Circulating Fluid Temperature Controller

Thermo-chiller Large Type

New

RoHS

Outstanding energy saving effect with the triple inverter!

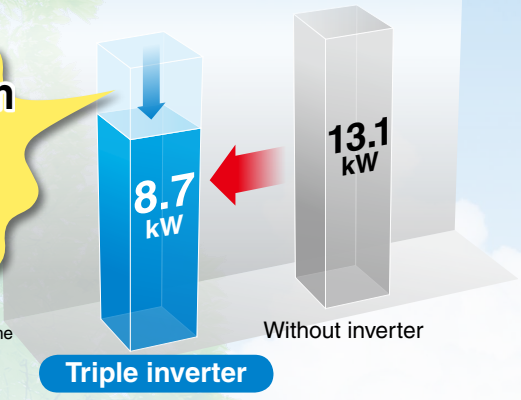
Compressor

Fan Pump

Triple inverter

- DC inverter **compressor**
- DC inverter **fan**
- Inverter **pump**

Power consumption 34%* Energy saving



* Under the conditions shown in the "Features 1" page

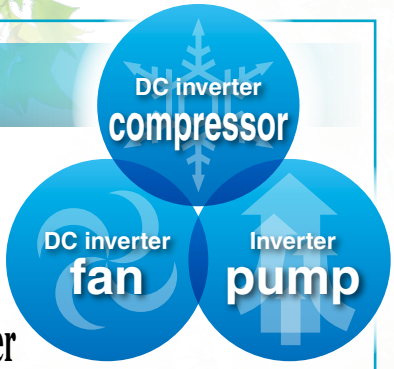
- Cooling capacity **25 kW**
- Max. ambient temperature **45°C**
- Temperature stability **±0.1°C** (when a load is stable)
- **Maintenance free pump**
  Mechanical seal-less **immersion pump** is used.
  No need to replace the seal → Maintenance hours reduced
- **Compact, Space-saving**
- **Outdoor installation, Spashproof type** (IPX4)
- **Low-noise design** Operating noise Max. **66 dB**

Series HRSH

SMC

CAT.ES40-57A

Triple inverter



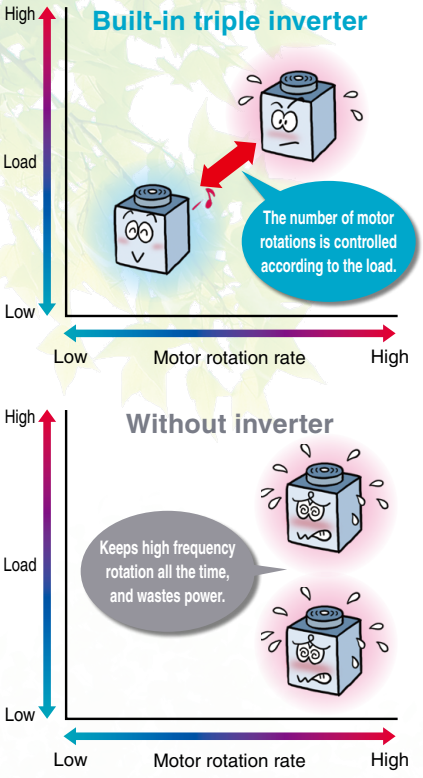
The inverter respectively controls the number of motor rotations of the compressor, fan and pump according to the load of the user's application.

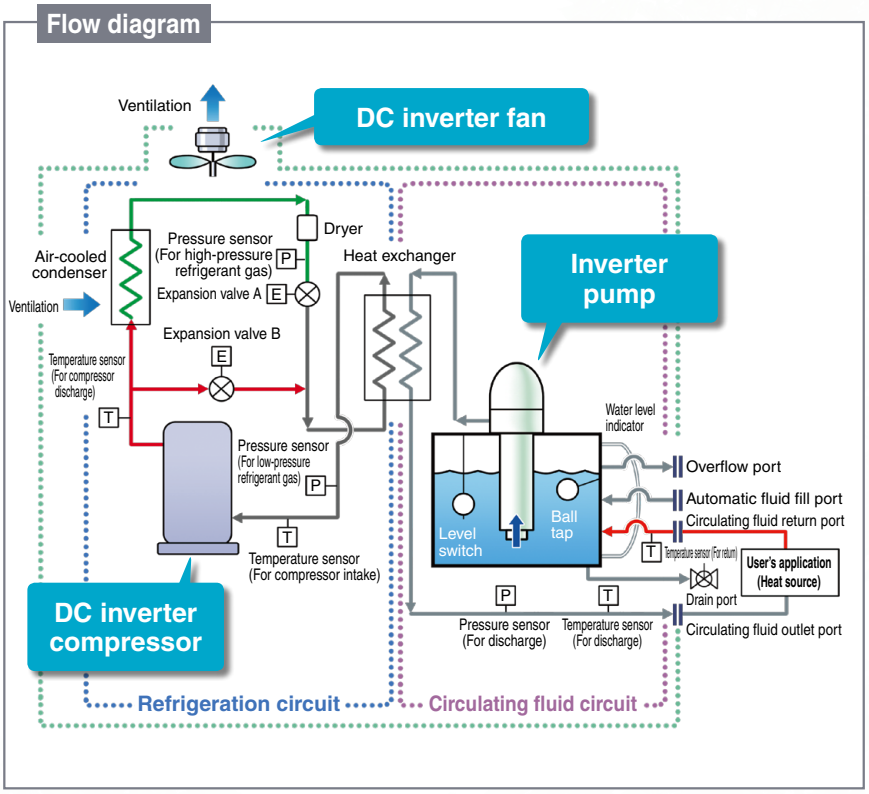
Power consumption reduced by 34% compared with a thermo-chiller without the inverter

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

Conditions

- Outdoor air temperature: 32°C ● Circulating fluid temperature setting: 20°C ● Heat load in the user's application: 25 kW ● Power supply: 200 V 60 Hz
- Circulating fluid flow rate: 60 L/min@0.5 MPa to the user's application ● External piping: The shortest distance assumed to the user's application
- 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 by-pass to the circulating fluid circuit.





Refrigeration circuit

High temperature and high pressure refrigerant gas that is compressed by the DC inverter compressor is cooled down by an air-cooled condenser with ventilation made by the DC inverter fan, and the cooled refrigerant gas will become liquid. The liquefied high pressure refrigerant gas swells and becomes lower temperature when it passes through the expansion valve A, and it takes the heat away from the circulating fluid and evaporates when it passes through the evaporator. The vaporized refrigerant gas will be sucked into the DC inverter compressor and compressed again, and the above stated cycle will be repeated. The expansion valve B is open to heat the circulating fluid.

Number of rotations of the DC inverter compressor and the DC inverter fan will change depending on the heat load of the user's application. By combining this change and the fine control of the expansion valve A and expansion valve B, waste-less energy saving operation is possible.

Circulating fluid circuit

The inverter pump discharges the circulating fluid to the user's application. The discharge pressure can be adjusted to be suitable for the piping conditions of the user's application by changing the number of rotations of the inverter pump, and this contributes in the energy saving operation.

