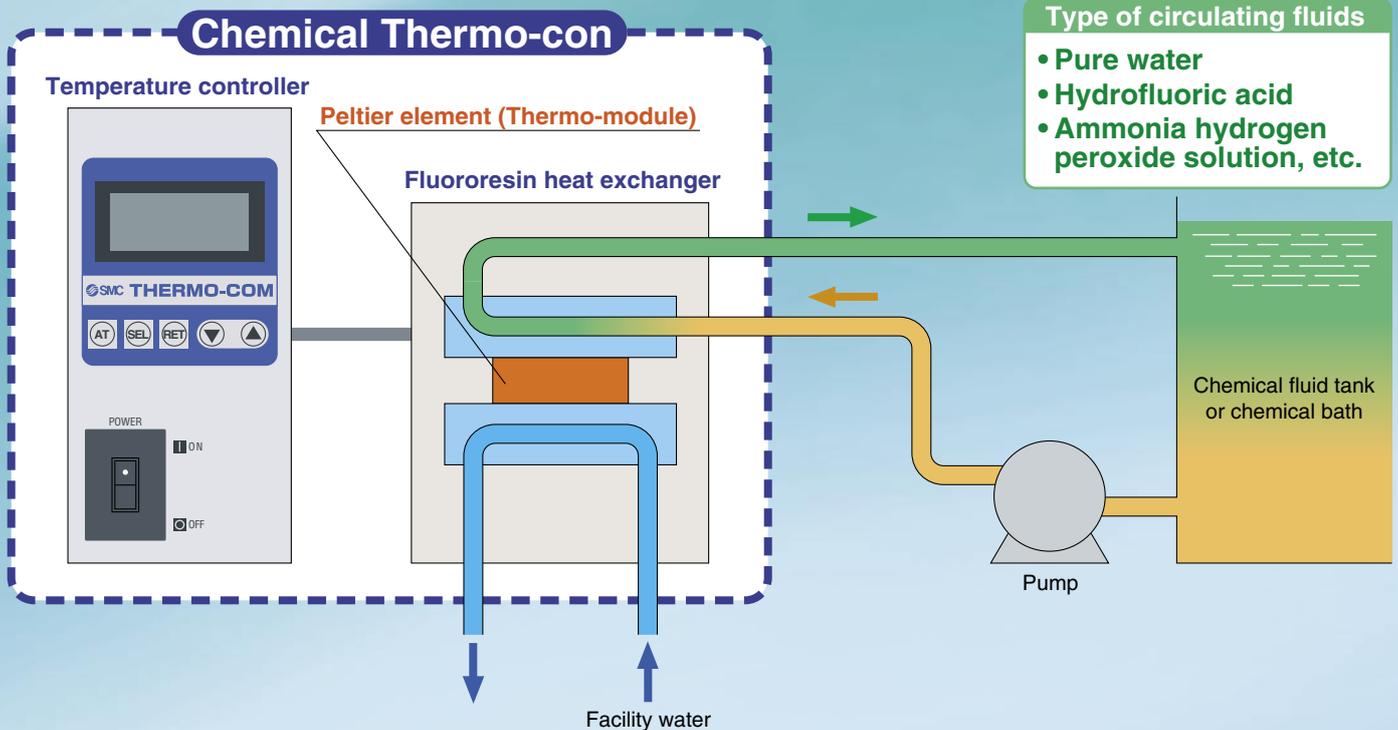


Peltier-Type Temperature Control System for Chemicals

Chemical Thermo-con

Fluororesin heat exchanger allows direct temperature control for chemicals!!



Industry-leading withstand pressure

0.35 MPa (50 PSI)!!

• Operating temp. range: **10°C to 60°C**

• Temperature stability: **±0.1°C**

• Cooling capacity (with water):

300 w, 500 w, 750 w

• Safety standards:

CE, UL, (eti[®])
NRTL conformed

• **RoHS** conformed

Series **HED**

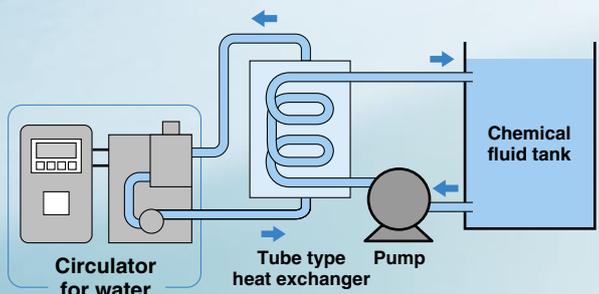


Allows direct control of chemical temperature.

