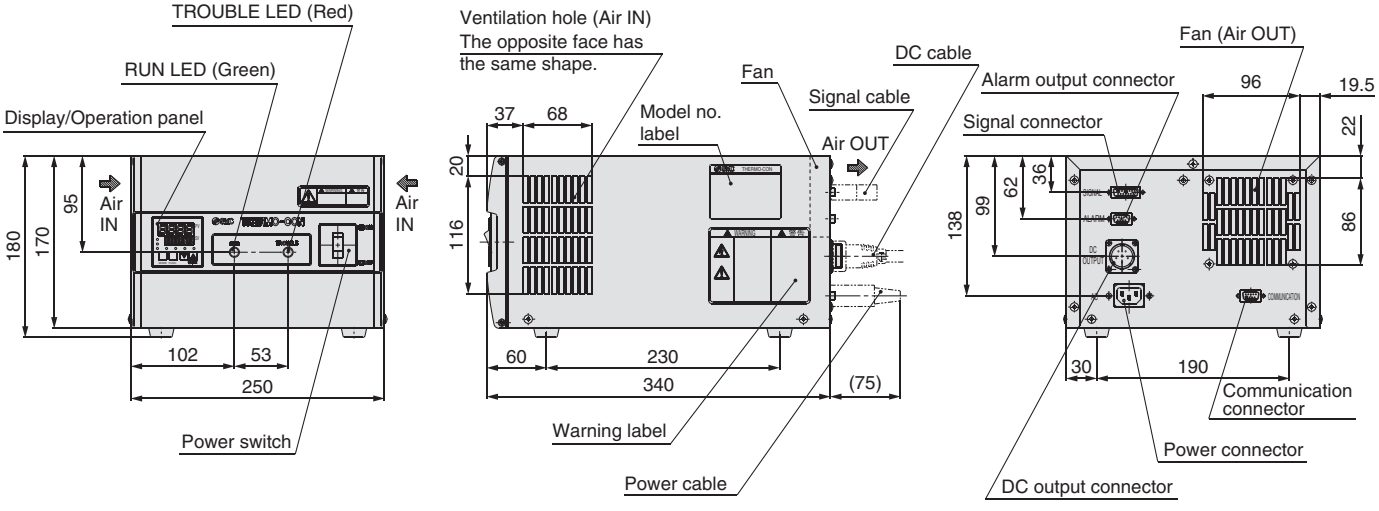
Liquid tank



Internal dimensions of liquid tank



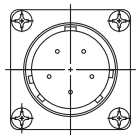
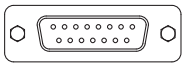
Controller



Connectors

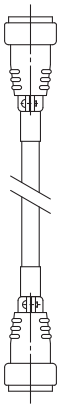
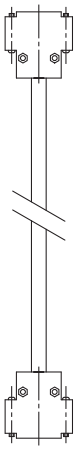
Water Bath and Controller Connection

■ **Connector for water baths**

DC connector (male connector)	Signal connector (male connector)
Nanaboshi Electric Mfg. Co., Ltd.: NJC-245-RM UL CSA 	**Hirose Electric Co., Ltd.: CDA-15P** **Holding screw M2.6** 

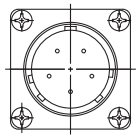
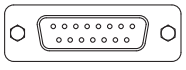
Connection **Connection**

■ **Connection cable**

DC cable	Signal cable
Nanaboshi Electric Mfg. Co., Ltd.: NJC-245-PF UL CSA **Female connector**  **Male connector** **Nanaboshi Electric Mfg. Co., Ltd. NJC-245-PM UL CSA**	**Hirose Electric Co., Ltd.: CDA-15S** **Holding screw M2.6** **Female connector**  **Male connector** **Hirose Electric Co., Ltd.: CDA-15P** **Holding screw M2.6**

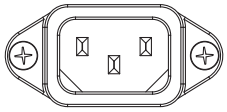
Connection **Connection**

■ **Connector for controllers**

DC connector (female connector)	Signal connector (female connector)
Nanaboshi Electric Mfg. Co., Ltd.: NJC-245-RF UL CSA 	**Hirose Electric Co., Ltd.: CDA-15S** **Holding screw M2.6** 

Power Cable Connection

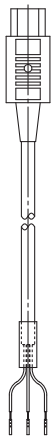
■ **Connector for controllers**

Power connector
IEC 60320 C-14 or equivalent **Male connector** 

Connection

■ **Power cable**

Connector side
IEC 60320 C-13 or equivalent
Female connector



AWG14

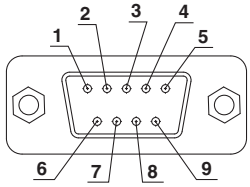
	Signal contents
Black 1	100 to 240 VAC (L)
Black 2	100 to 240 VAC (N)
Green/Yellow	PE

Connector for External Equipment

Connectors that fit with a communication connector and an alarm output connector should be prepared by customer.

■ **Alarm output connector**
Hirose Electric Co., Ltd.: CDE-9P
Holding screw M2.6
Fitting connector: CDE-9S or equivalent

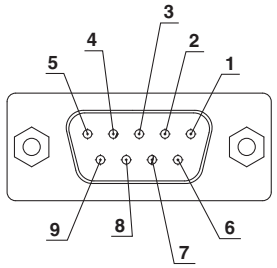
Pin No.	Signal contents
1	Contact for upper/lower temperature limit deviation alarm (open when alarm occurs)
2	Upper/lower temperature limit deviation alarm common
3-4	Unused
5	Contact for output cut-off alarm (open when alarm occurs)
6	Common for output cut-off alarm
7-9	Unused



Alarm output connector
D-sub 9 pin (male type)

■ **Communication connector**
Hirose Electric Co., Ltd.: CDE-9S
Holding screw M2.6
Fitting connector: CDE-9P or equivalent

Pin No.	Signal contents	
	HEBC002-WA10	**HEBC002-WB10**
1	RS-485 T/R (A)	Unused
2	RS-485 T/R (B)	RS-232C RX
3	Unused	RS-232C TX
4	Unused	Unused
5	Unused	RS-232C SG
6-9	Unused	Unused



Communication connector
D-sub 9 pin (female type)

Maintenance

Maintenance of this unit is performed only in the form of return to and repair at SMC's site. As a rule, SMC will not conduct on-site maintenance. Separately, the following parts have a limited life and need to be replaced before the life ends.

Parts Life Expectation

Description	Expected life	Possible failure
Circulating pump	3 to 5 years	The circulating fluid cannot be fed due to worn bearing and/or insufficient capacity of electrolytic capacitor, which results in temperature controlling failure.
Fan	5 to 10 years	The capacity of the fan lowers due to the end of lubricating performance of the bearing, which results in increase of internal temperature of the controller. The overheat protective function at the inside of the power supply starts, the output stops and the display goes off.
DC power supply	5 to 10 years	Abnormal voltage is generated and the display goes off due to insufficient capacity of electrolytic capacitor.

Series HEB
Specific Product Precautions 1

Be sure to read this before handling. Refer to page 341 for Safety Instructions. For Temperature Control Equipment Precautions, refer to pages 342 to 345 and the Operation Manual on SMC website, http://www.smcworld.com

System Design

⚠Warning

1. The catalog shows the specifications of the Thermoelectric Bath.

1. Check detailed specifications in the separate "Product Specifications", and evaluate the compatibility of the Thermoelectric Bath with customer's system.
2. The Thermoelectric Bath is equipped with a protective circuit independently, but the whole system should be designed by the customer to ensure safety.

Handling

⚠Warning

1. Thoroughly read the Operation Manual.

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

Operating Environment/Storage Environment

⚠Warning

1. Avoid using the Thermoelectric Bath in an environment where it could be splashed by fluids (including mist) such as water, salt water, oil, chemicals, or solvents.

2. The Thermoelectric Bath is not designed for clean room usage.

It generates dust from the pump inside the tank and the cooling fan in the controller.

3. Low molecular siloxane can damage the contact of the relay.

Use the Thermoelectric Bath in a place free from low molecular siloxane.

4. Reserve a space of 50 mm or more at the ventilation hole of the controller.

Radiation Air

⚠Caution

1. The ventilation hole for radiation air must not be exposed to particles and dust as far as possible.

2. Do not let the inlet and outlet for radiation air get closed.

If radiation is prevented, the internal power supply will overheat, causing the protective circuit to be activated and stopping the Thermoelectric Bath.

3. If more than one Thermoelectric Bath is used, consider their arrangement so that the downstream sides of the Thermoelectric Bath suck radiation air from the upstream sides.

Circulating Fluid

⚠Caution

1. Do not use fluids other than those described in the specification.

Otherwise, the pump will be overloaded and may break. If such a fluid is used, please contact SMC beforehand.

2. The Thermoelectric Bath must not be operated without circulating fluid.

The pump breaks by empty driving.

3. The circulating fluid may evaporate, lowering the level in the tank.

Significant reduction of the fluid level can break the circulating pump as well as causing the performance to deteriorate. Use with appropriate liquid level at all times.

Circulating Fluid

⚠Caution

4. The pump can be broken by foreign objects entering the circulating pump.

Control to prevent any foreign object from entering the fluid. If the fluid is fluorinated liquid and it is set to a temperature below freezing point, steam from the atmosphere will form ice (frost) when entering the fluid. Be sure to remove this ice (frost) regularly.

5. If water is used for the circulating fluid, set its temperature to over or more 5°C to prevent it from being frozen.

6. If tap water is used, it should satisfy the quality standards shown below.

Tap Water (as Circulating Fluid) Quality Standards

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

	Item	Unit	Standard value	Influence	
				Corrosion	Scale generation
Standard item	pH (at 25°C)	—	6.0 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		○
	Ionic state silica (SiO_2)	[mg/L]	30 or less		○
Reference item	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.
- ○: Factors that have an effect on corrosion or scale generation.
- Even if the water quality standards are met, complete prevention of corrosion is not guaranteed.

Facility Water

⚠Caution

1. The maximum operating pressure of facility water is 0.5 MPa.

If this value is exceeded, the internal piping of the tank can break, causing leakage of facility water.

2. Do not supply a flow rate of 8 L/min or more which can break the facility water piping.

3. Appropriate range of the flow rate of the facility water is 3 to 5 L/min.

Flow rate higher than this range will not slightly affect the cooling and heating capacity. However, a flow rate below 3 L/min will reduce the cooling and heating capacity significantly.

Communication

⚠Caution

1. The set value can be written to EEPROM, but only up to approx. 100,000 times.

In particular, pay attention to how many of times the writing is performed using the communication function.

Series HEB
Specific Product Precautions 2

Be sure to read this before handling. Refer to page 341 for Safety Instructions. For Temperature Control Equipment Precautions, refer to pages 342 to 345 and the Operation Manual on SMC website, http://www.smcworld.com

Maintenance

⚠ Warning

1. Prevention of electric shock and fire

Do not operate the switch with wet hands. Also, do not operate the Thermoelectric Bath with water or fluid left on it.

2. Action in the case of error

If any error such as abnormal sounds, smoke, or bad smell occurs, cut off the power at once, and stop supplying facility water. Please contact SMC or a sales distributor to repair the Thermoelectric Bath.

3. Regular inspection

Check the following items at least once a month. The inspection must be done by an operator who has sufficient knowledge and experience.

a) Check of displayed contents.
b) Check of temperature, vibration and abnormal sounds in the body of the Thermoelectric Bath.
c) Check of the voltage and current of the power supply system.
d) Check for leakage and contamination of the recirculating fluid and intrusion of foreign objects to it.
e) Check radiation air flow condition and temperature.
f) Check for leakage, quality change, flow rate and temperature of facility water.

Made to Order

Peltier-Type Thermoelectric Bath

Accurately controls the temperature of liquid in the bath.

Square type is newly added to the product lineup.

Temperature stability ±0.02°C to ±0.03°C

Compact · Lightweight 22 kg (INR-244-757)

Current consumption 3.5 A to 6 A

Power supply voltage 100 VAC to 240 VAC
(Except for some models)



Application Examples



INR-244-757

Temperature control of sample and reagent



Temperature control of source gas for MO-CVD or diffusion furnace



■Related Products

◎Fluoropolymer piping equipment

Fittings *Series* ***LQ1/LQ3***



Bore through connector *Series* ***LQHB***



Tubing *Series* ***TL/TLM***



◎Process gas equipment

Regulator



Diaphragm valve



For details about related products, refer to the SMC website.

■Variations

Model		Usable constant temperature liquid	Cooling method	Cooling capacity	Tank capacity	Temperature range	Temperature stability
	INR-244-745 INR-244-733	Water Ethylene glycol aqueous solution Fluorinated fluid (Square type can be used only at normal temperature.)	Water-cooled	140 W	Approx. 10 L	0 to 60°C	±0.03°C
	INR-244-747 INR-244-736			320 W			
	INR-244-746 INR-244-734		Water-cooled	320 W	Approx. 23 L	0 to 60°C	±0.03°C
	INR-244-749 INR-244-748				Approx. 39 L		
	INR-244-757		Air-cooled	220 W	Approx. 17 L	0 to 60°C	±0.03°C
	HEBC002-WA10		Water-cooled	140 W	Approx. 3 L	−15 to 60°C	±0.02°C
	INR-244-696A			280 W	Approx. 5.5 L		

Peltier-Type Thermoelectric Bath Lineup



(INR-244-733)

Specifications	Square type, water-cooled			
Model	**INR-244-745**	**INR-244-733**	**INR-244-747**	**INR-244-736**
Cooling method	Peltier, Water-cooled		Peltier, Water-cooled	
Cooling capacity*	140 W (at 20°C Water)		320 W (at 20°C Water)	
Dimensions (W x D x H)	266 x 376 x 400 mm		266 x 376 x 400 mm	
Tank capacity (W x D x H)	216 x 216 x 250 mm (Approx. 10 L)		216 x 216 x 250 mm (Approx. 10 L)	
Weight	Approx. 15.5 kg		Approx. 16.5 kg	
Power supply voltage range	100 VAC to 240 VAC		100 VAC to 240 VAC	
Rated current (at 100 VAC)	3.5 A		5.5 A	
Liquid temperature range	0 to 60°C		0 to 60°C	
Temperature stability	±0.03°C		±0.03°C	
Communications	RS-232C	RS-485	RS-232C	RS-485
Safety standards	CE marking, UL (NRTL) standard, RoHS			



(INR-244-749)

Specifications	Square type, water-cooled			
Model	**INR-244-746**	**INR-244-734**	**INR-244-749**	**INR-244-748**
Cooling method	Peltier, Water-cooled		Peltier, Water-cooled	
Cooling capacity*	320 W (at 25°C Water)		320 W (at 25°C Water)	
Dimensions (W x D x H)	350 x 510 x 400 mm		350 x 510 x 550 mm	
Tank capacity (W x D x H)	300 x 350 x 250 mm (Approx. 23 L)		300 x 350 x 400 mm (Approx. 39 L)	
Weight	Approx. 21 kg		Approx. 25 kg	
Power supply voltage range	100 VAC to 240 VAC		100 VAC to 240 VAC	
Rated current (at 100 VAC)	5.5 A		5.5 A	
Liquid temperature range	0 to 60°C		0 to 60°C	
Temperature stability	±0.03°C		±0.03°C	
Communications	RS-232C	RS-485	RS-232C	RS-485
Safety standards	CE marking, UL (NRTL) standard, RoHS			



Specifications	Square type, air-cooled
Model	**INR-244-757**
Cooling method	Peltier, Air-cooled
Cooling capacity	220 W (at 25°C Water, Ambient temperature 25°C)
Dimensions (W x D x H)	350 x 460 x 395 mm
Tank capacity (W x D x H)	300 x 290 x 200 mm (Approx. 17 L)
Weight	Approx. 22 kg
Power supply voltage range	100 VAC to 240 VAC
Rated current (at 100 VAC)	6 A
Liquid temperature range	0 to 60°C
Temperature stability	±0.03°C
Communications	RS-232C
Safety standards	RoHS



Specifications	Round type, water-cooled/Remote controller	
Model	**HEBC002-WA10/HEBC002-WB10**	
Cooling method	Peltier, Water-cooled	
Cooling capacity*	140 W (at 25°C Water)	
Dimensions (W x D x H)	Liquid tank 200 x 207 x 332 mm	Controller 250 x 300 x 180 mm
Tank capacity	ø130 x 188 mm (Approx. 3 L)	—
Weight	Approx. 8.5 kg	Approx. 6.5 kg
Power supply voltage range	100 VAC to 240 VAC	
Rated current (at 100 VAC)	4 A	
Liquid temperature range	−15 to 60°C	
Temperature stability	±0.02°C	
Communications	RS-485/RS-232C	
Safety standards	CE marking, UL (NRTL) standard, RoHS	



Specifications	Round type, water-cooled/Remote controller	
Model	**INR-244-696A**	
Cooling method	Peltier, Water-cooled	
Cooling capacity*	280 W (at 25°C Water)	
Dimensions (W x D x H)	Liquid tank 240 x 240 x 350 mm	Controller 220 x 330 x 123 mm
Tank capacity	ø170 x 202 mm (Approx. 5.5 L)	—
Weight	Approx. 12 kg	Approx. 5 kg
Power supply voltage range	200 VAC to 220 VAC	
Rated current (at 200 VAC)	5 A	
Liquid temperature range	−15 to 60°C	
Temperature stability	±0.02°C	
Communications	RS-485	
Safety standards	RoHS	

* Conditions: Facility water temperature 20°C, flow rate 5 L/min, ambient temperature 25°C

