Fluororesin heat exchanger allows direct temperature control for chemical liquids!!

Industry-leading withstand pressure 0.35 MPa!!

- With leakage detection function
- Operating temperature range: 10°C to 60°C
- Temperature stability: ±0.1°C
- Cooling capacity (with water): 300 W, 500 W, 750 W
Allows direct control of chemical liquid temperature.

- PFA wetted parts material prevents contamination from metal ion elution.
- No need for a tube-type heat exchanger.

Compact and light

- Self-developed heat exchanger matched to the configuration of the Peltier device (Thermo-module). Compact and light

### Heat Exchanger

<table>
<thead>
<tr>
<th>Model</th>
<th>W</th>
<th>D</th>
<th>H</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>HED003</td>
<td>130</td>
<td>263</td>
<td>170</td>
<td>8 kg</td>
</tr>
<tr>
<td>HED005</td>
<td>150</td>
<td>294</td>
<td>222</td>
<td>14 kg</td>
</tr>
<tr>
<td>HED007</td>
<td>150</td>
<td>294</td>
<td>222</td>
<td>15 kg</td>
</tr>
</tbody>
</table>

The outline dimensions do not include protruding parts such as the foot flange and tube.

### Temperature Controller

<table>
<thead>
<tr>
<th>Model</th>
<th>W</th>
<th>D</th>
<th>H</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>HED003</td>
<td>100</td>
<td>320</td>
<td>215</td>
<td>6 kg</td>
</tr>
<tr>
<td>HED005</td>
<td>140</td>
<td>350</td>
<td>215</td>
<td>8 kg</td>
</tr>
<tr>
<td>HED007</td>
<td>165</td>
<td>447</td>
<td>215</td>
<td>13 kg</td>
</tr>
</tbody>
</table>

The outline dimensions do not include protruding parts such as the foot flange, screw and connector.

### Applications

- Cleaning equipment
- Plating equipment
- Wet etching equipment, etc.

### Applicable Fluid Examples

<table>
<thead>
<tr>
<th>Chemical liquids</th>
<th>Operating temperature range</th>
<th>Chemical liquids</th>
<th>Operating temperature range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deionized water</td>
<td>10 to 60°C</td>
<td>Ammonia hydrogen peroxide solution</td>
<td>10 to 60°C</td>
</tr>
<tr>
<td>Hydrofluoric acid</td>
<td>10 to 40°C</td>
<td>Sodium hydroxide</td>
<td>10 to 60°C</td>
</tr>
<tr>
<td>Sulfuric acid (except fuming sulfuric acid)</td>
<td>10 to 50°C</td>
<td>Ozone water</td>
<td>10 to 60°C</td>
</tr>
<tr>
<td>Copper sulfate solution</td>
<td>10 to 50°C</td>
<td>*</td>
<td></td>
</tr>
</tbody>
</table>

* Chemical Thermo-con is not designed to be explosion proof, so it is not suitable for flammable fluids.
Principle of Peltier Device (Thermo-module, Thermoelectric device)

The Peltier device (thermo-module, thermoelectric device) is plate-shape solid state element with P-type, N-type semiconductor arrayed alternately. When direct current is supplied to the element, heat moves from one surface to another along with electron flow in N-type semiconductor and electron hole in P-type semiconductor. As a result of the heat move, one surface of the element absorbs heat and decrease temperature. And other surface heats up. When the DC current is switched to reverse direction, the heat move will also be reverse direction. Therefore, Peltier element can achieve heating effect as well as cooling effect depending on the current direction. It can achieve high speed switching and precise temperature control.

Construction and Principle

The temperature controller controls the circulating fluid in the heat exchanger. A temperature sensor (platinum resistance temperature detector) installed in the heat exchanger sends a signal to the controller, which changes the temperature of the circulating fluid by adjusting the output direction and energizing time of the built-in DC power supply based on the difference between the set and measured temperatures. This product can be used safely since the sensor to detect leakage of the circulating fluid is installed as a standard device.
## CONTENTS

**HED Series**

### Chemical Thermo-con HED Series

- Model Selection ............................................. Page 490
- How to Order .................................................. Page 491
- Main Specifications .......................................... Page 492
  - Heat Exchanger Specifications ......................... Page 492
  - Temperature Controller Specifications ................. Page 492
- Cooling Capacity ............................................ Page 493
- Heating Capacity ............................................. Page 493
- Pressure Loss in Circulating Fluid Circuit ............... Page 494
- Pressure Loss in Facility Water Circuit .................. Page 494
- Dimensions .................................................... Page 495
- Connectors .................................................... Page 497
- Alarm .......................................................... Page 498
- Maintenance ................................................. Page 498

- **Applicable Fluids** ........................................... Page 499

- Specific Product Precautions ............................... Page 500
Guide to Model Selection

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

Heat generation amount \( Q \): 400 W (at 25°C)

Cooling capacity = Considering a safety factor of 20%, select \( 400 \times 1.2 = 480 \text{ W (at 25°C)} \) or more.

