Thermo-chiller Standard Type
Air-cooled 200 V/400 V/460 V Type
HRS090 Series

(Only 400/460 VAC type) (Only 460 VAC type) RoHS

How to Order

HRS 090 − A □ − 20 − □

Cooling capacity

090	9 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)
46	3-phase 380 to 415 VAC (50/60 Hz) 3-phase 460 to 480 VAC (60 Hz)

Option

Nil	None
B∗1	With earth leakage breaker
J	With automatic fluid fill function
M	Applicable to deionized water piping
W	SI unit only

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

∗1 200 V type only.
400/460 V type is provided with an earth leakage breaker as standard.

Specifications

Model				HRS090-A□-20-□	HRS090-A□-40-□	HRS090-A□-46-□
Cooling method				Air-cooled refrigeration		
Refrigerant				R410A (HFC)		
Refrigerant charge			kg	1.15		
Control method				PID control		
Ambient temperature/Humidity/Altitude∗1, 2, 11			°C	Temperature: 5 to 45°C, Humidity: 30 to 70%, Altitude: less than 3000 m		
Circulating fluid system	**Circulating fluid**∗3			Tap water, 15% ethylene glycol aqueous solution, Deionized water		
	Set temperature range∗2		°C	5 to 35		
	Cooling capacity 50/60 Hz∗4		kW	8.0/9.0		
	Heating capacity∗5		kW	1.7/2.2		
	Temperature stability∗6		°C	±0.5		±0.1
	Pump capacity	**Rated flow 50/60 Hz (Outlet)**∗7	L/min	29/45		
		Maximum flow rate 50/60 Hz	L/min	55/68		
		Maximum pump head	m	50		
	Minimum operating flow rate 50/60 Hz∗8		L/min	29/45		
	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, PTFE, FKM, EPDM, PVC, NBR, POM, PE, PP, 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)	3-phase 380 to 415 VAC (50/60 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) 3-phase 460 to 480 VAC (60 Hz) Allowable voltage range +4%, −10% (Max. voltage less than 500 V and no continuous voltage fluctuation)
	Applicable earth leakage breaker∗9	**Rated current**	A	30	20	
		Sensitivity of leak current	mA	30		
	Rated operating current 50/60 Hz∗6		A	16/18	8.4/9.1	
	Rated power consumption 50/60 Hz∗6		kW (kVA)	4.3/5.4 (5.5/6.0)	4.4/5.6 (5.8/6.3)	
Noise level (Front 1 m/Height 1 m)∗6			dB (A)	73	75	
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 four M10 bolts)∗10		
Weight (dry state)			kg	Approx. 136		

∗1 No condensation should be present.
∗2 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.
∗3 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)
∗4 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
∗5 ① Ambient temperature: 32°C, ② Circulating fluid: Tap water, ③ Circulating fluid flow rate: Rated flow, ④ Power supply: 200/400 VAC
∗6 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
∗7 When circulating fluid outlet port pressure = 0.5 MPa.
∗8 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.
∗9 To be prepared by the user. Option "B" (With earth leakage breaker) as well as the 400 V and the 460 V specifications have the specified earth leakage breaker built into the product.
∗10 The anchor bolt fixing brackets (including four M10 bolts) are used for fixing to wooden skids when packaging the thermo-chiller. No anchor bolt is included.
∗11 If the product is used at an altitude of 1000 m or higher, refer to "Operating Environment/Storage Environment" (page 103) Item 14 "For altitudes of 1000 m or higher."

Thermo-chiller Standard Type
Water-cooled 200 V/400 V/460 V Type
HRS090 Series

(Only 400/460 VAC type) (Only 460 VAC type) RoHS

How to Order

HRS 090 − W □ − 20 − □

Cooling capacity

090	9 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)
46	3-phase 380 to 415 VAC (50/60 Hz) 3-phase 460 to 480 VAC (60 Hz)

Option

Nil	None
B∗1	With earth leakage breaker
J	With automatic fluid fill function
M	Applicable to deionized water piping
W	SI unit only

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

∗1 200 V type only.
400/460 V type is provided with an earth leakage breaker as standard.

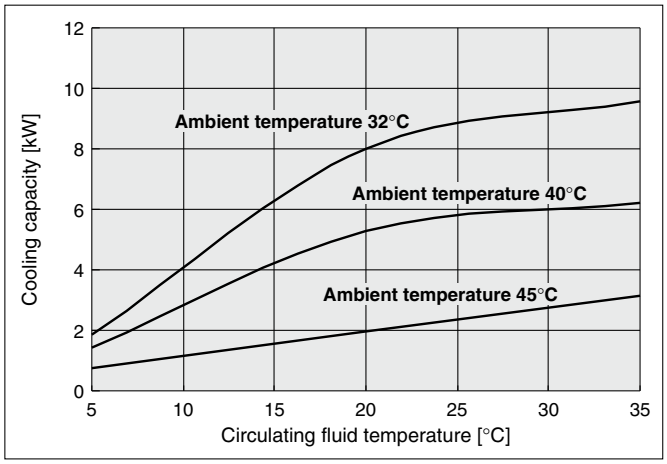
Specifications

Model				HRS090-W□-20-□	HRS090-W□-40-□	HRS090-W□-46-□
Cooling method				Water-cooled refrigeration		
Refrigerant				R410A (HFC)		
Refrigerant charge			kg	1.15		
Control method				PID control		
Ambient temperature/Humidity/Altitude∗1, 2			°C	Temperature: 5 to 45°C, Humidity: 30 to 70%, Altitude: less than 3000 m		
Circulating fluid system	**Circulating fluid**∗3			Tap water, 15% ethylene glycol aqueous solution, Deionized water		
	Set temperature range∗2		°C	5 to 35		
	Cooling capacity 50/60 Hz∗4		kW	9.0/10.5		
	Heating capacity 50/60 Hz∗5		kW	1.7/2.2		
	Temperature stability∗6		°C	±0.5		±0.1
	Pump capacity	**Rated flow 50/60 Hz (Outlet)**∗7	L/min	29/45		
		Maximum flow rate 50/60 Hz	L/min	55/68		
		Maximum pump head	m	50		
	Minimum operating flow rate 50/60 Hz∗8		L/min	29/45		
	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, PTFE, FKM, EPDM, PVC, NBR, POM, PE, PP, Carbon, Ceramic		
Facility water system	**Temperature range**		°C	5 to 40		
	Pressure range		MPa	0.3 to 0.5		
	Required flow 50/60 Hz∗11		L/min	25/25		
	Facility water pressure differential		MPa	0.3 or more		
	Facility water inlet/outlet			Rc1/2 (Symbol F: G1/2, Symbol N: NPT1/2)		
	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)	3-phase 380 to 415 VAC (50/60 Hz) Allowable voltage range ±10% (No continuous voltage fluctuation) 3-phase 460 to 480 VAC (60 Hz) Allowable voltage range +4%, −10% (Max. voltage less than 500 V and no continuous voltage fluctuation)
	Applicable earth leakage breaker∗9	**Rated current**	A	30	20	
		Sensitivity of leak current	mA	30		
	Rated operating current 50/60 Hz∗6		A	13/14	6.4/6.7	
	Rated power consumption 50/60 Hz∗6		kW (kVA)	3.3/4.2 (4.4/4.9)	3.4/4.2 (4.4/4.7)	
Noise level (Front 1 m/Height 1 m)∗6			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 four M10 bolts)∗10		
Weight (dry state)			kg	Approx. 124		