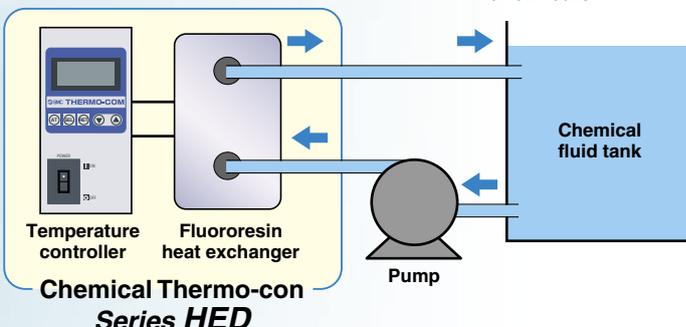
- PFA wetted material prevents contamination from metal ion elution.
- No need for a tube type heat exchanger.

No need for a tube type heat exchanger. Can directly control temperature of chemicals.

Indirect temperature control

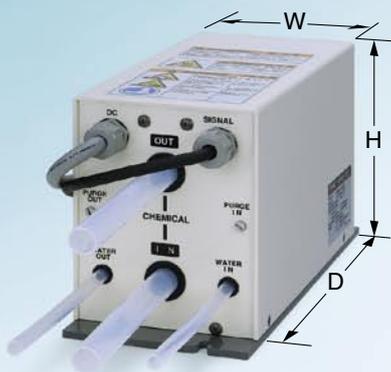


Direct temperature control



Compact/Lightweight

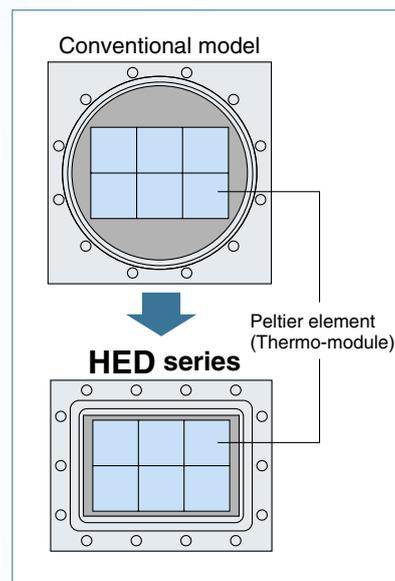
- Self-developed heat exchanger matched to the configuration of the Peltier element (Thermo-module). Compact and light weight



Heat Exchanger

Model	W	D	H	Mass
HED003	130 mm (5.12")	263 mm (10.4")	170 mm (6.69")	8 kg (17.6 lb)
HED005	150 mm (5.91")	294 mm (11.6")	222 mm (8.74")	14 kg (30.8 lb)
HED007	150 mm (5.91")	294 mm (11.6")	222 mm (8.74")	15 kg (33 lb)

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



Temperature Controller

Model	W	D	H	Mass
HED003	100 mm (3.94")	320 mm (12.6")	215 mm (8.46")	6 kg (13.2 lb)
HED005	140 mm (5.51")	350 mm (13.8")	215 mm (8.46")	8 kg (17.6 lb)
HED007	165 mm (6.50")	447 mm (17.6")	215 mm (8.46")	13 kg (28.6 lb)

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

● Applications

For Semiconductor industry

Cleaning equipment

Plating equipment

Wet etching equipment, etc.

And for any other industry ...