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

\[
Q = \frac{\Delta T \times L \times \gamma \times C}{60 \times 1000}
\]

\[
= \frac{1 \times 7 \times 1 \times 10^3 \times 4.2 \times 10^3}{60 \times 1000}
\]

\[= 490 \text{ W}\]

Cooling capacity = Considering a safety factor of 20%,
\[490 \times 1.2 = 588 \text{ W}\]

Example 3. In cases where cooling the object below a certain temperature and period of time.

Cooled substance total volume \( V \): 20 L

Cooling time \( h \): 15 min

Cooling temperature difference \( \Delta T \): 5°C (5 K)

Circulating fluid : Tap water

\[
\gamma = 1 \times 10^3 \text{ kg/m}^3
\]

\[
C = 4.2 \times 10^3 \text{ J/(kg·K)}
\]

\[
Q = \frac{\Delta T \times V \times \gamma \times C}{h \times 60 \times 1000}
\]

\[
= \frac{5 \times 20 \times 1 \times 10^3 \times 4.2 \times 10^3}{15 \times 60 \times 1000}
\]

\[= 467 \text{ W}\]

Cooling capacity = Considering a safety factor of 20%,
\[467 \times 1.2 = 560 \text{ W}\]

Precautions on Model Selection

The flow rate of the circulating fluid depends on the internal resistance of the user’s equipment and the length, diameter and resistance created by bends in the circulating fluid piping, etc. Check if the required flow rate of circulating fluid can be obtained before using.
Chemical Thermo-con

**HED Series**

**How to Order**

Part Number of Set (Temperature Controller + Heat Exchanger)
- The model numbers of the temperature controller and heat exchanger are printed respectively on the product name label.

**HED** 007 - W 2 B 13
- Tube size
  - 13: 1/2" x 3/8"
  - 19: 3/4" x 5/8"
- Communication
  - A: RS-485
  - B: RS-232C
- Power supply
  - 2: Single-phase 180 to 242 VAC  50/60 Hz

Combination in Set

<table>
<thead>
<tr>
<th>Part number of set</th>
<th>Heat exchanger model</th>
<th>Temperature controller model</th>
</tr>
</thead>
<tbody>
<tr>
<td>HED003-W2A13</td>
<td>HED003-HW13</td>
<td>HED003-C2A</td>
</tr>
<tr>
<td>HED003-W2A19</td>
<td>HED003-HW19</td>
<td>HED003-C2A</td>
</tr>
<tr>
<td>HED003-W2B13</td>
<td>HED003-HW13</td>
<td>HED003-C2B</td>
</tr>
<tr>
<td>HED003-W2B19</td>
<td>HED003-HW19</td>
<td>HED003-C2B</td>
</tr>
<tr>
<td>HED005-W2A13</td>
<td>HED005-HW13</td>
<td>HED005-C2A</td>
</tr>
<tr>
<td>HED005-W2A19</td>
<td>HED005-HW19</td>
<td>HED005-C2A</td>
</tr>
<tr>
<td>HED005-W2B13</td>
<td>HED005-HW13</td>
<td>HED005-C2B</td>
</tr>
<tr>
<td>HED005-W2B19</td>
<td>HED005-HW19</td>
<td>HED005-C2B</td>
</tr>
<tr>
<td>HED007-W2A13</td>
<td>HED007-HW13</td>
<td>HED007-C2A</td>
</tr>
<tr>
<td>HED007-W2A19</td>
<td>HED007-HW19</td>
<td>HED007-C2A</td>
</tr>
<tr>
<td>HED007-W2B13</td>
<td>HED007-HW13</td>
<td>HED007-C2B</td>
</tr>
<tr>
<td>HED007-W2B19</td>
<td>HED007-HW19</td>
<td>HED007-C2B</td>
</tr>
</tbody>
</table>

Heat Exchanger

**HED** 007 - H W 13
- Tube size
  - 13: 1/2" x 3/8"
  - 19: 3/4" x 5/8"
- Radiating method
  - W: Water-cooled

Temperature Controller

**HED** 007 - C 2 B
- Communication
  - A: RS-485
  - B: RS-232C
- Power supply
  - 2: Single-phase 180 to 242 VAC  50/60 Hz

The tube size should be specified when ordering.

- The model numbers of the temperature controller and heat exchanger are printed respectively on the product name label.
### Main Specifications
(For details, please refer to our “Product Specifications” information.)