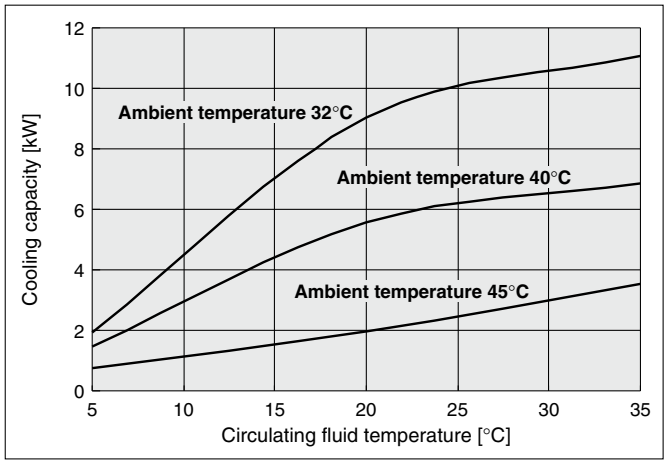
∗1 No condensation should be present.
∗2 Use a 15% ethylene glycol aqueous solution if operating in a place where the ambient temperature and/or circulating fluid temperature is 10°C or less. Also, when there is a possibility of the facility water being frozen, make sure to discharge all the facility water from the facility water circuit.
∗3 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)
∗4 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: 200/400 VAC
∗5 ① Facility water temperature: 32°C, ② Circulating fluid: Tap water, ③ Circulating fluid flow rate: Rated flow, ④ Power supply: 200/400 VAC
∗6 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: 200/400 VAC, ⑦ Piping length: Shortest
∗7 When circulating fluid outlet port pressure = 0.5 MPa.
∗8 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.
∗9 To be prepared by the user. Option "B" (With earth leakage breaker) as well as the 400 V and the 460 V specifications have the specified earth leakage breaker built into the product.
∗10 The anchor bolt fixing brackets (including four M10 bolts) are used for fixing to wooden skids when packaging the thermo-chiller. No anchor bolt is included.
∗11 The actual facility water flow rate will vary depending on the operating conditions.

Cooling Capacity

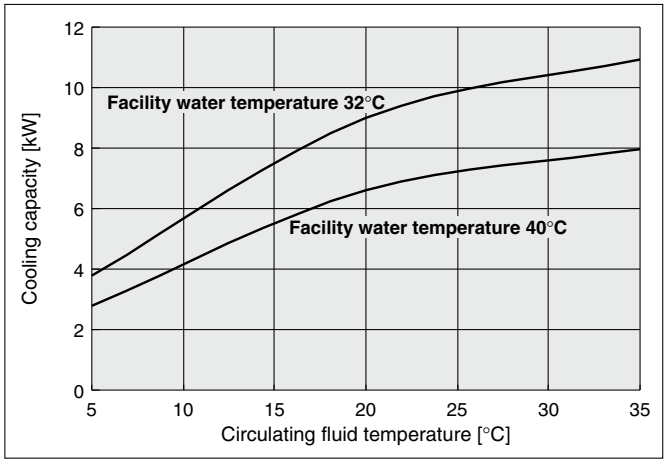
HRS090-A-20/40/46 (50 Hz)



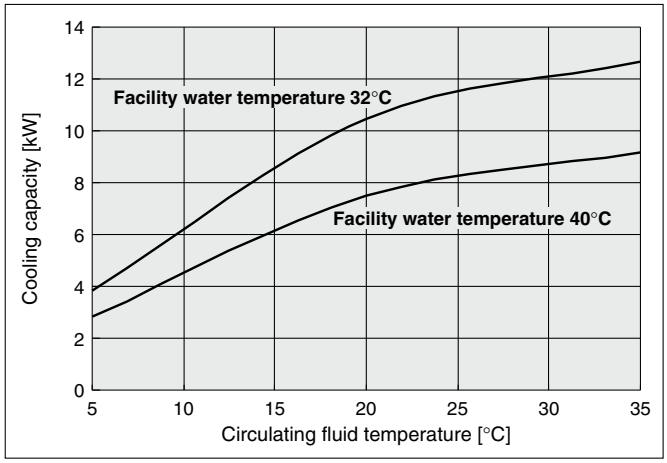
HRS090-A-20/40/46 (60 Hz)



HRS090-W-20/40/46 (50 Hz)

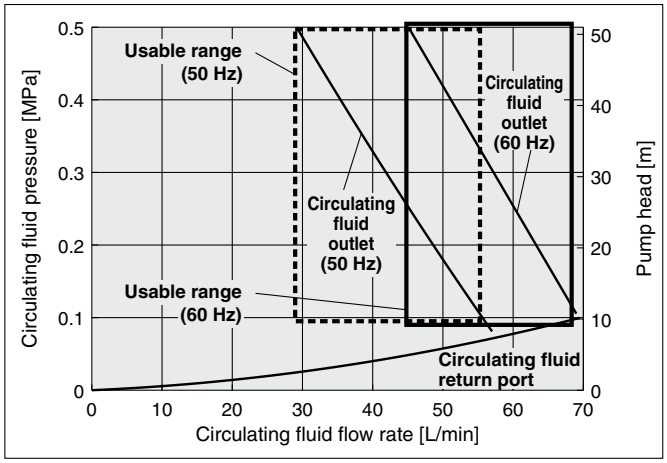


HRS090-W-20/40/46 (60 Hz)