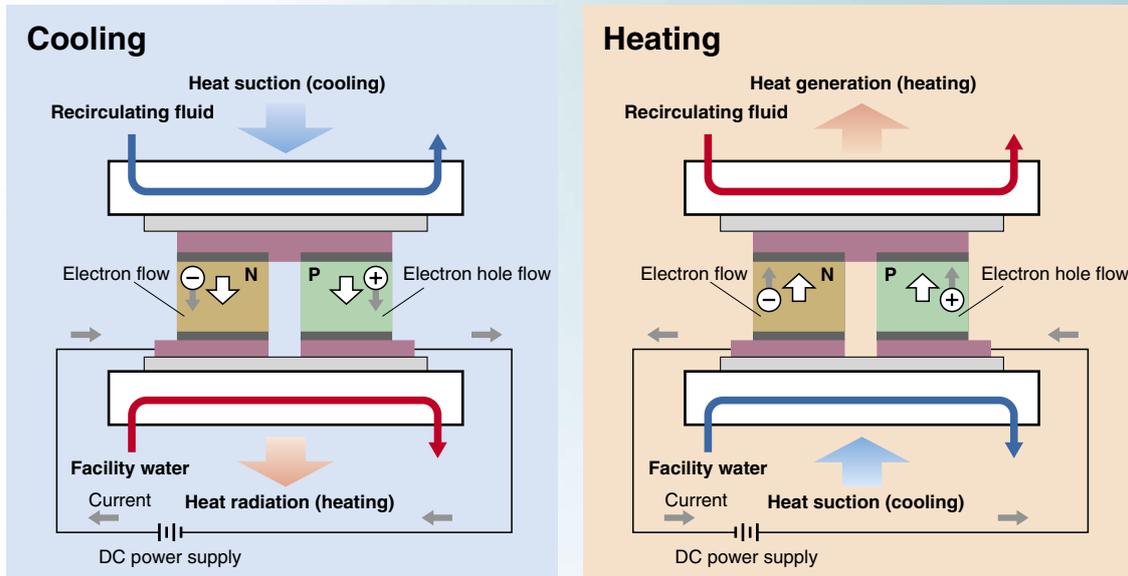
● Applicable Fluid Example

Chemical	Operating temperature range	Chemical	Operating temperature range
Pure water	10 to 60°C	Ammonia hydrogen peroxide solution	10 to 60°C
Hydrofluoric acid	10 to 40°C	Sodium hydroxide	10 to 60°C
Sulfuric acid (except fuming sulfuric acid)	10 to 50°C	Ozone water	10 to 60°C
Copper sulfate solution	10 to 50°C		

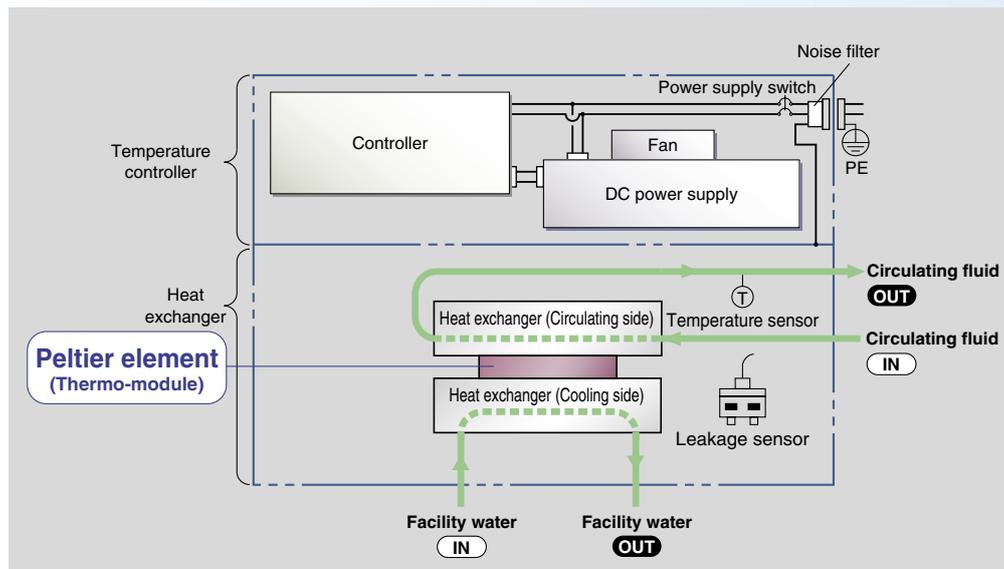
Caution) Chemical Thermo-con is not designed to be explosion proof, so it is not suitable for flammable fluids.

Principle of Peltier Element (Thermo-module/Thermoelectric device)

The Peltier element 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.