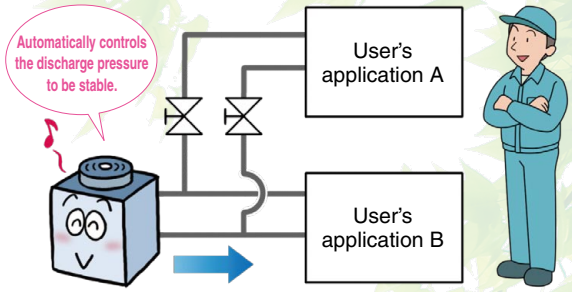
Circulating fluid which the pressure is adjusted and discharged will cool or heat the user's application, and thus, the circulating fluid will then be heated or cooled and returns to the thermo-chiller.

Temperature of the returned circulating fluid is always monitored, and the change in temperature will be converted into change in the heat load, and this change will promptly reflected to the control of the refrigeration circuit. This enables an accurate and flexible temperature control. With the above stated operation, there is no need to absorb the temperature change of the circulating fluid with a large tank capacity, and the good temperature stability can be obtained with a smaller tank.

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 by-pass piping under various piping conditions. Power consumption can be reduced by this control.
(Operation to the set pump operating frequency is also possible.)

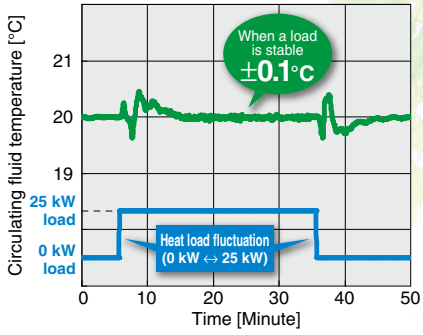


Operation display panel

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)

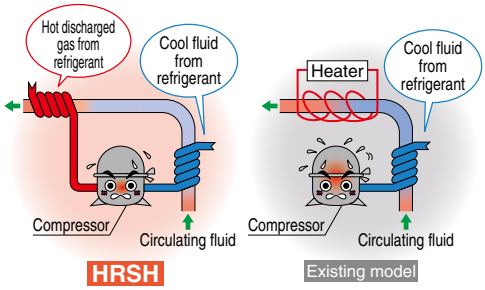
By controlling the DC inverter compressor, DC inverter fan, and electronic expansion valve simultaneously, it maintains the good temperature stability when the heat load fluctuates.



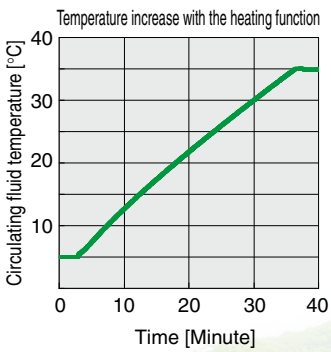
Conditions
- Outdoor air temperature: 32°C
- Circulating fluid temperature setting: 20°C
- Heat load in the user's application: 25 kW
- Power supply: 200 V 60 Hz
- Circulating fluid flow: 125 L/min@0.5 MPa
- External piping: By-pass piping + Heat load

Circulating fluid can be heated without a heater.

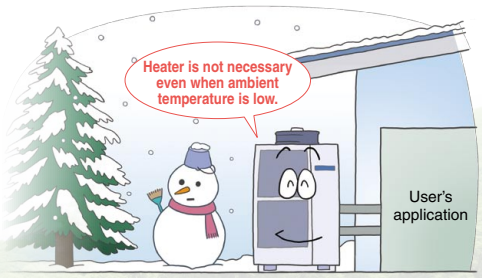
Heating method using discharged heat makes a heater unnecessary.



∗ This is just an example diagram.



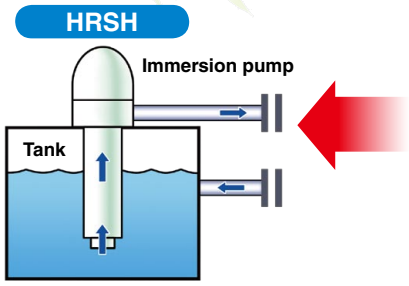
Conditions
- Ambient temperature: 5°C
- Power supply: 200 V 60 Hz
- Circulating fluid flow: 125 L/min@0.5 MPa
- External piping: By-pass piping

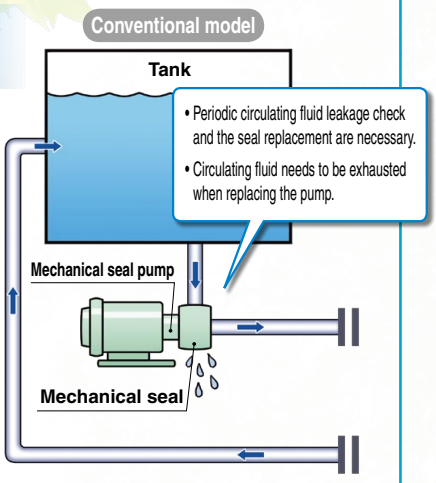


Reduces the maintenance hours for the pump

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

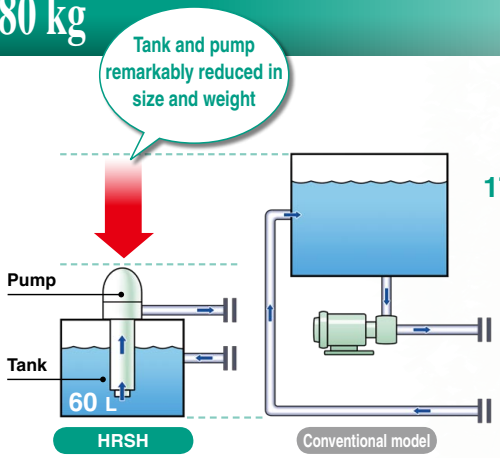
Compact tank 60 L

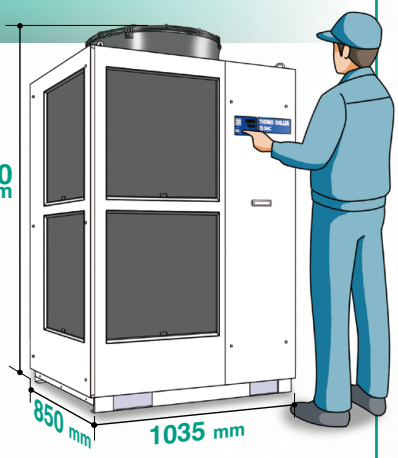
Temperature followability control reduced the tank capacity required as a buffer.

Aluminum air-cooled condenser

High heat transfer efficiency, lightweight

The integrated tank and pump saves space.





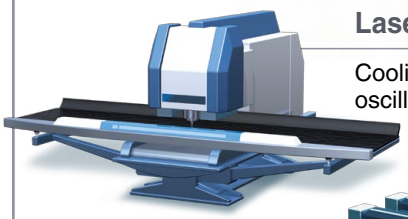
IPX4

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.