#### Heat Exchanger Specifications

<table>
<thead>
<tr>
<th>Heat exchanger model</th>
<th>HED003-HW13</th>
<th>HED003-HW19</th>
<th>HED005-HW13</th>
<th>HED005-HW19</th>
<th>HED007-HW13</th>
<th>HED007-HW19</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooling capacity (Water)&lt;sup&gt;1&lt;/sup&gt;</td>
<td>300 W</td>
<td>500 W</td>
<td>600 W</td>
<td>750 W</td>
<td>1000 W</td>
<td>1800 W</td>
</tr>
<tr>
<td>Heating capacity (Water)&lt;sup&gt;1&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooling/Heating method</td>
<td>Pelletier device (Thermoelectric device, Thermo-module)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radiating method</td>
<td>Water-cooled</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>10.0 to 60.0°C (depending on the type of circulating fluid)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circulating fluid</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Applicable fluid&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Deionized water, Hydrofluoric acid, Ammonia hydrogen peroxide solution, etc.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fluid contact material</td>
<td>PFA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating pressure&lt;sup&gt;3&lt;/sup&gt;</td>
<td>0 (atmospheric pressure) to 0.35 MPa</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tube size (PFA tube)</td>
<td>1/2” x 3/8”</td>
<td>3/4” x 5/8”</td>
<td>1/2” x 3/8”</td>
<td>3/4” x 5/8”</td>
<td>1/2” x 3/8”</td>
<td>3/4” x 5/8”</td>
</tr>
<tr>
<td>Facility water</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fluid contact material</td>
<td>FEP, Stainless steel 304, Stainless steel 316</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. operating pressure</td>
<td>0.5 MPa</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tube size</td>
<td>IN/OUT: FEP tube 3/8” x 1/4”</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flow rate</td>
<td>5 to 10 L/min</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient temperature/humidity</td>
<td>Temperature: 10 to 35°C, Humidity: 35 to 80%RH (no condensation)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dimensions&lt;sup&gt;4&lt;/sup&gt;</td>
<td>W130 mm x D263 mm x H170 mm</td>
<td>W150 mm x D294 mm x H222 mm</td>
<td>W150 mm x D294 mm x H222 mm</td>
<td>W150 mm x D294 mm x H222 mm</td>
<td>W150 mm x D294 mm x H222 mm</td>
<td>W150 mm x D294 mm x H222 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>Approx. 8 kg</td>
<td>Approx. 14 kg</td>
<td>Approx. 15 kg</td>
<td>Approx. 15 kg</td>
<td>Approx. 15 kg</td>
<td>Approx. 15 kg</td>
</tr>
<tr>
<td>Applied temperature controller</td>
<td>HED003-C2A</td>
<td>HED003-C2B</td>
<td>HED005-C2A</td>
<td>HED005-C2B</td>
<td>HED007-C2A</td>
<td>HED007-C2B</td>
</tr>
</tbody>
</table>

<sup>1</sup> The conditions are as follows. Circulating fluid: Water (Circulating flow rate 15 L/min, Set temperature 25°C), Facility water temperature 25°C, Facility water flow rate 5 L/min, Ambient temperature 25°C

<sup>2</sup> For the compatibility between the circulating fluid and materials, refer to “Applicable Fluids.”

<sup>3</sup> Note that the Chemical Thermo-con is not designed to be explosion proof so it is not suitable for flammable fluids.

<sup>4</sup> Install the heat exchanger in the discharge side of a circulating pump. Do not use at location where a negative pressure is applied. The circulating fluid pump should be prepared by user.

The outline dimensions do not included protruding parts such as the foot flange and tube.

#### Temperature Controller Specifications

<table>
<thead>
<tr>
<th>Temperature controller model</th>
<th>HED003-C2A</th>
<th>HED003-C2B</th>
<th>HED005-C2A</th>
<th>HED005-C2B</th>
<th>HED007-C2A</th>
<th>HED007-C2B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control method</td>
<td>Cooling/Heating automatic shift PID control</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>10.0 to 60.0°C (no condensation)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature stability&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Within ±0.1°C (with stable load)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature sensor</td>
<td>Resistance thermometer Pt100 Ω, 3-wires, class A, 2 mA (for both internal control sensor and external sensor)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main functions</td>
<td>Auto-tuning, Sensor fine adjustment, Offset, Learning control, External sensor control, Set value memory, Upper/Lower temperature limit alarm, Output shutdown alarm, Remote ON/OFF, Leakage detection</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient temperature/humidity</td>
<td>Temperature: 10 to 35°C, Humidity: 35 to 80%RH (no condensation)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power supply spec.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated current</td>
<td>3 A</td>
<td>5 A</td>
<td>14 A</td>
<td>14 A</td>
<td>14 A</td>
<td>14 A</td>
</tr>
<tr>
<td>Dimensions&lt;sup&gt;2&lt;/sup&gt;</td>
<td>W100 mm x D320 mm x H215 mm</td>
<td>W140 mm x D350 mm x H225 mm</td>
<td>W165 mm x D447 mm x H225 mm</td>
<td>W165 mm x D447 mm x H225 mm</td>
<td>W165 mm x D447 mm x H225 mm</td>
<td>W165 mm x D447 mm x H225 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>Approx. 6 kg</td>
<td>Approx. 8 kg</td>
<td>Approx. 13 kg</td>
<td>Approx. 13 kg</td>
<td>Approx. 13 kg</td>
<td>Approx. 13 kg</td>
</tr>
<tr>
<td>Applied heat exchanger&lt;sup&gt;3&lt;/sup&gt;</td>
<td>HED003-HW13</td>
<td>HED003-HW19</td>
<td>HED005-HW13</td>
<td>HED005-HW19</td>
<td>HED007-HW13</td>
<td>HED007-HW19</td>
</tr>
</tbody>
</table>

<sup>1</sup> This value is with a stable load with no disturbance and cannot be achieved in some operating conditions.

