

# Thermoelectric Bath

Series **HEB**

● Accurately controls the temperature of liquid in the bath.

Temperature stability:  $\pm 0.018^{\circ}\text{F}$

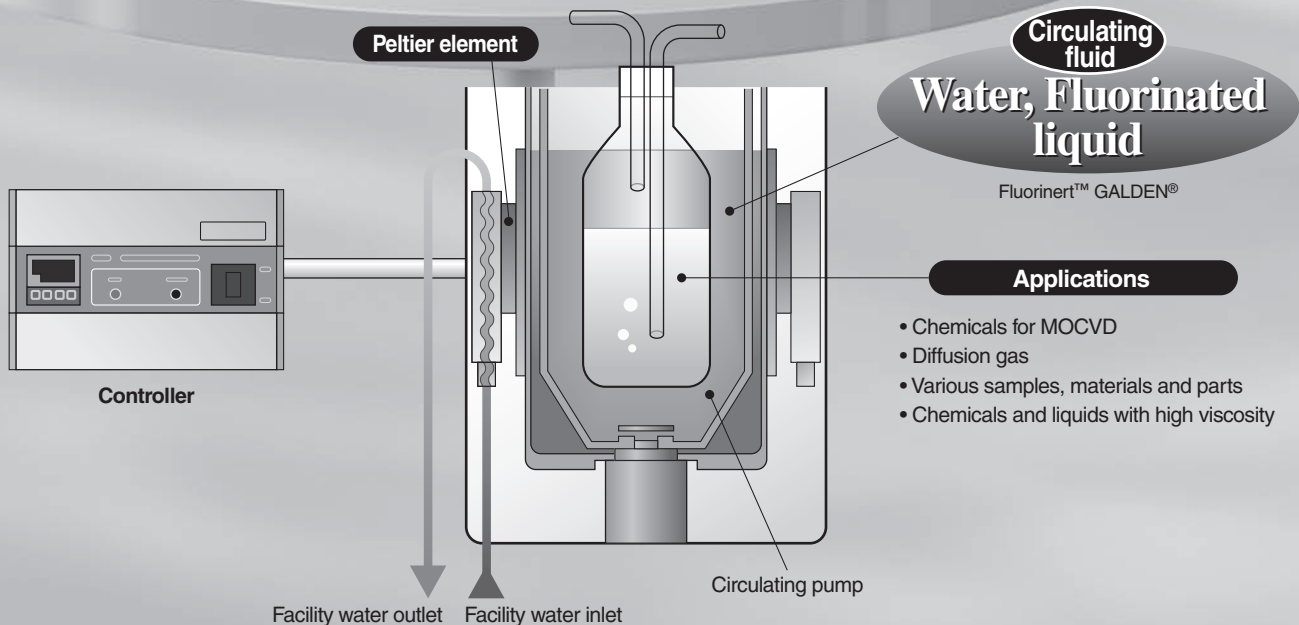
Temperature distribution:  $\pm 0.036^{\circ}\text{F}$  in the bath



- Environmentally friendly and refrigerant-free
- Heaterless
- Function to detect abnormal heating and temperature sensor errors comes standard.
- Light and compact
- Greatly reduced vibration and operating noise when compared with the refrigerated type.

W7.9 IN X H13.1 X D8.1 IN  
W200 x H332 x D207

W9.8 in x H 7.1 in x D13.4 in  
W250 mm x H180 mm x D340 mm

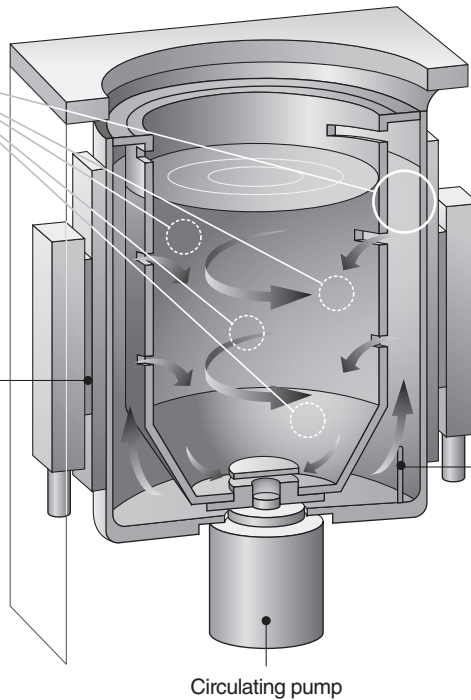


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| HRG              |
| HRS              |
| HRZ              |
| HRZD             |
| HRW              |
| HEC              |
| <b>HEB</b>       |
| HED              |
| Technical Data   |
| Related Products |

## Features

Exclusively developed dual tank construction to provide consistent temperature at any position in the bath

**Peltier element**  
(Thermo-module, Thermoelectric device)



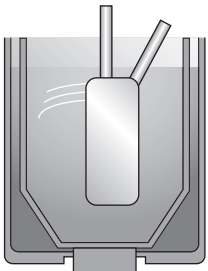
**Temperature sensor**

- Accurate display by measuring the circulating fluid with a temperature sensor directly