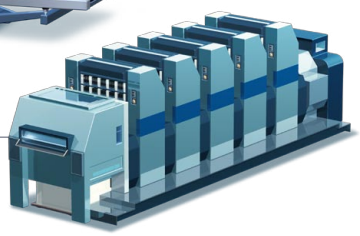
Can be installed outdoors.

Applications



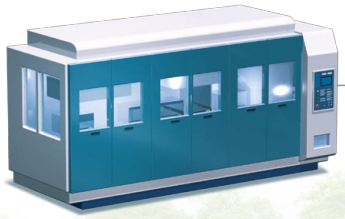
Laser beam machine

Cooling down of the laser oscillation part



Printing machine

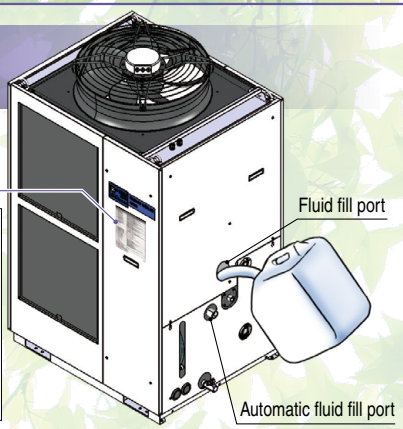
Temperature control of the ink roller



Cleaning machine

Temperature control of cleaning solution

Improved maintenance performance



Fluid fill port for the circulating fluid is available. (as an 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

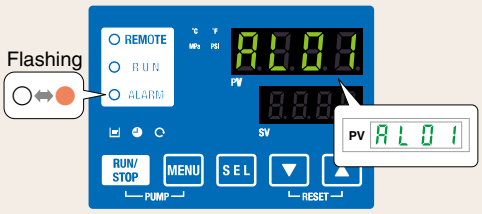
Alarm code list stickers (English 1 pc./Japanese 1 pc.) are included. This can be put under the operation panel for reference.

(Alarm ▶ Page 4)

Operation display panel Easy maintenance with the check display

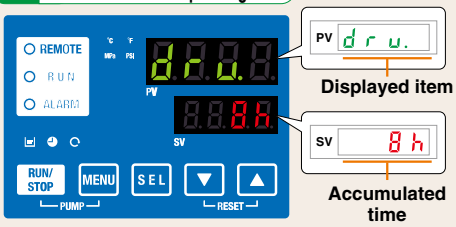
Alarm codes notify of checking times.
Notifies when to check the **pump** and **fan motor**. Helpful for facility maintenance.

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
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
	Accumulated operating time of compressor
	Accumulated operation time of dustproof filter

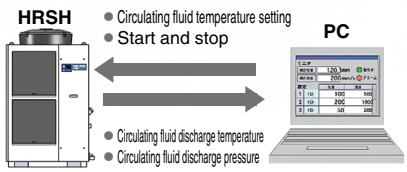
Convenient functions Details ▶ Page 4 Timer function, Anti-freezing function, Power failure auto-restart function, Warming-up function, Key-lock function

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 application 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

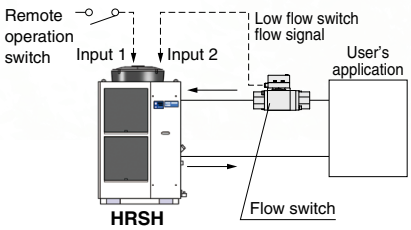
The remote operation is enabled (to start and stop) through serial communication.



- Circulating fluid temperature setting
- Start and stop
- Circulating fluid discharge temperature
- Circulating fluid discharge pressure
- Run and stop status
- Alarm information
- Various setting information
- Preparation completion status

Ex.2 Remote operation signal input

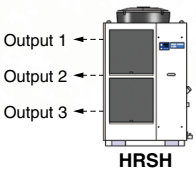
One of the contact inputs is used for remote operation and the other is used for a flow switch to monitor the flow, and their warning outputs are taken in.



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.)

Thermo-chiller Large Type

RoHS

Series HRSH

How to Order

HRSH 250 – A □ – 20 – □

Cooling capacity

250	25 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
B	With earth leakage breaker
K Note)	With fluid fill port

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

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 the model without the symbol K if the side panel is removed.)

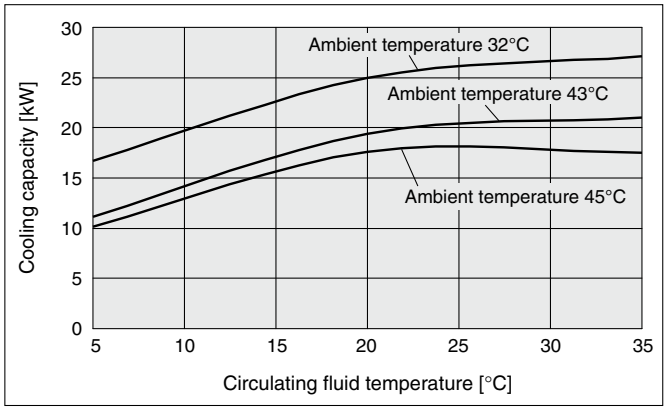
Specifications

Model				HRSH250-A□-20-□
Cooling method				Air-cooled refrigeration
Refrigerant				R410A (HFC)
Control method				PID control
Ambient temperature Note 1)				–5 to 45°C
Circulating fluid system	**Circulating fluid** Note 2)			Clean water, 15% Ethylene glycol aqueous solution, Deionized water
	Temperature range setting		°C	5 to 35
	Cooling capacity Note 3)		kW	25
	Heating capacity Note 4)		kW	7.5
	Temperature stability Note 5)		°C	±0.1
	Pump capacity	**Rated flow (Outlet port)**	L/min	125 (0.5 MPa)
		Maximum flow rate	L/min	180
		Maximum lifting height	m	80
	Settable pressure range Note 6)		MPa	0.1 to 0.8
	Minimum operating flow rate Note 7)		L/min	40
	Tank capacity		L	60
	Circulating fluid outlet port, 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)
	Wetted parts material			Stainless steel, Cu (Heat exchanger brazing), PTFE, PU, FKM, EPDM, PVC, NBR, POM, PE, NR, BS (Y-strainer)
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	50
		Sensitivity of leak current	mA	30
	Rated operating current Note 9)		A	34
	Rated power consumption Note 9)		kW (kVA)	10.4 (11.6)
Noise level (Front 1 m/Height 1 m)			dB (A)	66
Water-proof 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
Weight (dry state)			kg	Approx. 280