Pump Capacity

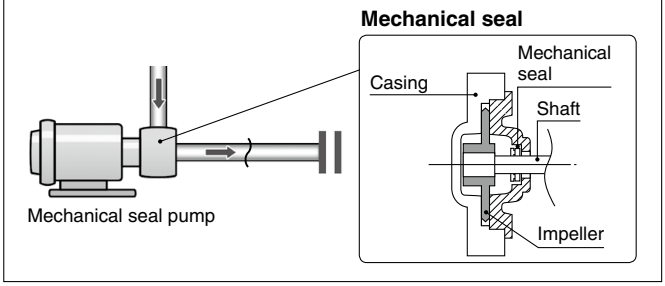
HRS090-A-20/40/46
HRS090-W-20/40/46



⚠ Caution

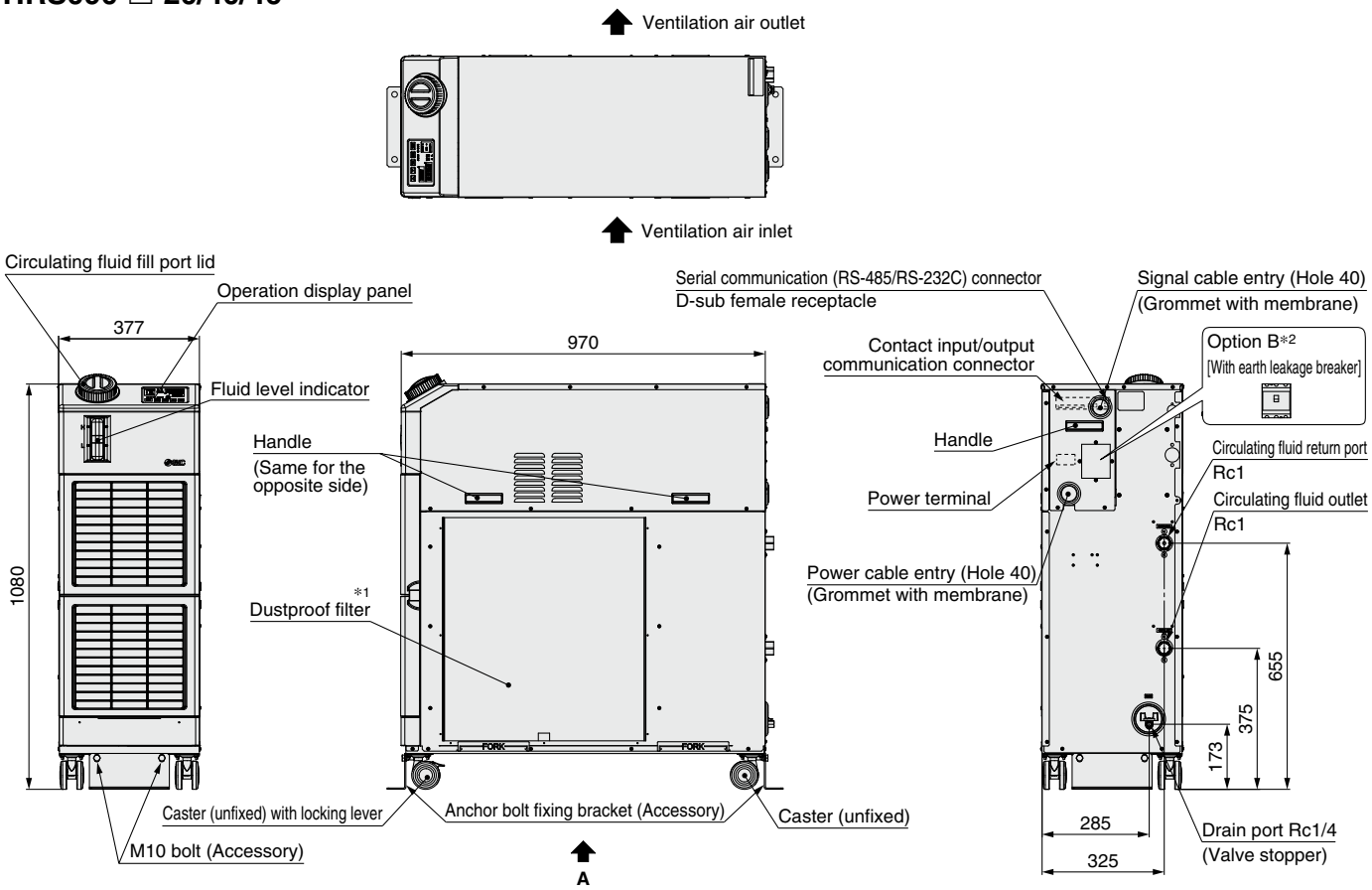
Mechanical Seal Pump

The pump used for the thermo-chiller HRS090 series uses a mechanical seal with the fixed ring and rotary ring used for the shaft seal part. If foreign matter enter the gap between the seals, this may cause a trouble such as leakage from the seal part or pump lock. Therefore, it is strongly recommended to install the particle filter in the return piping of the chiller.



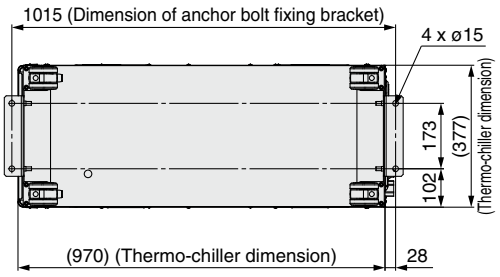
Dimensions

HRS090-□-20/40/46

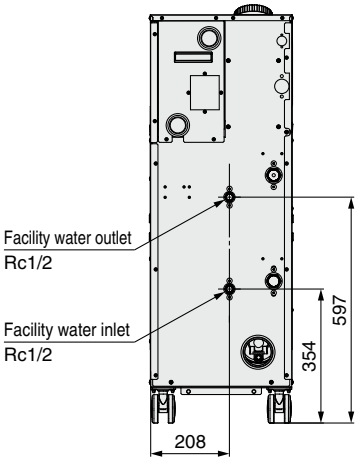


*1 The water-cooled type is not equipped with a dustproof filter.
*2 400 V type is provided with an earth leakage breaker "-B" as standard.