System Construction and Principle



The temperature controller consists of CPU and DC power supply to energize the Peltier elements. The temperature sensor is installed in the heat exchanger. The temperature controller outputs appropriate DC power to the peltier elements based on a differential between set point and a value of temperature sensor. And the leakage sensor is installed in the heat exchanger to detect unexpected leakage of facility water or chemical.

Series HED Model Selection

Guide to Model Selection

Example 1: In cases where the amount of heat generated in the customer's equipment is known.

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

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

Example 2: In cases where the amount of heat generated in the customer's equipment is not known.

Obtaining the temperature difference between inlet and outlet by circulating the circulating fluid inside the customer's equipment.

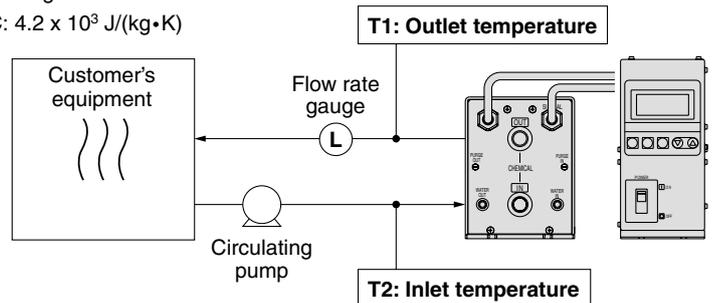
Heat generation amount Q : Unknown
 Circulating fluid temperature difference $\Delta T (= T_2 - T_1)$: 1.0°C (1.0 K)
 Circulating fluid outlet temperature T1 : 20°C (293.15 K)
 Circulating fluid inlet temperature T2 : 21°C (294.15 K)
 Circulating fluid flow rate L : 7 ℓ/min
 Circulating fluid : Water
 Density γ : $1 \times 10^3 \text{ kg/m}^3$
 Specific heat C: $4.2 \times 10^3 \text{ J/(kg}\cdot\text{K)}$

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

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

$$= 490 \text{ W}$$

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



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

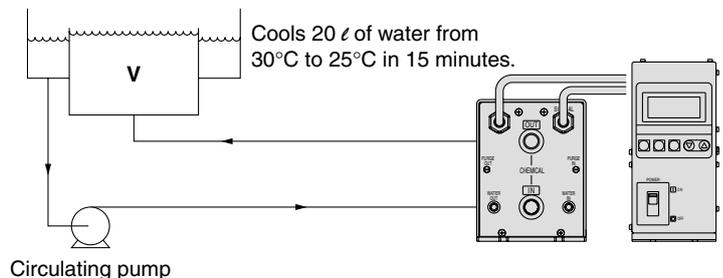
Total volume of the object being cooled down V : 20 ℓ
 Cooling time h : 15 min
 Cooling temperature difference ΔT : 5°C (5 K)
 Circulating fluid : Water
 Density γ : $1 \times 10^3 \text{ kg/m}^3$
 Specific heat C: $4.2 \times 10^3 \text{ J/(kg}\cdot\text{K)}$

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

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

$$= 467 \text{ W}$$

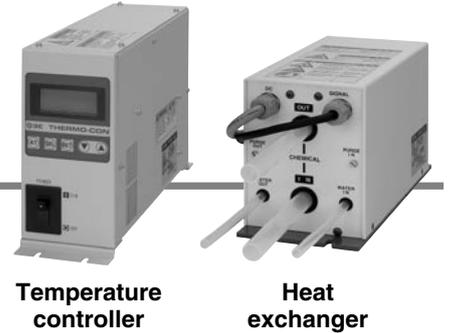
Cooling capacity = Considering a safety factor of 20%,
 $467 \times 1.2 = \boxed{560 \text{ W}}$



Precautions on Model Selection

The flow rate of the circulating fluid depends on the internal resistance of the customer'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.