<sup>2</sup> The outline dimensions do not included protruding parts such as the foot flange and connector.

<sup>3</sup> The temperature controller should be connected with a specific series of heat exchanger. If connected with a different series of heat exchanger, it may not operate normally. (The HED003 and HED005 series use the same connector, so be careful for incorrect wiring.)

⚠️ **Caution**

- For the combination of the heat exchanger and temperature controller, refer to “Combination in Set.”
The values shown on the performance chart are representative and not guaranteed. Allow a margin for safety to device when choosing the product.
Pressure Loss in Circulating Fluid Circuit  
**Condition**: Tap water

**HED003**

- Pressure loss [kPa] vs. Flow rate [L/min]
- Lines: HED003-HW13, HED003-HW19

**HED005**

- Pressure loss [kPa] vs. Flow rate [L/min]
- Lines: HED005-HW13, HED007-HW13

**HED007**

- Pressure loss [kPa] vs. Flow rate [L/min]
- Lines: HED005-HW19, HED007-HW19

Pressure Loss in Facility Water Circuit  
**Condition**: Tap water

**HED003**

- Pressure loss [kPa] vs. Flow rate [L/min]

**HED005**

- Pressure loss [kPa] vs. Flow rate [L/min]

**HED007**

- Pressure loss [kPa] vs. Flow rate [L/min]
**Dimensions**

**HED007-W2**

<table>
<thead>
<tr>
<th>Circulating Fluid Tube Size</th>
<th>Heat exchanger model</th>
<th>Circulating fluid tube size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HED007-HW13</td>
<td>1/2&quot; x 3/8&quot;</td>
</tr>
<tr>
<td></td>
<td>HED007-HW19</td>
<td>3/4&quot; x 5/8&quot;</td>
</tr>
</tbody>
</table>

**Power Cable (Accessory)**

Connector: DDK CE05-6A18-10SD-D-BSS

<table>
<thead>
<tr>
<th>Wire color</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black 1</td>
<td>180 to 242 VAC</td>
</tr>
<tr>
<td>Black 2</td>
<td>180 to 242 VAC</td>
</tr>
<tr>
<td>Green/Yellow</td>
<td>PE</td>
</tr>
</tbody>
</table>
Connectors

- Use the special power cable included with the temperature controller.
- Connect the DC cable and signal cable that come from the heat exchanger to the DC and signal connectors of the temperature controller.
- Prepare other required connectors and wiring by user.

1. Power connector

- **For HED003-C2□, HED005-C2□**
  - IEC 60320 C14 or equivalent
  - Connect the included special power cable.

- **For HED007-C2□**
  - DDK Ltd. CE05-2A18-10PD-D
  - Connect the included special power cable.

- **For HED007-C2□**
  - DDK Ltd. DM3102A20-15S
  - Connect the DC cable connector of the heat exchanger.

2. DC connector

- **For HED003-C2□, HED005-C2□**
  - Nanaboshi Electric Mfg. Co., Ltd.: NJC-243-RF (UL, CSA)
  - Connect the DC cable connector of the heat exchanger.

- **For HED007-C2□**
  - DDK Ltd. DM3102A20-15S
  - Connect the DC cable connector of the heat exchanger.

3. Signal connector

- **Common to HED003-C2□, HED005-C2□, HED007-C2□**
  - DDK JMR1610FG-36
  - Connect the signal cable connector of the heat exchanger.

4. Terminal block

- **Common to HED003-C2□, HED005-C2□, HED007-C2□**
  - Morimatsu Co., Ltd.: M111A-7A, for holding screw M3
  - Connection cable: 22AWG or more, max. 10 m

5. Alarm output connector: D-sub 9 pin

- **Common to HED003-C2□, HED005-C2□, HED007-C2□**
  - OMRON Corp. XM2A-0901 or equivalent, holding screw M2.6
  - Connection: With shielding 22AWG or more, max. 10 m

6. Communication connector: D-sub 9 pin

- **Common to HED003-C2□, HED005-C2□, HED007-C2□**
  - OMRON Corp. XM2D-0901 or equivalent, holding screw M2.6
  - Connection: With shielding 22AWG or more

---

**Pin No.** | **Signal contents**
---|---
1 | 180 to 242 VAC
2 | 180 to 242 VAC
3 | PE

**Pin No.** | **Signal contents**
---|---
A | 180 to 242 VAC
B | 180 to 242 VAC
C | Unused
D | PE

**Pin No.** | **Signal contents**
---|---
1 | Thermostat +
2 | Thermostat –
3 | Terminal A of resistance temperature detector
4 | Terminal B of resistance temperature detector
5 | Terminal B of resistance temperature detector
6 | Fluid leak sensor +24 V
7 | Fluid leak alarm signal input
8 | Fluid leak 24VE
9-10 | Unused
1-10 | Grounding

---

497
**Alarm**

This unit has failure diagnosis function. When an failure happens, its failure mode is displayed on the LCD display in the controller and it can be read out through the serial communication, and has relay outputs for upper/lower temperature limit alarm and shutdown alarm.