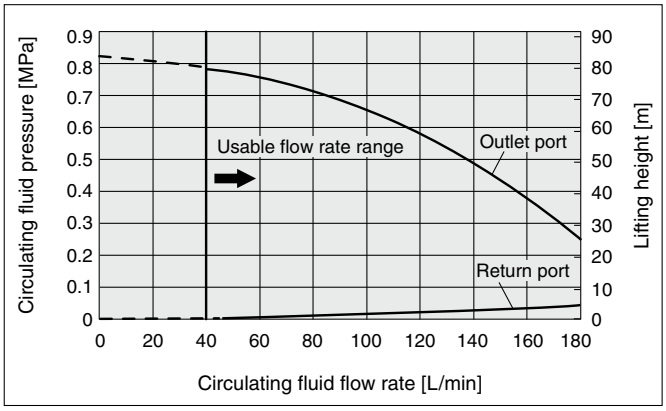
Note 1) Use a 15% ethylene glycol aqueous solution if operating in a place where the ambient temperature and/or circulating fluid temperature is 10°C or less.
Note 2) Use fluid in condition below as the circulating fluid.
Clean water: Standard of The Japan Refregeration And Air Conditioning Industry Association (JRA GL-02-1994)
15% ethylene glycol aqueous solution: diluted by clean 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: Clean water, ③ Circulating fluid temperature: 20°C, ④ Circulating fluid flow rate: Rated flow rate, ⑤ Power supply: 200 VAC
Note 4) ① Ambient temperature: 32°C, ② Circulating fluid: Clean water, ③ Circulating fluid flow rate: Rated flow rate, ④ Power supply: 200 VAC
Note 5) ① Ambient temperature and load: Stable to the values shown in the "Cooling Capacity" graph (Page 2) ② Circulating fluid: Clean water, ③ Circulating fluid flow rate: Rated flow rate, ④ Power supply: 200 VAC, ⑤ 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, please install a by-pass piping.
Note 8) To be prepared by user. A specified earth leakage breaker is installed for option B [With earth leakage breaker].
Note 9) ① Ambient temperature: 32°C, ② Circulating fluid: Clean water, ③ Circulating fluid temperature: 20°C, ④ Load: Same as the cooling capacity, ⑤ Circulating fluid flow rate: Rated flow rate, ⑥ Power supply: 200 VAC

SMC

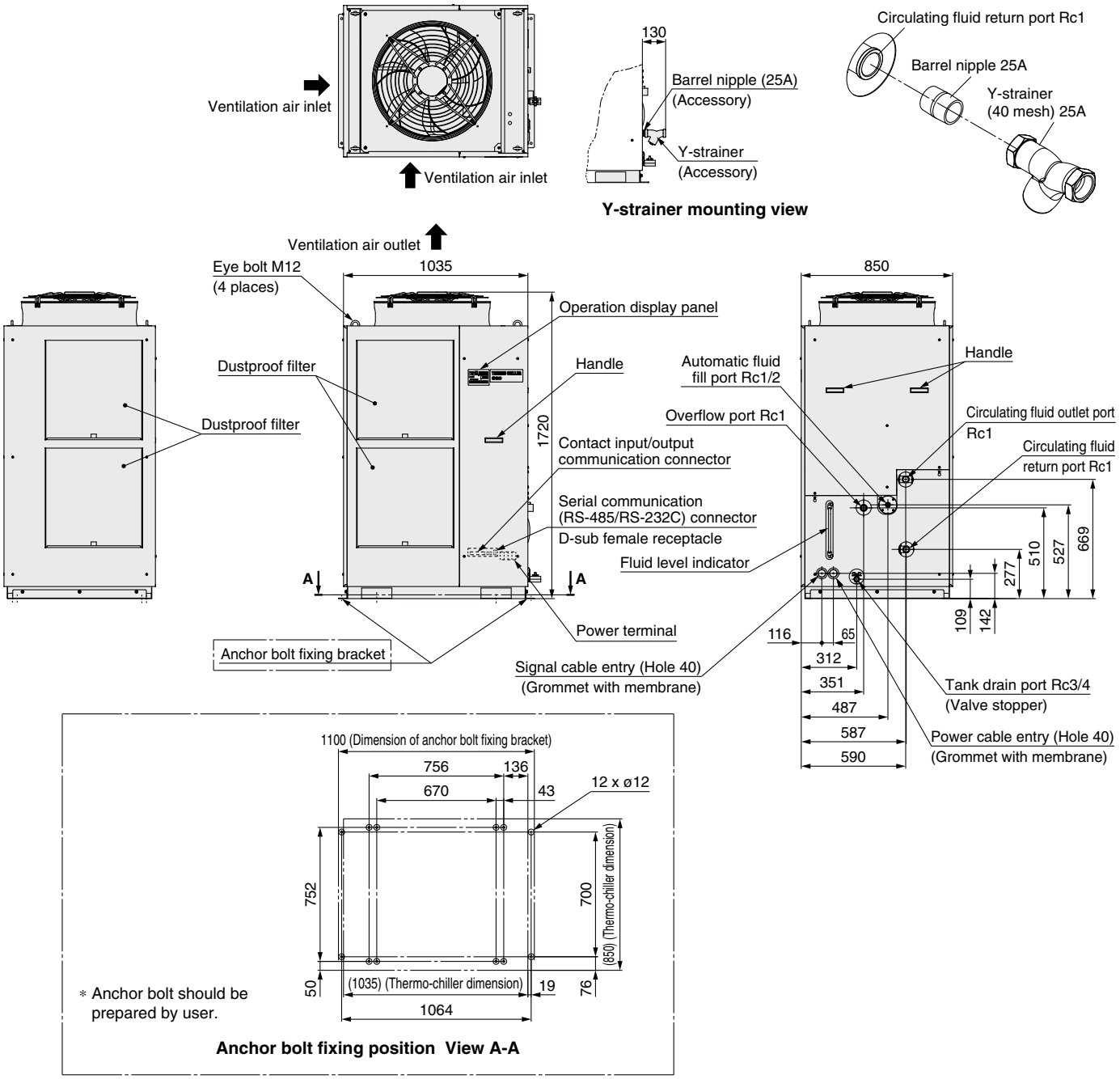
Cooling Capacity



Pump Capacity

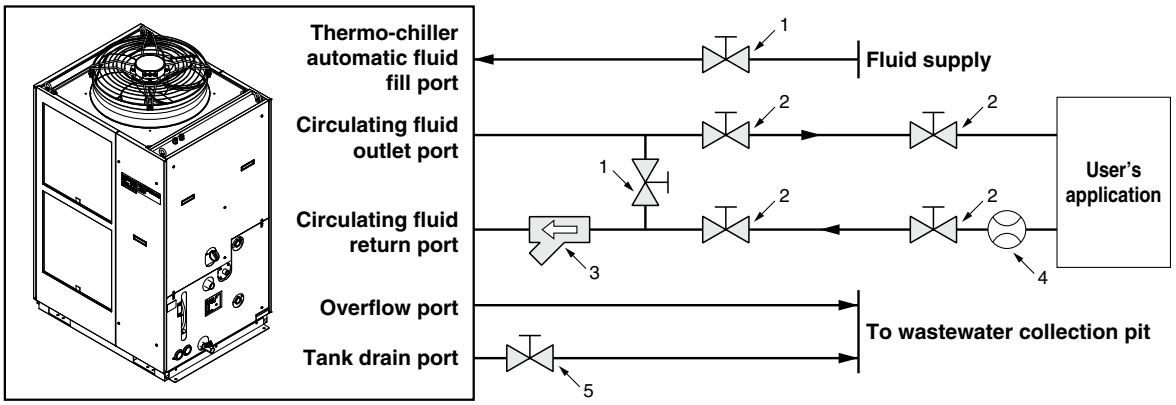


Dimensions



Recommended External Piping Flow

External piping circuit as shown in the Fig. below is strongly recommended.