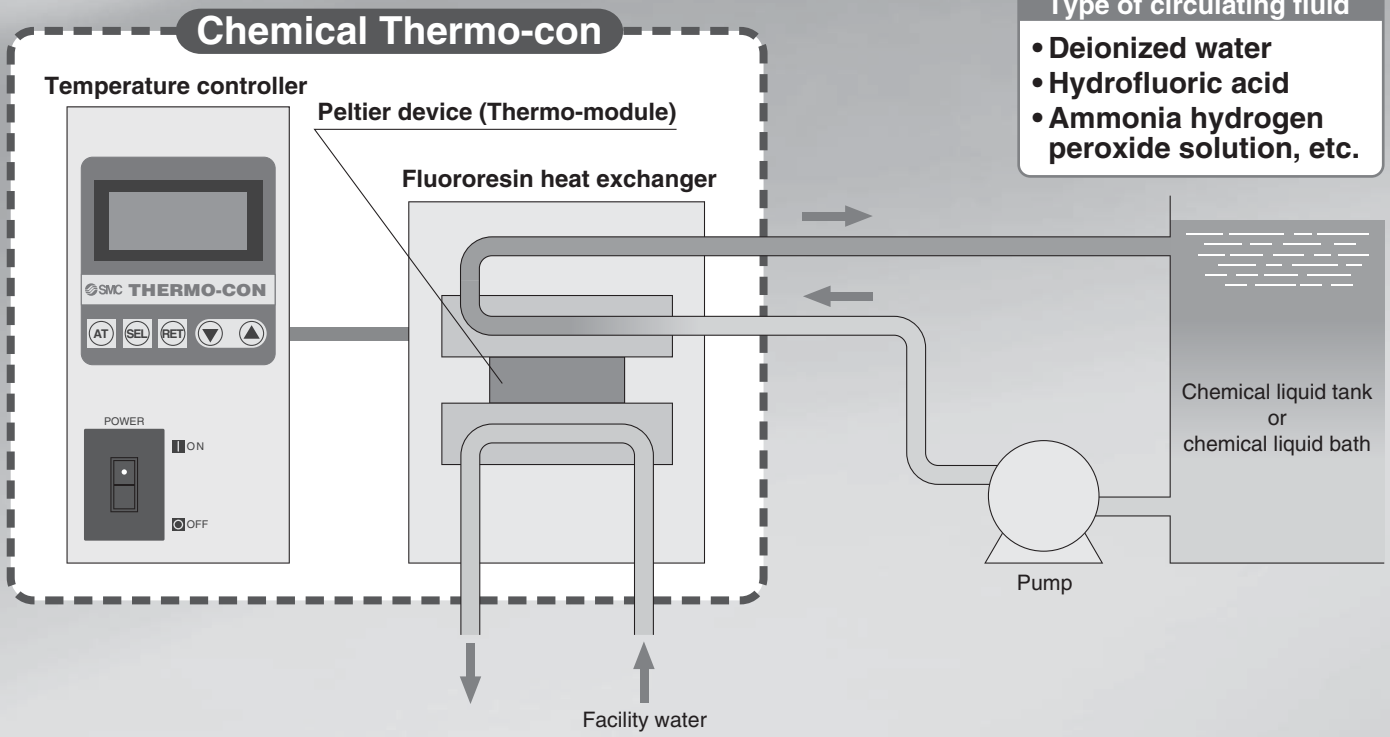
Chemical Thermo-con

Series HED

Fluororesin heat exchanger allows direct temperature control for chemical liquids!!

SEMI Standard S2-0706, F47-0706

RoHS



Type of circulating fluid

- Deionized water
- Hydrofluoric acid
- Ammonia hydrogen peroxide solution, etc.

Industry-leading withstand pressure 0.35 MPa!!

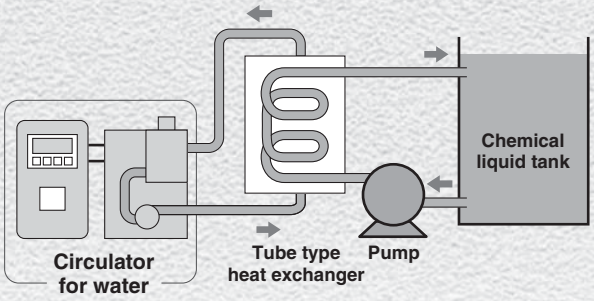
- With leakage detection function
- Operating temperature range: **10°c to 60°c**
- Temperature stability: ±**0.1°c**
- Cooling capacity (with water): **300 w, 500 w, 750 w**



Allows direct control of chemical liquid temperature.

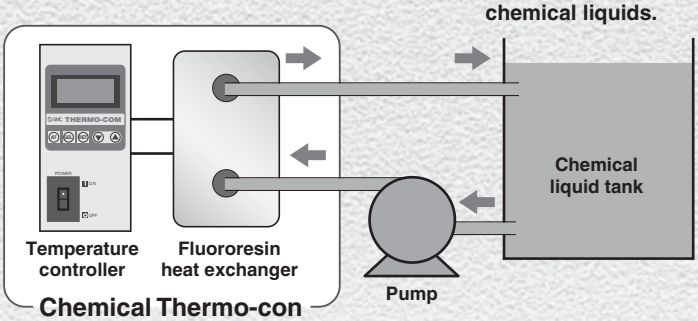
- PFA wetted parts material prevents contamination from metal ion elution.
- No need for a tube-type heat exchanger.

Indirect temperature control



Direct temperature control

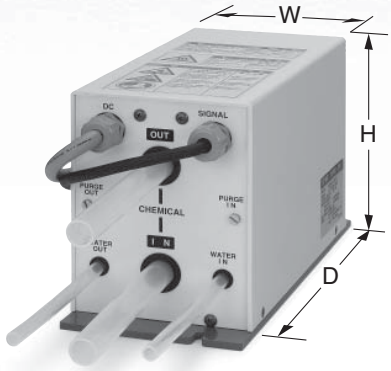
No need for a tube-type heat exchanger. Can directly control temperature of chemical liquids.



Series HED

Compact and light

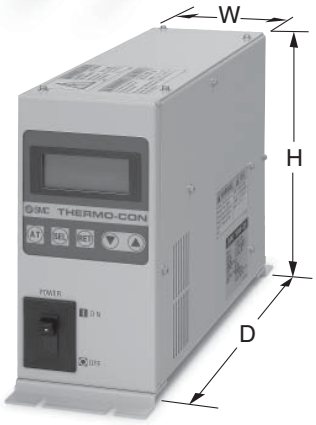
- Self-developed heat exchanger matched to the configuration of the Peltier device (Thermo-module). Compact and light



Heat Exchanger

Model	W	D	H	Weight
HED003	130	263	170	8 kg
HED005	150	294	222	14 kg
HED007				15 kg

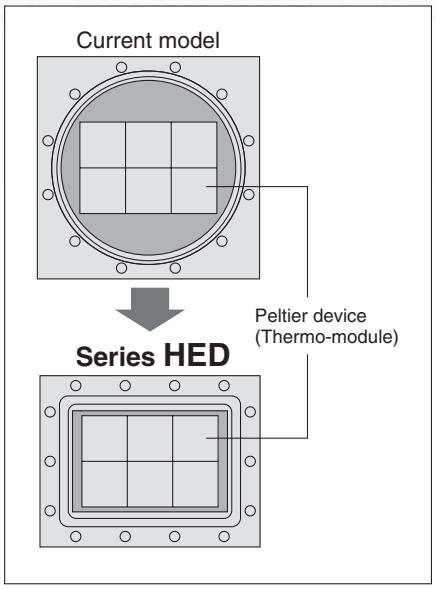
The outline dimensions do not include protruding parts such as the foot flange and tube.



Temperature Controller

Model	W	D	H	Weight
HED003	100	320	215	6 kg
HED005	140	350	215	8 kg
HED007	165	447	215	13 kg

The outline dimensions do not include protruding parts such as the foot flange, screw and connector.



Applications

- Cleaning equipment
- Plating equipment
- Wet etching equipment, etc.

Applicable Fluid Examples

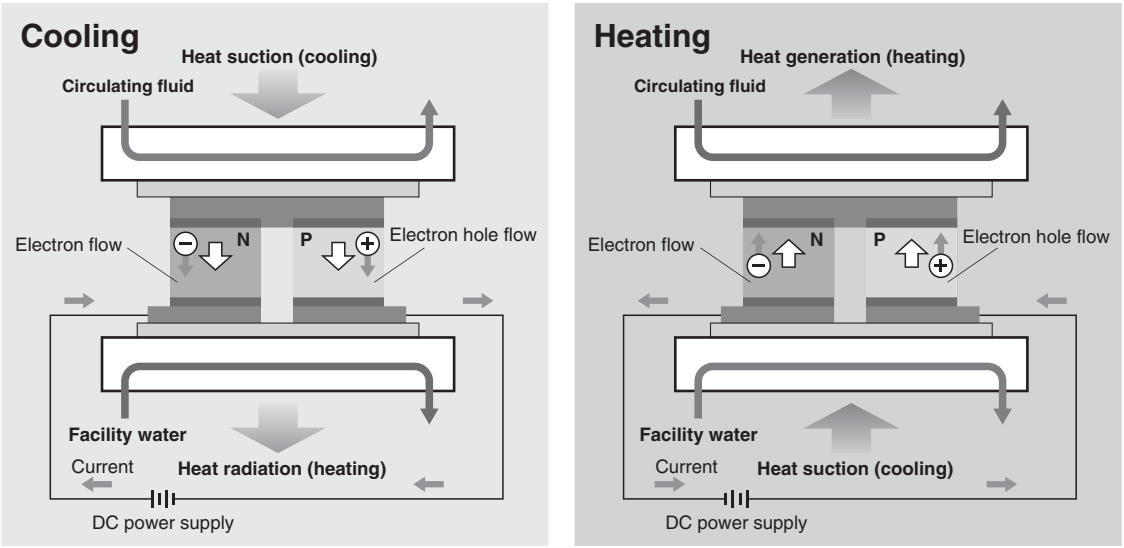
Chemical liquids	Operating temperature range	Chemical liquids	Operating temperature range
Deionized water	10 to 60°C	Ammonia hydrogen peroxide solution	10 to 60°C
Hydrofluoric acid	10 to 40°C	Sodium hydroxide	10 to 60°C
Sulfuric acid (except fuming sulfuric acid)	10 to 50°C	Ozone water	10 to 60°C
Copper sulfate solution	10 to 50°C		

∗ No condensation

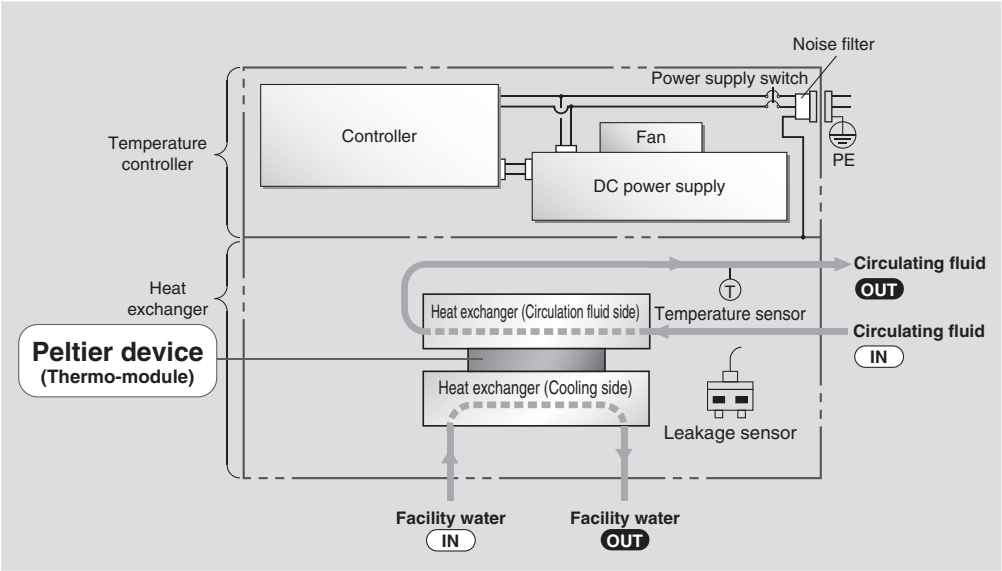
Note) Chemical Thermo-con is not designed to be explosion proof, so it is not suitable for flammable fluids.

Principle of Peltier Device (Thermo-module, Thermoelectric device)

The Peltier device (thermo-module, thermoelectric device) is plate-shape solid state element with P-type, N-type semiconductor arrayed alternately. When direct current is supplied to the element, heat moves from one surface to another along with electron flow in N-type semiconductor and electron hole in P-type semiconductor. As a result of the heat move, one surface of the element absorbs heat and decrease temperature. And other surface heats up. When the DC current is switched to reverse direction, the heat move will also be reverse direction. Therefore, Peltier element can achieve heating effect as well as cooling effect depending on the current direction. It can achieve high speed switching and precise temperature control.



Construction and Principle



The temperature controller controls the circulating fluid in the heat exchanger. A temperature sensor (platinum resistance temperature detector) installed in the heat exchanger sends a signal to the controller, which changes the temperature of the circulating fluid by adjusting the output direction and energizing time of the built-in DC power supply based on the difference between the set and measured temperatures.
This product can be used safely since the sensor to detect leakage of the circulating fluid is installed as a standard device.

CONTENTS

Series HED



Chemical Thermo-con Series HED

Model Selection ····· Page 318
How to Order ····· Page 319
Main Specifications ····· Page 320
· Heat Exchanger Specifications ····· Page 320
· Temperature Controller Specifications ····· Page 320
Cooling Capacity ····· Page 321
Heating Capacity ····· Page 321
Pressure Loss in Circulating Fluid Circuit ····· Page 322
Pressure Loss in Facility Water Circuit ····· Page 322
Dimensions ····· Page 323
Connectors ····· Page 325
Alarm ····· Page 326
Maintenance ····· Page 326
Applicable Fluids ····· Page 327
Specific Product Precautions ····· Page 328

Model Selection

Guide to Model Selection

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

Heat generation amount Q: 400 W (at 25°C)

Cooling capacity = Considering a safety factor of 20%, select **400 W x 1.2 =** **480 W (at 25°C)** or more.

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

Obtain the temperature difference between inlet and outlet by circulating the circulating fluid inside the customer's machine.

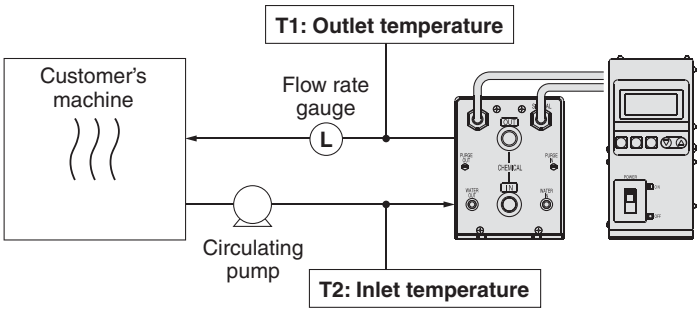
Heat generation amount **Q** : Unknown
Circulating fluid temperature difference Δ**T** (= **T2** − **T1**) : 1.0°C (1.0 K)
Circulating fluid outlet temperature **T1** : 20°C (293.15 K)
Circulating fluid inlet temperature **T2** : 21°C (294.15 K)
Circulating fluid flow rate **L** : 7 L/min
Circulating fluid : Water
: Density γ: 1 x 10^3 kg/m^3
: Specific heat **C**: 4.2 x 10^3 J/(kg·K)

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

$$= \frac{1 \times 7 \times 1 \times 10^3 \times 4.2 \times 10^3}{60 \times 1000}$$

$$= 490\ W$$

Cooling capacity = Considering a safety factor of 20%,
490 x 1.2 = **588 W**



Example 3. In cases where cooling the object below a certain temperature and period of time.

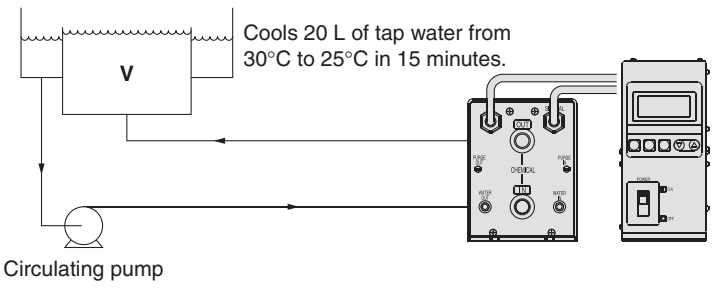
Cooled substance total volume **V** : 20 L
Cooling time **h** : 15 min
Cooling temperature difference Δ**T**: 5°C (5 K)
Circulating fluid : Tap water
Density γ: 1 x 10^3 kg/m^3
Specific heat **C**: 4.2 x 10^3 J/(kg·K)

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

$$= \frac{5 \times 20 \times 1 \times 10^3 \times 4.2 \times 10^3}{15 \times 60 \times 1000}$$

$$= 467\ W$$

Cooling capacity = Considering a safety factor of 20%,
467 x 1.2 = **560 W**



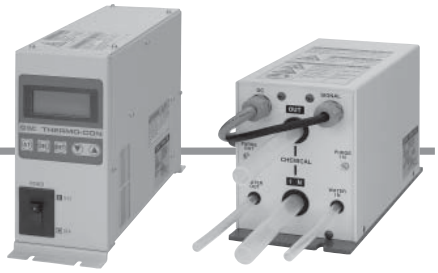
Precautions on Model Selection

The flow rate of the circulating fluid depends on the internal resistance of the customer's machine and the length, diameter and resistance created by bends in the circulating fluid piping, etc. Check if the required flow rate of circulating fluid can be obtained before using.