Anchor bolt fixing position



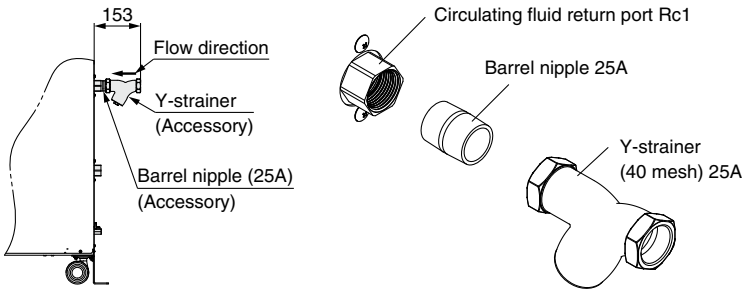
View A



For water-cooled type

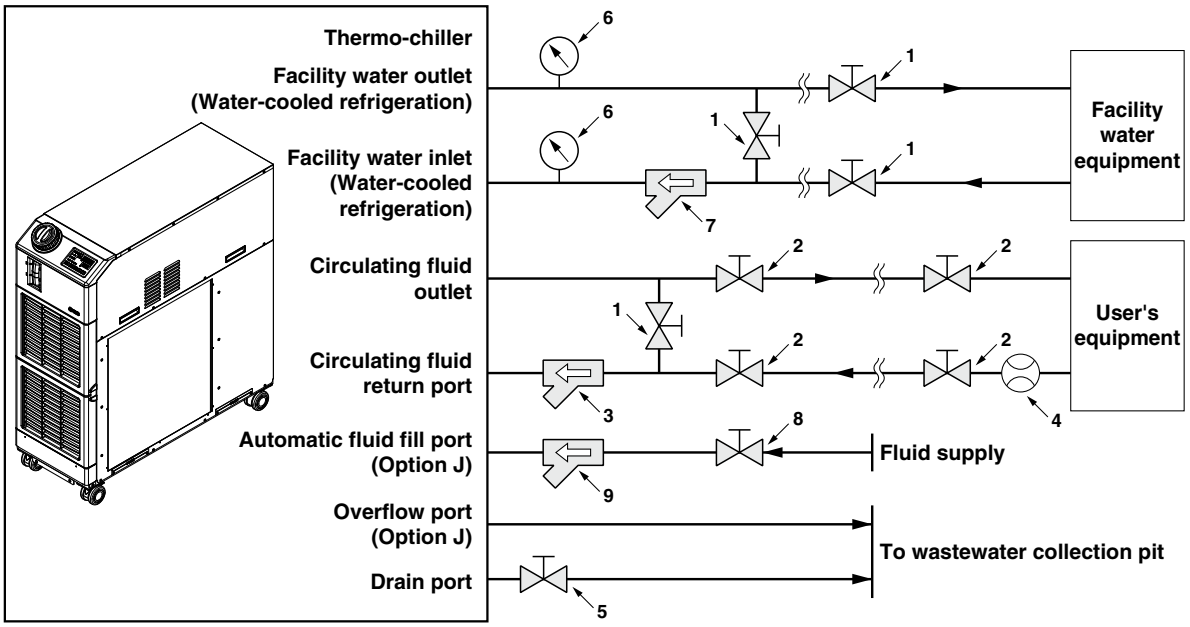
Accessory: Y-strainer mounting view

* 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	Recommended part no.	Note
1	Valve	Rc1/2	—	—
2	Valve	Rc1	—	—
3	Y-strainer	Rc1 #40	Accessory	Install either the strainer or filter. If foreign matter with a size of 20 μm or more are likely to enter, install the particle filter. For the recommended filter, refer to the optional accessory HRS-PF005 (page 98).
	Filter	Rc1 20 μm	HRS-PF005*1	
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 1.0 MPa	—	—
7	Y-strainer	Rc1/2 #40	—	Install either the strainer or filter. If foreign matter with a size of 20 μm or more are likely to enter, select the particle filter, and then prepare it.
	Filter	Rc1/2 20 μm	—	
8	Valve	Rc3/8	—	—
9	Y-strainer	Rc3/8 #40	—	Install either the strainer or filter. If foreign matter with a size of 20 μm or more are likely to enter, install the particle filter.
	Filter	Rc3/8 20 μm	FQ1011N-10-T020-B-X61*1	

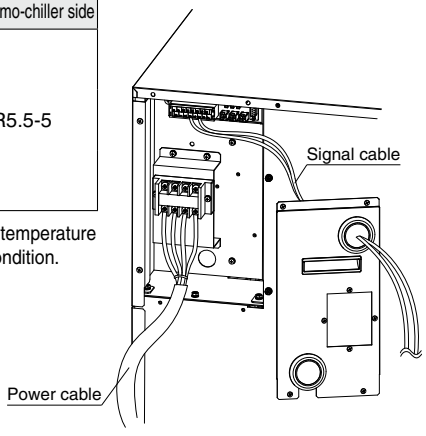
*1 The filter shown above cannot be directly connected to the thermo-chiller. Install it in the user's piping system.

Cable Specifications

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
HRS090-□□-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
HRS090-□□-40	3-phase 380 to 415 VAC (50/60 Hz)	20 A			
HRS090-□□-46	3-phase 380 to 415 VAC (50/60 Hz) 3-phase 460 to 480 VAC (60 Hz)				

* 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.

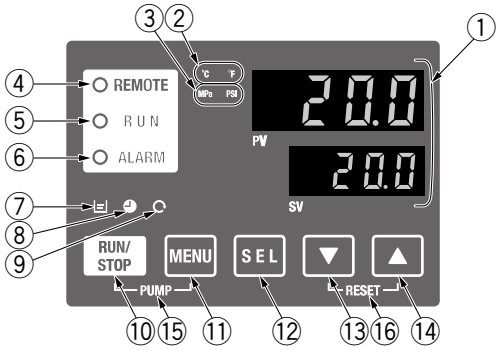


Signal Cable Specifications

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	

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	**Alarm buzzer sound setting**	Alarm sound can be set to on/off.
17	**Alarm customizing**	Operation during alarm condition and threshold values can be changed depending on the alarm type.
18	**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*1
AL41	Power stoppage
AL42	Compressor waiting
AL43	Fan failure*1
AL45	Compressor over current
AL47	Pump over current
AL50	Incorrect phase error
AL51	Phase board over current

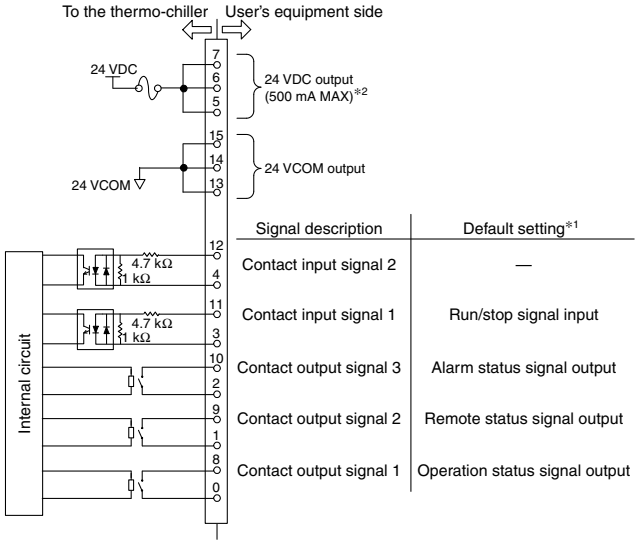
*1 Does not occur on the product of water-cooled refrigeration type.