∗ 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 that has an appropriate flow rate range.
5	Valve (Part of thermo-chiller)	Rc3/4

Cable Specifications

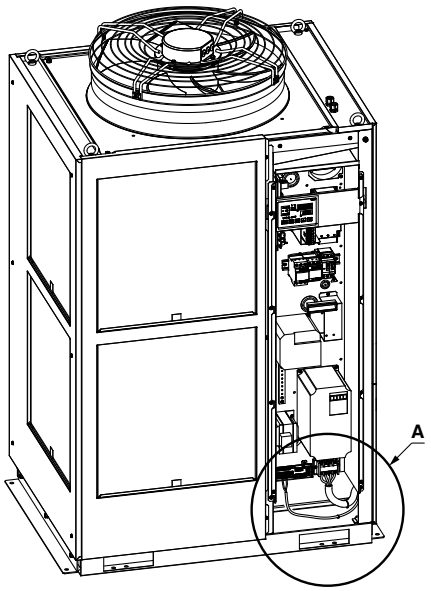
Power supply and signal cable should be prepared by user.

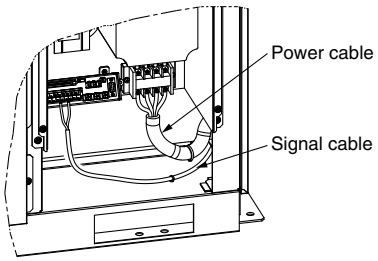
Power Cable Specifications

Model	Power supply voltage specifications		Cable specifications
HRSH250-A□-20-□	3-phase 200 VAC (50 Hz) 3-phase 200 to 230 VAC (60 Hz)		4 cores x 8 mm^2 (4 cores x AWG8)
	Terminal block screw diameter	Recommended crimp terminal	∗ Including grounding cable
	M5	R8-5	

Signal Cable Specifications

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

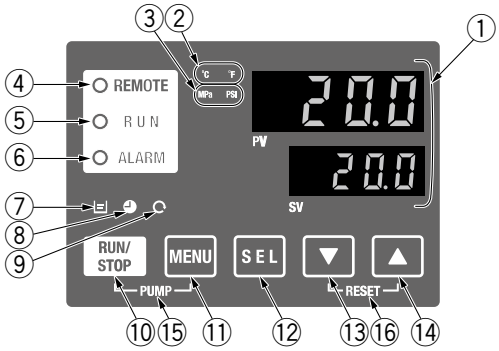




Partially enlarged view A

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 and 4 digits)**	PV	Displays the circulating fluid current discharge temperature and pressure and alarm codes and other menu items (codes).
		SV	Displays the circulating fluid discharge temperature and the set values of other menus.
②	**[°C] [°F] lamp**	Equipped with a unit conversion function. Displays the unit of 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 application.
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 39 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
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

Alarm 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

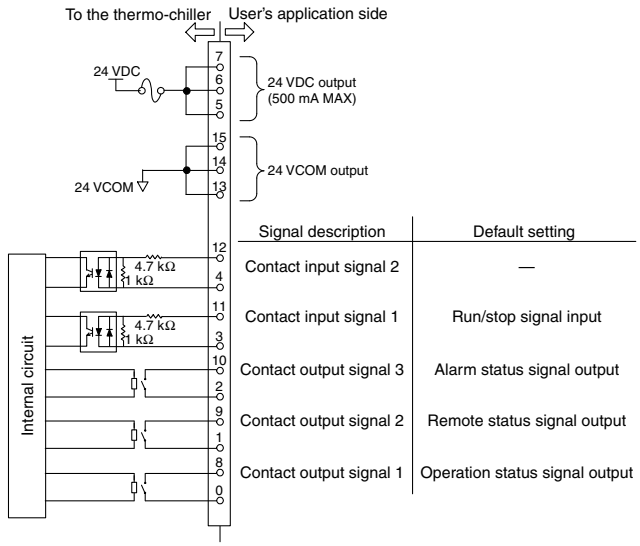
Alarm code	Alarm message
AL30	Compressor maintenance
AL31	Contact input 1 signal detection
AL32	Contact input 2 signal detection
AL37	Compressor discharge temp. sensor failure
AL38	Compressor discharge temp. rise
AL39	Internal unit fan stoppage
AL40	Dustproof filter maintenance
AL41	Power stoppage
AL42	Compressor waiting
AL43	Fan breaker trip
AL44	Fan inverter error
AL46	Compressor inverter error
AL48	Pump inverter error

∗ 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

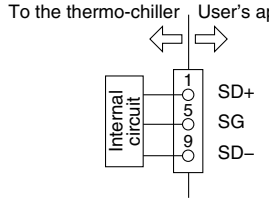
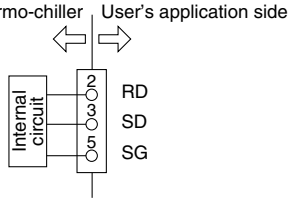
The serial communication (RS-485/RS-232C) enables the following items to be written and read out.
For details, refer to the Operation Manual for communication.

Writing

Run/Stop
Circulating fluid temperature setting (SV)

Readout

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

Item	Specifications	
Connector type	D-sub 9-pin, Female connector	
Protocol	Modicon Modbus compliant/Simple communication protocol	
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.

B Option symbol

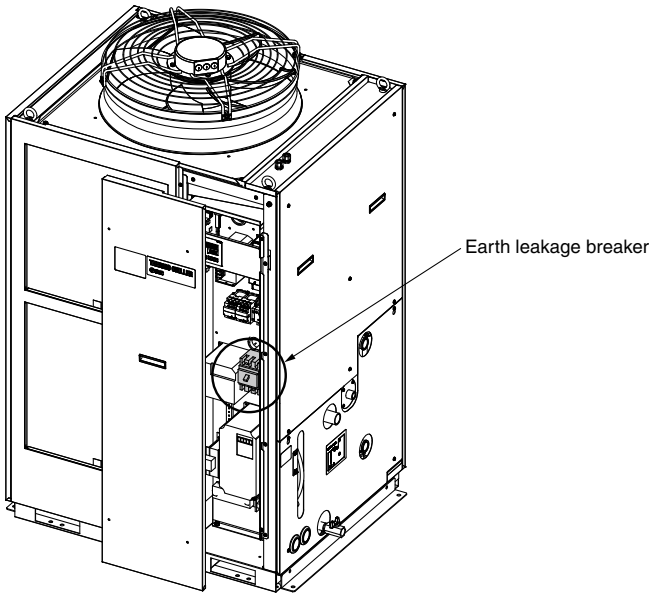
With Earth Leakage Breaker

HRSH250-A□-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	**HRSH250-A□-20-B**
Rated current sensitivity (mA)	30
Rated shutdown current (A)	50
Short circuit display method	Mechanical button