Chemical Thermo-con
Series HED

SEMI

RoHS



Temperature controller | Heat exchanger

How to Order

Part number of set (Temperature controller + Heat exchanger)

Note) The model numbers of the temperature controller and heat exchanger are printed respectively on the product name label.

HED 007 – W 2 B 13

Chemical Thermo-con

Cooling capacity

003	300 W
005	500 W
007	750 W

Radiating method

W	Water-cooled

Power supply

2	Single-phase 180 to 242 VAC 50/60 Hz

Communication

A	RS-485
B	RS-232C

Tube size

13	1/2" x 3/8"
19	3/4" x 5/8"

Combination in Set

Part number of set	Heat exchanger model	Temperature controller model
HED003-W2A13	HED003-HW13	HED003-C2A
HED003-W2A19	HED003-HW19	
HED003-W2B13	HED003-HW13	HED003-C2B
HED003-W2B19	HED003-HW19	
HED005-W2A13	HED005-HW13	HED005-C2A
HED005-W2A19	HED005-HW19	
HED005-W2B13	HED005-HW13	HED005-C2B
HED005-W2B19	HED005-HW19	
HED007-W2A13	HED007-HW13	HED007-C2A
HED007-W2A19	HED007-HW19	
HED007-W2B13	HED007-HW13	HED007-C2B
HED007-W2B19	HED007-HW19	

Heat exchanger

HED 007 – H W 13

Cooling capacity

003	300 W
005	500 W
007	750 W

Heat exchanger

Radiating method

W	Water-cooled

Tube size

13	1/2" x 3/8"
19	3/4" x 5/8"

* The tube size should be specified when ordering.

Temperature controller

HED 007 – C 2 B

Cooling capacity

003	300 W
005	500 W
007	750 W

Temperature controller

Power supply

2	Single-phase 180 to 242 VAC 50/60 Hz

Communication

A	RS-485
B	RS-232C

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

Heat Exchanger Specifications

Heat exchanger model		HED003-HW13	HED003-HW19	HED005-HW13	HED005-HW19	HED007-HW13	HED007-HW19
Cooling capacity (Water) Note 1)		300 W		500 W		750 W	
Heating capacity (Water) Note 1)		600 W		1000 W		1800 W	
Cooling/Heating method		Peltier device (Thermoelectric device, Thermo-module)					
Radiating method		Water-cooled					
Operating temperature range		10.0 to 60.0°C (depending on the type of circulating fluid)					
Circulating fluid	**Applicable fluid** Note 2)	Deionized water, Hydrofluoric acid, Ammonia hydrogen peroxide solution, etc.					
	Wetted parts material	PFA					
	Operating pressure Note 3)	0 (atmospheric pressure) to 0.35 MPa					
	Tube size (PFA tube)	1/2" x 3/8"	3/4" x 5/8"	1/2" x 3/8"	3/4" x 5/8"	1/2" x 3/8"	3/4" x 5/8"
Facility water	**Temperature**	10 to 35°C (no condensation)					
	Wetted parts material	FEP, Stainless steel 304, Stainless steel 316					
	Max. operating pressure	0.5 MPa					
	Tube size	IN/OUT: FEP tube 3/8" x 1/4"					
	Flow rate	5 to 10 L/min					
Ambient temperature/humidity		Temperature: 10 to 35°C, Humidity: 35 to 80%RH (no condensation)					
Dimensions Note 4)		W130 mm x D263 mm x H170 mm		W150 mm x D294 mm x H222 mm		W150 mm x D294 mm x H222 mm	
Weight		Approx. 8 kg		Approx. 14 kg		Approx. 15 kg	
Applied temperature controller		HED003-C2A HED003-C2B		HED005-C2A HED005-C2B		HED007-C2A HED007-C2B	

Note 1) The conditions are as follows.
Circulating fluid: Water (Circulating flow rate 15 L/min, Set temperature 25°C), Facility water temperature 25°C, Facility water flow rate 5 L/min, Ambient temperature 25°C
Note 2) For the compatibility between the circulating fluid and materials, refer to "Applicable Fluids".
Note that the Chemical Thermo-con is not designed to be explosion proof so it is not suitable for flammable fluids.
Note 3) Install the heat exchanger in the discharge side of a circulating pump. Do not use at location where a negative pressure is applied.
The circulating fluid pump should be prepared by the customer.
Note 4) The outline dimensions do not included protruding parts such as the foot flange and tube.

Temperature Controller Specifications

Temperature controller model		HED003-C2A	HED003-C2B	HED005-C2A	HED005-C2B	HED007-C2A	HED007-C2B
Communication		RS-485	RS-232C	RS-485	RS-232C	RS-485	RS-232C
Control method		Cooling/Heating automatic shift PID control					
Operating temperature range		10.0 to 60.0°C (no condensation)					
Temperature stability Note 1)		Within ±0.1°C (with stable load)					
Temperature sensor		Resistance thermometer Pt100 Ω, 3-wires, class A, 2 mA (for both internal control sensor and external sensor) The external sensor should be prepared by the customer.					
Main functions		Auto-tuning, Sensor fine adjustment, Offset, Learning control, External sensor control, Set value memory, Upper/Lower temperature limit alarm, Output shutdown alarm, Remote ON/OFF, Leakage detection					
Ambient temperature/humidity		Temperature: 10 to 35°C, Humidity: 35 to 80%RH (no condensation)					
Power supply spec.	**Power supply**	Single-phase 180 to 242 VAC 50/60 Hz					
	Rated current	3 A		5 A		14 A	
Dimensions Note 2)		W100 mm x D320 mm x H215 mm		W140 mm x D350 mm x H215 mm		W165 mm x D447 mm x H215 mm	
Weight		Approx. 6 kg		Approx. 8 kg		Approx. 13 kg	
Applied heat exchanger Note 3)		HED003-HW13 HED003-HW19		HED005-HW13 HED005-HW19		HED007-HW13 HED007-HW19	

Note 1) This value is with a stable load with no disturbance and cannot be achieved in some operating conditions.
Note 2) The outline dimensions do not included protruding parts such as the foot flange, screw and connector.
Note 3) The temperature controller should be connected with a specific series of heat exchanger. If connected with a different series of heat exchanger, it may not operate normally. (The HED003 and HED005 series use the same connector, so be careful for incorrect wiring.)

⚠Caution

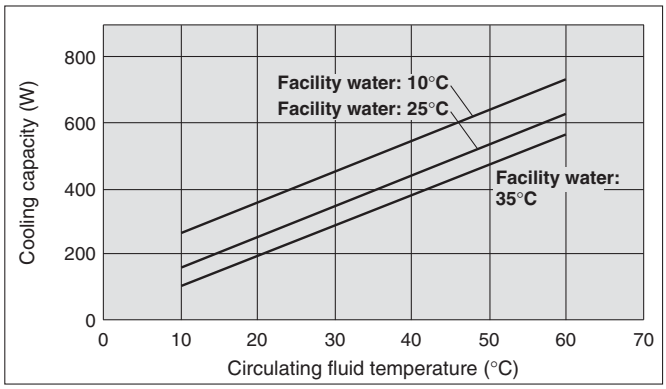
● For the combination of the heat exchanger and temperature controller, refer to "Combination in Set".

The values shown on the performance chart are representative and not guaranteed. Allow a margin for safety to device when choosing the product.

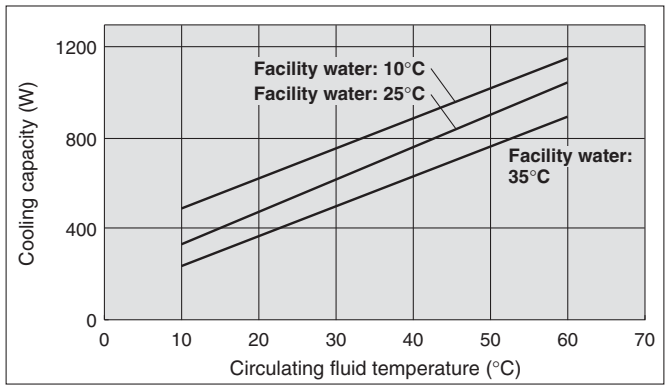
Cooling Capacity

<Conditions> Circulating fluid: Tap water, Circulating fluid flow rate: 15 L/min, Facility water flow rate: 5 L/min

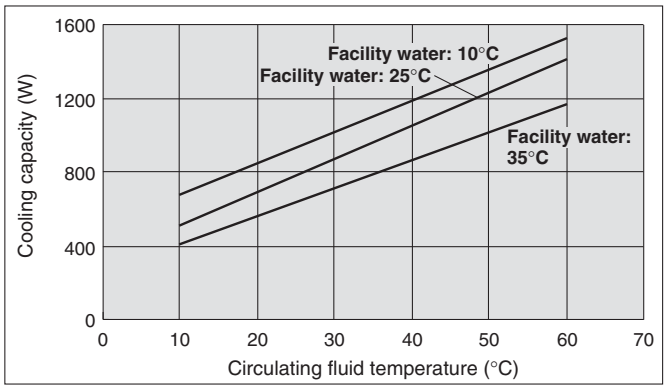
HED003



HED005



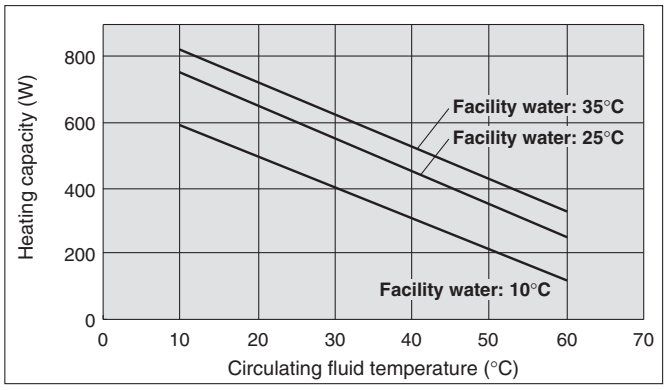
HED007



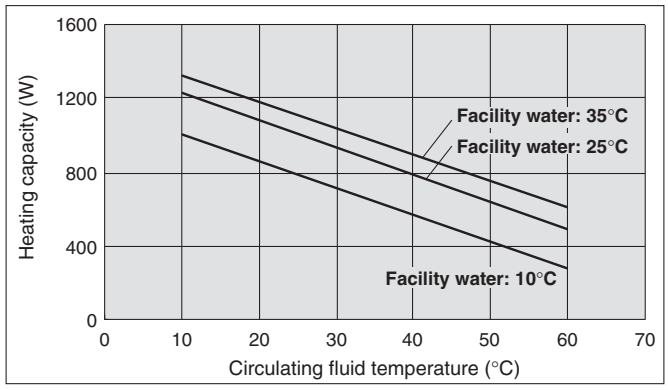
Heating Capacity

<Conditions> Circulating fluid: Tap water, Circulating fluid flow rate: 15 L/min, Facility water flow rate: 5 L/min

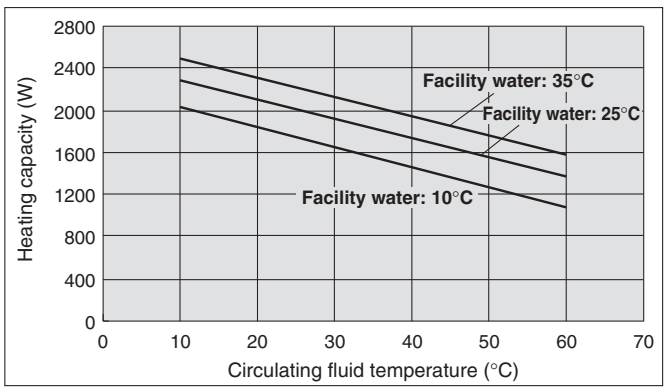
HED003



HED005

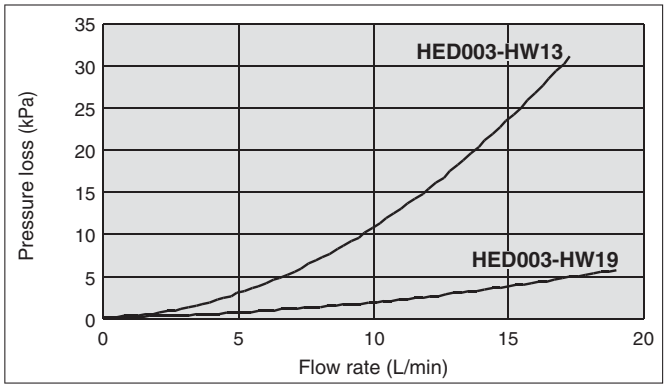


HED007

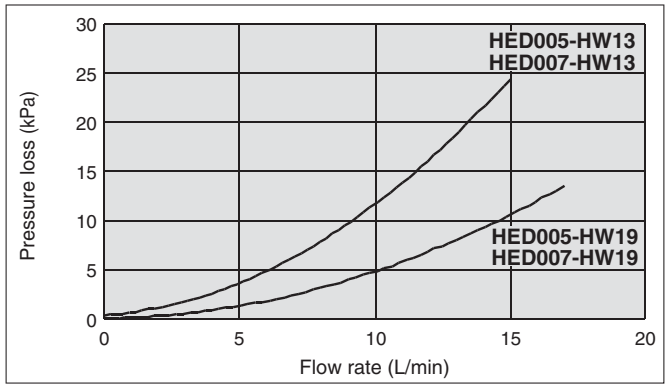


Pressure Loss in Circulating Fluid Circuit <Condition> Tap water

HED003

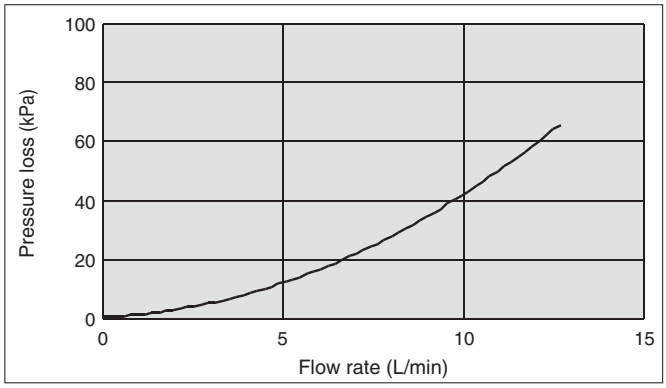


HED005
HED007

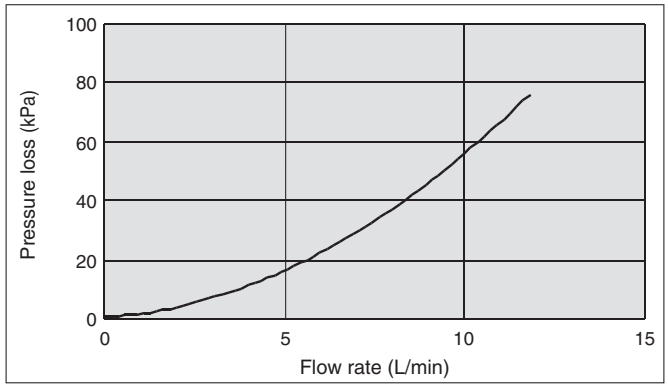


Pressure Loss in Facility Water Circuit <Condition> Tap water

HED003



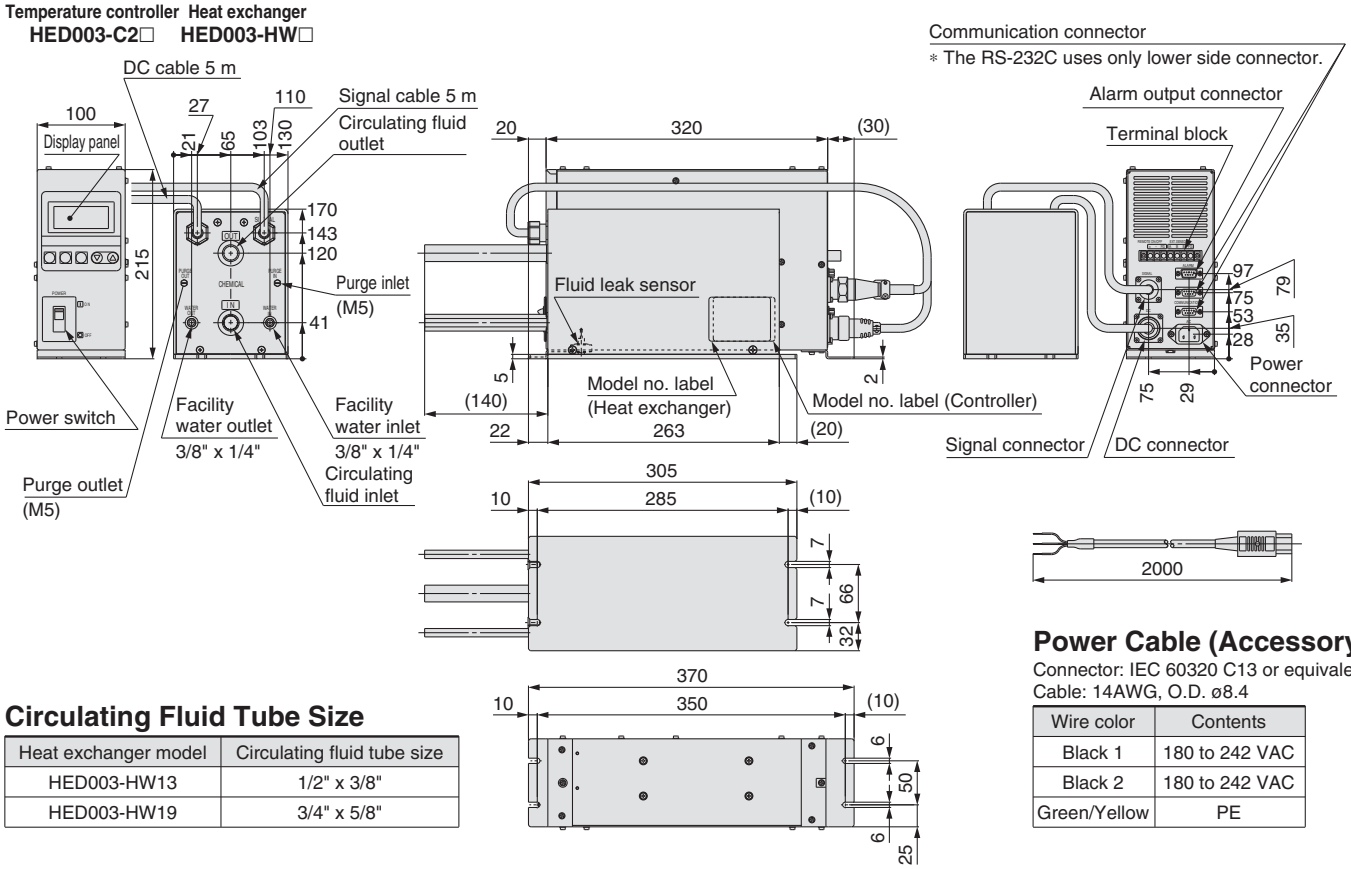
HED005
HED007



Dimensions

HED003-W2□□

Temperature controller HED003-C2□ Heat exchanger HED003-HW□



Circulating Fluid Tube Size

Heat exchanger model	Circulating fluid tube size
HED003-HW13	1/2" x 3/8"
HED003-HW19	3/4" x 5/8"

