

Circulating Fluid Temperature Controller

## Low GWP Refrigerant Chiller

# Thermo-chiller

Dual Channel Thermo-chiller for Lasers

New



# GWP:146<sup>\*1</sup>

EU refrigerant regulations: GWP150 or more  
US refrigerant regulations: GWP700 or more  
California, US refrigerant regulations: GWP750 or more

<sup>\*1</sup> Regulation (EU) 2024/573, AIM Act 40 CFR Part 84

## Environmentally friendly R454C as refrigerant

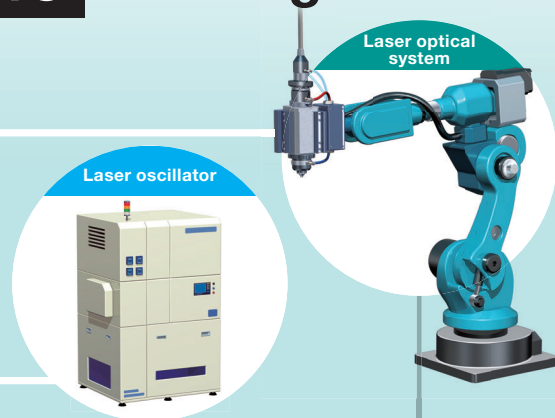
Not available for air transport

Temperatures for **2 fluid channel systems** can be controlled individually by one chiller.



Optical system **CH2**

Oscillator **CH1**

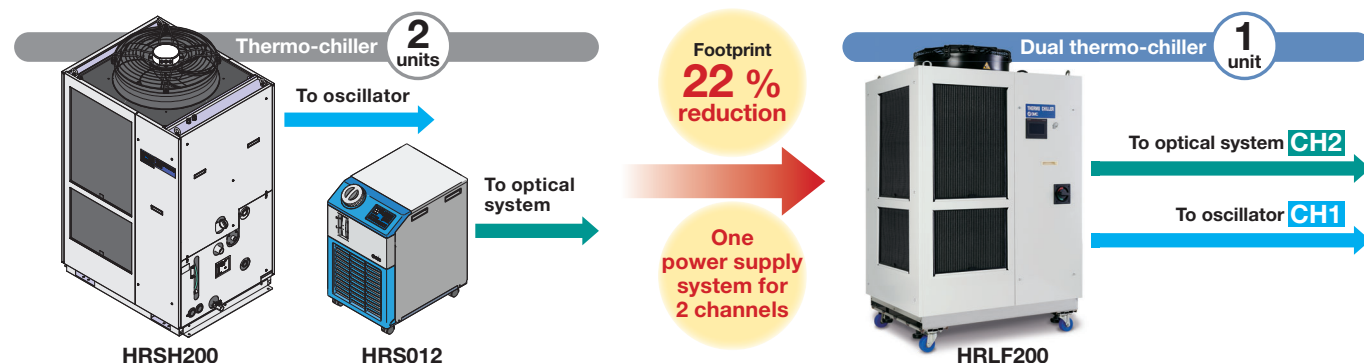


Cooling capacity [kW]
Temperature stability [°C]
Set temperature range [°C]

Oscillator CH1	Optical system CH2
19	1 (Max. 1.5)
±0.1	±0.5
5 to 35	10 to 40 <sup>*1</sup>

<sup>\*1</sup> CH2 ≥ CH1

## Space saving, Reduced wiring



## Touch panel

- Numeric keypad inputs
- Notice for alarms and maintenance
- Temperature waveform can be displayed.



Numeric keypad display

# HRLF Series



CAT.EUS40-80A-UK

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# Low GWP Refrigerant Chiller

## Thermo-chiller

Dual Channel Thermo-chiller for Lasers

3-phase 380 to 415 VAC (50 Hz)

3-phase 380 to 480 VAC (60 Hz)

## HRLF Series



RoHS



### How to Order

#### Air-cooled refrigeration

**HRLF 200-A**   **-40-**  

#### Cooling capacity

	CH1	CH2
200	19 kW	1 kW

#### Cooling method

A	Air-cooled refrigeration
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#### Pipe thread type

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

#### Power supply

40	3-phase 380 to 415 VAC (50 Hz) 3-phase 380 to 480 VAC (60 Hz)
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#### Option

Symbol	Options
—	CH2 Electric conductivity control
D1*1	CH1, CH2 Electric conductivity control
T2*2	CH2 High-pressure pump mounted

\*1 CH2 has electric conductivity control as standard.

\*2 For details, refer to "Options" on page 8.

### Specifications

Model		HRLF200-A□-40	
		CH1	CH2
Cooling method		Air-cooled refrigeration	
Refrigerant		R454C (HFO/HFC, GWP : 146)*15	
Refrigerant charge		kg	
Control method		PID control	
Ambient temperature		°C	
		2 to 45	
Circulating fluid system	Circulating fluid	Tap water*1, Deionised water*9	
	Set temperature range	°C	10 to 40
	Cooling capacity*2	kW	1*8
	Heating capacity*3	kW	1
	Temperature stability*4	°C	±0.5
	Pump capacity*13	Rated flow (Outlet pressure)	l/min
		45 (0.45 MPa)	10 (0.45 MPa)
		Maximum flow rate	l/min
	Maximum pump head	m	16*12
		49	49
	Settable pressure range*5	MPa	0.10 to 0.49
	Minimum operating flow rate*6	l/min	2
	Tank capacity	L	7
	Bypass circuit (With valve)	Installed	
Electrical system	Electric conductivity setting range	μS/cm	0.5 to 45
	Particle filter nominal filtration rating (Accessory)	μm	5
	Circulating fluid outlet, circulating fluid return port	Rc1 (Symbol F: G1/2, Symbol N: NPT1/2)	
	Tank drain port	Rc3/4 (Symbol F: G3/4, Symbol N: NPT3/4)	
	Fluid contact material	Stainless steel, Copper (Heat exchanger brazing)*10, Brass*10, Bronze*10, Fluororesin, PP, PBT, POM, PU, PC, PVC, EPDM, NBR, Ion replacement resin*9	
	Power supply	3-phase 380 to 415 VAC (50 Hz) Allowable voltage range ±10 % (No continuous voltage fluctuation)	
	Earth leakage breaker	3-phase 380 to 480 VAC (60 Hz) Allowable voltage range +4 %, -10 % (Max. voltage less than 500 V and no continuous voltage fluctuation)	
	Rated current	A	30
	Sensitivity current	mA	30
	Rated operating current*4	A	17.4
Accessories	Rated power consumption*4	kW (kVA)	11.1 (12.0)
	Noise level (Front 1 m/Height 1 m)*4	dB (A)	75
	Weight (dry state)*11	kg	265

\*1 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)

\*2 ① Ambient temperature: 32 °C, ② Circulating fluid: Tap water, ③ Circulating fluid temperature: CH1 20 °C/CH2 25 °C, ④ Circulating fluid flow rate: Rated flow, ⑤ Power supply: 400 VAC In the case of option T2 "CH2 High-Pressure Pump Mounted", refer to pages 421 to 423.