Circulating pump

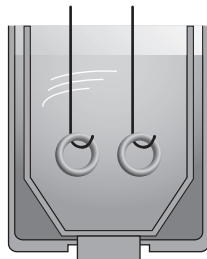
## Application Examples

### Semiconductor



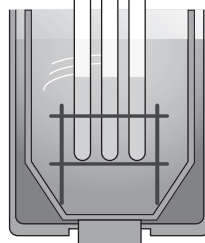
Evaporation of chemicals for MOCVD  
Temperature control of diffusion gas

### Various tests



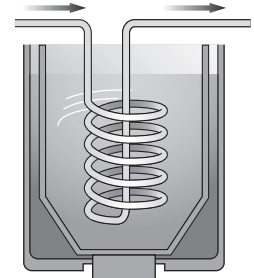
Thermal test with immersion

### Physical and chemical analysis



Temperature control of various samples, materials and parts

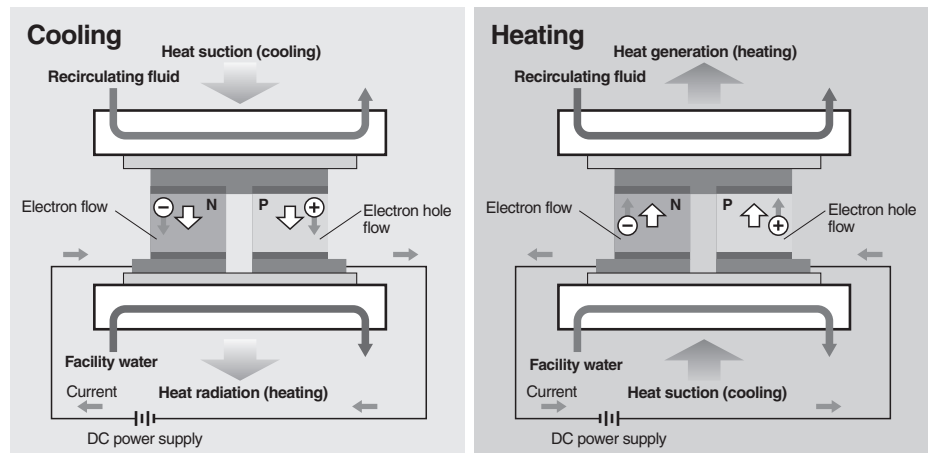
### Various chemical processes



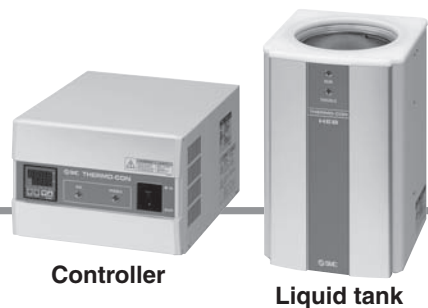
Indirect temperature control of chemicals and liquids with high viscosity

## Principle of Peltier Device (Thermo-module, Thermoelectric device)

A Peltier device (thermo-module, thermoelectric device) is a plate type element, inside which P-type semiconductors and N-type semiconductors are located alternately. If direct current is supplied to the Peltier device, heat is transferred inside the device, and one face generates heat and increases temperature while the other face sucked heat and decreases temperature. Therefore, changing the direction of the current supplied to the Peltier device can achieve heating and cooling operation. This method has a fast response and can shift quickly between heating and cooling, so temperature can be controlled very precisely.