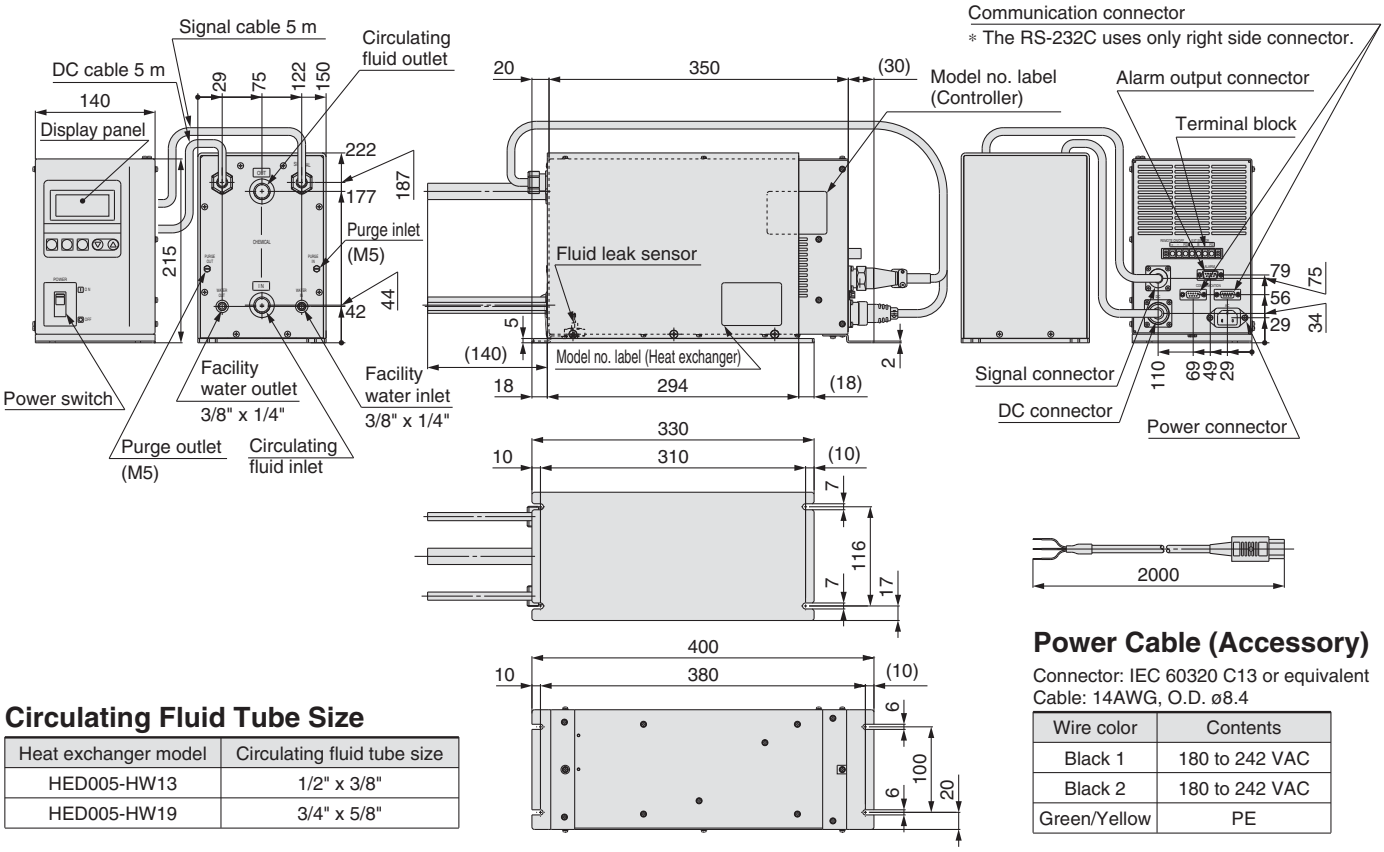
Power Cable (Accessory)

Connector: IEC 60320 C13 or equivalent
Cable: 14AWG, O.D. ø8.4

Wire color	Contents
Black 1	180 to 242 VAC
Black 2	180 to 242 VAC
Green/Yellow	PE

HED005-W2□□

Temperature controller HED005-C2□ Heat exchanger HED005-HW□



Circulating Fluid Tube Size

Heat exchanger model	Circulating fluid tube size
HED005-HW13	1/2" x 3/8"
HED005-HW19	3/4" x 5/8"

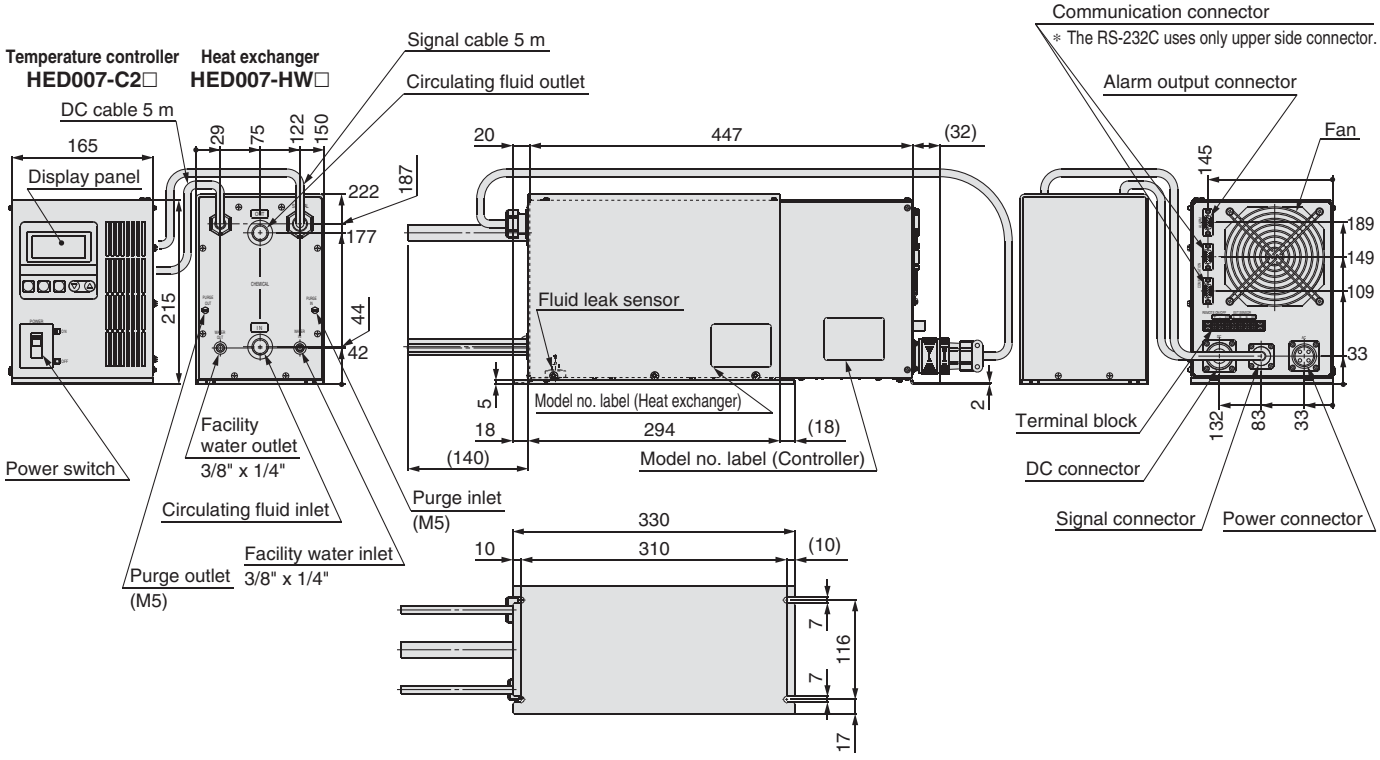
Power Cable (Accessory)

Connector: IEC 60320 C13 or equivalent
Cable: 14AWG, O.D. ø8.4

Wire color	Contents
Black 1	180 to 242 VAC
Black 2	180 to 242 VAC
Green/Yellow	PE

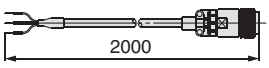
Dimensions

HED007-W2□□



Circulating Fluid Tube Size

Heat exchanger model	Circulating fluid tube size
HED007-HW13	1/2" x 3/8"
HED007-HW19	3/4" x 5/8"



Power Cable (Accessory)

Connector: DDK CE05-6A18-10SD-D-BSS
Cable: 12AWG, O.D. ø11.8

Wire color	Contents
Black 1	180 to 242 VAC
Black 2	180 to 242 VAC
Green/Yellow	PE

Connectors

- Use the special power cable included with the temperature controller.
- Connect the DC cable and signal cable that come from the heat exchanger to the DC and signal connectors of the temperature controller.
- Prepare other required connectors and wiring by the customer.

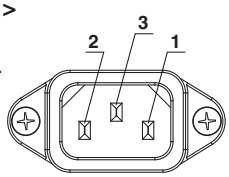
1. Power connector

<For HED003-C2□, HED005-C2□>

IEC 60320 C14 or equivalent

Connect the included special power cable.

Pin No.	Signal contents
1	180 to 242 VAC
2	180 to 242 VAC
3	PE



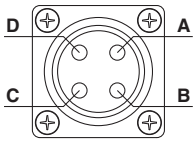
Power connector (HED003-C2□, HED005-C2□)

<For HED007-C2□>

DDK Ltd. CE05-2A18-10PD-D

Connect the included special power cable.

Pin No.	Signal contents
A	180 to 242 VAC
B	180 to 242 VAC
C	Unused
D	PE



Power connector (HED007-C2□)

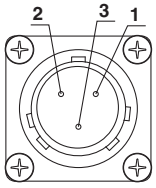
2. DC connector

<For HED003-C2□, HED005-C2□>

Nanaboshi Electric Mfg. Co., Ltd.: NJC-243-RF (UL, CSA)

Connect the DC cable connector of the heat exchanger.

Pin No.	Signal contents
1	DC output
2	DC output
3	FG



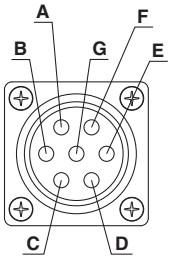
DC connector (HED003-C2□, HED005-C2□)

<For HED007-C2□>

DDK Ltd. D/MS3102A20-15S

Connect the DC cable connector of the heat exchanger.

Pin No.	Signal contents
A	DC output
B	DC output
C	DC output
D	DC output
E	DC output
F	DC output
G	FG



DC connector (HED007-C2□)

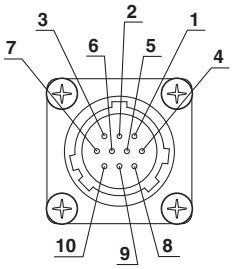
3. Signal connector

<Common to HED003-C2□, HED005-C2□, HED007-C2□>

Tajimi Electronics Co., Ltd.: TRC01-A16R-10FA

Connect the signal cable connector of the heat exchanger.

Pin No.	Signal contents
1	Thermostat +
2	Thermostat –
3	Terminal A of resistance temperature detector
4	Terminal B of resistance temperature detector
5	Terminal B of resistance temperature detector
6	Fluid leak sensor +24 V
7	Fluid leak alarm signal input
8	Fluid leak 24VE
9-10	Unused
Grounding	FG



Signal connector

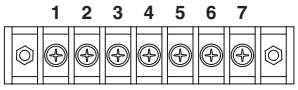
4. Terminal block

<Common to HED003-C2□, HED005-C2□, HED007-C2□>

Morimatsu Co., Ltd.: M111A-7A, for holding screw M3

Connection cable: 22AWG or more, max. 10 m

Pin No.	Signal contents
1	Remote ON/OFF +
2	Remote ON/OFF –
3	FG
4	External sensor: Terminal A of resistance temperature detector
5	External sensor: Terminal B of resistance temperature detector
6	External sensor: Terminal B of resistance temperature detector
7	FG



Terminal block

A short pin is installed between No. 1 and No. 2 pins to short-circuit it (Remote ON) when shipped.

Remote ON/OFF signal

Circuit voltage: 24 VDC ±10%; passing current: 2.9 to 4.3 mA

Exterior sensor signal

Applicable sensor: Pt100 Ω; passing current: 2 mA

5. Alarm output connector: D-sub 9 pin

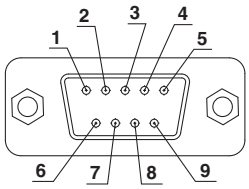
<Common to HED003-C2□, HED005-C2□, HED007-C2□>

OMRON Corp. XM2A-0901 or equivalent, holding screw M2.6

Fixed contact point (load resistance: 125 VAC, 0.3 A; 30 VDC, 2 A)

Connection cable: With shielding 22AWG or more, max. 10 m

Pin No.	Signal contents
1	Contact a for output cut-off alarm (open when alarm occurs)
2	Common for output cut-off alarm
3	Contact b for output cut-off alarm (closed when alarm occurs)
4	Contact a for upper/lower temp. limit alarm (open when alarm occurs)
5	Common for upper/lower temp. limit alarm
6	Contact b for upper/lower temp. limit alarm (closed when alarm occurs)
7-9	Unused



Alarm output connector D-sub 9 pin (pin type)

6. Communication connector: D-sub 9 pin

OMRON Corp. XM2D-0901 or equivalent, holding screw M2.6

Connection cable: With shielding 22AWG or more

1) Common to HED003-C2A, HED005-C2A, HED007-C2A

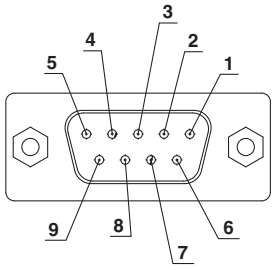
RS-485

Pin No.	Signal contents
1	RS-485 BUS +
2	RS-485 BUS –
3	Unused
4	Unused
5	SG
6-9	Unused

2) Common to HED003-C2B, HED005-C2B, HED007-C2B

RS-232C

Pin No.	Signal contents
1	Unused
2	RS-232C RD
3	RS-232C SD
4	Unused
5	SG
6-9	Unused



Communication connector D-sub 9 pin (socket type)

Alarm

This unit has failure diagnosis function. When an failure happens, its failure mode is displayed on the LCD display in the controller and it can be read out through the serial communication, and has relay outputs for upper/lower temperature limit alarm and shutdown alarm.

Alarm code	Alarm description	Operation status	Main reason
WRN	Upper/Lower temp. limit alarm	Continue	The temperature has exceeded the upper or lower limit of the set temperature.
WRN	Remote OFF alarm	Stop	The remote ON/OFF contact is set to be off. (This alarm is not generated by the relay output.)
ERR00	CPU hung-up	Stop	The CPU has crashed due to noise, etc.
ERR01	CPU check failure	Stop	The contents of the CPU cannot be read out correctly when the power supply is turned on.
ERR03	Back-up data error	Stop	The contents of the back-up data cannot be read out correctly when the power supply is turned on.
ERR04	EEPROM writing error	Stop	The data cannot be written to EEPROM.
ERR05	EEPROM input over time error	Stop	The number of times of writing to EEPROM has exceeded the maximum value.
ERR11	DC power voltage failure	Stop	Momentary loss of AC power supply, DC power supply has excessive temperature, or the thermo-module has been short-circuited.
ERR12	Internal sensor value is high.	Stop	The internal temperature sensor has exceeded the upper limit where the Chemical Thermo-con is set to stop.
ERR13	Internal sensor value is low.	Stop	The internal temperature sensor has exceeded the lower limit where the Chemical Thermo-con is set to stop.
ERR14	Thermostat alarm	Stop	The thermostat has been activated due to insufficient flow rate of the circulating fluid or facility water or high temperature.
ERR15	Output failure alarm	Continue	The temperature cannot be changed even at 100% output, due to overload or disconnection of the thermo-module.
ERR17	Cutoff/short of internal sensor	Stop	The internal temperature sensor has been disconnected or short-circuited.
ERR18	Cutoff/short of external sensor	Continued by normal control	The external temperature sensor has been disconnected or short-circuited. (Only detected when in learning control, auto-tuning operation 2, or external sensor control)
ERR19	Auto-tuning failure	Stop	Auto-tuning has not been completed within 60 minutes.
ERR21	Fan alarm	Stop	The air-cooled fan alarm of the power supply has been activated.
ERR22	Leak alarm	Stop	The fluid leak sensor has detected leakage of fluid.