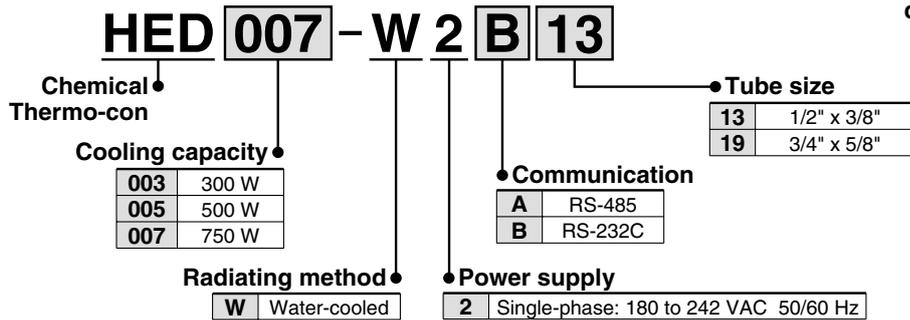
Chemical Thermo-con Series HED



How to Order

Part number of set (Temperature controller + Heat exchanger)

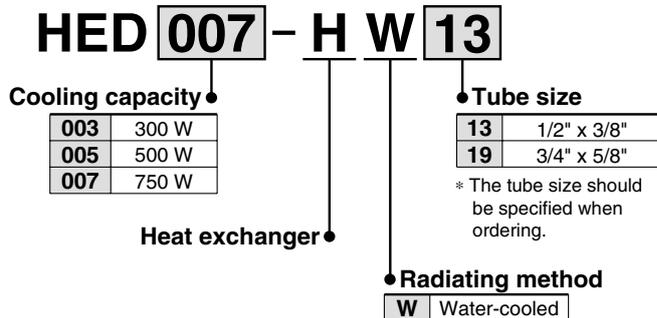
Note) The name plate on the Chemical Thermo-con shows the model numbers of the controller and heat exchanger.



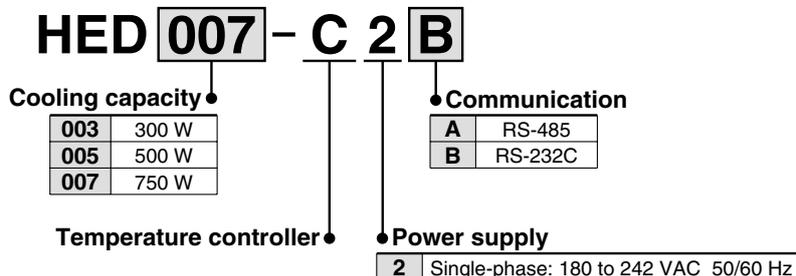
Combination in Set

Part number of set	Heat exchanger model	Temperature controller model
HED003-W2A13	HED003-HW13	HED003-C2A
HED003-W2A19	HED003-HW19	
HED003-W2B13	HED003-HW13	HED003-C2B
HED003-W2B19	HED003-HW19	
HED005-W2A13	HED005-HW13	HED005-C2A
HED005-W2A19	HED005-HW19	
HED005-W2B13	HED005-HW13	HED005-C2B
HED005-W2B19	HED005-HW19	
HED007-W2A13	HED007-HW13	HED007-C2A
HED007-W2A19	HED007-HW19	
HED007-W2B13	HED007-HW13	HED007-C2B
HED007-W2B19	HED007-HW19	

Heat exchanger



Temperature controller



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

Heat Exchanger Specifications

Heat exchanger model		HED003-HW13	HED003-HW19	HED005-HW13	HED005-HW19	HED007-HW13	HED007-HW19
Cooling capacity (Water) <small>Note 1)</small>		300 W		500 W		750 W	
Heating capacity (Water) <small>Note 1)</small>		600 W		1000 W		1800 W	
Cooling/Heating method		Peltier element (Thermoelectric device, Thermo-module)					
Radiating method		Water-cooled					
Operating temperature range		10.0 to 60.0°C (depending on the type of circulating fluid)					
Circulating fluid	Applicable fluid <small>Note 2)</small>	Pure water, Hydrofluoric acid, Ammonia hydrogen peroxide solution, etc.					
	Wetted material	PFA					
	Operating pressure <small>Note 3)</small>	0 (atmospheric pressure) to 0.35 MPa (0 to 50.75 PSI)					
	Tube size (PFA tube)	1/2" x 3/8"	3/4" x 5/8"	1/2" x 3/8"	3/4" x 5/8"	1/2" x 3/8"	3/4" x 5/8"
Facility water	Temperature	10 to 35°C (no condensation)					
	Wetted material	FEP, Stainless steel 304, Stainless steel 316					
	Max. operating pressure	0.5 MPa (72.5 PSI)					
	Tube size	IN/OUT: FEP tube 3/8" x 1/4"					
	Flow rate	5 to 10 l/min (1.3 to 2.6 g/m)					
Ambient		Temperature: 10 to 35°C, Humidity: 35 to 80%RH (no condensation)					
Dimensions <small>Note 4)</small>		W130 mm x D263 mm x H170 mm (W5.12" x D10.4" x H6.69")		W150 mm x D294 mm x H222 mm (W5.91" x D11.6" x H8.74")		W150 mm x D294 mm x H222 mm (W5.91" x D11.6" x H8.74")	
Mass		Approx. 8 kg (17.6 lb)		Approx. 14 kg (30.8 lb)		Approx. 15 kg (33 lb)	
Applied temperature controller		HED003-C2A HED003-C2B		HED005-C2A HED005-C2B		HED007-C2A HED007-C2B	