<table>
<thead>
<tr>
<th>Alarm code</th>
<th>Alarm description</th>
<th>Operation status</th>
<th>Main reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>WRN</td>
<td>Upper/Lower temp. limit alarm</td>
<td>Continue</td>
<td>The temperature has exceeded the upper or lower limit of the set temperature.</td>
</tr>
<tr>
<td>WRN</td>
<td>Remote OFF alarm</td>
<td>Stop</td>
<td>The remote ON/OFF contact is set to be off. (This alarm is not generated by the relay output.)</td>
</tr>
<tr>
<td>ERR00</td>
<td>CPU hung-up</td>
<td>Stop</td>
<td>The CPU has crashed due to noise, etc.</td>
</tr>
<tr>
<td>ERR01</td>
<td>CPU check failure</td>
<td>Stop</td>
<td>The contents of the CPU cannot be read out correctly when the power supply is turned on.</td>
</tr>
<tr>
<td>ERR03</td>
<td>Back-up data error</td>
<td>Stop</td>
<td>The contents of the back-up data cannot be read out correctly when the power supply is turned on.</td>
</tr>
<tr>
<td>ERR04</td>
<td>EEPROM writing error</td>
<td>Stop</td>
<td>The data cannot be written to EEPROM.</td>
</tr>
<tr>
<td>ERR05</td>
<td>EEPROM input over time error</td>
<td>Stop</td>
<td>The number of times of writing to EEPROM has exceeded the maximum value.</td>
</tr>
<tr>
<td>ERR11</td>
<td>DC power voltage failure</td>
<td>Stop</td>
<td>Momentary loss of AC power supply, DC power supply has excessive temperature, or the thermo-module has been short-circuited.</td>
</tr>
<tr>
<td>ERR12</td>
<td>Internal sensor value is high.</td>
<td>Stop</td>
<td>The internal temperature sensor has exceeded the upper limit where the Chemical Thermo-con is set to stop.</td>
</tr>
<tr>
<td>ERR13</td>
<td>Internal sensor value is low.</td>
<td>Stop</td>
<td>The internal temperature sensor has exceeded the lower limit where the Chemical Thermo-con is set to stop.</td>
</tr>
<tr>
<td>ERR14</td>
<td>Thermostat alarm</td>
<td>Stop</td>
<td>The thermostat has been activated due to insufficient flow rate of the circulating fluid or facility water or high temperature.</td>
</tr>
<tr>
<td>ERR15</td>
<td>Output failure alarm</td>
<td>Continue</td>
<td>The temperature cannot be changed even at 100% output, due to overload or disconnection of the thermo-module.</td>
</tr>
<tr>
<td>ERR17</td>
<td>Cutoff/short of internal sensor</td>
<td>Stop</td>
<td>The internal temperature sensor has been disconnected or short-circuited.</td>
</tr>
<tr>
<td>ERR18</td>
<td>Cutoff/short of external sensor</td>
<td>Continued by normal control</td>
<td>The external temperature sensor has been disconnected or short-circuited. (Only detected when in learning control, auto-tuning operation 2, or external sensor control)</td>
</tr>
<tr>
<td>ERR19</td>
<td>Auto-tuning failure</td>
<td>Stop</td>
<td>Auto-tuning has not been completed within 60 minutes.</td>
</tr>
<tr>
<td>ERR21</td>
<td>Fan alarm</td>
<td>Stop</td>
<td>The air-cooled fan alarm of the power supply has been activated.</td>
</tr>
<tr>
<td>ERR22</td>
<td>Leak alarm</td>
<td>Stop</td>
<td>The fluid leak sensor has detected leakage of fluid.</td>
</tr>
</tbody>
</table>

**Maintenance**

Please prepare back-up equipment as necessary to minimize the downtime.

1) **Heat exchanger**  
   The heat exchanger will not be repaired in principle. Only the return to SMC for an investigation within warranty will be accepted. The return unit has to be completely decontaminated with appropriate method such as use of neutralizing agent before return to SMC.

2) **Temperature controller**  
   Maintenance of the temperature controller will be performed only at SMC. SMC will not support on-site maintenance. The following parts have published life time. To make a maintenance return schedule is recommended based on the following parts life expectation.

**Parts Life Expectation**

<table>
<thead>
<tr>
<th>Description</th>
<th>Expected life</th>
<th>Possible failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fan</td>
<td>5 to 10 years</td>
<td>Lack of fan cooling because of the life time of the bearing. It will activate the overheat protection of DC power supply and generate alarm.</td>
</tr>
<tr>
<td>DC power supply</td>
<td>5 to 10 years</td>
<td>End life of electrolytic condenser. It will generate DC power supply alarm.</td>
</tr>
<tr>
<td>Display panel</td>
<td>50,000 hours</td>
<td>End life of backlight of LCD.</td>
</tr>
<tr>
<td></td>
<td>(approx. 5 years)</td>
<td></td>
</tr>
</tbody>
</table>
### Chemical Liquid Compatibility Table