Maintenance

Please prepare back-up equipment as necessary to minimize the downtime.

1) Heat exchanger

The heat exchanger will not be repaired in principle.

Only the return to SMC for an investigation within warranty will be accepted. The return unit has to be completely decontaminated with appropriate method such as use of neutralizing agent before return to SMC.

2) Temperature controller

Maintenance of the temperature controller will be performed only at SMC. SMC will not support on-site maintenance. The following parts have published life time. To make a maintenance return schedule is recommended based on the following parts life expectation.

Parts Life Expectation

Description	Expected life	Possible failure
Fan	5 to 10 years	Lack of fan cooling because of the life time of the bearing. It will activate the overheat protection of DC power supply and generate alarm.
DC power supply	5 to 10 years	End life of electrolytic condenser. It will generate DC power supply alarm.
Display panel	50,000 hours (approx. 5 years)	End life of backlight of LCD.

Series HED
Applicable Fluids

Chemical Liquid Compatibility Table against the Wetted Parts Material in Chemical Thermo-con

Chemical	Concentration	Operating temperature range	Compatibility
Hydrofluoric acid	HF: 10% or less	10 to 40°C	○ Note 2)
Buffered hydrogen fluoride	HF: 10% or less	10 to 40°C	○ Note 2)
Hydrofluoric acid and Nitric acid mixture	HF: 5% or less HNO_3: 5% or less		△
Nitric acid (except fuming nitric acid)	HNO_3: 5% or less		△
Hydrochloric acid	HCl: 5% or less		△
Copper sulfate solution	H_2SO_4: 96% or less	10 to 50°C Note) HED007 10 to 30°C	○ Note 2)
Sulfuric acid (except fuming sulfuric acid)	H_2SO_4: 96% or less	10 to 50°C Note) HED007 10 to 30°C	○ Note 2)
Ozone	—	10 to 60°C	○
Ammonium hydroxide	NH_3: 5% or less	10 to 60°C	○ Note 2)
Ammonia hydrogen peroxide solution	NH_3: 5% or less H_2O_2: 20% or less	10 to 60°C	○ Note 1) 2)
Sodium hydroxide	NaOH: 50% or less	10 to 60°C	○ Note 2)
Deionized water	—	10 to 60°C	○ Note 1)
Ultrapure water	—	10 to 60°C	○ Note 1)

How to read the table:
○: Useable
△: Consult with SMC separately.

• The Chemical Liquid Compatibility Table shows reference values only and does not guarantee successful use of chemical liquids in products.
• SMC is not responsible for the accuracy of this data or for any damage arising out of the use of these chemical liquids.
• Chemical Thermo-con is not designed to be explosion proof, so it is not suitable for flammable fluids.

Note 1) Static electricity may be generated. Anti-static electricity countermeasures should be implemented.
Flow friction may generate static electricity, which can cause electric discharge to the temperature sensor or other devices and cause a malfunction.
It is possible to discharge electricity by using a conductive PFA tube, metal piping (metal flexible hose), or other type of tubing, and by installing a ground line.

Note 2) Permeation of the fluid may be possible. The permeated fluid may have a moderate corrosion to inside components and it may effect their life time.
If the chemical liquid has high concentration, permeation becomes greater, which effects the service life. In case the fluid has a possibility to generate corrosive gas, SMC recommends a nitrogen purge of the enclosure. N_2 purge ports are located at the piping connection side of the heat exchanger.

Series HED
Specific Product Precautions 1

Be sure to read this before handling. Refer to page 341 for Safety Instructions. For Temperature Control Equipment Precautions, refer to pages 342 to 345 and the Operation Manual on SMC website, http://www.smcworld.com

System Design

⚠ Warning

This catalog shows the specifications of the Chemical Thermo-con.

1. Check detailed specifications in the separate "Product Specifications", and evaluate the compatibility of the Chemical Thermo-con with the customer's system.

2. The Chemical Thermo-con is equipped with a protective circuit independently, but the whole system should be designed by customer to ensure safety.

Handling

⚠ Warning

1. Thoroughly read the Operation Manual.

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

Operating Environment/Storage Environment

⚠ Warning

1. Keep within the specified ambient temperature and humidity range. Also, if the set temperature is too low, condensation may form on the inside of the Chemical Thermo-con or the surface of piping even within the specified ambient temperature range. Dew condensation can cause failure, and so must be avoided by considering operating conditions.

2. The Chemical Thermo-con is not designed for clean room usage. The fan will generate dust.

3. Low molecular siloxane can damage the contact of the relay. Use the Chemical Thermo-con in a place free from low molecular siloxane.

Piping

⚠ Warning

1.Piping must be designed taking the whole system into consideration.

For this product and future equipment, design of the piping system should be performed by a knowledgeable and experienced person.

The fitting is not attached, and should be prepared separately by customer.

Select a fitting suitable for the material and dimensions of the tube. When connecting the fitting, use a specific tool specified by fitting manufacturer.

Piping

⚠ Warning

2. Work performed on the piping should be done by a knowledgeable and experienced person.

If work performed on the piping is done by a less knowledgeable and inexperienced person, it will likely lead to operating fluid leakage, etc.

3. Confirm the leakage of fluid.

Fluid leakage can cause dangerous accidents. Be sure to confirm that the hose or tubing is not pulled out and that there is no leakage in the fitted parts.

4. Confirm that the resin tube is not kinked or collapsed.

If a resin tube is used, it should be checked for the presence and possibility of kink or collapse.

5. Countermeasures against fluid leakage

Water drops may accumulate due to leakage of circulating fluid or facility water, or condensation on the piping. Install the Chemical Thermo-con with a drip pan, fluid leak sensor and exhaust system.

If leakage is detected, cut off the circulating pump with a hardware interlock, and cut off the power to the Chemical Thermo-con.

Depending on the type of chemical used (circulating fluid), it may have a harmful effect on the surrounding equipment and the human body.

⚠ Caution

1. Before piping

Confirm that dust, scales etc., in contact with piping is cleaned up or air blown (flushing) before piping.

2. Take care over the direction of fluid.

Do not mistake the direction of "IN" and "OUT" for the facility water system and circulating fluid system.

3. Take countermeasures against condensation.

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

4. Avoid electrostatic discharge.

If a fluid with low conductivity such as deionized water is used as the circulating fluid, static electricity generated by flow friction may be discharged to the temperature sensor and malfunction the Chemical Thermo-con. Consider measures to minimize the discharge of static electricity from the circulating fluid to signal line including the temperature sensor.

For example, a PFA conductive tube or metal piping (metal flexible hose) can be used to provide grounding to the piping of the external sensor and to discharge.

Series HED
Specific Product Precautions 2

Be sure to read this before handling. Refer to page 341 for Safety Instructions. For Temperature Control Equipment Precautions, refer to pages 342 to 345 and the Operation Manual on SMC website, http://www.smcworld.com

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 earth leakage breaker.

As a countermeasure against current leakage, install an earth leakage breaker in the main power supply.

3. Confirmation of power supply

If this product is used with voltages other than specified, it will likely lead to a fire or an electrical shock. Before wiring, confirm the voltage, capacity, and frequency.
Confirm that the voltage fluctuation is within the specified value.

4. Grounding

Be sure to ground (frame ground) with class D grounding. (grounding resistance of 100 Ω or less)
Can be grounded with the PE line of the power supply cable.
Also, do not use together with equipment that generates a strong electrical magnetic noise or high frequency noise.

5. Wiring cable should be handled with care.

Do not bend, twist or pull the cord or cable.

6. Wire with an applicable cable size and terminal.

In the event of attaching a power supply cable, use a cable and terminal size which is suitable for the electrical current of each product.
Forcibly mounting with an unsuitable size cable will likely result in a fire.

7. Avoid wiring the signal line and power line in parallel.

Since there may be a possibility of malfunction from noise, avoid parallel wiring between the temperature sensor line, communications line, signal line of alarm line, etc. and the power line and high voltage line. Also, do not place them in the same wiring tube.

8. Check for incorrect wiring.

Incorrect wiring can damage the Chemical Thermo-con or cause malfunction. Be sure to check wiring is connected properly.

9. Check the model of the Chemical Thermo-con.

The HED003 and HED005 series use the same connector. If the temperature controller and heat exchanger of different models are combined by mistake, an alarm may be generated and the specified performance may not be obtained. Be sure to check the combination of models.

Facility Water Supply

⚠ Warning

1. Be sure to supply the facility water.

1. Prohibition of water-cut operation, very little flow rate of water operation.
   Do not operate under the condition that there is no facility water or where there is very little flow rate of water is flowing. (Facility water flow rate range: 5 to 10 L/min)
   In this kind of operation, facility water temperature may become extremely higher. It is dangerous enough the material of hose may soften and burst when the piping supplying the facility water is connected with hose.
2. Actions to be taken when an emergency stop occurs due to extremely high temperature.
   In case a stop occurs due to extremely high temperature resulting from a decrease in the facility water flow rate, do not immediately flow facility water. It is dangerous enough the material of hose may soften and burst when the piping supplying the facility water is connected with hose. First, naturally let it cool down, and removing the cause of the flow rate reduction. Secondly, make sure that there is no leakage again.

⚠ Caution

1. Facility water quality

1. Use the facility water within the specified range.
   When using with other fluid than facility water, please consult with SMC.
2. When it is likely that foreign objects may enter the fluid, install a filter (20 mesh or equivalent).

Facility Water Quality Standards

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

	Item	Standard value
Standard item	pH (at 25°C)	6.5 to 8.2
	Electrical 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

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

2. If the temperature of the facility water is too low, it can cause formation of condensation inside the heat exchanger.

Supply facility water with a temperature over the atmospheric dew point to avoid the formation of dew condensation.

3. If the facility water piping is connected to multiple machines, the facility water exchanges heat at the upstream side and its temperature will become higher as it goes downstream.

Limit the number of connected Chemical Thermo-cons to two per facility water system, and if more than two chemical thermo-cons are to be connected, increase the number of systems.

Specific Product Precautions 3

Be sure to read this before handling. Refer to page 341 for Safety Instructions. For Temperature Control Equipment Precautions, refer to pages 342 to 345 and the Operation Manual on SMC website, http://www.smcworld.com

Mounting

⚠Caution

1. Mount and install horizontally.

When mounting, fix the foot of the Chemical Thermo-con by tightening the screws to the specified torque below.

Recommended Mounting Torque

Device to mount	Thread size	Applicable tightening torque N·m
Heat exchanger	M6	1.5 to 2.5
Temperature controller	M5	1.5 to 2.5

Circulating Fluid

⚠Caution

1. Applicable fluids

For the compatibility between the material of components and fluid, refer to “Applicable Fluids” (page 327). Please contact SMC for fluids other than those described on the check list.

2. Caution for the use of fluids with high permeation

When the Chemical Thermo-con is used for a fluid with high permeation into fluorine resin, the permeation can affect its life. If the fluid also generates corrosive gas, perform N_2 supply and exhaust (N_2 purge) inside the heat exchanger.

3. Caution for the use of deionized water

If deionized water is used, bacteria and algae may grow in a short period. If the Chemical Thermo-con is operated with bacteria and algae, the performance of the heat exchanger may deteriorate. Exchange all deionized water regularly depending on the conditions (once a month as a guide).

4. Prohibition of small flow rate

Be sure to avoid operation with the circulating pump stopped or with extremely small flow rate of recirculating fluid (7 L/min or less for water). Otherwise, the Chemical Thermo-con will repeat change cooling and heating operation, which may shorten the life of the Peltier element significantly, and it will become unable to control the temperature accurately. When the circulating pump is stopped, stop the temperature control of the Chemical Thermo-con as well by using the remote ON/OFF function.

5. Operating pressure range of circulating fluid

The operating pressure range is 0 to 0.35 MPa. Do not use with negative pressure which can cause the Chemical Thermo-con to fail. (Specifically, install the heat exchanger at the secondary (discharge) side of the circulating pump.) Also, avoid excessive pressure being applied to the circulating fluid circuit by a clogged filter or fully closed valve.

6. Prohibition of fluid pulsation

If a pump generating pulsation is used, install a damper to absorb the pulsation directly before the Chemical Thermo-con. Fluid pulsation can break the Chemical Thermo-con.

Communication

⚠Caution

1. The set value can be written to EEPROM, but only up to approx. 1 million times.

In particular, pay attention to how many of times the writing is performed using the communication function.

Maintenance

⚠Warning

1. Prevention of electric shock and fire

Do not operate the switch with wet hands. Also, do not operate the Chemical Thermo-con with water or fluid left on it.

2. Action in the case of error

If any error such as abnormal noise, smoke, or bad smell occurs, cut off the power at once, and stop supplying facility water. Please contact SMC or a sales distributor to repair the Chemical Thermo-con.

3. Regular inspection

Check the following items at least once a month. The inspection must be done by an operator who has sufficient knowledge and experience.

a) Check of displayed contents.
b) Check of temperature, vibration and abnormal sounds in the body of the Chemical Thermo-con.
c) Check of the voltage and current of the power supply system.
d) Check for leakage and contamination of the circulating fluid and intrusion of foreign objects to it, and subsequent replacement water.
e) Check for leakage, quality change, flow rate and temperature of facility water.

4. Wearing of protective clothing

Some fluids can be dangerous when handled incorrectly. Wear protective clothing for safety during maintenance. In particular, observe the MSDS of the circulating fluid, and wear protective goggles, gloves and mask for the operation of the Chemical Thermo-con accompanied with the use of fluids.



Goggles　Mask　Gloves　Safety shoes

Technical Data CONTENTS

A

Accumulator····Page 333
Adjustment sensitivity (Hysteresis)···Page 337
Air-cooled condenser····Page 332
Analog communication····Page 339
ARW width (Anti-Reset Windup width)···Page 337
Auto-tuning····Page 337

B

Band width, Temperature upper/lower limit width···Page 338
Breaker····Page 338

C

Capillary tube····Page 332
Cascade pump····Page 334
CE marking····Page 339
Centrifugal pump····Page 334
CFC refrigerant····Page 332
Check valve····Page 335
Circulating fluid, constant temperature circulating fluid···Page 336
Compressor····Page 332
Condenser····Page 332
Cooler····Page 332
Cooling capacity····Page 335
Cooling tower····Page 333
CSA standards····Page 339

D

DC canned pump····Page 335
DC power supply····Page 338
Degree of viscosity····Page 335
Deionized water····Page 336
Density, specific gravity····Page 335
DeviceNet····Page 339
DI filter····Page 335

E

Electrical conductivity····Page 336
Electromagnetic contactor····Page 338
Electromagnetic switch····Page 338
EMO circuit····Page 338
Ethylene glycol aqueous solution····Page 336
eti mark····Page 339
ETL mark····Page 339
Evaporator····Page 332
Expansion valve····Page 332
External sensor····Page 337

F

Facility water····Page 333
Flow sensor/Flow switch····Page 335
Fluorinated fluids····Page 336
Fluorinert™····Page 336
Fundamentals of refrigeration circuits···Page 332

G

GALDEN®····Page 336
Gear pump····Page 334

H

Hardware interlock····Page 338
Heat····Page 335
Heat load····Page 335
Hot gas by-pass····Page 333

I

Impedance protection····Page 338
Insulation resistance····Page 339
Insulation withstand voltage····Page 339
Inverter control····Page 333

L

Learning control····Page 337
Level switch····Page 335
Lifting height/Pressure····Page 333

M

Magnet pump····Page 335
Mechanical seal pump····Page 334

N

Non-return valve····Page 335
NRTL (National Recognized Test Laboratories)···Page 339

O

Offset function····Page 337
ON/OFF temperature control····Page 337
Overload relay····Page 338

P

Particle filter····Page 335
Peltier device····Page 333
Phase reversal relay (Plugging relay)···Page 338
PID control····Page 337
Pipe resistance····Page 334
Power supply frequency····Page 338
Propylene glycol aqueous solution···Page 336
Protective devices in refrigeration circuits···Page 333
PT sensor, platinum resistance temperature detector···Page 336
Pump capacity/Water-supply capacity···Page 333
Pump heat input····Page 335
PV····Page 337
PWM control····Page 337

R

Refrigerant dryer····Page 332
Refrigerator····Page 332
Relay····Page 338
Relief valve····Page 335
RS232C····Page 338
RS485····Page 339
RTD (Resistance Temperature Detector)···Page 336

S

Sealing mechanism····Page 334
SEMI F47····Page 339
SEMI S2····Page 339
SEMI S8····Page 339
Signal input/output, I/O····Page 339
Solenoid valve····Page 335
Solid state relay (SSR)····Page 338
Specific heat, specific heat capacity···Page 335
Specific resistance····Page 336
Specified CFC····Page 332
SV····Page 337

T

Tap water····Page 336
Temperature fuse····Page 337
Thermal relay····Page 338
Thermistor····Page 336
Thermo couple····Page 336
Thermoelectric device····Page 333
Thermoelectric system····Page 333
Thermo-module····Page 333
Thermostat····Page 336
Three-phase power supply····Page 338
Time division proportional output····Page 337
Turbine pump····Page 334

U

UL standards····Page 339

V

Vane pump····Page 334
Vortex pump····Page 334

W

Water control valve····Page 333
Water-cooled condenser····Page 332

Refrigeration Circuits, Peltier Devices, Cooling Sources

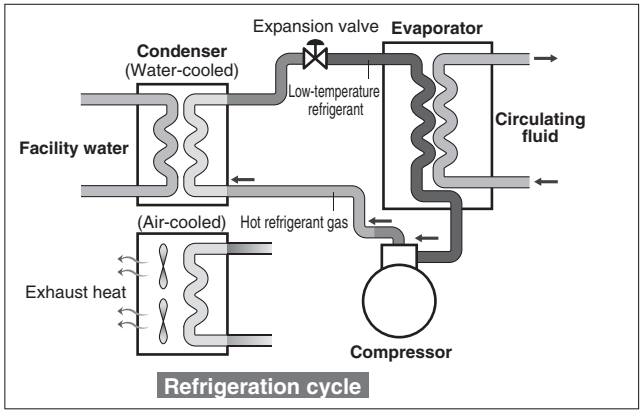
Compressor
A compressor draws in low-pressure chlorofluorocarbon (CFC) refrigerant gas, compresses the gas and then discharges it as a high-pressure, high-temperature gas. Compressors are classified into various types (reciprocating, rotary, screw, etc.) according to the mechanical compression method used.