\*3 ① Ambient temperature: 32 °C, ② Circulating fluid: Tap water, ③ Circulating fluid flow rate: Rated flow, ④ Power supply: 400 VAC

\*4 ① Ambient temperature: 32 °C, ② Circulating fluid: Tap water, ③ Circulating fluid temperature: CH1 20 °C/CH2 25 °C, ④ Load: Same as the cooling capacity, ⑤ Circulating fluid flow rate: Rated flow, ⑥ Power supply: 400 VAC, ⑦ Piping length: Shortest

\*5 With the pressure control mode by inverter. If the pressure control mode is not necessary, use the flow control function or the pump output setting function.

\*6 Fluid flow rate to maintain the cooling capacity. If the actual flow rate is lower than this, adjust the bypass valve. In the case of option T2 "CH2 High-Pressure Pump Mounted", refer to page 8.

\*7 The anchor bolt fixing brackets (including 6 M8 bolts) are used for fixing to wooden skids when packaging the thermo-chiller. No anchor bolt is included.

\*8 Max. 1.5 kW. When 1.5 kW is applied, the cooling capacity of CH1 decreases by 0.5 kW.

\*9 For Option D1 (With electric conductivity control) only

\*10 Not included for Option D1 (With electric conductivity control)

\*11 The weight will increase by 1 kg when option "D1" (CH1, CH2 electric conductivity control) or option "T2" (CH2 high-pressure pump mounted) is selected.

\*12 The usable flow rate range is varied depending on the pump control mode. For details, refer to pump capacity curve on page 4.

\*13 In the case of option T2 "CH2 High-Pressure Pump Mounted", refer to page 8.

\*14 Included in option "T2 (CH2 High-Pressure Pump Mounted)"

\*15 R454C is a slightly flammable refrigerant. Avoid using this product in proximity to open flames.

# HRLF Series Dual Channel Thermo-chiller for Lasers



## How to Order



### Water-cooled refrigeration

## HRLF 200 - W - 40 -

	CH1	CH2
200	21.5 kW	1 kW

Cooling capacity

	Cooling method
W	Water-cooled refrigeration

Cooling method

	Pipe thread type
-	Rc
F	G (with Rc-G conversion fitting)
N	NPT (with Rc-NPT conversion fitting)

Pipe thread type

	Power supply
40	3-phase 380 to 415 VAC (50 Hz) 3-phase 380 to 480 VAC (60 Hz)

Power supply

Option

Symbol	Options
-	CH2 Electric conductivity control
D1*1	CH1, CH2 Electric conductivity control
T2*2	CH2 High-pressure pump mounted

\*1 CH2 has electric conductivity control as standard.

\*2 For details, refer to "Options" on page 8.

## Specifications

Model		HRLF200-W-40	
		CH1	CH2
Cooling method		Water-cooled refrigeration	
Refrigerant		R454C (HFO/HFC, GWP : 146)*16	
Refrigerant charge		kg 1.7	
Control method		PID control	
Ambient temperature		°C 2 to 45	
Circulating fluid system	Circulating fluid	Tap water*1, Deionised water*9	
	Set temperature range	°C 5 to 35	10 to 40
	Cooling capacity*2	kW 21.5	1*8
	Heating capacity*3	kW 4	1
	Temperature stability*4	°C ±0.1	±0.5
	Pump capacity*13	Rated flow (Outlet pressure)	l/min 45 (0.45 MPa)
		Maximum flow rate	l/min 130
		Maximum pump head	m 55
	Settable pressure range*5	MPa 0.10 to 0.55	0.10 to 0.49
	Minimum operating flow rate*6	l/min 25	2
	Tank capacity	L 42	7
	Bypass circuit (With valve)	Installed	
	Electric conductivity setting range	µS/cm 0.5 to 45*9	0.5 to 45
Facility water system	Particle filter nominal filtration rating (Accessory)	µm 5	5
	Circulating fluid outlet, circulating fluid return port	Rc1 (Symbol F: G1, Symbol N: NPT1)	Rc1/2 (Symbol F: G1/2, Symbol N: NPT1/2)
	Tank drain port	Rc3/4 (Symbol F: G3/4, Symbol N: NPT3/4)	Rc1/2 (Symbol F: G1/2, Symbol N: NPT1/2)
	Fluid contact material	Stainless steel, Copper (Heat exchanger brazing)*10, Brass*10, Bronze*10, Fluororesin, PP, PBT, POM, PU, PC, PVC, EPDM, NBR, Ion replacement resin*9	
	Fluid contact material	Stainless steel, Alumina ceramic, Carbon, Fluororesin, PP, PBT, POM, PU, PVC, PPS, AS, PS, EPDM, NBR, Ion replacement resin, PA*14	
Electrical system	Temperature range	°C 5 to 35	
	Pressure range	MPa 0.3 to 0.5	
	Required flow rate*15	l/min 50	
	Inlet-outlet pressure differential of facility water	MPa 0.3 or more	
	Facility water inlet/outlet	Rc1 (Symbol F: G1, Symbol N: NPT1)	
	Fluid contact material	Stainless steel, Copper (Heat exchanger brazing), Bronze, Brass, PTFE, NBR, EPDM	
	Power supply	3-phase 380 to 415 VAC (50 Hz) Allowable voltage range ±10 % (No continuous voltage fluctuation) 3-phase 380 to 480 VAC (60 Hz) Allowable voltage range +4 %, -10 % (Max. voltage less than 500 V and no continuous voltage fluctuation)	
	Earth leakage breaker	Rated current	A 30
Accessories		Sensitivity current	mA 30
		Rated operating current*4	A 16.7
		Rated power consumption*4	kW (kVA) 10.7 (11.5)
	Noise level (Front 1 m/Height 1 m)*4	dB (A) 72	
Accessories		Operation Manual (for installation/operation) 2 pcs. (English 1 pc./Japanese 1 pc.), Particle filter set for CH1, Particle filter set for CH2, Anchor bolt fixing brackets 2 pcs. (including 6 M8 bolts)*7	
Weight (dry state)*11		kg Approx. 255	