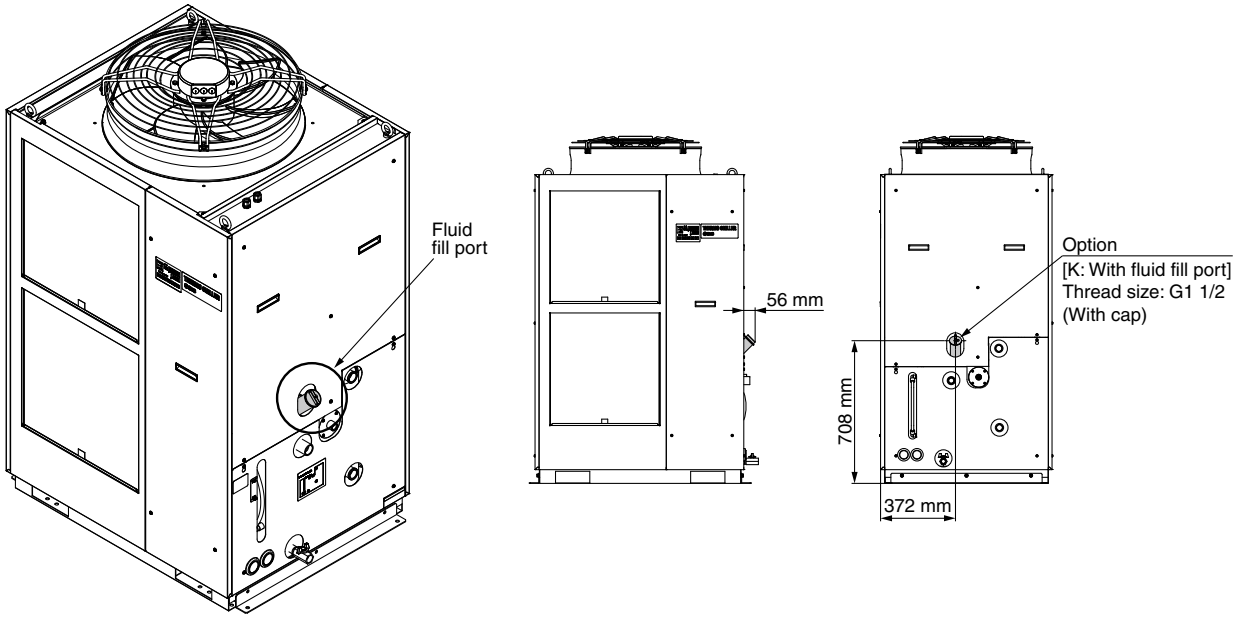
K Option symbol

With Fluid Fill Port

HRSH250-A□-20-K

With fluid fill port

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



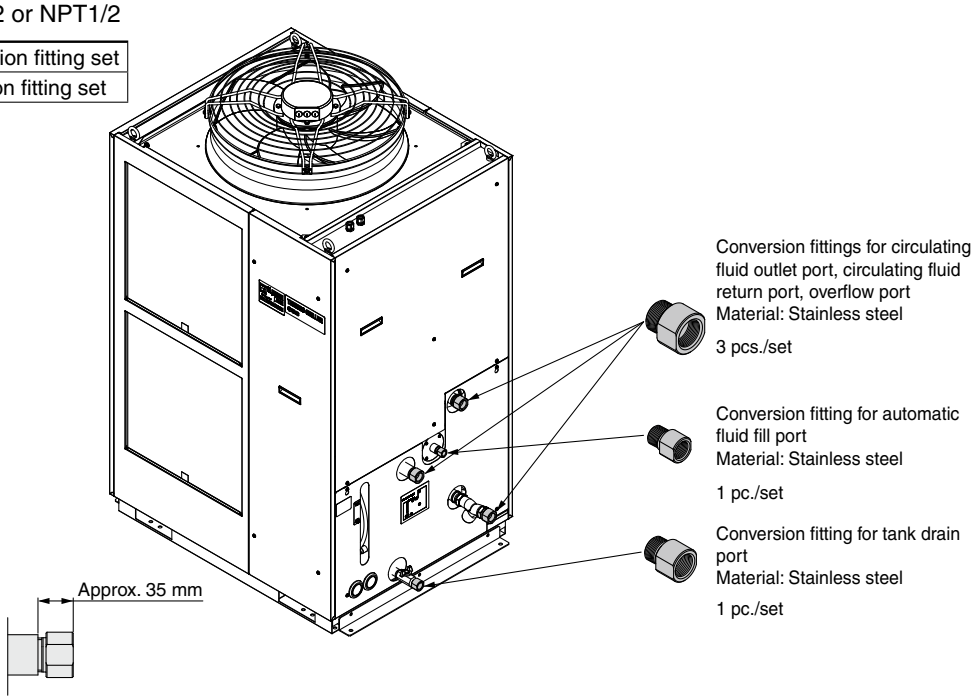
Series HRSH
Optional Accessories

① Piping Conversion Fitting

For the HRSH250-A□-20-□

This is a fitting to change the port from Rc to G or NPT.
- Circulating fluid outlet port, Circulating fluid return port, Overflow port Rc1 → G1 or NPT1
- Drain port Rc3/4 → G3/4 or NPT3/4
- Automatic fluid fill port Rc1/2 → G1/2 or NPT1/2

Part no.	**HRS-EP013**	NPT thread conversion fitting set
	HRS-EP014	G thread conversion fitting set



Protrusion when the conversion fitting for circulating fluid is mounted

② Caster Adjuster-foot Kit

For the HRSH250-A□-20-□

This is a set of unfixed casters and adjuster feet stop.

Part no.	**HRS-KS001**	For the HRSH250-A□-20-□

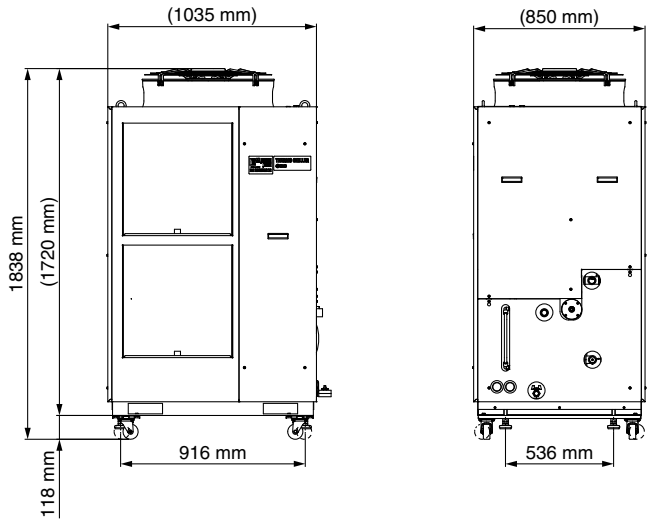


Fig. 1 Mounting view

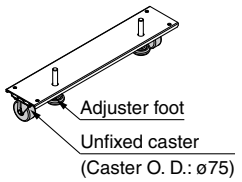


Fig. 2 Caster adjuster-foot bracket × 2 pcs.