Refrigerator
A compressor that compresses a refrigerant gas. These are called refrigerators to distinguish them from machines such as air compressors.

CFC refrigerant
CFC (chlorofluorocarbon) refrigerants are organic compounds made up of elements including carbon, hydrogen, chlorine and fluorine. They are referred to generically using the DuPont brand name of Freon®.
When CFCs are used as heat-transfer mediums and circulated inside refrigeration circuits, causing heating and cooling during their condensation and evaporation phase changes, the CFCs are referred to as CFC refrigerants.

Specified CFC
Due to their stability as a chemical substance and their safety with respect to humans, CFCs came to be widely used as industrial materials, particularly refrigerants. However, it was later recognized that when CFCs (and HCFCs (hydrochlorofluorocarbons)) containing chlorine are released into the atmosphere, they rise up into the ozone layer and deplete it.
This resulted in the establishment of the Montreal Protocol in 1987, which classified CFCs such as Freon R12 and HCFCs such as Freon R22 as “specified CFCs” and prohibited their manufacture. As a result, their use has now almost completely died out.
Instead of specified CFCs and HCFCs, SMC products now use HFC refrigerants such as R134a and R404A that have an ozone depletion potential (ODP) of zero.

Fundamentals of refrigeration circuits
In a refrigeration circuit, refrigerant gas injected into the circuit repeatedly travels through a cycle of compression, condensation, expansion and evaporation, creating high-temperature and low-temperature sections in the circuit. The compressor compresses low-pressure refrigerant gas and discharges the gas at a high temperature and pressure level. The hot, pressurized refrigerant gas enters the condenser where it is cooled by the external air or cooling water and condenses to form a high-pressure liquid refrigerant. As the high-pressure liquid refrigerant passes through a constricting mechanism, such as an expansion valve, it rapidly depressurizes and some of the refrigerant evaporates. The release of evaporation heat causes the refrigerant itself to cool so that it becomes a combination of gas and liquid at a low-temperature and pressure level. In its combined gas-liquid state, the refrigerant enters the evaporator where it continually evaporates while absorbing the heat within the evaporator, thereby cooling the interior of the evaporator. When the refrigerant emerges from the evaporator, it evaporates entirely and becomes a low-pressure refrigerant gas. The low-pressure refrigerant gas is then drawn into the compressor and again becomes a high-temperature, high-pressure gas as the cycle is repeated.



Refrigeration cycle

Condenser
A heat exchanger used to condense high-temperature, high-pressure refrigerant gas. A condenser has the function of releasing heat drawn up by the refrigeration circuit to the outside. Condensers can be air-cooled or water-cooled, depending on the cooling method used.

Air-cooled condenser
Air-cooled condensers are generally made up of copper tubes through which the refrigerant flows, with numerous thin aluminum fins attached around the outside of the tubes. Outside air is forced over the fins by a device, such as a fan motor, to cool the pipes to the ambient temperature and condense the refrigerant gas.
If an air-cooled condenser is installed inside a building, it can be used to heat the interior of the building since the heat generated by the refrigeration circuit is released as waste heat from the outside of the condenser. The room in which an air-cooled condenser is installed must have adequate ventilation or air-conditioning equipment.

Water-cooled condenser
A heat exchanger that uses cooling water to cool and condense the coolant. Water-cooled condensers can be used in environments, such as large factories where cooling tower water or the cooling water for an air-conditioning system can be circulated and used.
Depending on their construction, heat exchangers can be double-pipe type, shell-and-tube type or plate type units.

Refrigerant dryer
In a refrigeration circuit, a refrigerant dryer consists of filters that absorb and remove moisture inside the refrigeration circuit. Refrigerant dryers are normally installed in pipes carrying liquid refrigerant after it emerges from the condenser.

Expansion valve
A component that creates an expansion in the refrigeration circuit. As the refrigerant passes through this valve, a large pressure loss results, thereby making it possible to create high-pressure and low-pressure segments within the refrigeration circuit.
There are several types of expansion valve, including constant-pressure expansion valves and thermal expansion valves. Such types allow the size of the valve aperture to be adjusted using refrigerant pressure or temperature feedback from an outlet passage.

Capillary tube
The capillary tubes used in refrigeration circuits are simply small-caliber copper tubes, normally used in the expansion step, that act as a fixed restrictor in the refrigerant passage.

Evaporator
A heat exchanger used to cool the target substance (e.g., water or air) using the evaporative heat from a low-temperature, low-pressure combined gaseous and liquid refrigerant in the refrigeration circuit.

Cooler
→ Evaporator

Accumulator
A tank installed in a refrigeration circuit on the inlet side of the compressor. A compressor is a component designed to compress gas, so a malfunction will occur if any liquid coolant enters the compressor. Installing an accumulator has the function of separating out the coolant gas that is sucked into the compressor and any remaining refrigerant, and of preventing the liquid refrigerant from being sucked into the compressor. The inclusion of an accumulator creates a system that is highly resistant to variability in factors such as the cooling load.

Hot gas by-pass
A refrigeration circuit sometimes includes a circuit that allows high-temperature, high-pressure refrigerant gas (hot gas) discharged from the compressor to by-pass the condenser so that it reaches the evaporator (on the low-pressure side) without being condensed. This prevents the evaporator temperature (on the low-pressure side) from dropping too far and reduces the risk of liquid refrigerant being drawn into the compressor when the cooling load is low (if there is nothing to refrigerate), thereby ensuring more stable functions of the refrigeration circuit.
This also allows a flow of hot gas to be intentionally directed to the evaporator with the aim of heating the evaporator rather than cooling it.

Water control valve
A water control valve, installed on the cooling water pipe for a water-cooled condenser, used to adjust the amount of cooling water flowing to the condenser. Water control valves can be either pressure-regulated or temperature-regulated, with the amount of flow regulated using feedback from the condensing pressure or condensing temperature, respectively.
When the cooling water temperature is low, a large flow of cooling water to a water-cooled condenser reduces the condensing pressure and lowers the cooling capacity. In this sort of situation, a water control valve restricts the cooling water flow and maintains the condensing pressure at the desired value. Water control valves also have the function of reducing water consumption by preventing unnecessarily large flows of cooling water.

Inverter control
In compressors that use an ordinary AC motor, the motor rotation rate is fixed according to the frequency of the AC power supply, with the result that the refrigerant discharge rate is also fixed. Inverter control in a refrigeration circuit is the use of an inverter to vary the compressor rotation rate and thereby control the rate of refrigerant circulation.
This provides means of saving energy by, for example, running the compressor at a slower rate when the cooling load is low.

Protective devices in refrigeration circuits
In refrigeration circuits, protection must be provided for electrical components such as compressors, and against abnormal refrigerant pressures. Protective measures for compressors (motors) include protective devices such as overload relays (built into the compressor to detect overcurrent and overheating), thermal relays (fitted externally to detect motor overcurrent) and temperature switches.
The devices used to protect against pressure faults include pressure switches, safety valves and rupture disks. However, in refrigeration circuits built into compact devices, the protective devices are often confined to just overload relays, or just thermal relays and pressure switches depending on the anticipated level of risk.

Facility water
The cooling water flowing through a water-cooled condenser used to expel waste heat generated in the refrigeration circuit to the outside.
In ordinary factories or buildings, fluids such as cooling tower water or chiller water are used as facility water.

Cooling tower
A cooling tower is a facility that uses cooling water to expel the waste heat circulated and collected inside a factory or other building into the outside air. Cooling towers are installed in outdoor locations such as on the rooftops of buildings. The cooling water is sprayed down like a shower from the top of the cooling tower and forcibly brought into contact with the outside air by a fan motor. As well as being directly cooled by the temperature of the outside air, the partial evaporation of the cooling water itself draws off evaporation heat, cooling the water further.
Because cooling towers are directly cooled by the outside air, the resulting cooling water temperature varies seasonally depending on the climatic conditions. In addition, the cooling water cannot theoretically be cooled to a temperature any lower than 5°C above the wet-bulb temperature of the outside air.

Peltier device
An element with a structure made up of alternating layers of flat P-type and N-type semiconductors arrayed in series. When a direct current flows through the element, heat moves from one plate surface to the next, so that one surface is cooled as the opposing surface is heated. This is referred to as the Peltier effect.
By changing the direction of current flow, the direction of heat movement can also be changed, providing a simple means of cooling and heating.

Thermo-module
→ Peltier device

Thermoelectric device
→ Peltier device

Thermoelectric system
A temperature control system that uses a Peltier element to directly cool and heat a liquid, gas or solid.
Heat exchangers suitable for fluids are installed on both sides of the Peltier element, with the fluid to be temperature-controlled on one side of the element while the heat exchanger on the other side is used to dissipate heat.

Fluid Control and Heat-related

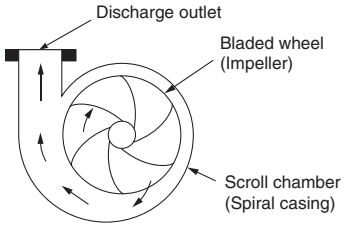
Pump capacity/Water-supply capacity
A pump's water-supply capacity is indicated by the amount of water it can cause to flow at a given pressure (lifting height).
The characteristic curve (pump curve) that indicates the correlation between pressure and flow rate varies depending on the pump type, and thus, the user must check that the type of pump selected is suitable for the intended application.

Lifting height/Pressure
Lifting height (in meters) is often used instead of pressure to indicate the pump capacity. Lifting height is a numerical value that indicates the capacity of a pump in terms of the height (in meters) to which it can lift a fluid.
The value for pressure is obtained by multiplying the lifting height by the density of the fluid; for example, if a pump capable of generating a lifting height of 10 meters is used to pump water, which has a density of 1 kg/L, the unit pressure generated by the pump is 1 kgf/cm^2 (0.1 MPa).
If a more dense fluid is used, the pressure is higher even though the lifting height remains the same.

● **Pipe resistance**
When water or another fluid is caused to flow through a passage composed of pipes, valves, etc., the pressure differential generated by friction between the various devices and the fluid is known as “pipe resistance.” A synonymous term is “pressure loss.”

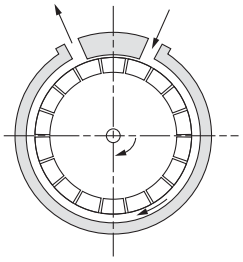
● **Centrifugal pump**
This is one type of pump in which a bladed wheel (impeller) spins inside the pump chamber (casing), applying centrifugal force to the fluid. This force is converted to pressure that discharges the fluid. A large volume of fluid can be pumped, but it is difficult to attain high pressure. When high-pressure is desired, a type fitted with multistage impellers can be used.
This is a low-lifting height, high-flow volume pump.

Centrifugal pump



● **Vortex pump**
In this type of pump, a bladed wheel (impeller) spins inside the pump chamber (casing), applying centrifugal force to the fluid. This force is converted to pressure that discharges the fluid. As in a centrifugal pump, the fluid is discharged using centrifugal force, but the impeller has more blades than in a centrifugal pump, and in the pump chamber (casing), the aperture (clearance) is set more narrowly, allowing for a higher discharge pressure.
The pressure and flow characteristics attained are somewhere between that of a centrifugal pump and a vane pump.
This is a mid-lifting height, mid-flow volume pump.

Vortex pump

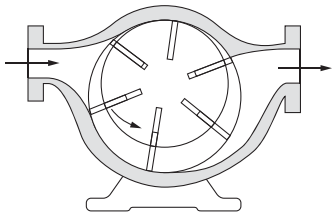


● **Turbine pump**
→ Vortex pump

● **Cascade pump**
→ Turbine pump

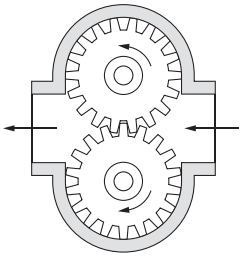
● **Vane pump**
In this type of pump, vanes set in a rotor inside the pump chamber brush against the inside walls of the chamber as they rotate, pushing out and discharging the fluid that is surrounded by the vanes, rotor and pump chamber walls. This is a type of PD (positive displacement) pump.
This is a high-lifting height, low-flow volume pump.
The vanes slide against the interior walls of the pump chamber, generating abrasion powder. In addition, this type of pump is susceptible to entry of foreign objects such as outside debris, etc.

Vane pump



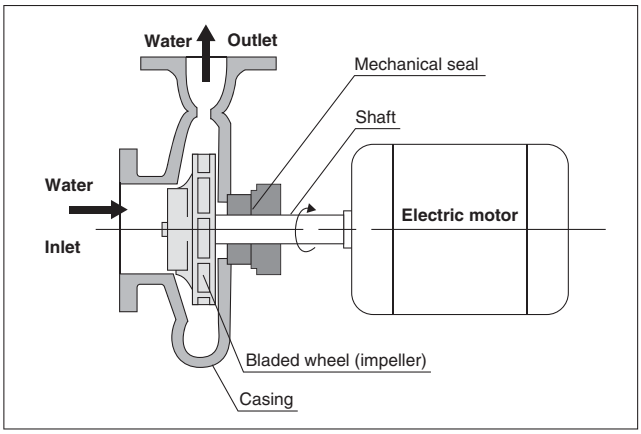
● **Gear pump**
Like the vane pump, this is a type of PD (positive displacement) pump, in which a pair of gears meshes with one another and rotates, pushing the fluid through the gap between them and discharging it.
This is a high-lifting height, low-flow volume pump.

Gear pump

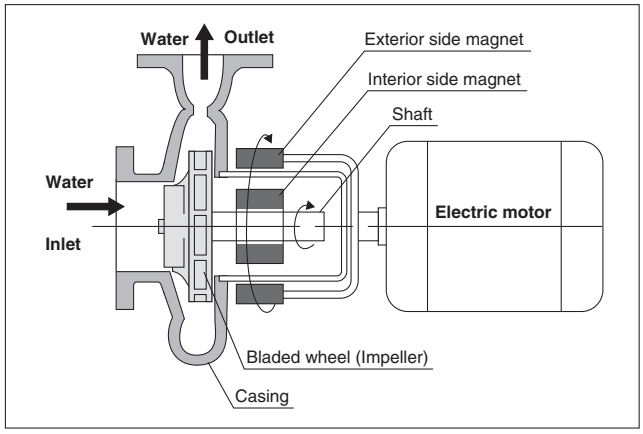


● **Sealing mechanism**
The bladed wheel (impeller) in the pump chamber through which the fluid passes is linked to the shaft of the external electric motor, and the rotation of the impeller discharges the fluid. As water or other fluids seeping through the motor shaft and reaching the electric motor can cause short circuits and other damage, it is necessary to have a mechanism sealing the pump chamber off from the shaft. This is known as a “sealing mechanism.”
There are mechanical seal types, magnet coupling types and others.

● **Mechanical seal pump**
This is a general terms for pumps that use mechanical seals for the sealing mechanism.
The rotating seal mounted on the motor shaft side and the fixed seal mounted on the pump chamber side rotate, and their surfaces touch one another, sealing off the fluid. As a result, there is a slight, external leakage of fluid. The volume of leakage increases over time, so it is necessary to replace the seal portions regularly.
This type can be used for applications where the motor shaft and impeller are directly linked and there is high-shaft power.



● **Magnet pump**
This is a general term for pumps that use magnetic coupling for the sealing mechanism.
Using magnetism to couple the rotor on the inside of the pump chamber to the permanent magnet mounted on the motor shaft side, with the pump chamber wall between them, the rotation is conveyed to the rotor inside the pump chamber. Since the pump chamber can be completely separated, pump chamber can be completely sealed off, so there is absolutely no external leakage.
Since a large magnet coupling is needed, this type of pump is more difficult to make in small sizes than the mechanical seal type, and the cost is also higher.



● **DC canned pump**
A pump with a seal-less construction combining the motor and the pump in one. It can be made in compact sizes with absolutely no external leakage of fluid. A DC brushless motor is used.

● **Pump heat input**
The volume of heat applied to the circulation loop, generated by the operation of the pump. When calculating the overall volume of heat applied to the circulation loop, it is necessary to consider the volume of heat generated by the pump, along with that of the object being cooled.
The pump converts the electrical power entering the motor into the kinetic energy of the fluid, which causes the fluid to circulate. This kinetic energy is reduced as a result of undergoing pressure loss inside the piping, and eventually the entirety of the kinetic energy is released into the circulating fluid as heat.
While there are differences depending on the type of pump, for rough calculations, the nominal heat emitted from the pump can be treated as the pump heat input.