against the Fluid Contact Material in Chemical Thermo-con

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Concentration</th>
<th>Operating temperature range</th>
<th>Compatibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrofluoric acid</td>
<td>HF: 10% or less</td>
<td>10 to 40°C</td>
<td>○ *2</td>
</tr>
<tr>
<td>Buffered hydrogen fluoride</td>
<td>HF: 10% or less</td>
<td>10 to 40°C</td>
<td>○ *2</td>
</tr>
<tr>
<td>Hydrofluoric acid and Nitric acid mixture</td>
<td>HF: 5% or less HNO₃: 5% or less</td>
<td></td>
<td>Δ</td>
</tr>
<tr>
<td>Nitric acid (except fuming nitric acid)</td>
<td>HNO₃: 5% or less</td>
<td></td>
<td>Δ</td>
</tr>
<tr>
<td>Hydrochloric acid</td>
<td>HCl: 5% or less</td>
<td></td>
<td>Δ</td>
</tr>
<tr>
<td>Copper sulfate solution</td>
<td>H₂SO₄: 96% or less</td>
<td>10 to 50°C</td>
<td>○</td>
</tr>
<tr>
<td>Sulfuric acid (except fuming sulfuric acid)</td>
<td>H₂SO₄: 96% or less</td>
<td>10 to 50°C</td>
<td>○</td>
</tr>
<tr>
<td>Ozone</td>
<td>—</td>
<td>10 to 60°C</td>
<td>○</td>
</tr>
<tr>
<td>Ammonium hydroxide</td>
<td>NH₃: 5% or less</td>
<td>10 to 60°C</td>
<td>○ *2</td>
</tr>
<tr>
<td>Ammonia hydrogen peroxide solution</td>
<td>NH₃: 5% or less H₂O₂: 20% or less</td>
<td>10 to 60°C</td>
<td>○ *1, 2</td>
</tr>
<tr>
<td>Sodium hydroxide</td>
<td>NaOH: 50% or less</td>
<td>10 to 60°C</td>
<td>○ *2</td>
</tr>
<tr>
<td>Deionized water</td>
<td>—</td>
<td>10 to 60°C</td>
<td>○ *1</td>
</tr>
<tr>
<td>Ultrapure water</td>
<td>—</td>
<td>10 to 60°C</td>
<td>○ *1</td>
</tr>
</tbody>
</table>

* The Chemical Liquid Compatibility Table shows reference values only and does not guarantee successful use of chemical liquids in products.
* SMC is not responsible for the accuracy of this data or for any damage arising out of the use of these chemical liquids.
* Chemical Thermo-con is not designed to be explosion proof, so it is not suitable for flammable fluids.
* Static electricity may be generated. Anti-static electricity countermeasures should be implemented.
  
  Flow friction may generate static electricity, which can cause electric discharge to the temperature sensor or other devices and cause a malfunction.
  It is possible to discharge electricity by using a conductive PFA tube, metal piping (metal flexible hose), or other type of tubing, and by installing a ground line.

* Permeation of the fluid may be possible. The permeated fluid may have a moderate corrosion to inside components and it may effect their life time. If the chemical liquid has high concentration, permeation becomes greater, which effects the service life. In case the fluid has a possibility to generate corrosive gas, SMC recommends a nitrogen purge of the enclosure. Ni purge ports are located at the piping connection side of the heat exchanger.
**HED Series**

Specific Product Precautions 1

Be sure to read this before handling the products. Refer to page 513 for safety instructions and pages 514 to 517 for temperature control equipment precautions.

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### Design

**Warning**

This catalog shows the specifications of the Chemical Thermo-con.

1. Check detailed specifications in the separate “Product Specifications”, and evaluate the compatibility of the Chemical Thermo-con with the user’s system.

2. The Chemical Thermo-con is equipped with a protective circuit independently, but the whole system should be designed by user to ensure safety.

### Handling

**Warning**

1. Thoroughly read the operation manual.

   Read the operation manual completely before operation, and keep the manual where it can be referred to as necessary.

### Operating Environment/Storage Environment

**Warning**

1. Keep within the specified ambient temperature and humidity range. Also, if the set temperature is too low, condensation may form on the inside of the Chemical Thermo-con or the surface of piping even within the specified ambient temperature range. Dew condensation can cause failure, and so must be avoided by considering operating conditions.

2. The Chemical Thermo-con is not designed for clean room usage. The fan will generate dust.

3. Low molecular siloxane can damage the contact of the relay. Use the Chemical Thermo-con in a place free from low molecular siloxane.

### Piping

**Warning**

1. Work performed on the piping should be done by a knowledgeable and experienced person.

   If work performed on the piping is done by a less knowledgeable and inexperienced person, it will likely lead to operating fluid leakage, etc.

2. Confirm the leakage of fluid.

   Fluid leakage can cause dangerous accidents. Be sure to confirm that the hose or tubing is not pulled out and that there is no leakage in the fitted parts.

3. Confirm that the resin tube is not kinked or collapsed.

   If a resin tube is used, it should be checked for the presence and possibility of kink or collapse.