* For details, read the Operation Manual.

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

Communication Functions

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		

*1 The pin numbers and output signals can be set by user. For details, refer to the Operation Manual for communication.
*2 When using with optional accessories, depending on the accessory, the allowable current of 24 VDC devices will be reduced. Refer to the operation manual of the optional accessories for details.

Serial Communication

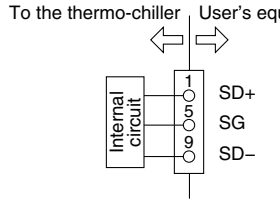
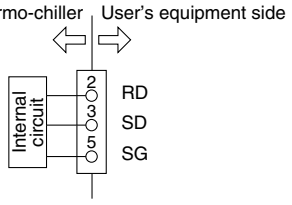
The serial communication (RS-485/RS-232C) enables the following items to be written and read out.
For details, refer to the Operation Manual for communication.

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 (Mounting screw: M2.6 x 0.45)	
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, https://www.smcworld.com

HRS090 Series
Options

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

B Option symbol

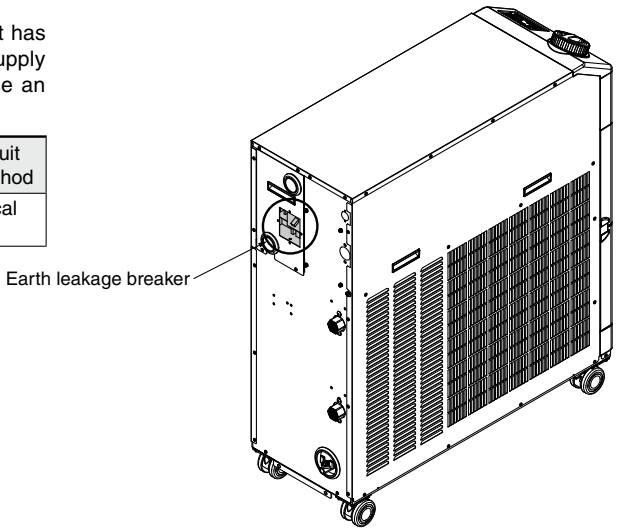
With Earth Leakage Breaker

HRS090−□□−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' or '-46', 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
HRS090-□□-20-B	30	30	Mechanical button



* **400/460 V type is equipped as standard.**

J Option symbol

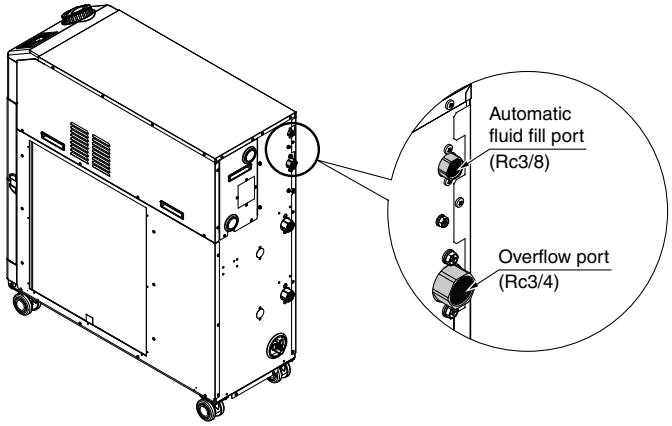
With Automatic Fluid Fill Function

HRS090−□□−□−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 filling fluid while the circulating fluid is decreasing.

Applicable model	**HRS090-□□-□-J**
Fluid fill method	Built-in solenoid valve for automatic fluid filling
Fluid fill pressure [MPa]	0.2 to 0.5
Feed water temperature [°C]	5 to 40



M Option symbol

Applicable to Deionized Water Piping

HRS090−□□−□−M

Applicable to deionized water piping

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

Applicable model	**HRS090-□□-□-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

W Option symbol

SI Unit Only

HRS090−□□−□−W

SI unit only

The circulating fluid temperature and pressure are displayed in SI units [MPa/°C] only.
If this option is not selected, a product with a unit selection function will be provided by default.

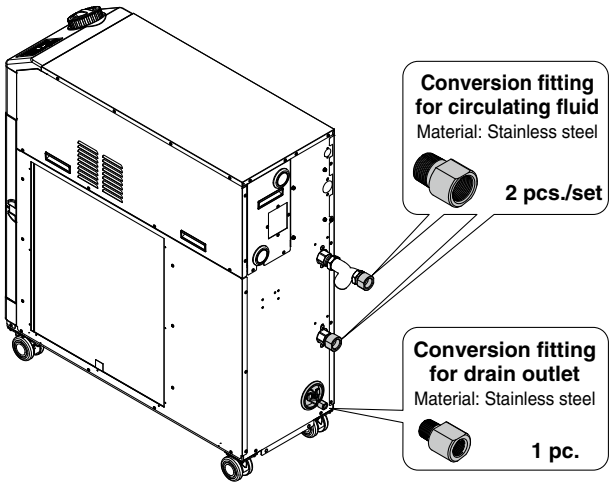
* No change in external dimensions

HRS090 Series
Optional Accessories

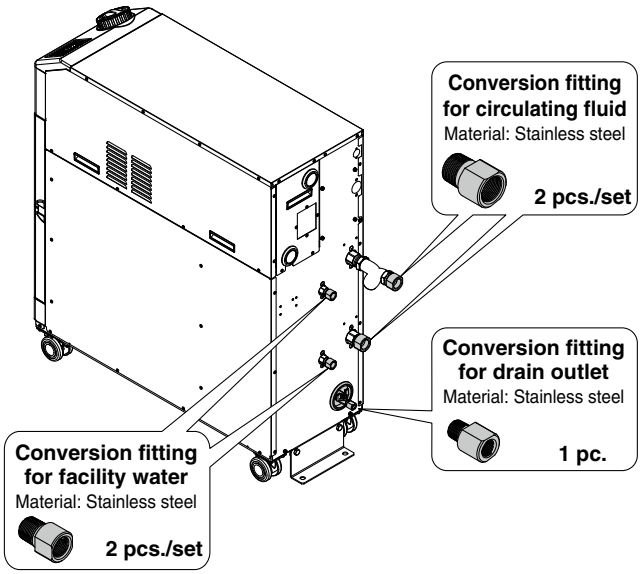
① Piping Conversion Fitting

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	**HRS090-A-20/40/46**
HRS-EP019	G thread conversion fitting set	