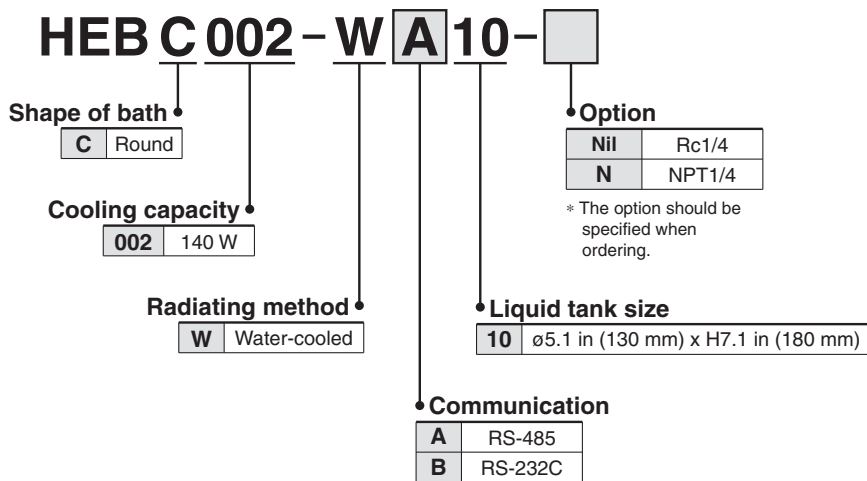


# Peltier-Type Thermoelectric Bath Series *HEB*

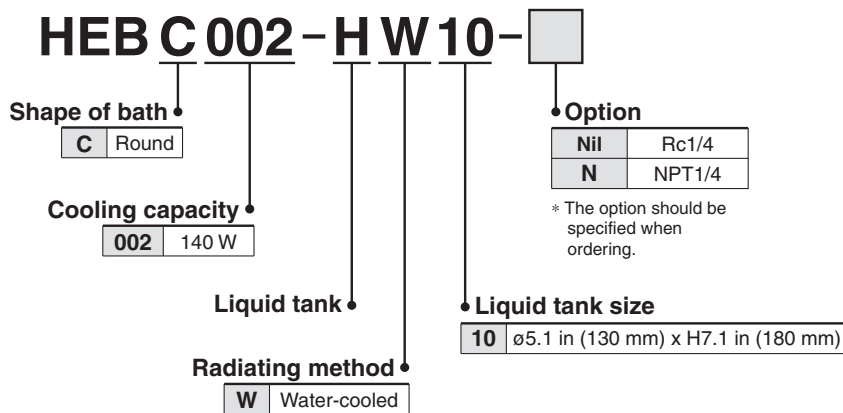


## How to Order

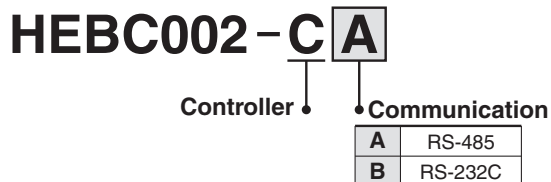
### Combination (Controller + Liquid tank)



### Liquid tank



### Controller



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| HRG              |
| HRS              |
| HRZ              |
| HRZD             |
| HRW              |
| HEC              |
| <b>HEB</b>       |
| HED              |
| Technical Data   |
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# Series HEB

## Specifications (For details, please consult our "Product Specifications" information.)

| Model                               |                                                                                 | HEBC002-WA10                                                                                                                                   | HEBC002-WB10 |
|-------------------------------------|---------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Cooling method</b>               |                                                                                 | Peltier device (Thermo-module, Thermoelectric device)                                                                                          |              |
| <b>Radiating method</b>             |                                                                                 | Liquid tank: Water-cooled, Controller: Forcible air-cooled                                                                                     |              |
| <b>Control method</b>               |                                                                                 | Cooling/Heating automatic shift PID control                                                                                                    |              |
| <b>Ambient temperature/humidity</b> |                                                                                 | 50 to 95°F (10 to 35°C), 35 to 80%RH                                                                                                           |              |
| <b>Circulating fluid system</b>     | <b>Application fluid</b> <sup>Note 1)</sup>                                     | Clear water, Fluorinated liquid (Fluorinert™ FC-3283, GALDEN® HT135, HT200)                                                                    |              |
|                                     | <b>Set temperature range</b> <sup>Note 1) Note 5)</sup>                         | 5.0 to 140.0 °F (-15.0 to 60.0°C) (41 to 140°F (5 to 60°C for water))                                                                          |              |
|                                     | <b>Cooling capacity</b> <sup>Note 2)</sup>                                      | 140 W (Water)                                                                                                                                  |              |
|                                     | <b>Heating capacity</b> <sup>Note 2)</sup>                                      | 300 W (Water)                                                                                                                                  |              |
|                                     | <b>Temperature stability</b> <sup>Note 3)</sup>                                 | ±0.017°F ( ±0.01°C)                                                                                                                            |              |
|                                     | <b>Temperature distribution</b> <sup>Note 3)</sup>                              | ±0.036°F ( ±0.02°C)                                                                                                                            |              |
|                                     | <b>Tank dimensions</b>                                                          | Internal diameter ø130 x Liquid level 188 mm                                                                                                   |              |
| <b>Facility water system</b>        | <b>Temperature</b>                                                              | 50 to 95°F (10 to 35°C) (no condensation)                                                                                                      |              |
|                                     | <b>Pressure range</b>                                                           | Within 73 psi (0.5 MPa)                                                                                                                        |              |
|                                     | <b>Flow rate</b> <sup>Note 4)</sup>                                             | 0.8 to 1.3 gpm (3 to 5 L/min)                                                                                                                  |              |
|                                     | <b>Port size</b>                                                                | IN/OUT: Rc1/4                                                                                                                                  |              |
|                                     | <b>Wetted parts material</b>                                                    | Stainless steel 303, Stainless steel 304, FEP, A6063 (anodized)                                                                                |              |
| <b>Electrical system</b>            | <b>Power supply</b>                                                             | Single-phase 100 to 240 VAC, 50/60 Hz                                                                                                          |              |
|                                     | <b>Overcurrent protector</b>                                                    | 10 A                                                                                                                                           |              |
|                                     | <b>Current consumption</b>                                                      | 4 A (100 VAC) to 2 A (240 VAC)                                                                                                                 |              |
|                                     | <b>Alarm (With alarm output connector)</b>                                      | 1) Overheating of liquid tank (which activates the thermostat)<br>2) Controller output voltage reduction<br>3) Controller fan rotation stopped |              |
|                                     | <b>Communications</b>                                                           | RS-485                                                                                                                                         | RS-232C      |
| <b>Weight</b>                       | Liquid tank: Approx. 18.7 lbs (8.5 kg)<br>Controller: Approx. 14.3 lgs (6.5 kg) |                                                                                                                                                |              |
| <b>Accessories</b>                  | Power cable (2 m), DC cable, Signal cable (3 m each)                            |                                                                                                                                                |              |
| <b>Safety standards</b>             | CE marking, UL (NRTL) standard                                                  |                                                                                                                                                |              |

Note 1) GALDEN® is a trademark of Solvay Solexis and Fluorinert™ is a trademark of 3M. For other fluids, please contact SMC.