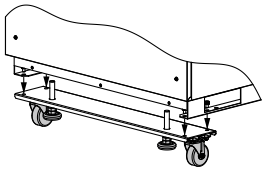


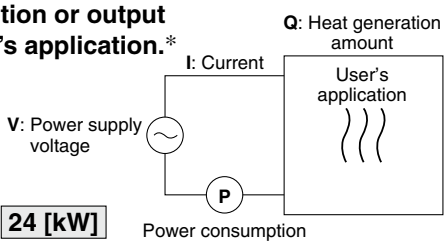
Fig. 3 Fixing bolt x 8 pcs.

Series HRSH
Cooling Capacity Calculation

Required Cooling Capacity Calculation

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



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]

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

In this example, using an efficiency of 0.7:

$$= \frac{13}{0.7} = 18.6 \text{ [kW]}$$

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 application. Please be sure to check it carefully.

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

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

Heat generation amount by user's application **Q**	: Unknown [W] ([J/s])
Circulating fluid	: Clean 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 T_1	: 293 [K] (20 [°C])
Circulating fluid return temperature T_2	: 297 [K] (24 [°C])
Circulating fluid temperature difference ΔT	: 4 [K] (= $T_2 - T_1$)
Conversion factor: minutes to seconds (SI units)	: 60 [s/min]

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

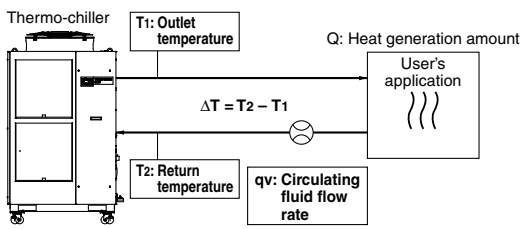
$$Q = qm \times C \times (T_2 - T_1)$$

$$= \frac{\rho \times qv \times C \times \Delta T}{60} = \frac{1 \times 70 \times 4.186 \times 10^3 \times 4.0}{60}$$

$$= 19535 \text{ [J/s]} \approx 19535 \text{ [W]} = 19.5 \text{ [kW]}$$

Cooling capacity = Considering a safety factor of 20%,

19.5 [kW] x 1.2 = 23.4 [kW]



Example of conventional measurement units (Reference)

Heat generation amount by user's application **Q**	: Unknown [cal/h] → [W]
Circulating fluid	: Clean 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 T_1	: 20 [°C]
Circulating fluid return temperature T_2	: 24 [°C]
Circulating fluid temperature difference ΔT	: 4 [°C] (= $T_2 - T_1$)
Conversion factor: hours to minutes	: 60 [min/h]
Conversion factor: kcal/h to kW	: 860 [(cal/h)/W]

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

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

$$= \frac{1 \times 70 \times 60 \times 1.0 \times 10^3 \times 4.0}{860}$$

$$= \frac{16800000 \text{ [cal/h]}}{860}$$

$$\approx 19534 \text{ [W]} = 19.5 \text{ [kW]}$$

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])

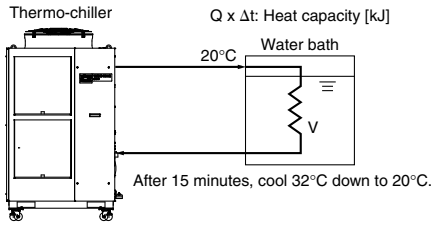
∗ Refer to the following for the typical physical property values by circulating fluid.

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

$$= \frac{1 \times 300 \times 4.186 \times 10^3 \times 12}{900} = 16744 \text{ [J/s]} \approx 16.7 \text{ [kW]}$$

Cooling capacity = Considering a safety factor of 20%,

16.7 [kW] x 1.2 = 20 [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** : 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]

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

$$= \frac{1 \times 300 \times 60 \times 1.0 \times 10^3 \times 12}{15 \times 860}$$

$$\approx 16744 \text{ [W]} = 16.7 \text{ [kW]}$$

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 application 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 application, 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 application 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. Please contact circulating fluid supplier for details.

Series HRSH
Specific Product Precautions 1

Be sure to read this before handling. Refer to back cover for Saftey Instructions, "Handling Precautions for SMC Products" (M-E03-3) and "Operation Manual" for Temperature Control Equipment Precautions. The Operation Manual can be downloaded from the SMC website, http://www.smcworld.com

Design

⚠ Warning

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

1) Confirm the specifications of the single unit (contents of this catalog) and thoroughly consider the adaptability between the 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 customer's operating condition. Also, the customer is requested to carry out the safety design for the whole system.

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

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

Selection

⚠ Warning

Model selection

For selecting a model of thermo-chiller, it is required to know the heat generation amount of the user's application. Obtain the heat generation amount, referring to "Cooling Capacity Calculation" on pages 8 and 9 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 steam, 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
5) In locations where condensation may build on the inner electric parts.
6) In locations where there is a heat source nearby and the ventilation is poor.
7) In locations where temperature substantially changes.
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 at 1000 meters or more above sea level.
    (Except storage and transportation. For use in locations at the sea level above 1000 meters or more, please consult SMC.)
13) In locations where strong impacts or vibrations occur.
14) In locations where a massive force strong enough to deform the product is applied or a weight from a heavy object is applied.
15) In locations where there is not sufficient space for maintenance.
16) In locations where liquid that exceeds the conditions required for the degrees of protection IPX4 may splash on the product.

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

Series HRSH
Specific Product Precautions 2

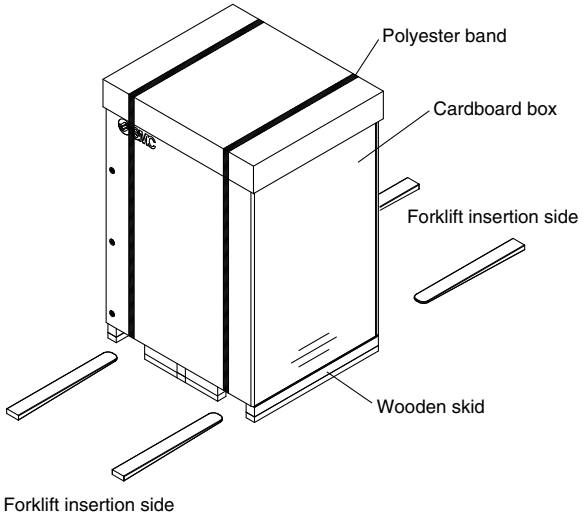
Be sure to read this before handling. Refer to back cover for Saftey Instructions, "Handling Precautions for SMC Products" (M-E03-3) and "Operation Manual" for Temperature Control Equipment Precautions. The Operation Manual can be downloaded from the SMC website, http://www.smcworld.com

Transportation/Transfer/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. Please prepare a forklift.

The product will be delivered in the packaging shown below.