Part no.	Contents	Applicable model
HRS-EP022	NPT thread conversion fitting set	**HRS090-W-20/40/46**
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	**HRS090-A-20/40/46-J**
HRS-EP021	G thread conversion fitting set	

Part no.	Contents	Applicable model
HRS-EP024	NPT thread conversion fitting set	**HRS090-W-20/40/46-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.

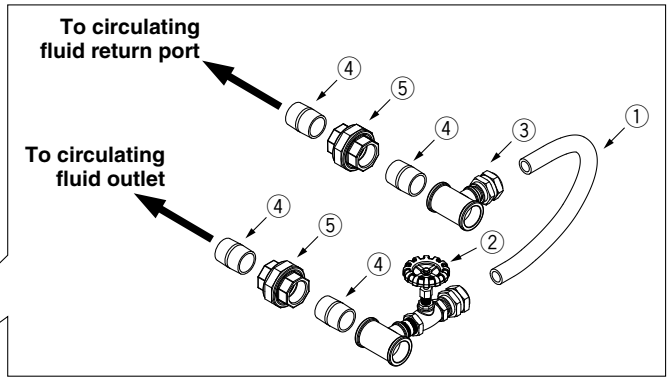
Bypass Piping Set

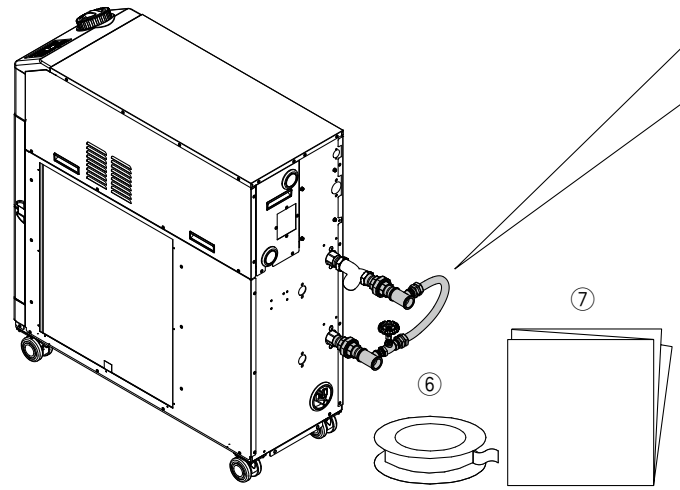
Part no.	Applicable model	Minimum operating flow rate (50/60 Hz) [L/min]
HRS-BP005	**HRS090-□□-20/40/46**	29/45

Bypass Piping Set (Stainless Steel)

Part no.	Applicable model	Minimum operating flow rate (50/60 Hz) [L/min]
HRS-BP011	**HRS090-□□-20/40/46**	29/45

∗ When selecting option "M," the HRS-BP011 is recommended.





Parts List

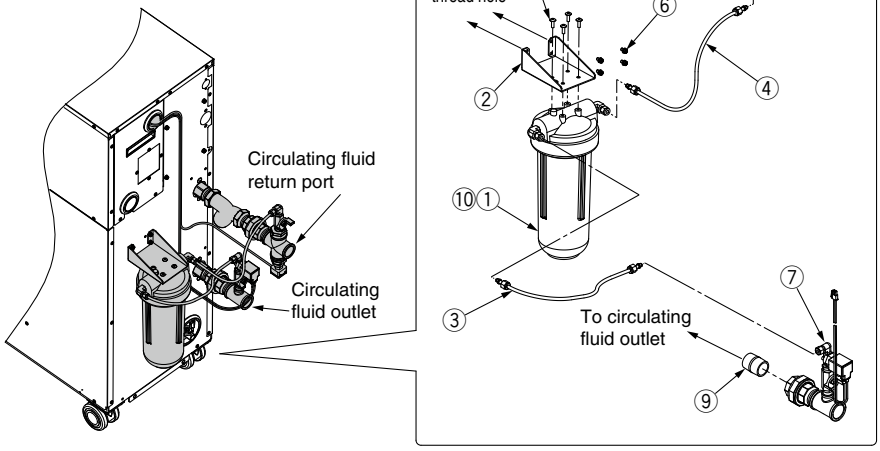
No.	Description	Fluid contact material		Qty.
		HRS-BP005	**HRS-BP011**	
①	Hose (I.D.: 15 mm)	PVC	PVC	1 (Approx. 700 mm)
②	Outlet piping assembly (With globe valve)	Stainless steel, Brass, Bronze	Stainless steel	1
③	Return piping assembly	Stainless steel, Brass	Stainless steel	1
④	Nipple (Size: 1 inch)	Stainless steel	Stainless steel	4
⑤	Union (Size: 1 inch)	Stainless steel	Stainless steel	2
⑥	Sealant tape	PTFE	PTFE	1
⑦	Operation Manual	—	—	1

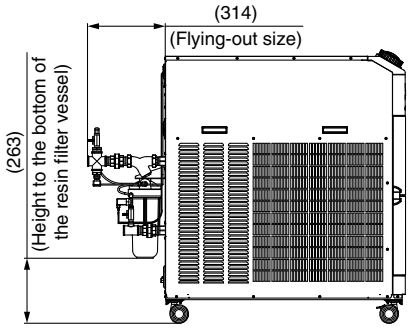
③ Electric Conductivity Control Set

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	**HRS090-□□-20/40/46**

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





Parts List

No.	Description	Fluid contact material	Qty.
①	DI filter vessel	PC, PP	1
②	Mounting bracket	—	1
③	DI filter inlet tube	PFA, POM	1
④	DI filter outlet tube	PFA, POM	1
⑤	Tapping screw (M5 screw)	—	4
⑥	Mounting screw (M5 screw)	—	4
⑦	DI control piping assembly	Stainless steel, EPDM	1
⑧	DI sensor assembly	Stainless steel, PPS	1
⑨	Nipple (Size: 1 inch)	Stainless steel	2
⑩	DI filter cartridge (Part no.: HRS-DF001)*1	PP, PE	1

*1 The product should be replaced when it can no longer preserve the electrical conductivity set value.