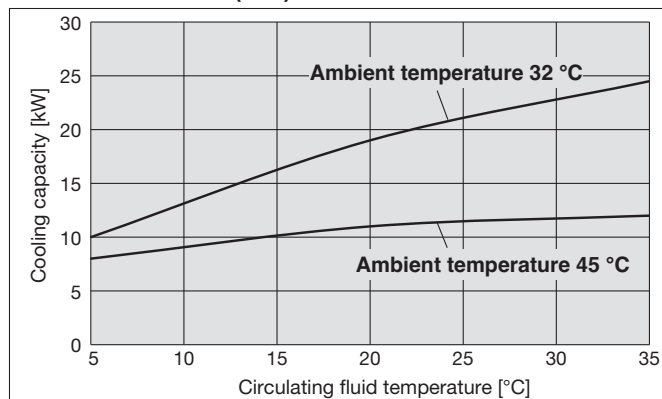
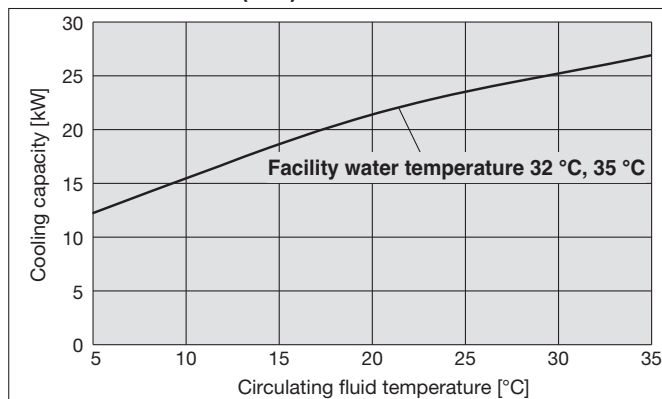
- \*1 Use fluid in condition below as the circulating fluid.  
Tap water: Standard of The Japan Refrigeration and Air Conditioning Industry Association (JRA GL-02-1994)
- \*2 ① Facility water temperature: 32 °C, ② Circulating fluid: Tap water, ③ Circulating fluid temperature: CH1 20 °C/CH2 25 °C, ④ Circulating fluid flow rate: Rated flow, ⑤ Power supply: 400 VAC  
In the case of option T2 "CH2 High-Pressure Pump Mounted", refer to page 421 and 422.
- \*3 ① Facility water temperature: 32 °C, ② Circulating fluid: Tap water, ③ Circulating fluid flow rate: Rated flow, ④ Power supply: 400 VAC
- \*4 ① Facility water temperature: 32 °C, ② Circulating fluid: Tap water, ③ Circulating fluid temperature: CH1 20 °C/CH2 25 °C, ④ Load: Same as the cooling capacity, ⑤ Circulating fluid flow rate: Rated flow, ⑥ Power supply: 400 VAC, ⑦ Piping length: Shortest
- \*5 With the pressure control mode by inverter. If the pressure control mode is not necessary, use the flow control function or the pump output setting function.
- \*6 Fluid flow rate to maintain the cooling capacity. If the actual flow rate

- is lower than this, adjust the bypass valve. In the case of option T2 "CH2 High-Pressure Pump Mounted", refer to page 8.
- \*7 The anchor bolt fixing brackets (including 6 M8 bolts) are used for fixing to wooden skids when packaging the thermo-chiller. No anchor bolt is included.
- \*8 Max. 1.5 kW. When 1.5 kW is applied, the cooling capacity of CH1 decreases by 0.5 kW.
- \*9 For Option D1 (With electric conductivity control) only
- \*10 Not included for Option D1 (With electric conductivity control)
- \*11 The weight will increase by 1 kg when option D1 "With electrical conductivity control" and option T2 "CH2 High-Pressure Pump Mounted" is selected.
- \*12 The usable flow rate range is varied depending on the pump control mode. For details, refer to pump capacity curve on page 4.
- \*13 In the case of option T2 "CH2 High-Pressure Pump Mounted", refer to page 8.
- \*14 Included in option "T2"
- \*15 The actual flow rate of facility water will fluctuate according to your operating conditions.
- \*16 R454C is a slightly flammable refrigerant. Avoid using this product in proximity to open flames.

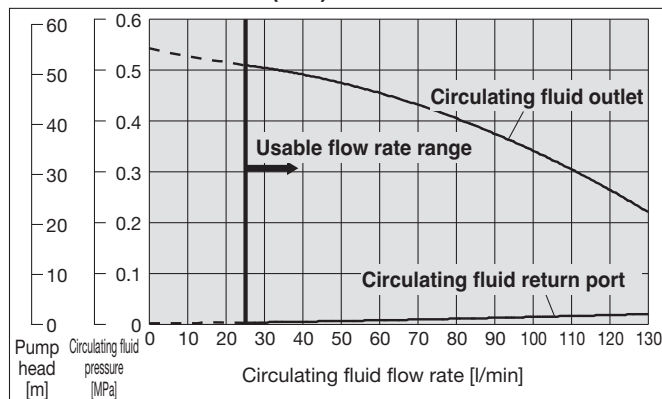
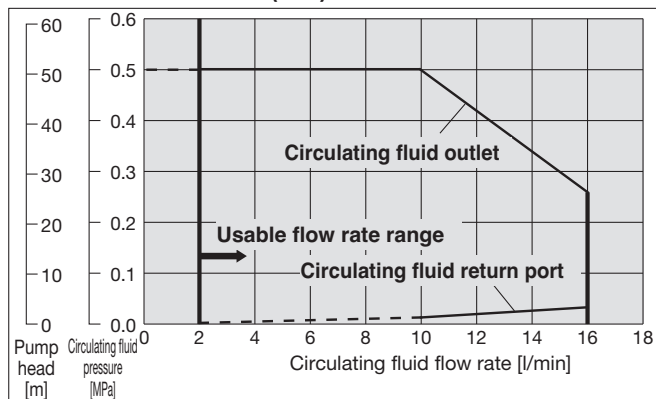
## Cooling Capacity

\*1 This is the cooling capacity of the CH1 side when 1 kW heat load is applied to the CH2 side.

\*2 Max. 1.5 kW. When 1.5 kW is applied, the cooling capacity of CH1 decreases by 0.5 kW.