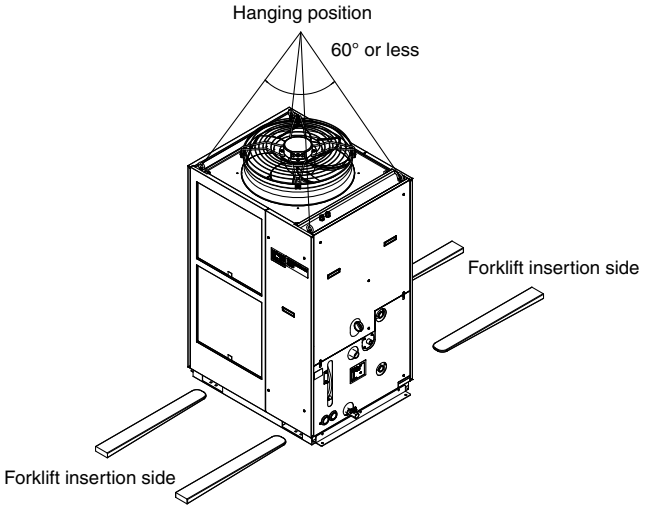
Model	Dimensions (mm)	Weight (kg)
HRSH250-A□-20-□	Height 1895 x Width 1230 x Depth 1040	330

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 Operation Manual to confirm, and be sure to drive the fork in far enough for it to come out the other side.
3) Be careful not to bump the fork to the cover panel or piping ports.

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°.



(When using optional accessories/Caster adjuster-foot kit HRS-KS001)

4. Transporting using casters

1) This product is heavy and should be moved by at least two people.
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.

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

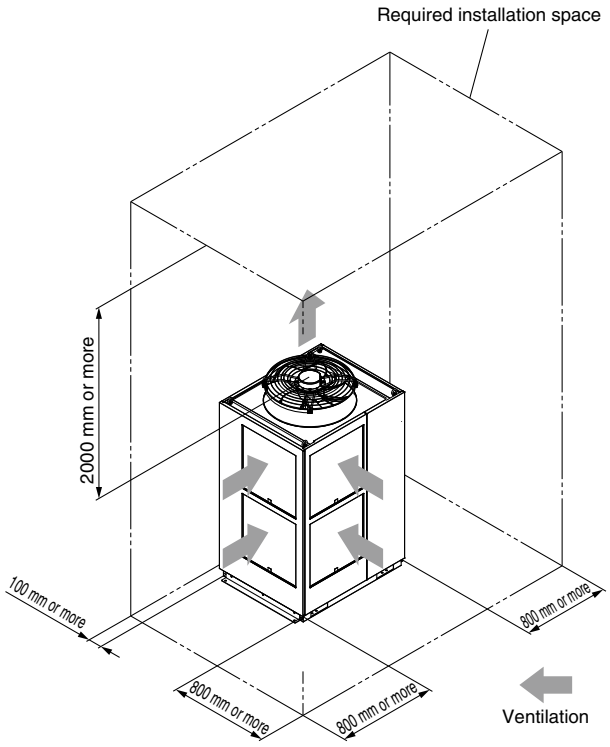
Be sure to read this before handling. Refer to back cover for Saftey Instructions, "Handling Precautions for SMC Products" (M-E03-3) and "Operation Manual" for Temperature Control Equipment Precautions. The Operation Manual can be downloaded from the SMC website, http://www.smcworld.com

Mounting/Installation

⚠ Caution

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

1. This product exhausts heat using the fan that is mounted to this 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 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
HRSH250-A□-20-□	Approx. 44	730	365

Piping

⚠ Caution

1. Regarding the circulating fluid pipings, consider carefully the suitability for 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 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.

Electrical Wiring

⚠ Warning

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

Series HRSH
Specific Product Precautions 4

Be sure to read this before handling. Refer to back cover for Saftey Instructions, "Handling Precautions for SMC Products" (M-E03-3) and "Operation Manual" for Temperature Control Equipment Precautions. The Operation Manual can be downloaded from the SMC website, http://www.smcworld.com

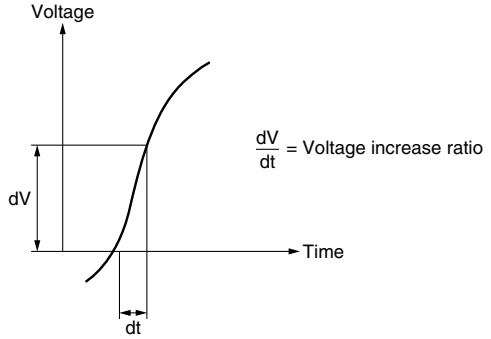
Electrical Wiring

⚠ 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.

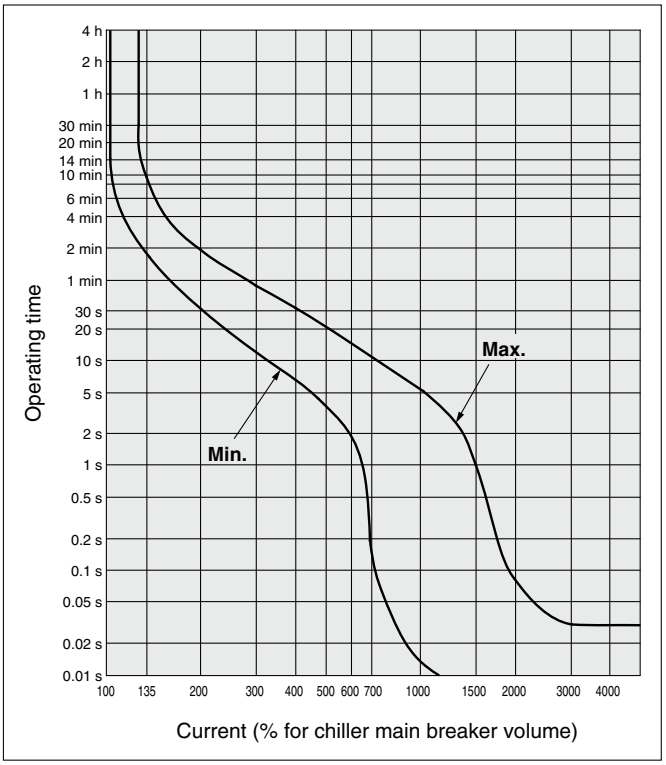
If the voltage increase ratio (dV/dt) at the zero cross should exceed 40 V/200 µsec., it may result in malfunction.



For the option B [With earth leakage breaker]

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

For the user's application (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 application 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 clean water that conforms to the appropriate water quality standards.

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

Clean 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.

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).

Series HRSH
Specific Product Precautions 5

Be sure to read this before handling. Refer to back cover for Saftey Instructions, "Handling Precautions for SMC Products" (M-E03-3) and "Operation Manual" for Temperature Control Equipment Precautions. The Operation Manual can be downloaded from the 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 application 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, make sure to turn off the breaker of the user's application (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 application 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 fin portion of the air-cooled condenser becomes clogged with dust or debris, a decline in cooling performance can result.
In order to avoid deforming or damaging the fin, clean it with a long-haired brush or air gun.

<Periodical inspection every three months>

Inspect the circulating fluid.

1. When using clean 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 freezing when the product is stopped, release the circulating fluid 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.

⚠ 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.

⚠ Safety Instructions | Be sure to read "Handling Precautions for SMC Products" (M-E03-3) before using.

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