4. Countermeasures against fluid leakage

   Water drops may accumulate due to leakage of circulating fluid or facility water, or condensation on the piping. Install the Chemical Thermo-con with a drip pan, fluid leak sensor and exhaust system.

   If leakage is detected, cut off the circulating pump with a hardware interlock, and cut off the power to the Chemical Thermo-con.

   Depending on the type of chemical used (circulating fluid), it may have a harmful effect on the surrounding equipment and the human body.

**Caution**

1. Before piping

   Confirm that dust, scales, etc., in contact with piping is cleaned up or air blown (flushing) before piping.

2. Take care over the direction of fluid.

   Do not mistake the direction of “IN” and “OUT” for the facility water system and circulating fluid system.

3. Take countermeasures against condensation.

   Depending on the operating condition, condensation may occur on the piping. In such a case, take countermeasures such as installing insulation material, etc.

4. Avoid electrostatic discharge.

   If a fluid with low conductivity such as deionized water is used as the circulating fluid, static electricity generated by flow friction may be discharged to the temperature sensor and malfunction the Chemical Thermo-con. Consider measures to minimize the discharge of static electricity from the circulating fluid to signal line including the temperature sensor.

   For example, a PFA conductive tube or metal piping (metal flexible hose) can be used to provide grounding to the piping of the external sensor and to discharge.

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500
**Warning**

1. **Electrical wiring job should be performed by a knowledgeable and experienced person.**
   Power supply facilities and wiring works should be implemented in accordance with the electric facilities technical standards and provisions and conducted correctly.

2. **Mounting a dedicated earth leakage breaker.**
   As a countermeasure against current leakage, install an earth leakage breaker in the main power supply.

3. **Confirmation of power supply**
   If this product is used with voltages other than specified, it will likely lead to a fire or an electrical shock. Before wiring, confirm the voltage, capacity, and frequency. Confirm that the voltage fluctuation is within the specified value.

4. **Grounding**
   Be sure to ground (frame ground) with class D grounding. Can be grounded with the PE line of the power supply cable. Also, do not use together with equipment that generates a strong electrical magnetic noise or high frequency noise.

5. **Wiring cable should be handled with care.**
   Do not bend, twist or pull the cord or cable.

6. **Wire with an applicable cable size and terminal.**
   In the event of attaching a power supply cable, use a cable and terminal size which is suitable for the electrical current of each product. Forcibly mounting with an unsuitable size cable will likely result in a fire.

7. **Avoid wiring the signal line and power line in parallel.**
   Since there may be a possibility of malfunction from noise, avoid parallel wiring between the temperature sensor line, communications line, signal line of alarm line, etc. and the power line and high voltage line. Also, do not place them in the same wiring tube.

8. **Check for incorrect wiring.**
   Incorrect wiring can damage the Chemical Thermo-con or cause malfunction. Be sure to check wiring is connected properly.

9. **Check the model of the Chemical Thermo-con.**
   The HED003 and HED005 series use the same connector. If the temperature controller and heat exchanger of different models are combined by mistake, an alarm may be generated and the specified performance may not be obtained. Be sure to check the combination of models.

**Facility Water Supply**

**Warning**

1. **Be sure to supply the facility water.**
   1. Prohibition of water-cut operation, very little flow rate of water operation.
   Do not operate under the condition that there is no facility water or where there is very little flow rate of water is flowing.
   (Facility water flow rate range: 5 to 10 L/min)
   In this kind of operation, facility water temperature may become extremely higher. It is dangerous enough the material of hose may soften and burst when the piping supplying the facility water is connected with hose.
   2. Actions to be taken when an emergency stop occurs due to extremely high temperature.
   In case a stop occurs due to extremely high temperature resulting from a decrease in the facility water flow rate, do not immediately flow facility water. It is dangerous enough the material of hose may soften and burst when the piping supplying the facility water is connected with hose. First, naturally let it cool down, and removing the cause of the flow rate reduction. Secondly, make sure that there is no leakage again.

**Caution**

1. **Facility water quality**
   1. Use the facility water within the specified range.
   When using with other fluid than facility water, please consult with SMC.
   2. When it is likely that foreign matter may enter the fluid, install a filter (20 mesh or equivalent).

**Facility Water Quality Standards**

The Japan Refrigeration and Air Conditioning Industry Association
JRA GL-02-1994 “Cooling water system – Circulating type – Circulating water”