**HRLF200-A□-40 (CH1)\*1****HRLF200-W□-40 (CH1)\*1**

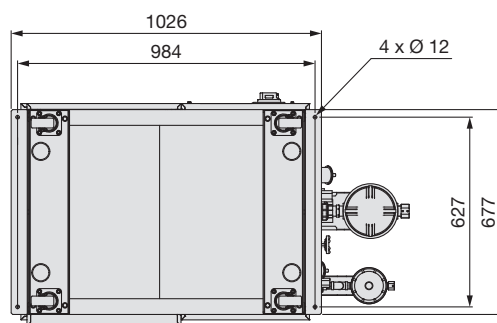
## Pump Capacity

**HRLF200-A/W□-40 (CH1)****HRLF200-A/W□-40 (CH2)**

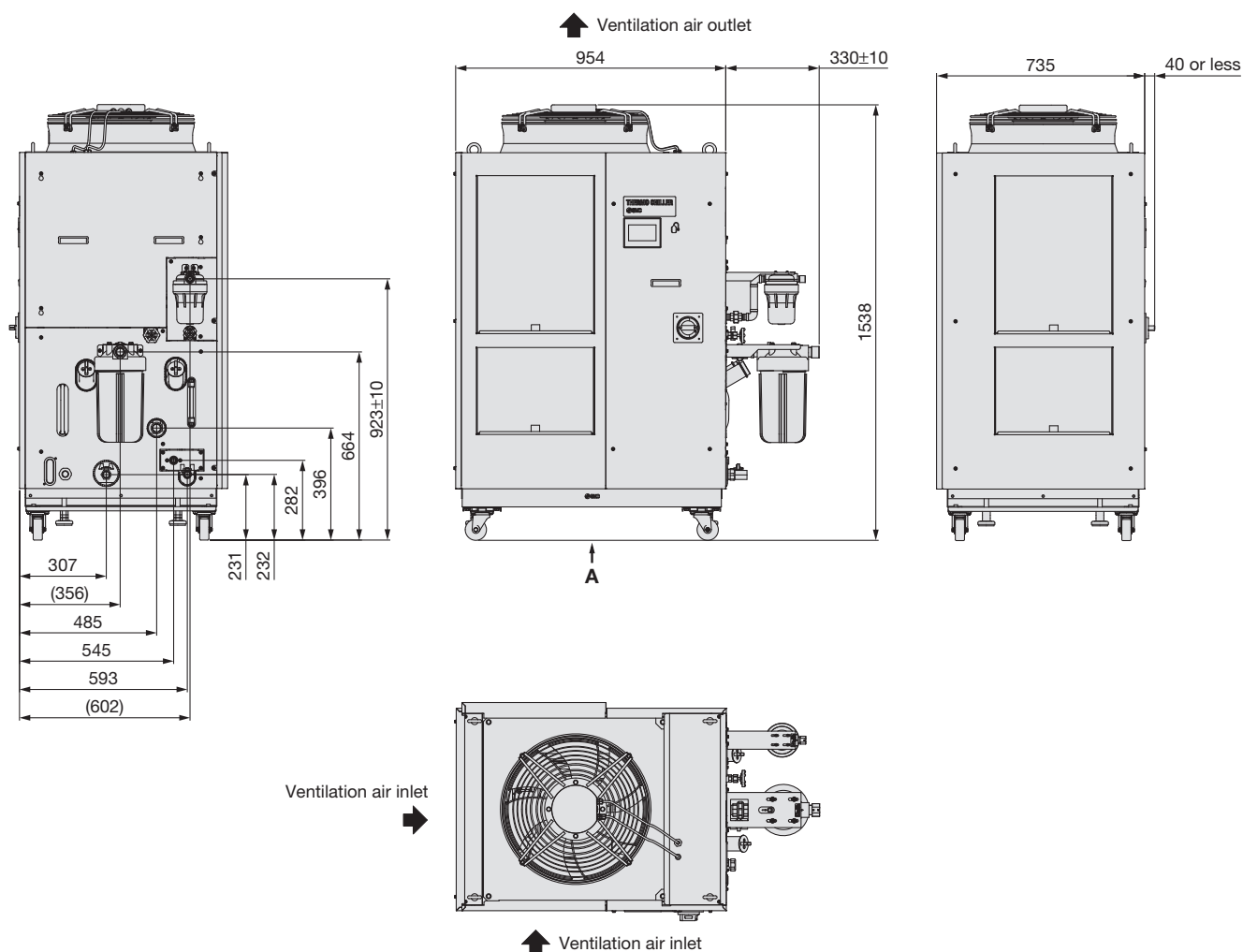
\* The flow rate is displayed up to 16 L/min on the chiller display.

## Dimensions

HRLF200-A□-40



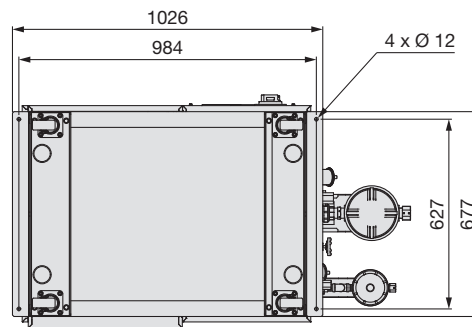
Anchor bolt mounting position (View A)



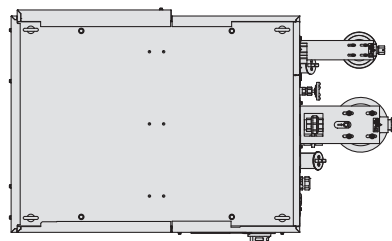
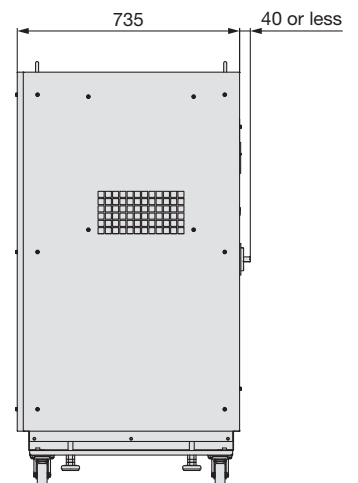
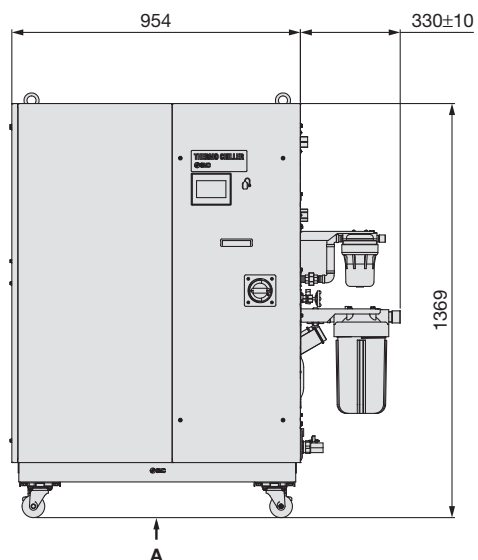
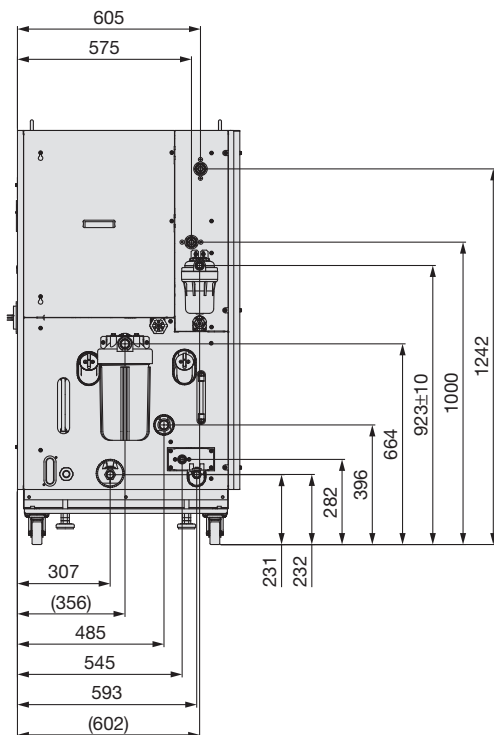
For piping port sizes, refer to the "Parts Description" on page 7.