Note 1) 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

Note 2) For the compatibility between the circulating fluid and materials, refer to "Applicable Fluids" (page 8).

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

Note 3) 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 the customer.

Note 4) The outline dimensions do not included protruding parts such as the foot flange and tube.

Temperature Controller Specifications

Temperature controller model		HED003-C2A	HED003-C2B	HED005-C2A	HED005-C2B	HED007-C2A	HED007-C2B
Communication		RS-485	RS-232C	RS-485	RS-232C	RS-485	RS-232C
Control method		Cooling/Heating automatic shift PID control					
Operating temp. range		10.0 to 60.0°C (no condensation)					
Temperature stability <small>Note 1)</small>		Within ±0.1°C (with stable load)					
Temperature sensor		Resistance thermometer Pt100 Ω, 3-wires, class A, 2 mA (for both internal control sensor and external sensor) The external sensor should be prepared by the customer.					
Main functions		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					
Ambient		Temperature: 10 to 35°C, Humidity: 35 to 80%RH (no condensation)					
Power supply spec.	Power supply	Single-phase: 180 to 242 VAC 50/60 Hz					
	Rated current	3A		5A		14A	
Dimensions <small>Note 2)</small>		W100 mm x D320 mm x H215 mm (W3.94" x D12.6" x H8.46")		W140 mm x D350 mm x H215 mm (W5.51" x D13.8" x H8.46")		W165 mm x D447 mm x H215 mm (W6.50" x D17.6" x H8.46")	
Mass		Approx. 6 kg (13.2 lb)		Approx. 8 kg (17.6 lb)		Approx. 13 kg (28.6 lb)	
Applied heat exchanger <small>Note 3)</small>		HED003-HW13 HED003-HW19		HED005-HW13 HED005-HW19		HED007-HW13 HED007-HW19	

Note 1) This value is with a stable load with no disturbance and cannot be achieved in some operating conditions.

Note 2) The outline dimensions do not included protruding parts such as the foot flange, screw and connector.

Note 3) 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

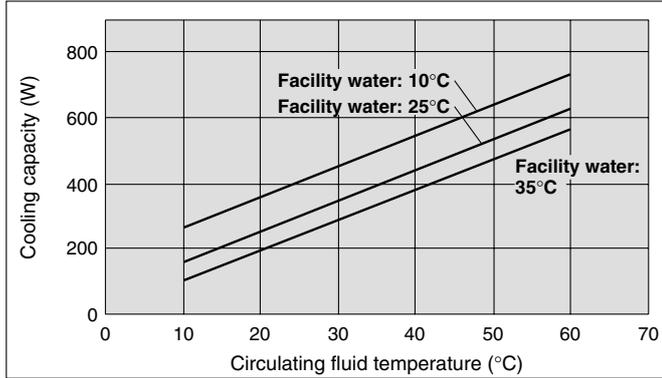
• For the combination of the heat exchanger and temperature controller, refer to "Combination in Set".

Series HED

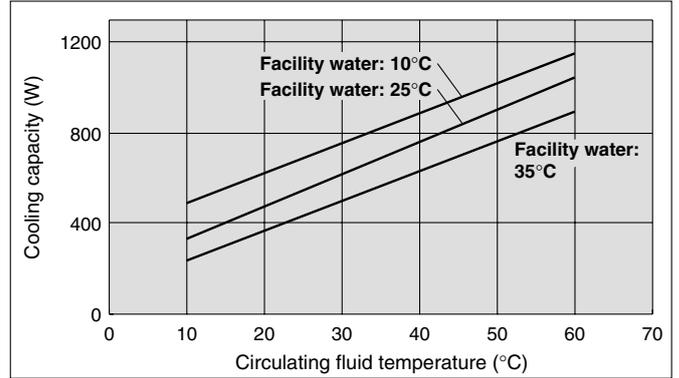
The values shown on the performance chart are representative and not guaranteed. Allow a margin for safety to device when choosing the product.