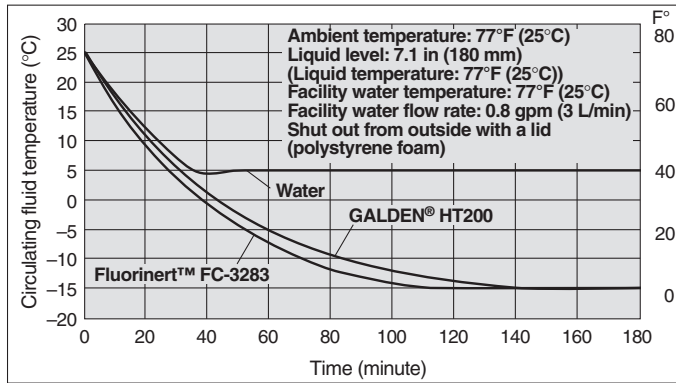
Note 2) Determined under the following conditions: water as the recirculating fluid, set temperature 77°F (25°C), facility water temperature 77°F (25°C), flow rate 0.8 gpm (3 L/min), ambient temperature 77°F (25°C), and sealed from outside air with a lid.

Note 3) Differs depending on the operating conditions.

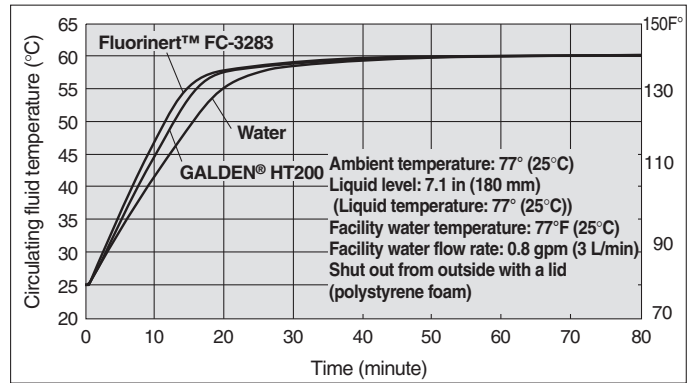
Note 4) An appropriate range is from 0.8 to 1.3 gpm (3 to 5 L/min). To prevent damage to the radiating system, do not supply a flow over the maximum flow rate of 2.11 gpm (8 L/min).

Note 5) When the temperature is set high, the liquid temperature inside of the liquid tank and the temperature inside of the thermostat could differ greatly depending on the heating mode at start-up, and the thermostat could then begin operating and stop the output. Confirm that there is no problem by carrying out an operating test beforehand.