## Dimensions

HRLF200-W□-40



Anchor bolt mounting position (View A)

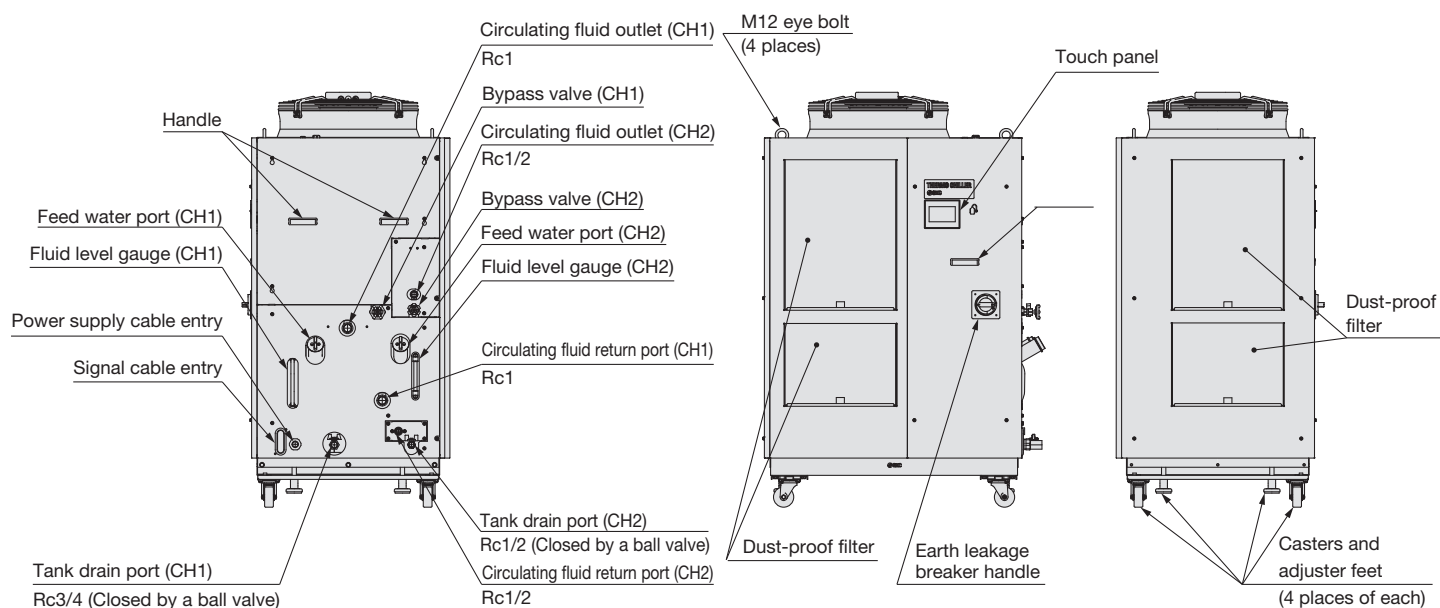


For piping port sizes, refer to the "Parts Description" on page 7.

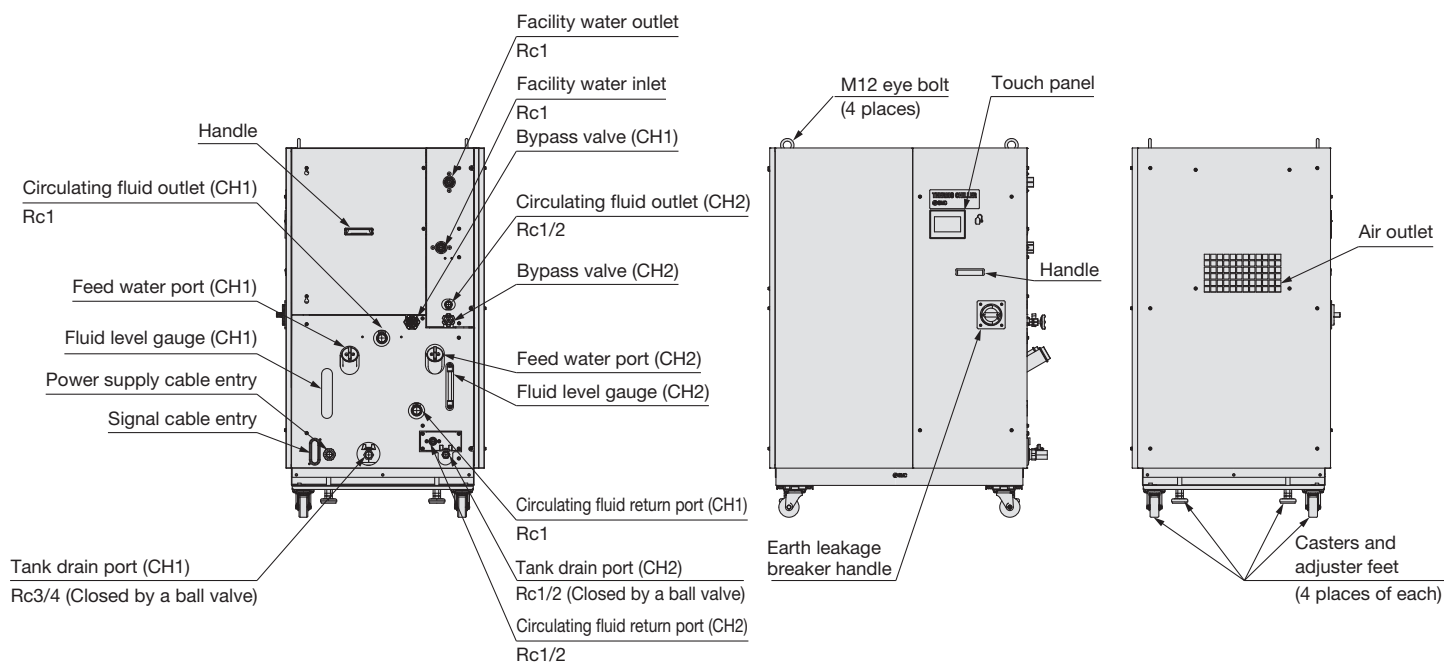


## Parts Description

### Air-cooled refrigeration



### Water-cooled refrigeration





# HRLF Series

## Options

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

### D1

Option symbol

#### CH1, CH2 Electric Conductivity Control

HRLF ☐ - ☐ - 40 - D1

● CH1, CH2 Electric conductivity control

- For the standard model, only CH2 has electric conductivity control. However, if option "D1" is selected, CH1 also has electric conductivity control.
- Contact material of the circulating fluid circuit is made from non-copper materials.