Cooling Capacity <Conditions> Circulating fluid: Water, Circulating fluid flow rate: 15 l/min, Facility water flow rate: 5 l/min

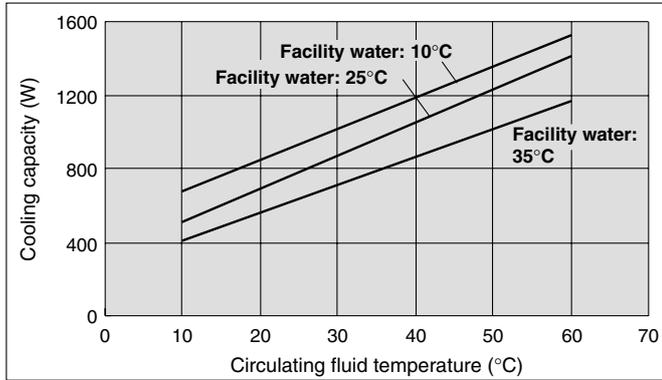
HED003



HED005

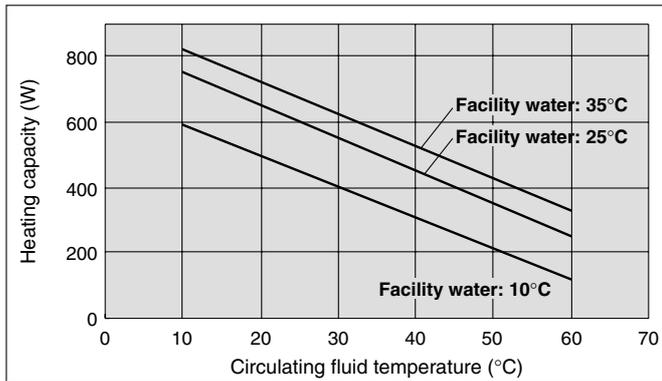


HED007

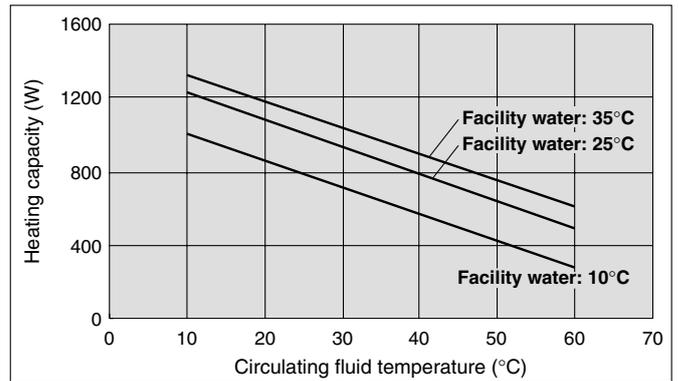


Heating Capacity <Conditions> Circulating fluid: Water, Circulating fluid flow rate: 15 l/min, Facility water flow rate: 5 l/min