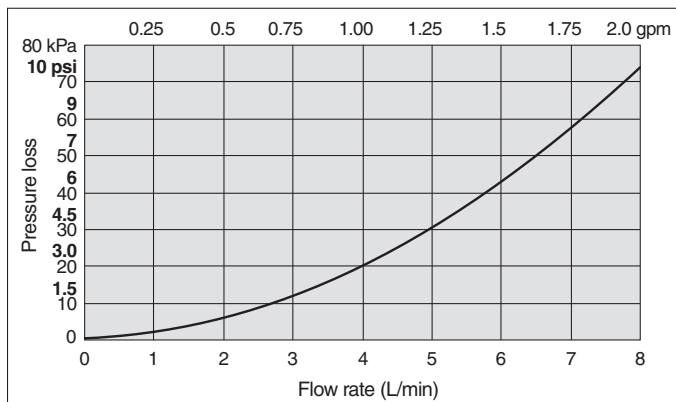
## Cooling Capacity



## Heating Capacity

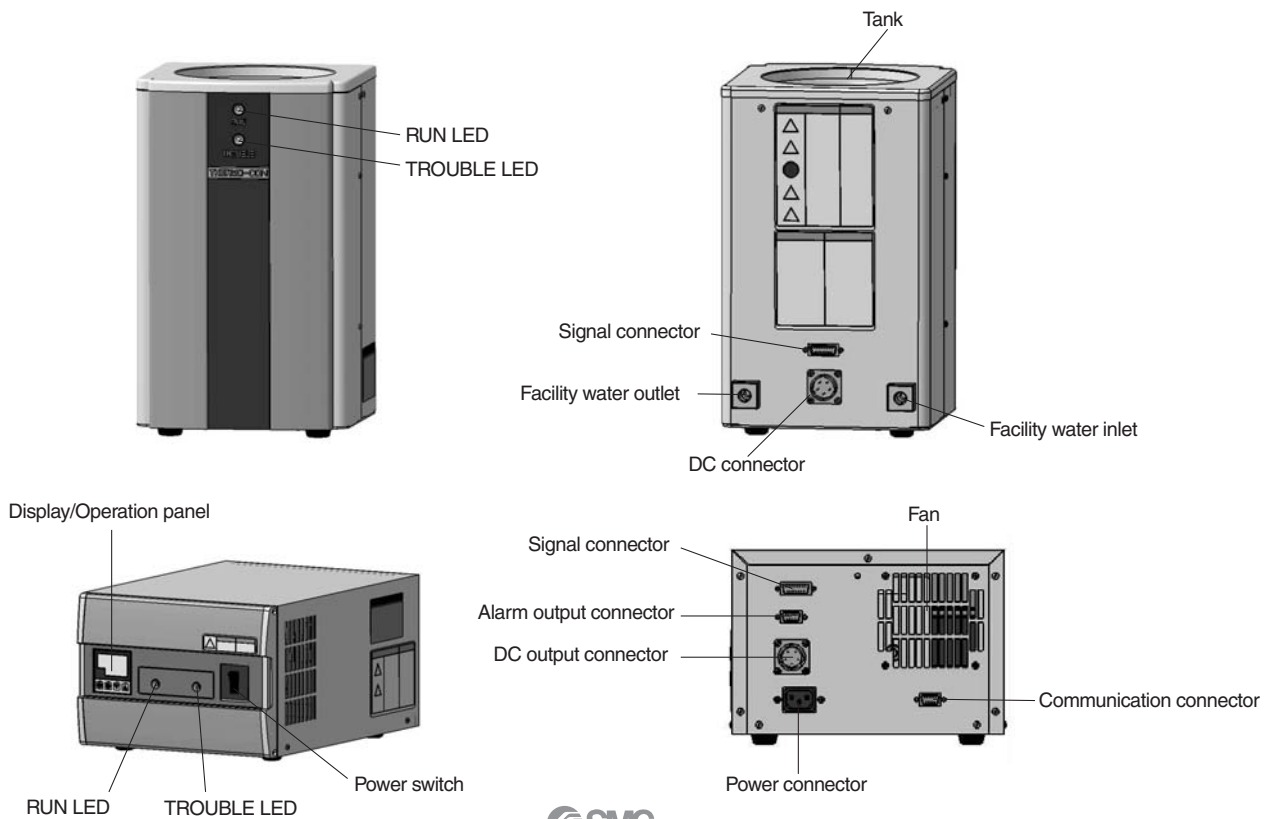


## Pressure Loss in Facility Water Circuit



The values shown on the performance chart are not guaranteed, but typical. Allow margins for safety when selecting the model.