### T2

Option symbol

#### CH2 High-Pressure Pump Mounted

HRLF ☐ - ☐ - 40 - T2

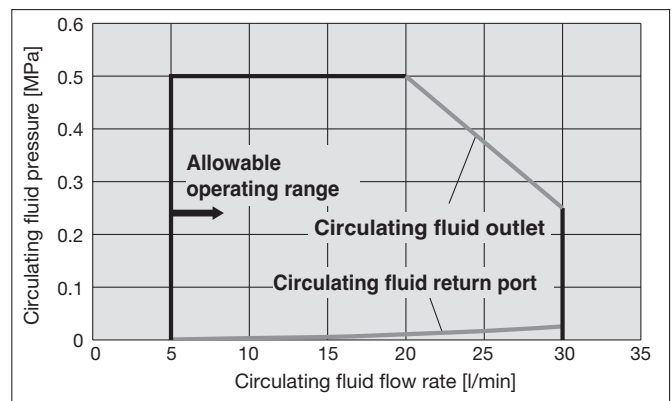
● CH2 High-pressure pump mounted

Possible to choose a high-pressure pump in accordance with user's piping resistance  
Total cooling capacity of CH1 and CH2 will decrease by heat generated in the pump.

Applicable model		HRLF <input type="checkbox"/> -A/W <input type="checkbox"/> -40-T2	
		CH1	CH2
Pump	Rated flow rate (Outlet) l/min	Same as standard product	20 (0.45 MPa)
	Maximum flow rate l/min	Same as standard product	30
	Maximum pump head m	Same as standard product	Same as standard product
Minimum operating flow rate l/min		Same as standard product	5
Tank capacity L		Same as standard product	Same as standard product
Cooling capacity W		It differs from the standard cooling capacity. Refer to the table below for the details.	

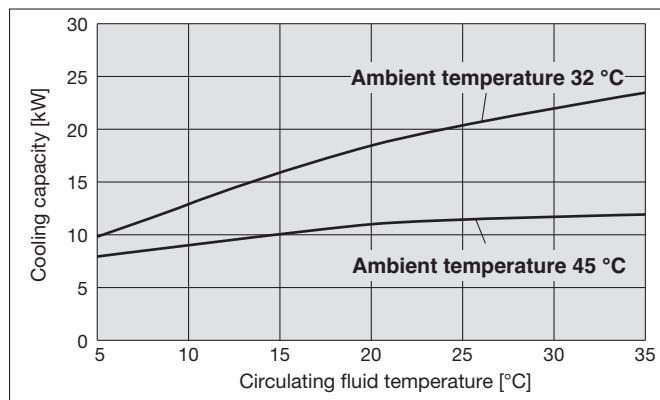
### Pump Capacity

HRLF ☐ -A/W ☐ -40-T2

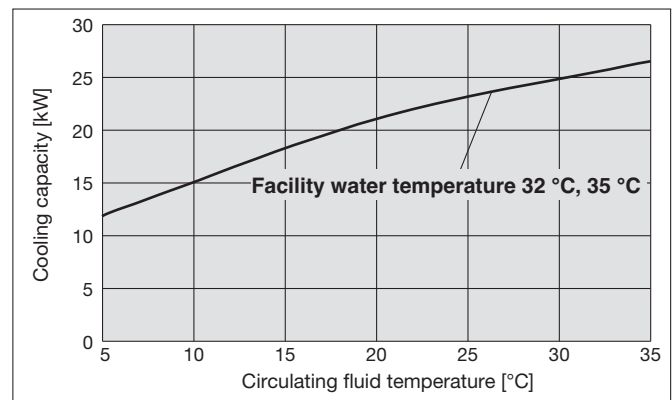


### Cooling Capacity

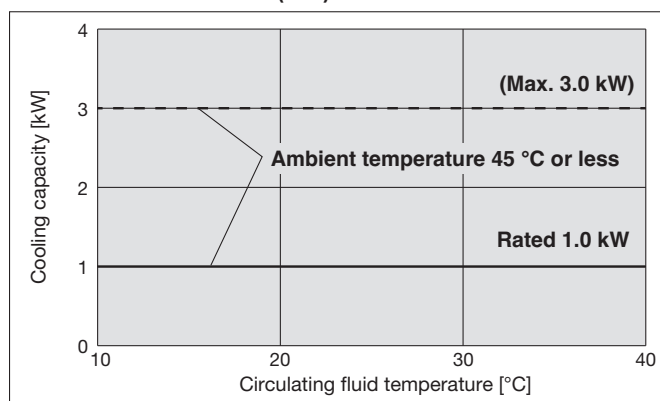
HRLF200-A ☐ -40-T2 (CH1)\*



HRLF200-W ☐ -40-T2 (CH1)\*1



HRLF ☐ -A/W ☐ -40-T2 (CH2)\*2



\*1 This is the cooling capacity of the CH1 side when 1 kW heat load is applied to the CH2 side.

\*2 Up to 3.0 kW. However, when 3.0 kW heat load is applied, the cooling capacity of CH1 will decrease by 2.0 kW.

# ***HRLF Series***

## **Optional Accessories**

### **Consumables List**

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Part no.	Description	Qty.	Note
<b>HRS-S0213</b>	Dustproof filter (Lower)	1	For HRLF200-A: 2 pcs. are used per unit.
<b>HRS-S0214</b>	Dustproof filter (Upper)	1	For HRLF200-A: 2 pcs. are used per unit.
<b>HRS-PF006</b>	Particle filter element	1	Common to each model: For CH1
<b>EJ202S-005X11</b>	Particle filter element	1	Common to each model: For CH2
<b>HRR-DF001</b>	DI filter replacement cartridge	1	Common to each model: For CH2
<b>HRR-DF002</b>	DI filter replacement cartridge	1	Common to each model: For CH1 Option D1 only

# 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**: 20 [kW]

$$Q = P = 20 \text{ [kW]}$$

Cooling capacity = Considering a safety factor of 20 %,  $20 \text{ [kW]} \times 1.2 = 24 \text{ [kW]}$

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

Power supply output **VI**: 20 [kVA]

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

In this example, using a power factor of 0.85:

$$= 20 \text{ [kVA]} \times 0.85 = 17 \text{ [kW]}$$

Cooling capacity = Considering a safety factor of 20 %,  $17 \text{ [kW]} \times 1.2 = 20.4 \text{ [kW]}$

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

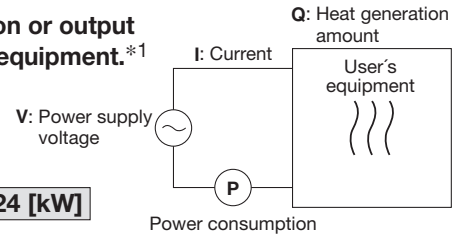
Output (shaft power, etc.) **W**: 13 [kW]

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

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 %,  $18.6 \text{ [kW]} \times 1.2 = 22.3 \text{ [kW]}$



\*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.