④ Particle Filter Set

Removes foreign matter in the circulating fluid. If foreign matter such as scales in the piping enter the circulating fluid, this may cause the pump to malfunction. Therefore, it is strongly recommended to install the particle filter set. This set cannot be directly connected to the thermo-chiller. Install it in the user's piping system. For details, refer to the Operation Manual.

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

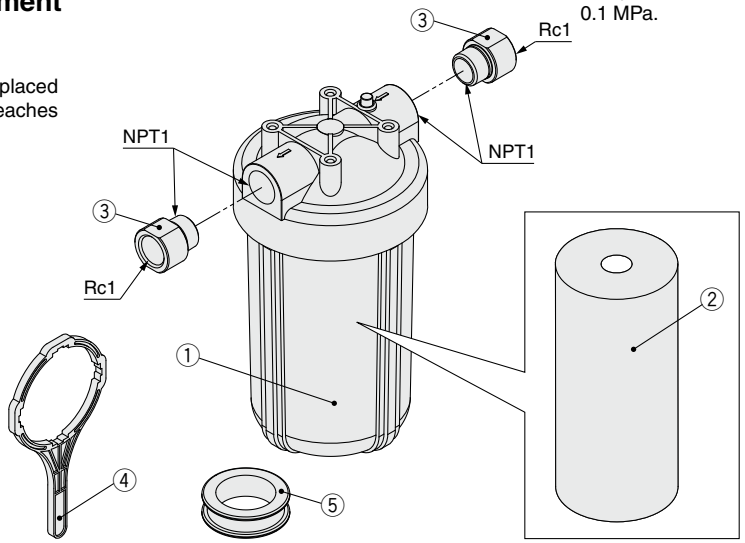
No.	Description	Material	Qty.	Note
①	Body	PC, PP	1	—
②	Element*1	PP	1	—
③	Extension piece	Stainless steel	2	Conversion from NPT to Rc
④	Handle	—	1	When -H is selected
⑤	Sealant tape	PTFE	1	—

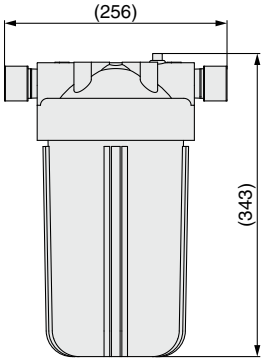
*1 The product should be replaced when the pressure drop reaches 0.1 MPa.

Replacement Element

HRS−PF006

The product should be replaced when the pressure drop reaches 0.1 MPa.



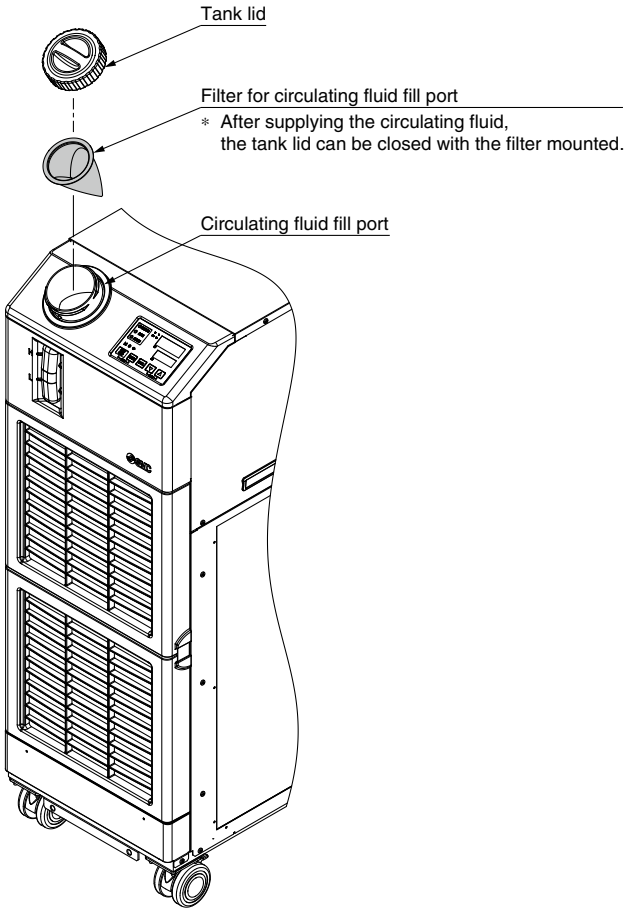


⑤ Filter for Circulating Fluid Fill Port

Prevents foreign matter from entering the tank when supplying the circulating fluid. Can be used just by fitting into the circulating fluid fill port.

■ Filter for circulating fluid fill port HRS-PF007

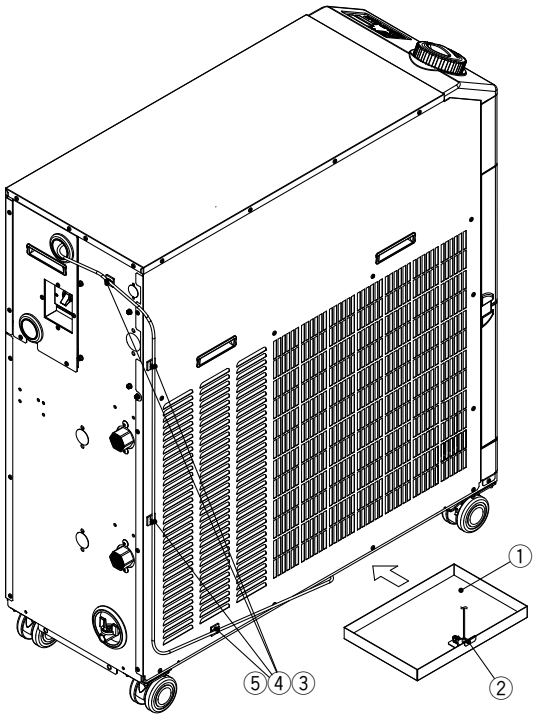
Material	Stainless steel 304, Stainless steel 316
Mesh size	200



⑥ 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. Align the drain pan with the hole in the bottom of the thermo-chiller for installation.