## Parts Description



HRG

HRH

HRZ

HRZD

HRW

HEC

**HEB**

HED

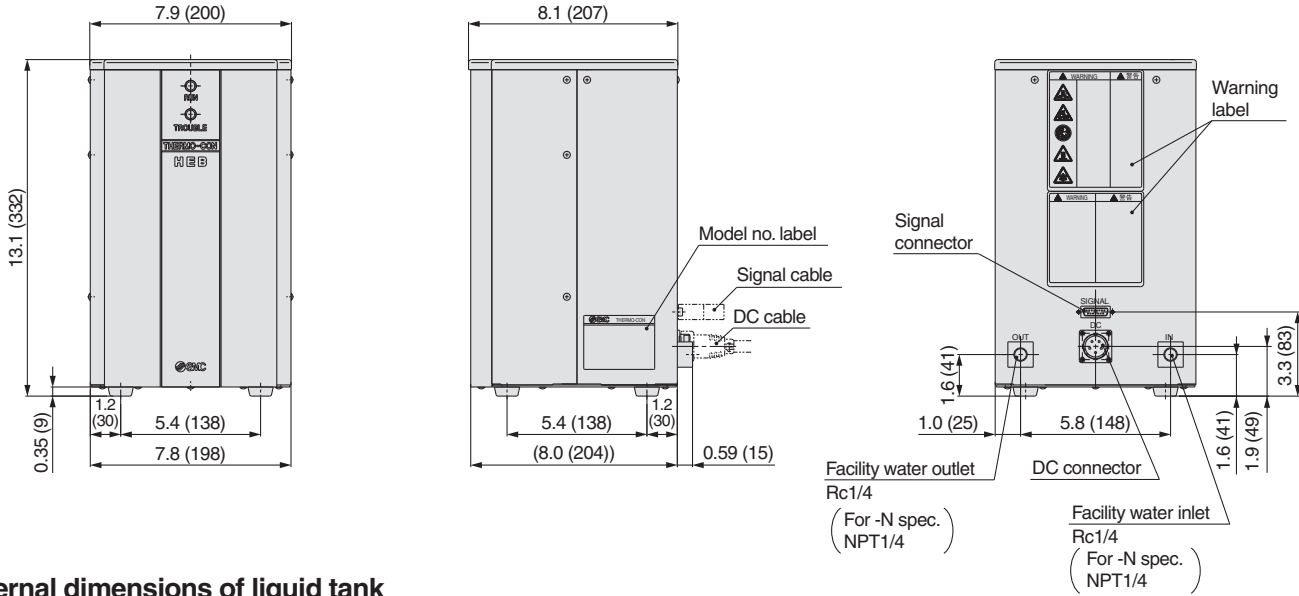
Technical Data

Related Products

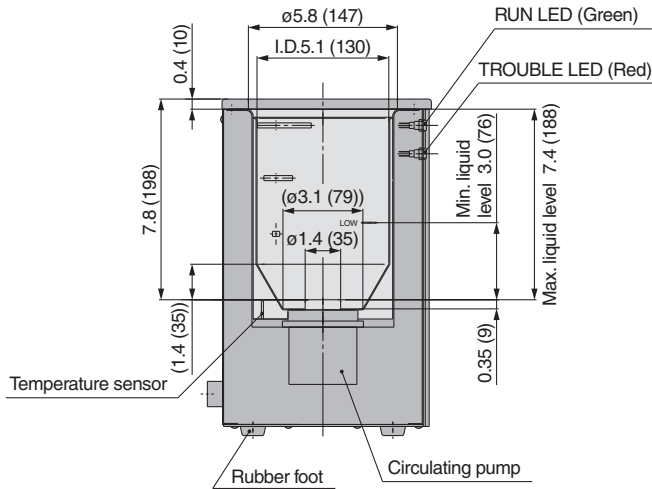
# Series HEB

## Dimensions

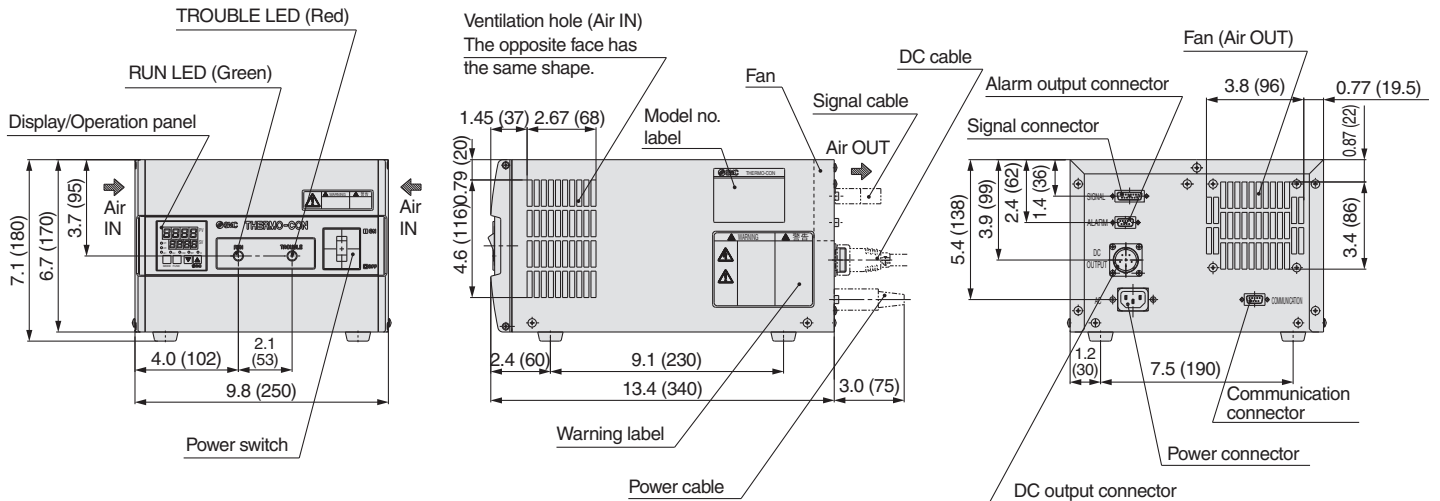
### Liquid tank



### Internal dimensions of liquid tank



### Controller



## Connectors

### Water Bath and Controller Connection

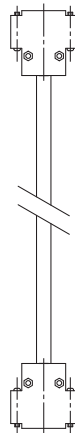
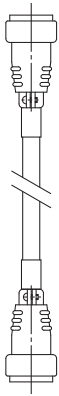
#### ■ Connector for water baths

|                                                                                          |                                                                                                  |
|------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| DC connector (male connector)<br>Nanaboshi Electric Mfg. Co., Ltd.:<br>NJC-245-RM UL CSA | Signal connector (male connector)<br>Hirose Electric Co., Ltd.:<br>CDA-15P<br>Holding screw M2.6 |
|------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|



#### ■ Connection cable

|                                                                                         |                                                                                                 |
|-----------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| DC cable<br>Nanaboshi Electric Mfg. Co., Ltd.:<br>NJC-245-PF UL CSA<br>Female connector | Signal cable<br>Hirose Electric Co., Ltd.:<br>CDA-15S<br>Holding screw M2.6<br>Female connector |
|-----------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|

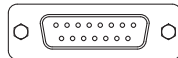
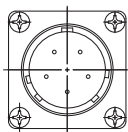


|                                                                           |                                                                               |
|---------------------------------------------------------------------------|-------------------------------------------------------------------------------|
| Male connector<br>Nanaboshi Electric Mfg. Co., Ltd.:<br>NJC-245-PM UL CSA | Male connector<br>Hirose Electric Co., Ltd.:<br>CDA-15P<br>Holding screw M2.6 |
|---------------------------------------------------------------------------|-------------------------------------------------------------------------------|