● **Solenoid valve**
A component that switches the flow of fluid from ON to OFF, or changes the direction by moving the plunger (iron core) using the force of electromagnetism.

● **Relief valve**
When the inlet pressure exceeds a set level, this valve opens to release the outlet pressure.

● **Flow sensor/Flow switch**
These components monitor the flow rate of the fluid. The flow sensor measures the flow rate linearly. The flow switch only has the function of commencing operation when the flow rate reaches a certain level, and does not perform measurement of the flow volume.

● **Particle filter**
A filter that removes debris and other particles.

● **Check valve**
A check valve is a device that prevents reverse flow of the fluid, keeping it flowing in one direction only.

● **Non-return valve**
→ Check valve

● **Level switch**
A switch that detects the fluid level inside the liquid tank. There are many different types, but the most common type employs a floating buoy, which causes a lead switch (magnetic switch) to turn ON and OFF.

● **DI filter**
A filter that is filled with ion exchange resin used to remove leftover ions from the water. DI stands for “deionized,” while “DI water” is deionized water, or water with its ions removed.

Fluid Properties, Materials, Physical Values

● **Density, specific gravity**
The weight per unit of volume, measured in units of [kg/m^3]. Specific gravity is the ratio of the density of a given substance to the density of water (1.0 [g/cm^3]), and is a dimensionless quantity. When expressing this quantity within the CGS system of units, density and specific gravity have the same value.

● **Degree of viscosity**
Thickness of a fluid. The units used to express absolute degree of viscosity are [Pa·s] units, but it is often expressed within the CGS system of units with [P] (Poise).
1 [Pa·s] = 10 [P]
The value obtained by dividing absolute degree of viscosity by density is called the kinetic viscosity. This can be measured in [m^2/s] units, but in general, [St] (Stokes) are used.
1 [St] = 0.0001 [m^2/s]

● **Specific heat, specific heat capacity**
The heat energy required to increase the temperature of an object by a certain temperature interval, under specific pressure and volume conditions.
The specific heat of water: 1 [cal/g·K] = 4.184 x 10^3 [J/kg·K]

● **Cooling capacity**
The volume of heat (heat energy) that temperature control equipment can absorb (cool) per unit of time, at an arbitrary temperature.

● **Heat load**
→ Cooling capacity

● **Heat**
Terms such as heat, heat load, cooling capacity, etc., that are used in this catalog, indicate quantities of heat that can be absorbed or radiated per unit of time. As a result, the units employed are [W] = [J/s] (work rate) or [kcal/hr].
1 kW = 860 kcal/hr

● **Specific resistance**
A value indicating the electrical insulating properties of a liquid, and the unit used is [Ω·cm]. When expressing the specific resistance of deionized water, it is sometimes called "DI level." At 25°C, the specific resistance of theoretically 100% deionized water is 18.3 [MΩ·cm].

● **Electrical conductivity**
A value indicating the ease with which electricity passes through a liquid, and is inversely proportional to the specific resistance. The unit used is [S/m], incorporating [S] (Siemens), the opposite of [Ω] (resistance).
At 25°C, the electrical conductivity of theoretically 100% deionized water is 0.055 [μS/m].

● **Tap water**
Water that has been filtered and distilled and any impurities eliminated. It is also known as purified water.

● **Deionized water**
Water that has had any impurities or ion elements removed. It is obtained by removing ion elements with ion exchange resin, after filtering out impurities with a particle filter. Its theoretical specific resistance has a limit of 18.3 [MΩ·cm], but it is impossible to actually attain this value. As a general rule, water with a specific resistance of 1 to 10 MΩ·cm is referred to as deionized water.

● **Ethylene glycol aqueous solution**
Ethylene glycol is a type of alcohol, and adding it to water causes the freezing point of the water to drop. It is a major ingredient in antifreeze for automobiles. At a concentration of 60%, the freezing point drops to –40°C or lower, but the viscosity increases as the temperature drops, so taking fluidity into account, it is practical to consider about –20°C as the minimum temperature.
By adding ethylene glycol to deionized water, it is possible to raise the fluid's specific resistance, so it can be used for applications where circulating fluid with high insulating properties is desired.

● **Propylene glycol aqueous solution**
Propylene glycol is a type of alcohol, and adding it to water causes the freezing point of water to drop. Like ethylene glycol, it is a major ingredient in antifreeze for automobiles.
It has lubricating properties, and is characteristically non-volatile.

● **Fluorinated fluids**
Inert fluids in the fluorine series. There are many types, including perfluoropolyether (PFPE), perfluorocarbon (PFC), hydrofluoropolyether (HFPE), and hydrofluoroether (HFE), but they share the characteristic of high electrical insulation properties, and grades can be selected with appropriate fluidity even at low temperatures, such as –100°C, and high temperatures, such as 200°C and above.
They are chemically inert and non-poisonous.
Products are sold on the market, such as Fluorinert, made by 3M, and GALDEN, made by Solvay Solexis.

● **GALDEN®**
The product name of a fluorinated fluid manufactured by Solvay Solexis. It is a perfluoropolyether with a high polymer compound, and various grades can be selected with differing temperature ranges and viscosity ranges depending on the degree of polymerization.

● **Fluorinert™**
The product name of a fluorinated fluid manufactured by 3M. Its basic structure is a perfluorocarbon, but it has a wide variety of chemical structures, and various grades can be selected with differing temperature and viscosity ranges.

● **Circulating fluid, constant temperature circulating fluid**
Fluid that circulates among the customer's equipment, with temperature controlled by a chiller.
Taking freezing temperature, boiling point, electrical insulation properties and so on into consideration, tap water, deionized water, ethylene glycol aqueous solution, fluorinated fluids, etc., can be selected depending on the application.

Temperature Measurement and Control

● **PT sensor, platinum resistance temperature detector**
A type of temperature sensor taking advantage of the properties of platinum (Pt), which has an electrical resistance that increases in proportion to the temperature. A sensor with the specification Pt 100Ω has a resistance of 100Ω at 0°C. As the resistance value is relatively small, and the sensor is easily influenced by the resistance value of the conductive wires, an input circuit is generally used which cancels out the resistance value of the conductive wires, by using, for instance, 3-wire or 4-wire wiring configurations and long conductive wires.

● **RTD (Resistance Temperature Detector)**
→ PT sensor

● **Thermo couple**
This is created by forming a loop, connecting the ends of two wires made of two different metals, and by keeping the two wires at separate temperatures at the connecting point. Thermoelectric power is generated according to this temperature differential (the Seebeck effect).
As a sensor, by keeping the end of one wire at a standard temperature and measuring the thermoelectric power generated, it can determine the temperature of the other wire terminal. A thermo couple is a sensor employing this principle.

● **Thermistor**
A temperature sensor employing a semiconductor with electrical resistance that changes in accordance with the temperature. There are two types,
PTC: positive temperature coefficient (a type for which the resistance increases as the temperature rises)
NTC: negative temperature coefficient (a type for which the resistance decreases as the temperature rises.)
The resistance value is generally large, amounting to several MΩ, and there is little influence from the resistance of the conductive wires, so a 2-wire configuration is generally used.

● **Thermostat**
A switch that turns ON or OFF when it reaches a certain set temperature. Most thermostats are bimetallic.
They are sometimes used for direct temperature control, such as switching a heater ON or OFF, but are also used often for safety circuits which switch OFF when the temperature becomes abnormally high.
The switch can be returned to its original position either automatically or manually.

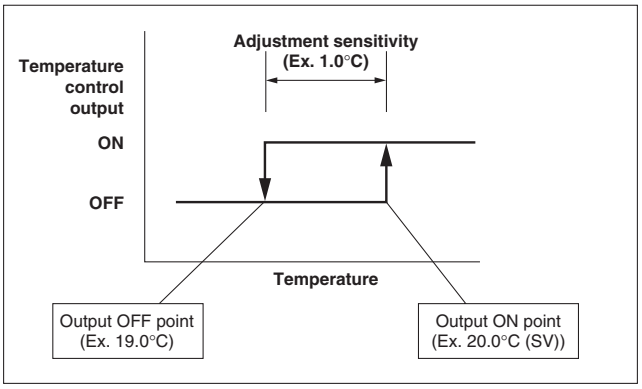
● **Temperature fuse**
A fuse in which an internal metal wire melts, breaking the circuit when exposed to a temperature exceeding the set temperature. When this kind of fuse blows, it cannot be reset and must be replaced.

● **PV**
PV: Process Value. In temperature control equipment, this indicates the current temperature measured by the temperature sensor.

● **SV**
SV: Set Value. In temperature control equipment, this indicates the target value (set value) for performing temperature control.

● **ON/OFF temperature control**
A control method for adjusting temperature by turning temperature control output ON or OFF relative to the set temperature.
When the temperature is above (below) the set temperature, output of the refrigerator (heater) is turned ON, and when the temperature is below (above) the set temperature, output is turned OFF.
Since there are only two operating rates relative to the set temperature, 0% or 100%, this is also called 2-position control.

● **Adjustment sensitivity (Hysteresis)**
When the PV is extremely close to the SV in ON/OFF control, there may be "chattering" where the temperature control output repeatedly turns ON/OFF with small temperature variations, and this may have an adverse impact on output relays and connected equipment. To prevent this, spacing is provided between ON and OFF operation to stabilize control. This operation spacing is called adjustment sensitivity (hysteresis).
For example, if the cooling output ON point (SV) is set to 20.0°C and hysteresis is set to 1.0°C, then cooling output will go OFF when temperature drops to 19.0°C, and go ON when temperature rises to 20.0°C.



● **PID control**
A control method for producing temperature control output by comparing the temperature difference between the input value from the temperature sensor (PV) and the set temperature (SV), and using a combination of P (Proportional) operation, I (Integral) operation and D (Derivative) operation.
Output is linearly variable from 0 to 100%, and this enables smooth temperature control with no temperature wavering.
P (Proportional) operation: Operation where the amount of output is varied from 0 to 100% in proportion to the deviation between PV and SV (temperature difference). The range of temperatures for performing proportional operation (proportional band) must be input as a parameter.
I (Integral) operation: Operation where the temperature discrepancy is corrected by adjusting the amount of output relative to the time that deviation between PV and SV has continued. Since the amount of output is determined in response to the time that deviation continues, the integral time must be input as a parameter.
D (Derivative) operation: Operation where output is produced in accordance with the derivative (speed of change) of the temperature deviation. This is used to quickly correct sudden temperature variations when there is a sudden change in the ambient environment or load. The derivative time is input as a parameter, and the longer the derivative time, the stronger the correction output that is produced.

● **ARW width (Anti-Reset Windup width)**
Range of integral operation used for PID control. This value is used to designate the range for calculating the integral term, to suppress buildup of the integral component.

● **Auto-tuning**
In PID control, P, I, D and each parameter must be optimally set for the balance of the heat capacity of all parts where the circulation loop is connected. Auto-tuning refers to a function for automatically determining the setting of those parameters.
SMC's temperature control equipment is shipped with PID parameters set at factory shipment to the greatest common factor for the various use conditions. However, if those parameter settings are likely to be unsuitable for the actual operating environment, some models provide a function which can automatically set parameters by using auto-tuning.

● **Time division proportional output**
When controlling output of a heater or other device via a relay or SSR, this method of operation makes the ratio of ON time to OFF time proportional to the control output over a fixed time (0.2 to 1.0 sec) in accordance with a previously set time cycle.
For example, if the control cycle is 1.0 sec, and the control output is 70%, then the ON time will be 0.7 sec and the OFF time 0.3 sec.

● **PWM control**
→ Time division control

● **Offset function**
Function for shifting the target temperature for actual temperature control from SV by adding or subtracting a separately set offset value (+ or – a certain number of °C) to or from the set temperature (SV).
For example, if the temperature upon arrival at the object of temperature control is shifted higher (or lower) relative to the temperature discharged from the chiller because a certain amount of heat input is received from piping due to the effects of ambient temperature, this offset value is set to correct that effect.

● **Learning control**
A function for automatically calculating and setting the offset value (correction value for the set temperature).
A temperature sensor (external sensor) is provided near the object to be temperature controlled, and those signals are input to the chiller. The offset value is automatically calculated from the deviation between the discharged temperature and the external sensor.

● **External sensor**
Temperature sensor mounted to the outside of temperature control equipment and used for learning control etc.

● **Band width, Temperature upper/lower limit width**
Temperature range for outputting alarms etc., when PV deviates by more than a fixed temperature from the set temperature (SV).

Power Supply, Electrical Equipment

● **Power supply frequency**
There are two frequencies for commercial AC power: 50 Hz and 60 Hz. The AC motors installed in temperature control equipment turn at a rotation speed corresponding to the power supply frequency. When operating with a 60 Hz power supply, the rotation speed is generally 10% faster than with 50 Hz. In the case of a pump, the flow rate and pressure increase, and in the case of a compressor in a refrigeration circuit, the cooling capacity increases. Current consumption also increases in the same way.
In the case of a resistance load, such as a DC pump or heater, performance does not depend on the frequency.

● **Three-phase power supply**
With three-line AC current or AC voltage, the phases of the lines are shifted by 120°.
The current values of each line are $1/\sqrt{3}$ smaller than single phase with the same level of transmitted power, so thinner wires can be used. There is also the advantage that a rotating magnetic field can be easily produced. (It is possible to use a 3-phase motor with a simple structure.)
A 3-phase power supply is used for equipment with high output.

● **Breaker**
A device which protects load circuits and wires by breaking the circuit when an abnormal current flows in an outlet circuit due to problems such as overload or shorting. Depending on the application, a breaker may be called a motor breaker, circuit protector or other names. Ground fault circuit interrupters monitor both current in the main circuit and leakage current, and break the circuit if leakage current is too high.

● **Relay**
A switch which turns a mechanical contact ON/OFF with the power of an electromagnet (solenoid). This makes it possible to turn ON/OFF the high power of the contact with the low power needed to drive the electromagnet only, and thus relays are used for amplification. They are also frequently used as logic elements in sequence circuits.

● **Electromagnetic contactor**
An electric device for turning power circuits ON/OFF to start and stop power equipment (e.g. motors, heaters). Just like a relay, these devices open or close a mechanical contact with the power of a solenoid. The principle of operation is the same as a relay, but a contactor is designed for high-voltage and large current.

● **Thermal relay**
A circuit protection device incorporated into the power input circuit of a motor to provide output when motor overcurrent is detected. It is comprised of a heater which heats up in response to current, and a bimetal which opens and closes a contact in response to that heat. Since the thermal relay itself cannot open and close a high capacity power circuit, the main circuit for a motor or other device is broken by incorporating a control circuit with an electromagnetic contactor or relay.

● **Electromagnetic switch**
A device integrating an electromagnetic contactor with a thermal relay.

● **Overload relay**
This has the same structure as a thermal relay, and is used for the same purpose. Overload relays built into the compressors of small refrigeration circuits are installed on the wall of the compressor, and are actuated not by heat due to overcurrent but by the temperature of the compressor itself. In many small compressors, the main circuit is directly broken by the overload relay.

● **Impedance protection**
A type of motor protection generally used for small AC fan motors and other small motors.
The motor is constructed so that it will not rise above a certain temperature, even when locked for some reason, due to the inherent impedance (AC resistance) of the motor coil itself. Therefore, the motor itself is protected against burnout, even though no thermal relay or other protective device is installed.

● **Solid state relay (SSR)**
A relay which enables switching of high power using low power by using a thyristor or other semiconductor element. In comparison with an electromagnetic relay, this type has no mechanical moving parts, and thus is capable of high-speed switching. SSRs are compact, and have a long service life.
However, this does not mean that contacts are physically isolated. The fact that there is some leakage current even when the device is OFF must be taken into account.

● **Phase reversal relay (Plugging relay)**
A switch which monitors the phase sequence of a 3-phase main power supply, and issues a warning if anything is abnormal.
When driving a 3-phase motor with a 3-phase power supply, the motor will turn backwards if the phase sequence of wiring is wrong. This relay is installed to prevent such reverse rotation. These relays are also called plugging relays.

● **DC power supply**
A device which produces DC power from commercial AC power. DC power is for CPUs inside equipment and other control circuits. Peltier elements for Peltier circulators, thermoelectric baths and other equipment are driven with DC power, so they have a high-capacity DC power supply built-in.

● **EMO circuit**
An EMO (EMergency Off) circuit is an electrical circuit provided to shut off all power and ensure safe conditions when an emergency stop button (EMO button) is pressed in an emergency.

● **Hardware interlock**
This is an equipment control circuit for shutting off power in case of trouble. The circuit is logically configured using only relays and other hardware, and does not use software running on the CPU.

● **RS232C**
A standard for serial communication. This is the communication standard when connecting a PC with an acoustic coupler or modem, and is used for one-to-one communication between PCs.
Since RS232C itself only roughly stipulates the use of wiring systems and other hardware, detailed hardware specifications and software protocols are determined independently by each equipment manufacturer.

● **RS485**
A standard for serial communication. Only one-to-one communication between devices can be done with RS232C, but with RS485 it is possible to communicate simultaneously with multiple devices by wiring them in a chained, multidrop fashion, and providing addresses via software.
Since RS485 itself only roughly stipulates the use of wiring systems and other hardware, detailed hardware specifications and software protocols are determined independently by each equipment manufacturer. Actual detailed protocols are determined independently by each equipment manufacturer.

● **DeviceNet**
A standard for serial communication.
An open network owned by ODVA (Open DeviceNet Vendor Association Inc.), a non-profit organization headquartered in the US. This is a field network standard covering a wide scope, from the sensor level to the device level.