#### ④ Calculate based on the laser output.

Laser output power 6 [kW], conversion efficiency 30 %

The oscillator's power consumption is,

$$6 \text{ [kW]} \div 0.3 = 20 \text{ [kW]}$$

The cooling capacity required for the oscillator is,

$$20 \text{ [kW]} - 6 \text{ [kW]} = 14 \text{ [kW]}$$

Considering a safety factor of 20 %,  $14 \text{ [kW]} \times 1.2 = 16.8 \text{ [kW]}$

### 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.

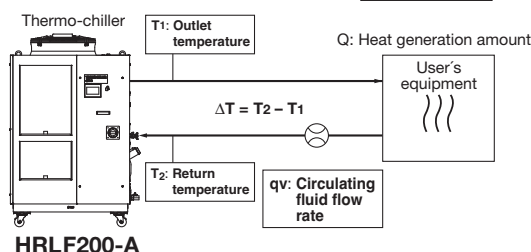
Heat generation amount by user's equipment **Q** : Unknown [W] [(J/s)]  
 Circulating fluid : Tap water\*1  
 Circulating fluid mass flow rate **qm** : (=  $\rho \times qv \div 60$ ) [kg/s]  
 Circulating fluid density  $\rho$  : 1 [kg/L]  
 Circulating fluid (volume) flow rate **qv** : 70 [l/min]  
 Circulating fluid specific heat **C** :  $4.186 \times 10^3$  [J/(kg·K)]  
 Circulating fluid outlet temperature **T1** : 293 [K] (20 [°C])  
 Circulating fluid return temperature **T2** : 297 [K] (24 [°C])  
 Circulating fluid temperature difference  $\Delta T$  : 4 [K] (=  $T_2 - T_1$ )  
 Conversion factor: minutes to seconds (SI units): 60 [s/min]

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

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

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

Cooling capacity = Considering a safety factor of 20 %,  $19.5 \text{ [kW]} \times 1.2 = 23.4 \text{ [kW]}$



### 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** : (=  $\rho \times qv \times 60$ ) [kgf/h]  
 Circulating fluid weight volume ratio  $\gamma$ : 1 [kgf/L]  
 Circulating fluid (volume) flow rate **qv** : 70 [l/min]  
 Circulating fluid specific heat **C** :  $1.0 \times 10^3$  [cal/(kgf·°C)]  
 Circulating fluid outlet temperature **T1**: 20 [°C]  
 Circulating fluid return temperature **T2**: 24 [°C]  
 Circulating fluid temperature difference  $\Delta T$ : 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 %,  $19.5 \text{ [kW]} \times 1.2 = 23.4 \text{ [kW]}$

## 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** : (=  $\rho \times V$ ) [kg]  
 Cooled substance density  $\rho$  : 1 [kg/L]  
 Cooled substance total volume **V** : 250 [L]  
 Cooled substance specific heat **C** :  $4.186 \times 10^3$  [J/(kg·K)]  
 Cooled substance temperature when cooling begins **T<sub>0</sub>** : 305 [K] (32 [°C])  
 Cooled substance temperature after t hour **T<sub>t</sub>** : 293 [K] (20 [°C])  
 Cooling temperature difference  $\Delta T$  : 12 [K] (=  $T_0 - T_t$ )  
 Cooling time  $\Delta t$  : 900 [s] (= 15 [min])

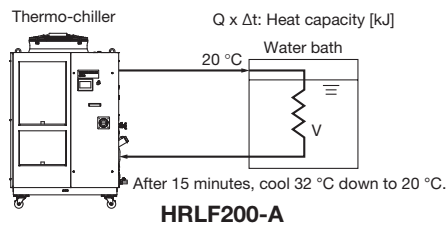
\* Refer to the following for the typical physical property values by circulating fluid.

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

$$= \frac{1 \times 250 \times 4.186 \times 10^3 \times 12}{900} = 13953 \text{ [J/s]} \approx 14.0 \text{ [kW]}$$

Cooling capacity = Considering a safety factor of 20 %,

$$14.0 \text{ [kW]} \times 1.2 = 16.8 \text{ [kW]}$$



### 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** : (=  $\rho \times V$ ) [kgf]  
 Cooled substance weight volume ratio  $\gamma$  : 1 [kgf/L]  
 Cooled substance total volume **V** : 250 [L]  
 Cooled substance specific heat **C** :  $1.0 \times 10^3$  [cal/(kgf·°C)]  
 Cooled substance temperature when cooling begins **T<sub>0</sub>** : 32 [°C]  
 Cooled substance temperature after t hour **T<sub>t</sub>** : 20 [°C]  
 Cooling temperature difference  $\Delta T$  : 12 [°C] (=  $T_0 - T_t$ )  
 Cooling time  $\Delta t$  : 15 [min]  
 Conversion factor: hours to minutes : 60 [min/h]  
 Conversion factor: kcal/h to kW : 860 [(cal/h)/W]

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

$$= \frac{1 \times 250 \times 60 \times 1.0 \times 10^3 \times 12}{15 \times 860}$$

$$\approx 13953 \text{ [W]} = 14.0 \text{ [kW]}$$

Cooling capacity = Considering a safety factor of 20 %,

$$14.0 \text{ [kW]} \times 1.2 = 16.8 \text{ [kW]}$$

\* 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 catalogue uses the following values for density and specific heat in calculating the required cooling capacity.