#### ■ Connector for controllers

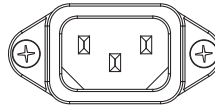
|                                                                                            |                                                                                                    |
|--------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| DC connector (female connector)<br>Nanaboshi Electric Mfg. Co., Ltd.:<br>NJC-245-RF UL CSA | Signal connector (female connector)<br>Hirose Electric Co., Ltd.:<br>CDA-15S<br>Holding screw M2.6 |
|--------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|



### Power Cable Connection

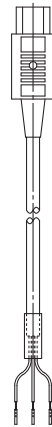
#### ■ Connector for controllers

|                                                                   |
|-------------------------------------------------------------------|
| Power connector<br>IEC 60320 C-14 or equivalent<br>Male connector |
|-------------------------------------------------------------------|



#### ■ Power cable

|                                                                    |
|--------------------------------------------------------------------|
| Connector side<br>IEC 60320 C-13 or equivalent<br>Female connector |
|--------------------------------------------------------------------|



AWG14

|              | Signal contents    |
|--------------|--------------------|
| Black 1      | 100 to 240 VAC (L) |
| Black 2      | 100 to 240 VAC (N) |
| Green/Yellow | PE                 |

### Connector for External Equipment

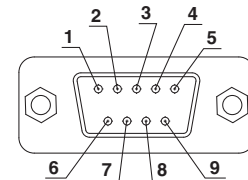
Connectors that fit with a communication connector and an alarm output connector should be prepared by customer.

#### ■ Alarm output connector

Hirose Electric Co., Ltd.: CDE-9P  
Holding screw M2.6

Fitting connector: CDE-9S or equivalent

| Pin No. | Signal contents                                                                    |
|---------|------------------------------------------------------------------------------------|
| 1       | Contact for upper/lower temperature limit deviation alarm (open when alarm occurs) |
| 2       | Upper/lower temperature limit deviation alarm common                               |
| 3-4     | Unused                                                                             |
| 5       | Contact for output cut-off alarm (open when alarm occurs)                          |
| 6       | Common for output cut-off alarm                                                    |
| 7-9     | Unused                                                                             |



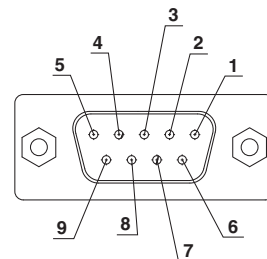
Alarm output connector  
D-sub 9 pin (male type)

#### ■ Communication connector

Hirose Electric Co., Ltd.: CDE-9S  
Holding screw M2.6

Fitting connector: CDE-9P or equivalent

| Pin No. | Signal contents |              |
|---------|-----------------|--------------|
|         | HEBC002-WA10    | HEBC002-WB10 |
| 1       | RS-485 T/R (A)  | Unused       |
| 2       | RS-485 T/R (B)  | RS-232C RX   |
| 3       | Unused          | RS-232C TX   |
| 4       | Unused          | Unused       |
| 5       | Unused          | RS-232C SG   |
| 6-9     | Unused          | Unused       |



Communication connector  
D-sub 9 pin (female type)

## Maintenance

Maintenance of this unit is performed only in the form of return to and repair at SMC's site. As a rule, SMC will not conduct on-site maintenance. Separately, the following parts have a limited life and need to be replaced before the life ends.

#### Parts Life Expectation

| Description      | Expected life | Possible failure                                                                                                                                                                                                                                                                    |
|------------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Circulating pump | 3 to 5 years  | The circulating fluid cannot be fed due to worn bearing and/or insufficient capacity of electrolytic capacitor, which results in temperature controlling failure.                                                                                                                   |
| Fan              | 5 to 10 years | The capacity of the fan lowers due to the end of lubricating performance of the bearing, which results in increase of internal temperature of the Controller. The overheat protective function at the inside of the power supply starts, the output stops and the display goes off. |
| DC power supply  | 5 to 10 years | Abnormal voltage is generated and the display goes off due to insufficient capacity of electrolytic capacitor.                                                                                                                                                                      |



# Series HEB Specific Product Precautions 1

Be sure to read this before handling. Refer to back page 1 for Safety Instructions and back pages 2 to 5 for Temperature Control Equipment Precautions.

## System Design

### Warning

- The catalog shows the specifications of the Thermoelectric Bath.**
  - Check detailed specifications in the separate "Product Specifications", and evaluate the compatibility of the Thermoelectric Bath with customer's system.
  - The Thermoelectric Bath is equipped with a protective circuit independently, but the whole system should be designed by the customer to ensure safety.