Part no.	Applicable model
HRS-WL003	**HRS090-□□-20/40/46**



Parts List

No.	Description
①	Drain pan
②	Water leakage sensor
③	Extension cable
④	Binding band (4 pcs.)
⑤	Cable fixture (4 pcs.)

⑦ Wired Remote Controller

When the wired remote controller is connected to the thermo-chiller, the operation start/stop setting or the set temperature can be changed from a place apart from the thermo-chiller. For details, refer to the Operation Manual.

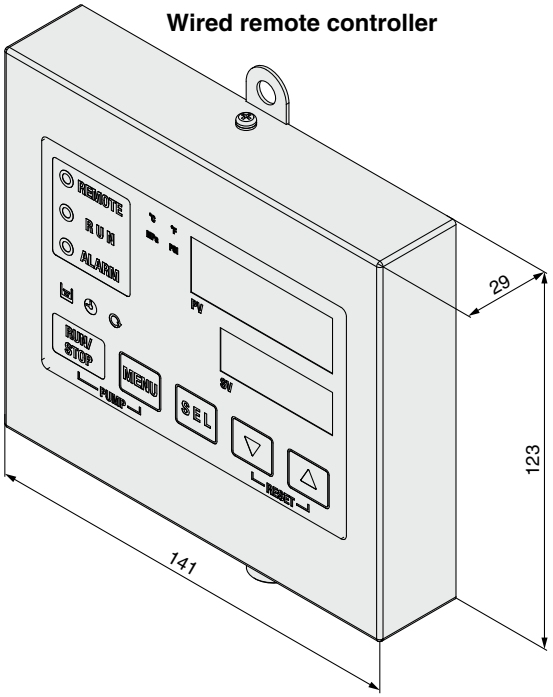
Wired Remote Controller

HRS−CV004− 1

Accessories

Symbol	Accessories
Nil	None
1	With cable (Approx. 20 m)
2	With cable (Approx. 50 m)
3	With cable (Approx. 100 m)

Wired remote controller



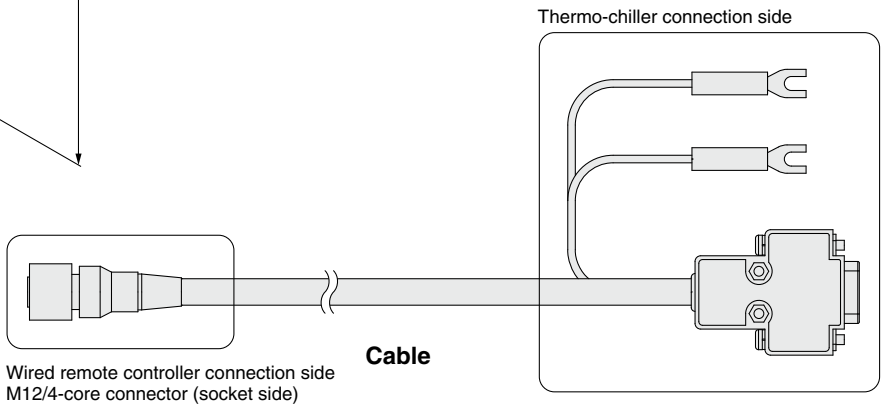
Displayed items

Circulating fluid discharge temperature
Circulating fluid discharge set temperature
Circulating fluid discharge pressure
Circulating fluid electric conductivity*1
Circulating fluid flow rate
Alarm code*2

∗1 Only when the electric conductivity control set is used.
∗2 Only when an alarm occurs. The alarm cannot be reset with the remote controller. Be sure to reset the alarm with the thermo-chiller main unit.

Operable items

Operation start/stop
Circulating fluid temperature setting
Alarm sound stop
Key-lock
Key operation sound ON/OFF
Digital display brightness adjustment
Alarm sound ON/OFF



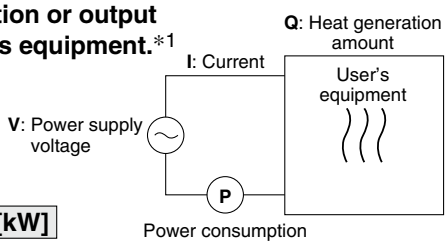
∗ To use the wired remote controller, the thermo-chiller main unit setting is needed.
∗ Use the wired remote controller indoors.
∗ Pass the cable through the duct, etc. so that it is not exposed to rain water or direct sunlight.

HRS090 Series
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



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]**

∗1 The examples above 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∗1
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]

∗1 Refer to page 102 for the typical physical property value of tap water or other circulating fluids.

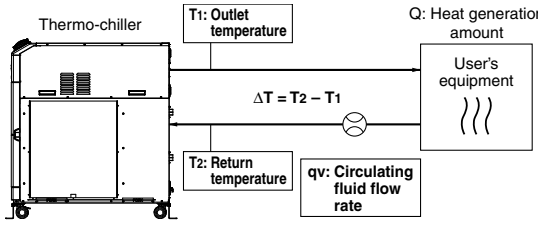
$$\mathbf{Q = qm \times C \times (T_2 - T_1)}$$

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

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

Cooling capacity = Considering a safety factor of 20%,

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



HRS090-A

Example of conventional units (Reference)

Heat generation amount by user's equipment **Q**	: Unknown [cal/h] → [W]
Circulating fluid	: Tap water∗1
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])

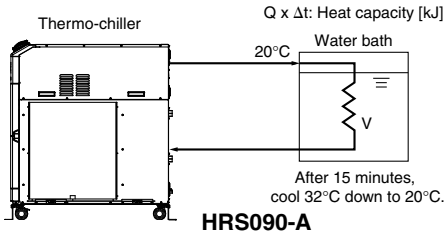
∗ Refer to the following for the typical physical property values by circulating fluid.

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

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

Cooling capacity = Considering a safety factor of 20%,

7.0 [kW] x 1.2 = 8.4 [kW]



HRS090-A

Example of conventional 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]

∗ 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 units, weight volume ratio γ = 1 [kgf/L])
Specific heat **C**: 4.19 x 10^3 [J/(kg·K)] (or, using conventional units, 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 units	
			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 units	
			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

∗ Shown above are reference values. Contact circulating fluid supplier for details.