Density  $\rho$ : 1 [kg/L] (or, using conventional units, weight volume ratio  $\gamma = 1$  [kgf/L])

Specific heat **C**:  $4.19 \times 10^3$  [J/(kg·K)] (or, using conventional units,  $1 \times 10^3$  [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 $\rho$ [kg/L]	Specific heat <b>C</b> [J/(kg·K)]	Conventional units	
			Weight volume ratio $\gamma$ [kgf/L]	Specific heat <b>C</b> [cal/(kgf·°C)]
5 °C	1.00	$4.2 \times 10^3$	1.00	$1 \times 10^3$
10 °C	1.00	$4.19 \times 10^3$	1.00	$1 \times 10^3$
15 °C	1.00	$4.19 \times 10^3$	1.00	$1 \times 10^3$
20 °C	1.00	$4.18 \times 10^3$	1.00	$1 \times 10^3$
25 °C	1.00	$4.18 \times 10^3$	1.00	$1 \times 10^3$
30 °C	1.00	$4.18 \times 10^3$	1.00	$1 \times 10^3$
35 °C	0.99	$4.18 \times 10^3$	0.99	$1 \times 10^3$
40 °C	0.99	$4.18 \times 10^3$	0.99	$1 \times 10^3$



## HRLF Series

# Specific Product Precautions 1

Be sure to read this before handling the products. Refer to the back cover for safety instructions. For temperature control equipment precautions, refer to the “Handling Precautions for SMC Products” and the “Operation Manual” on the SMC website: <https://www.smc.eu>

### Design

#### Warning

##### 1. This catalogue shows the specifications of a single unit.

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

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

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

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

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

##### 4. This product uses a slightly flammable refrigerant (R454C). Avoid using this product in proximity to open flames.

Ensure compliance with local laws and regulations regarding the use and application of this product.

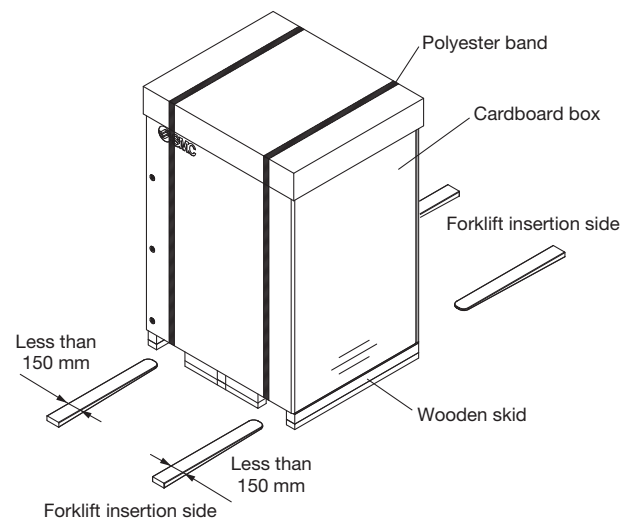


### Transportation / Carriage / Movement

#### Warning

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

The product will be delivered in the packaging shown below.



#### <Weights and Dimensions When Packaged>

Model	Weight [kg]	Dimensions [mm]
HRLF200-A□-40	344	Height 2020 x Width 1200 x Depth 893
HRLF200-W□-40	334	

##### 2. Transporting with forklift

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



# HRLF Series

## Specific Product Precautions 2

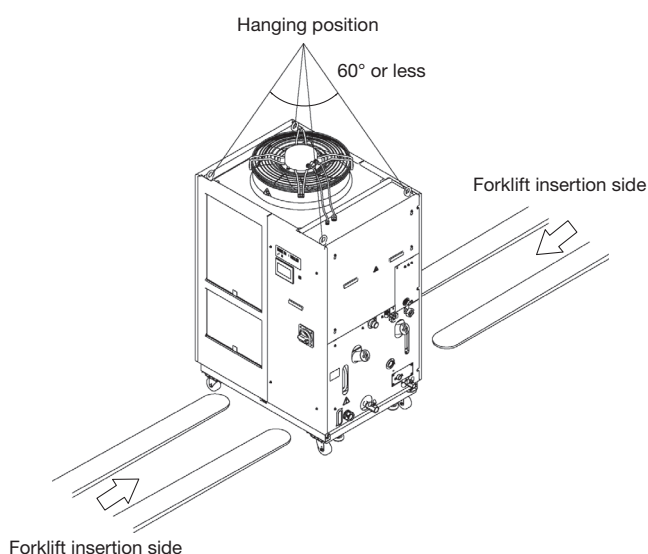
Be sure to read this before handling the products. Refer to the back cover for safety instructions. For temperature control equipment precautions, refer to the “Handling Precautions for SMC Products” and the “Operation Manual” on the SMC website: <https://www.smc.eu>

### Transportation / Carriage / Movement

## Warning

### 3. Hanging transportation

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



Forklift insertion side

HRLF200-A-20

### 4. Transporting with 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.
- 4) Do not get across steps with casters.

### 5. This product cannot be transported by air as this product uses a slightly flammable refrigerant (R454C).

## Caution

If this product is to be transported after delivery, please use the original packaging the product was delivered in. If other packaging is to be used, carefully package the product so as to prevent the product from incurring any damage during transport.

### Refrigerant with GWP reference

Refrigerant	Global Warming Potential (GWP)		
	Regulation (EU) 2024/573, AIM Act 40 CFR Part 84	Fluorocarbon Emissions Control Act (Japan) GWP value labeled on products	GWP value to be used for reporting the calculated amount of leakage
R134a	1,430	1,430	1,300
R404A	3,922	3,920	3,940
R407C	1,774	1,770	1,620
R410A	2,088	2,090	1,920
R448A	1,386	1,390	1,270
R454C	146	145	146




\*1 This product is hermetically sealed and contains fluorinated greenhouse gases.

\*2 For refrigerant type used in this product, refer to the product specifications.



## 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) <sup>1)</sup>, and other safety regulations.

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

- 1) ISO 4414: Pneumatic fluid power – General rules and safety requirements for systems and their components.  
ISO 4413: Hydraulic fluid power – General rules and safety requirements for systems and their components.  
IEC 60204-1: Safety of machinery – Electrical equipment of machines. (Part 1: General requirements)  
ISO 10218-1: Robots and robotic devices - Safety requirements for industrial robots - Part 1: Robots.  
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 catalogue 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. Our products cannot be used beyond their specifications. Our products are not developed, designed, and manufactured to be used under the following conditions or environments.

**Use under such conditions or environments is not covered.**

1. Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.
2. Use for nuclear power, railways, aviation, space equipment, ships, vehicles, military application, equipment affecting human life, body, and property, fuel equipment, entertainment equipment, emergency shut-off circuits, press clutches, brake circuits, safety equipment, etc., and use for applications that do not conform to standard specifications such as catalogues and operation manuals.
3. Use for interlock circuits, except for use with double interlock such as installing a mechanical protection function in case of failure. Please periodically inspect the product to confirm that the product is operating properly.

### Caution

**We develop, design, and manufacture our products to be used for automatic control equipment, and provide them for peaceful use in manufacturing industries.**

**Use in non-manufacturing industries is not covered.**

Products we manufacture and sell cannot be used for the purpose of transactions or certification specified in the Measurement Act.

The new Measurement Act prohibits use of any unit other than SI units in Japan.

## 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. <sup>2)</sup> 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 catalogue 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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