## Handling

### Warning

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

## Operating Environment/Storage Environment

### Warning

- Avoid using the Thermoelectric Bath in an environment where it could be splashed by fluids (including mist) such as water, salt water, oil, chemicals, or solvents.**
- The Thermoelectric Bath is not designed for clean room usage.**  
It generates dust from the pump inside the tank and the cooling fan in the controller.
- Low molecular siloxane can damage the contact of the relay.**  
Use the Thermoelectric Bath in a place free from low molecular siloxane.
- Reserve a space of 1.97 inch (50 mm) or more at the ventilation hole of the controller.**

## Radiation Air

### Caution

- The ventilation hole for radiation air must not be exposed to particles and dust as far as possible.**
- Do not let the inlet and outlet for radiation air get closed.**  
If radiation is prevented, the internal power supply will overheat, causing the protective circuit to be activated and stopping the Thermoelectric Bath.
- If more than one Thermoelectric Bath is used, consider their arrangement so that the down-stream sides of the Thermoelectric Bath suck radiation air from the upstream sides.**

## Circulating Fluid

### Caution

- Do not use fluids other than those described in the specification.**  
Otherwise, the pump will be overloaded and may break. If such a fluid is used, please contact SMC beforehand.
- The Thermoelectric Bath must not be operated without circulating fluid.**  
The pump breaks by empty driving.
- The circulating fluid may evaporate, lowering the level in the tank.**  
Significant reduction of the fluid level can break the circulating pump as well as causing the performance to deteriorate. Use with appropriate liquid level at all times.

## Circulating Fluid

### Caution

- The pump can be broken by foreign objects entering the circulating pump.**  
Control to prevent any foreign object from entering the fluid. If the fluid is fluorinated liquid and it is set to a temperature below freezing point, steam from the atmosphere will form ice (frost) when entering the fluid. Be sure to remove this ice (frost) regularly.
- If water is used for the circulating fluid, set its temperature to over or more 41°F (5°C) to prevent it from being frozen.**
- Clear Water (as Circulating Water) Quality Standards**

### Facility Water Quality Standard

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

|                | Item                                               | Unit    | Standard value          | Influence |                  |
|----------------|----------------------------------------------------|---------|-------------------------|-----------|------------------|
|                |                                                    |         |                         | Corrosion | Scale generation |
| Standard item  | pH (at 77°F (25°C))                                | —       | 6.0 to 8.0              | ○         | ○                |
|                | Electrical conductivity (77°F (25°C))              | [μS/cm] | 100* to 300*            | ○         | ○                |
|                | Chloride ion (Cl <sup>-</sup> )                    | [mg/L]  | 50 or less              | ○         |                  |
|                | Sulfuric acid ion (SO <sub>4</sub> <sup>2-</sup> ) | [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 <sub>3</sub> )              | [mg/L]  | 50 or less              |           | ○                |
| Reference item | Ionic state silica (SiO <sub>2</sub> )             | [mg/L]  | 30 or less              |           | ○                |
|                | Iron (Fe)                                          | [mg/L]  | 0.3 or less             | ○         | ○                |
|                | Copper (Cu)                                        | [mg/L]  | 0.1 or less             | ○         |                  |
|                | Sulfide ion (S <sub>2</sub> <sup>-</sup> )         | [mg/L]  | Should not be detected. | ○         |                  |
|                | Ammonium ion (NH <sub>4</sub> <sup>+</sup> )       | [mg/L]  | 0.1 or less             | ○         |                  |
|                | Residual chlorine (Cl)                             | [mg/L]  | 0.3 or less             | ○         |                  |
|                | Free carbon (CO <sub>2</sub> )                     | [mg/L]  | 4.0 or less             | ○         |                  |

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

○: Factors that have an effect on corrosion or scale generation.

• Even if the water quality standards are met, complete prevention of corrosion is not guaranteed.

## Facility Water

### Caution

- The maximum operating pressure of facility water is 73 psi (0.5 MPa).**  
If this value is exceeded, the internal piping of the tank can break, causing leakage of facility water.
- Do not supply a flow rate of 8 L/min or more which can break the facility water piping.**
- Appropriate range of the flow rate of the facility water is 0.8 to 1.3 gpm (3 to 5 L/min).**  
Flow rate higher than this range will not slightly affect the cooling and heating capacity. However, a flow rate below 0.8gpm (3 L/min) will reduce the cooling and heating capacity significantly.

## Communication

### Caution

- The set value can be written to EEPROM, but only up to approx. 100,000 times.**  
In particular, pay attention to how many of times the writing is performed using the communication function.





# Series HEB

## Specific Product Precautions 2

Be sure to read this before handling. Refer to back page 1 for Safety Instructions and back pages 2 to 5 for Temperature Control Equipment Precautions.

### Maintenance

#### Warning

##### 1. Prevention of electric shock and fire

Do not operate the switch with wet hands. Also, do not operate the Thermoelectric Bath with water or fluid left on it.

##### 2. Action in the case of error

If any error such as abnormal sounds, smoke, or bad smell occurs, cut off the power at once, and stop supplying facility water. Please contact SMC or a sales distributor to repair the Thermoelectric Bath.

##### 3. Regular inspection

Check the following items at least once a month. The inspection must be done by an operator who has sufficient knowledge and experience.

- a) Check of displayed contents.
- b) Check of temperature, vibration and abnormal sounds in the body of the Thermoelectric Bath.
- c) Check of the voltage and current of the power supply system.
- d) Check for leakage and contamination of the recirculating fluid and intrusion of foreign objects to it.
- e) Check radiation air flow condition and temperature.
- f) Check for leakage, quality change, flow rate and temperature of facility water.

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| HRG              |
| HRS              |
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| HRZD             |
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