● **Analog communication**
A method of communicating with external devices using voltage output such as 0 to 10 V. This enables output of PV (measured temperature etc.) and reception of values like SV (set temperature).

● **Signal input/output, I/O**
Input/Output signals such as alarm signal, or operation signals. Since there are various communication methods depending on the equipment model, such as relay output and open collector output, communication specifications must be checked before wiring.

● **Insulation withstand voltage**
Electric potential difference where an insulator material will not be destroyed. In withstand voltage testing at product shipment from the factory, a high AC voltage of 1.5 kV (varies depending on the model) is applied between the electric circuit conductor and the chassis (grounded). Then it is checked that there is no flow of leakage current above the reference value.

● **Insulation resistance**
Electrical resistance between the conductor inside the device and the chassis (grounded). In insulation resistance testing at product shipment from the factory, it is checked that the resistance value with a measured DC voltage of 500 V (or 250 V) is at or above the reference value (a value such as 1 MΩ; varies depending on the model).

Safety Standards

● **CE marking**
For machinery and other equipment distributed in the EU (European Union), it is mandatory to display the CE mark. To display the CE mark, a product must declare itself to be in compliance with EU Directives. The main EU Directives relating to the products in this catalog are the Machinery Directive, EMC Directive and Low Voltage Directive. Each directive requires product compliance with the corresponding EN Standard (European Standard).

● **UL standards**
Standards of a non-profit testing organization founded by the US National Fire Protection Association.
In the US, some states and municipalities require UL certification for the sale of electrical products.

● **CSA standards**
Safety standards by the Canadian Standard Association, a non-governmental Canadian standardization organization.
Electrical products distributed in Canada must be CSA certified.

● **NRTL (National Recognized Test Laboratories)**
Testing organizations capable of certification (of UL or CSA standards etc.) which have been recognized according to Occupational Safety and Health Law set forth by OSHA (the US Occupational Safety and Health Administration). At present, 18 organizations have been recognized as NRTLs. UL and CSA are examples of certified organizations.

● **eti mark**
eti (Electro-Test Inc.) is the mark that demonstrates compliance with UL standards.

● **ETL mark**
Intertek ETL SEMKO is an NRTL, and issues the ETL mark. This mark demonstrates compliance with UL standards.

● **SEMI S2**
SEMI is an international industry association of companies producing equipment and materials for the manufacture of semiconductors and flat panel displays. It has established its own standards as safety guidelines for the design of semiconductor manufacturing equipment.
SEMI S2 requirements relate to the work environment, health and safety for products used in semiconductor manufacturing, and cover chemical, radiation, electrical, physical, mechanical, environmental, fire, earthquake, emissions and ergonomics, as well as quality, documentation and manuals etc. Many semiconductor manufacturers require that equipment operating in their plants comply with SEMI S2.

● **SEMI S8**
SEMI S8 is a guideline on ergonomics which is more detailed than the ergonomic requirements in Section 14 of SEMI S2.

● **SEMI F47**
SEMI F47 is a SEMI standard which stipulates guidelines regarding voltage sag immunity.
Semiconductor manufacturers require this standard for temperature control equipment, just like SEMI S2.

Temperature Control Equipment
Warranty

1. Conditions of warranty

When a nonconformance should take place to our temperature control equipment, we will repair the unit without charge in accordance with our current terms and conditions.

This free repair covers the replacement of all nonconforming parts, their adjustment and checks. Please note that the disassembled parts will be the property of SMC.

2. Period of warranty

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

3. Items out of warranty

The following cases are not subject to warranty.

1. Nonconformance caused by implementing no check-up (daily check-up, regular check-up) specified by SMC.
2. Nonconformance caused by the usage other than stipulated in the operating manual or outside the specification designated by SMC.
3. Nonconformance caused by remodeling which is not permitted by SMC.
4. Nonconformance caused by the usage other than the specified circulating fluid or facility water.
5. Nonconformance caused by elapsing. (painted surface, plated surface discolored naturally)
6. Sensuous phenomenon which is not affected functionally (sound, noise, vibration, etc.)
7. Nonconformance caused by natural disasters such as earthquake, typhoon, water disaster, accidents, or fire hazard.
8. Nonconformance caused by the installation environment stipulated in the operating manual.
9. Nonconformance caused by no observation to the following 5, “Items to be observed by customer.”

4. Exemption from liability

1. Cost for daily check-up, regular check-up.
2. Cost for repair by a third party other than the designated distributors or agents.
3. Cost for moving this unit and installation or dislocation.
4. Cost for replacement or replenishment of the component parts or liquid other than specified.
5. Cost for inconvenience or loss caused by not being able to use the unit. (Telephone charge, warranty for job suspension, commercial loss, etc.)
6. Cost or compensation, etc. stipulated other than the above 1. “Conditions of warranty.”

5. Items to be observed by customer

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

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

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

6. How to ask a repair upon warranty

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

With this, we will repair the unit upon warranty.

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

⚠ Safety Instructions

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

⚠ 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

1. 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.

2. 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.

3. Do not service or attempt to remove product and machinery/ equipment until safety is confirmed.

1. The inspection and maintenance of machinery/equipment should only be performed after measures to prevent falling or runaway of the driven objects have been confirmed.
2. When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.
3. Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.

4. Contact SMC beforehand and take special consideration of safety measures if the product is to be used in any of the following conditions.

1. Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.
2. 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.
3. An application which could have negative effects on people, property, or animals requiring special safety analysis.
4. Use in an interlock circuit, which requires the provision of double interlock for possible failure by using a mechanical protective function, and periodical checks to confirm proper operation.

⚠ Caution

1. 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

1. The warranty period of the product is 1 year in service or 1.5 years after the product is delivered, whichever is first.*2)
   Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.
2. 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.
3. Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalog for the particular products.

*2) **Vacuum pads are excluded from this 1 year warranty.**
A vacuum pad is a consumable part, so it is warranted for a year after it is delivered.
Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty.

Compliance Requirements

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

⚠ Caution

SMC products are not intended for use as instruments for legal metrology.

Measurement instruments that SMC manufactures or sells have not been qualified by type approval tests relevant to the metrology (measurement) laws of each country. Therefore, SMC products cannot be used for business or certification ordained by the metrology (measurement) laws of each country.

Temperature Control Equipment Precautions 1

Be sure to read this before handling.
For detailed precautions on each series, refer to the main text.

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 ambient temperature range.

The operating ambient temperature range must be within the specification range shown in this catalog.
Use caution because using beyond the range will lead to damage, breakage or malfunction.

2. Avoid using and storing in the following environment because it will lead to malfunction.

1. In locations where water, water steam, salt water, and oil may splash on the product.
2. In locations where a large amount of particles are airborne.
3. In locations with an atmosphere of corrosive or explosive gases, solvents, or chemicals.
   (This product is not explosion proof.)
4. In locations which receive direct sunlight or radiated heat.
   (Protect from direct sunshine to avoid the resin from deteriorating by ultraviolet rays or increasing the temperature.)
5. In locations where temperature substantially changes.
6. In locations where there is a heat source nearby and the ventilation is poor.
   (Insulate the heat source or ventilate well to avoid damages caused by the heat or temperature increase, such as softening.)
7. In locations where condensation occurs.
8. In locations where strong magnetic noise occurs.
   (In locations where strong electric fields, strong magnetic fields and surge voltage occur.)
9. In locations where static electricity occurs, or conditions which make the product discharge static electricity.
10. In locations where high frequency occurs.
11. In locations where damage is likely to occur due to lightning.
12. In locations where impacts or vibrations occur.
13. In conditions where a massive force strong enough to deform the product is applied or a weight from a heavy object is applied.
14. In locations more than 1000 m in altitude (except storage, transportation)

Fluid

⚠ Warning

1. Type of fluids

1. The operating fluids must be used within the specified range shown in this catalog.
   Please consult with SMC when using the product with other fluids.
2. Depending on the combination, foreign matter, chemical leakage and catalysts may change the piping material and operating fluid qualities.
3. When solid foreign objects may be mixed with a fluid, install a filter to remove them.

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

Facility Water Quality Standard

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

	Item	Unit	Standard value	Influence	
				Corrosion	Scale generation
Standard item	pH (at 25°C)	—	6.0 to 8.0	○	○
	Electric 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		○
	Ionic state silica (SiO_2)	[mg/L]	30 or less		○
Reference item	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.
• ○ : Factors that have an effect on corrosion or scale generation.
• Even if the water quality standards are met, complete prevention of corrosion is not guaranteed.

Transportation/Transfer/Movement

⚠ Warning

1. Product transfer should be performed by a knowledgeable and experienced person.

Especially, transferring a heavy object is dangerous.
Use adequate caution to prevent falling down or dropping accidents from occurring.

2. Avoid transportation in the following environment because it will lead to breakage.

1. In conditions where strong shock and vibrations occur.
2. In operating and storage environments other than those specified.

3. Caution when transferring a heavy object

This product is heavy. Use adequate caution to avoid injury when picking up and setting down the product, and falling and dropping accidents should be avoided.

4. Before moving this product, remove operating fluid, facility water from the inside of this product.

Temperature Control Equipment Precautions 2

Be sure to read this before handling.
For detailed precautions on each series, refer to the main text.

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. Verify the mounting orientation.

Mount and install horizontally.

Piping

⚠ Warning

1. For this product and future equipment, design of the piping system should be performed by a knowledgeable and experienced person.

2. Work performed on the piping should be done by a knowledgeable and experienced person.

If work performed on the piping is done by a less knowledgeable and inexperienced person, it will likely lead to operating fluid leakage, etc.

3. Thoroughly read the operation manual.

Read the operation manual completely before piping. Also, keep the manual where it can be referred to as necessary.

4. Tighten threads with the proper tightening torque.

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

Tightening Torque for Piping

Connection thread	Proper tightening torque (N·m)
M5	1.5 to 2
Rc 1/8	7 to 9
Rc 1/4	12 to 14
Rc 3/8	22 to 24
Rc 1/2	28 to 30
Rc 3/4	28 to 30
Rc 1	36 to 38
Rc 1 1/4	40 to 42
Rc 1 1/2	48 to 50
Rc 2	48 to 50

5. Confirm the leakage of fluid.

Confirm that the hose or tubing is not pulled out and that there is no leakage in the fitted parts.

Piping

⚠ Caution

1. Refer to the Fittings and Tubing Precautions on SMC website for handling One-touch fittings.

2. Preparation before piping

Before piping is connected, it should be thoroughly blown out with air (flushing) or washed to remove chips, cutting oil and other debris from inside the pipe.

3. 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 operation manual before connection.

4. Sealant tape

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

5. 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.
For detailed precautions on each series, refer to the main text.

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 ground fault circuit interrupter (GFCI) in the main power supply.

3. Check the power supply.

If this product is used with voltages other than specified, it will likely lead to a fire or an electrical shock. Before wiring, confirm the voltage, volume, and frequency.
Confirm that the voltage fluctuation is within ±10% of the specified value.

4. Grounding

Be certain to ground (frame ground) with class D grounding (grounding resistance of 100 Ω or less).
Can be grounded with the PE line of the power supply cable.
Also, do not use together with equipment that generates a strong electrical magnetic noise or high frequency noise.

5. Wiring cable should be handled with care.

Do not bend, twist or stretch the cord or cable.

6. Wire with an applicable size cable and terminal.

In the event of attaching a power supply cable, use a cable and terminal size which is suitable for the electrical current of each product.
Forcibly mounting with an unsuitable size cable will likely result in a fire.

7. Avoid wiring the signal line and power line in parallel.

Since there may be a possibility of malfunction from noise, avoid parallel wiring between the temperature sensor line, communication line, signal line of alarm line, etc. and the power line and high voltage line. Also, do not place them in the same wiring tube.

Facility Water Supply
(Water-cooled refrigeration)

⚠ Warning

1. Be certain to supply the facility water.

1. Prohibition of water-cut operation, very little flow rate of water operation.
   Do not operate under the condition that there is no facility water or where there is very little flow rate of water is flowing. In this kind of operation, facility water temperature may become extremely higher. It is dangerous enough the material of hose may soften and burst when the piping supplying the facility water is connected with hose.
2. Actions to be taken when an emergency stop occurs due to high temperature.
   In case a stop occurs due to extremely high temperature resulting from a decrease in the facility water flow rate, do not immediately flow facility water. It is dangerous enough the material of hose may soften and burst when the piping supplying the facility water is connected with hose.
   First, naturally let it cool down by removing the cause of the flow rate reduction. Secondly, confirm that there is no leakage again.

⚠ Caution

1. Facility water quality

1. Use the facility water within the specified range.
   When using with other fluid than facility water, please consult with SMC.
2. When it is likely that foreign matter may enter the fluid, install a filter (20 mesh or equivalent).

Facility Water Quality Standard

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

	Item	Unit	Standard value	Influence	
				Corrosion	Scale generation
Standard item	pH (at 25°C)	—	6.5 to 8.2	○	○
	Electric conductivity (25°C)	[μS/cm]	100* to 800*	○	○
	Chloride ion (Cl^-)	[mg/L]	200 or less	○	
	Sulfuric acid ion (SO_4^{2-})	[mg/L]	200 or less	○	
	Acid consumption amount (at pH4.8)	[mg/L]	100 or less		○
	Total hardness	[mg/L]	200 or less		○
	Calcium hardness ($CaCO_3$)	[mg/L]	150 or less		○
	Ionic state silica (SiO_2)	[mg/L]	50 or less		○
Reference item	Iron (Fe)	[mg/L]	1.0 or less	○	○
	Copper (Cu)	[mg/L]	0.3 or less	○	
	Sulfide ion (S_2^-)	[mg/L]	Should not be detected.	○	
	Ammonium ion (NH_4^+)	[mg/L]	1.0 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 0.00125 to 0.01.
• ○ : Factors that have an effect on corrosion or scale generation.
• Even if the water quality standards are met, complete prevention of corrosion is not guaranteed.

Temperature Control Equipment Precautions 4

Be sure to read this before handling.
For detailed precautions on each series, refer to the main text.

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.
   Be certain 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 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 cutting off 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 off the power supply breaker.

6. When not used for long periods of time, confirm the safety once again prior to beginning its operation.

Maintenance

⚠ Warning

1. Perform maintenance inspection according to the procedures indicated in the operation manual.

If handled improperly, malfunction and damage of machinery or equipment may occur.

2. Maintenance operations

Improper handling of compressed air is dangerous. Therefore, in addition to observing the product specifications, replacement of elements and other maintenance activities should be performed by personnel having sufficient knowledge and experience pertaining to pneumatic equipment.

3. Pre-maintenance inspection

When removing this product, cut off the electric power, and be certain to shut off the supply pressure and exhaust the compressed air in the system. Proceed only after confirming that all pressure has been released to the atmosphere.

4. Post maintenance inspection

After installation or repair, reconnect compressed air and electricity and conduct appropriate inspections to confirm proper operation. If there is an audible air leakage, or if the equipment does not operate properly, stop operation and confirm that the equipment is installed correctly.

5. Modification prohibited

Do not modify or reconstruct the unit.

6. Stopping for long periods of time

When not using for long periods of time, remove the fluid (circulating fluid, facility water) and cut off the main power supply.

7. Removal of product

Take the stop/inspection measures and confirm that there is no danger before the product is removed.
In the event of removing the product, discharge the used fluid and clean the inside of the piping.
When a dangerous fluid or polluted fluid is left, it is likely that the polluted area will be enlarged or an accident will occur.

8. Disposal of product

When the product is disposed, it must be in compliance the ordinance or rules of the local municipality.
Ask for help from a professional industrial waste disposal company.
In particularly, in case of a refrigerated type product, entrust a company to collect the refrigerant, etc.
In that case, the customer may be requested to submit a certificate that is showing the type of operating fluid and whether any quantity is left. These procedures are the responsibility of the customer.

9. Preparation of a backup product

In order to keep the downtime of a customer's system to a minimum, prepare a backup product, when necessary.

Revision history

Edition B	* Addition of the inverter type to water-cooled thermo-chiller, HRW series. * Addition of the 140 W and 320 W types to thermo-con (water-cooled), HEC series. * Addition of the 600 W type to thermo-con (air-cooled), HEC series. * Addition of an option (NPT fitting) and optional accessories (60% ethylene glycol aqueous solution, concentration meter) to the thermo-chillers, HRZ and HRW series. * Addition of deionized water and 15% ethylene glycol aqueous solution as circulating fluids for the thermo-cooler, HRGC series.	MY
Edition C	* Addition of the thermo-chiller compact type, HRS series. * Addition of options and optional accessories to the thermo-cooler, HRGC series. * Addition of the dual thermo-chiller, HRZD series.	PP
Edition D	* Deletion of the thermo-cooler, HRG001/002/005. * Deletion of the thermo-cooler, HRGC series. * Addition of the thermo-chiller, HRS050. * Number of pages from 248 to 216	QP
Edition E	* Deletion of the thermo-cooler, HRG series. * Addition of the standard type to thermo-chiller, HRS030/060 series. * Addition of the standard type to thermo-chiller, HRS100/150 series. * Addition of the inverter type to thermo-chiller, HRSH090 series. * Addition of the inverter type to thermo-chiller, HRSH series. * Addition of the basic type to thermo-chiller, HRSE series. * Addition of the thermo-con, HECR series. * Number of pages from 216 to 348	TU

Global Service Network

SMC overseas subsidiaries and sales representatives (400 offices in total), and global production system support diversified needs.



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Japan



Yamatsuri Plant (Fukushima Prefecture)

SMC's temperature control equipment has been efficiently manufactured with SMC's originally developed, integrated production system at Yamatsuri Plant.


Integrated chiller production line at Yamatsuri Plant

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