<table>
<thead>
<tr>
<th>Standard item</th>
<th>Item Standard value</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH (at 25°C)</td>
<td>6.5 to 8.2</td>
</tr>
<tr>
<td>Electric conductivity (25°C)</td>
<td>100*1 to 800 [µS/cm]</td>
</tr>
<tr>
<td>Chloride ion</td>
<td>200 [mg/L] or less</td>
</tr>
<tr>
<td>Sulfuric acid ion</td>
<td>200 [mg/L] or less</td>
</tr>
<tr>
<td>Acid consumption amount (at pH4.8)</td>
<td>100 [mg/L] or less</td>
</tr>
<tr>
<td>Total hardness</td>
<td>200 [mg/L] or less</td>
</tr>
<tr>
<td>Calcium hardness</td>
<td>150 [mg/L] or less</td>
</tr>
<tr>
<td>Ionic state silica</td>
<td>50 [mg/L] or less</td>
</tr>
<tr>
<td>Iron</td>
<td>1.0 [mg/L] or less</td>
</tr>
<tr>
<td>Copper</td>
<td>0.3 [mg/L] or less</td>
</tr>
<tr>
<td>Sulfide ion</td>
<td>Should not be detected</td>
</tr>
<tr>
<td>Ammonium ion</td>
<td>1.0 [mg/L] or less</td>
</tr>
<tr>
<td>Residual chlorine</td>
<td>0.3 [mg/L] or less</td>
</tr>
<tr>
<td>Free carbon</td>
<td>4.0 [mg/L] or less</td>
</tr>
</tbody>
</table>

*1 Electric conductivity should be 100 [µS/cm] or more.

2. **If the temperature of the facility water is too low, it can cause formation of condensation inside the heat exchanger.**
   Supply facility water with a temperature over the atmospheric dew point to avoid the formation of dew condensation.

3. **If the facility water piping is connected to multiple machines, the facility water exchanges heat at the upstream side and its temperature will become higher as it goes downstream.**
   Limit the number of connected Chemical Thermo-cons to two per facility water system, and if two Chemical Thermo-cons or more are to be connected, increase the number of systems.
**Mounting**

**Caution**

1. **Mount and install horizontally.**
   When mounting, fix the foot of the Chemical Thermo-con by tightening the screws to the specified torque below.

**Recommended Mounting Torque**

<table>
<thead>
<tr>
<th>Device to mount</th>
<th>Thread size</th>
<th>Applicable tightening torque N·m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat exchanger</td>
<td>M6</td>
<td>1.5 to 2.5</td>
</tr>
<tr>
<td>Temperature controller</td>
<td>M5</td>
<td>1.5 to 2.5</td>
</tr>
</tbody>
</table>

---

**Circulating Fluid**

**Caution**

1. **1. Applicable fluids**
   For the compatibility between the material of components and fluid, refer to “Applicable Fluids” (page 499). Please contact SMC for fluids other than those described on the check list.

2. **2. Caution for the use of fluids with high permeation**
   When the Chemical Thermo-con is used for a fluid with high permeation into fluorine resin, the permeation can affect its life. If the fluid also generates corrosive gas, perform N₂ supply and exhaust (N₂ purge) inside the heat exchanger.

3. **3. Caution for the use of deionized water**
   If deionized water is used, bacteria and algae may grow within a short period. If the Chemical Thermo-con is operated with bacteria and algae present, the performance of the heat exchanger may deteriorate. Replace all deionized water regularly according to the conditions (once a month as a guide).

4. **4. Prohibition of small flow rate**
   Be sure to avoid operation with the circulating pump stopped or with extremely small flow rate of recirculating fluid (7 L/min or less for water). Otherwise, the Chemical Thermo-con will repeat change cooling and heating operation, which may shorten the life of the Peltier element significantly, and it will become unable to control the temperature accurately. When the circulating pump is stopped, stop the temperature control of the Chemical Thermo-con as well by using the remote ON/OFF function.

5. **5. Operating pressure range of circulating fluid**
   The operating pressure range is 0 to 0.25 MPa. Do not use with negative pressure which can cause the Chemical Thermo-con to fail. (Specifically, install the heat exchanger at the secondary (discharge) side of the circulating pump.) Also, avoid excessive pressure being applied to the circulating fluid circuit by a clogged filter or fully closed valve.

6. **6. Prohibition of fluid pulsation**
   If a pump generating pulsation is used, install a damper to absorb the pulsation directly before the Chemical Thermo-con. Fluid pulsation can break the Chemical Thermo-con.

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**Communication**

**Caution**

1. **The set value can be written to EEPROM, but only up to approx. 1 million times.**
   In particular, pay attention to how many times the writing is performed using the communication function.

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**Maintenance**

**Warning**

1. **1. Prevention of electric shocks and fire**
   Do not operate the switch with wet hands. Also, do not operate the Chemical Thermo-con when water is present on its exterior surface.

2. **2. Action in the case of error**
   If any error such as an abnormal sound, smoke, or bad odor occurs, cut off the power at once, and stop supplying facility water. Please contact SMC or a sales distributor to repair the Chemical Thermo-con.

3. **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 the displayed contents.
   b) Check the temperature, vibration level, and for abnormal sounds in the body of the Chemical Thermo-con.
   c) Check the voltage and current of the power supply system.
   d) Check the circulating fluid for leakage, contamination, and the presence of foreign matter. Replace water when necessary.
   e) Check for leakage, quality change, flow rate and temperature of facility water.

4. **4. Wearing of protective clothing**
   Some fluids can be dangerous when handled incorrectly. Wear protective clothing for safety during maintenance. In particular, observe the MSDS of the circulating fluid, and wear protective goggles, gloves and mask for the operation of the Chemical Thermo-con accompanied with the use of fluids.