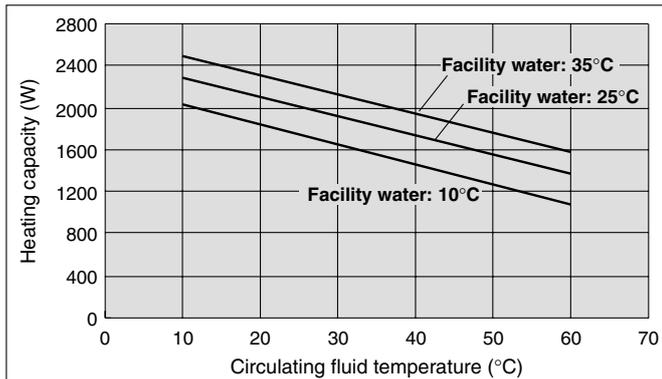
HED003



HED005

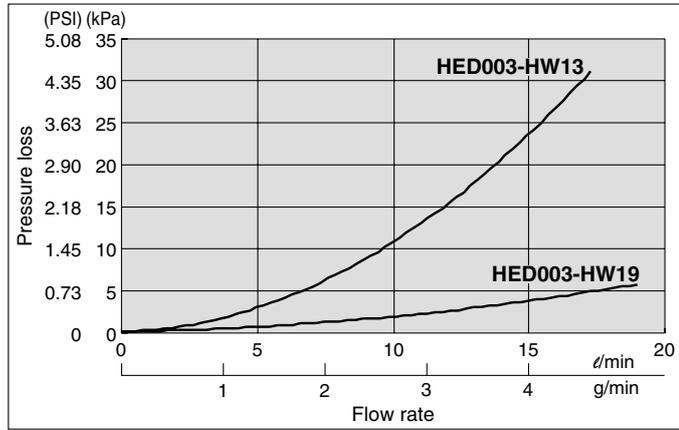


HED007

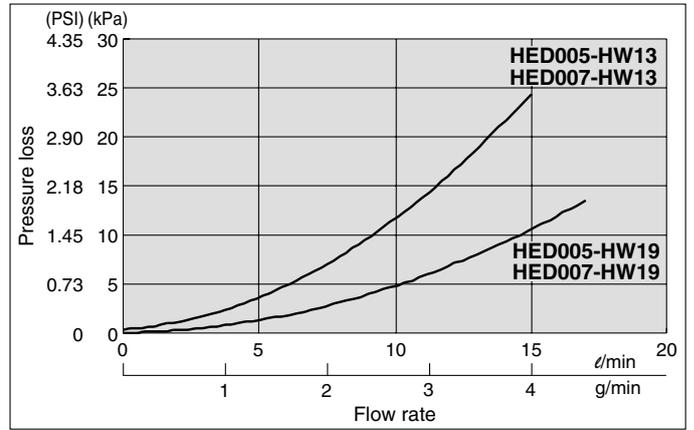


Pressure Loss in Circulating Fluid Circuit <Condition> Water

HED003

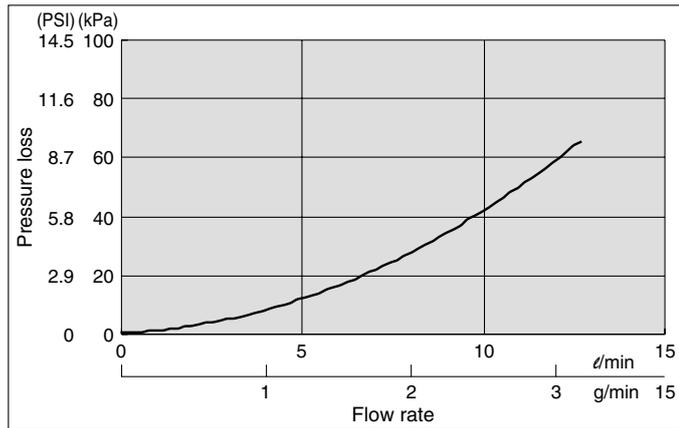


**HED005
HED007**

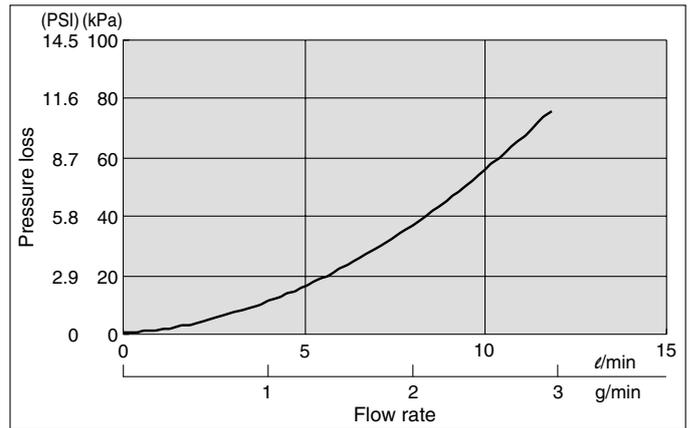


Pressure Loss in Facility Water Circuit <Condition> Water

HED003



**HED005
HED007**

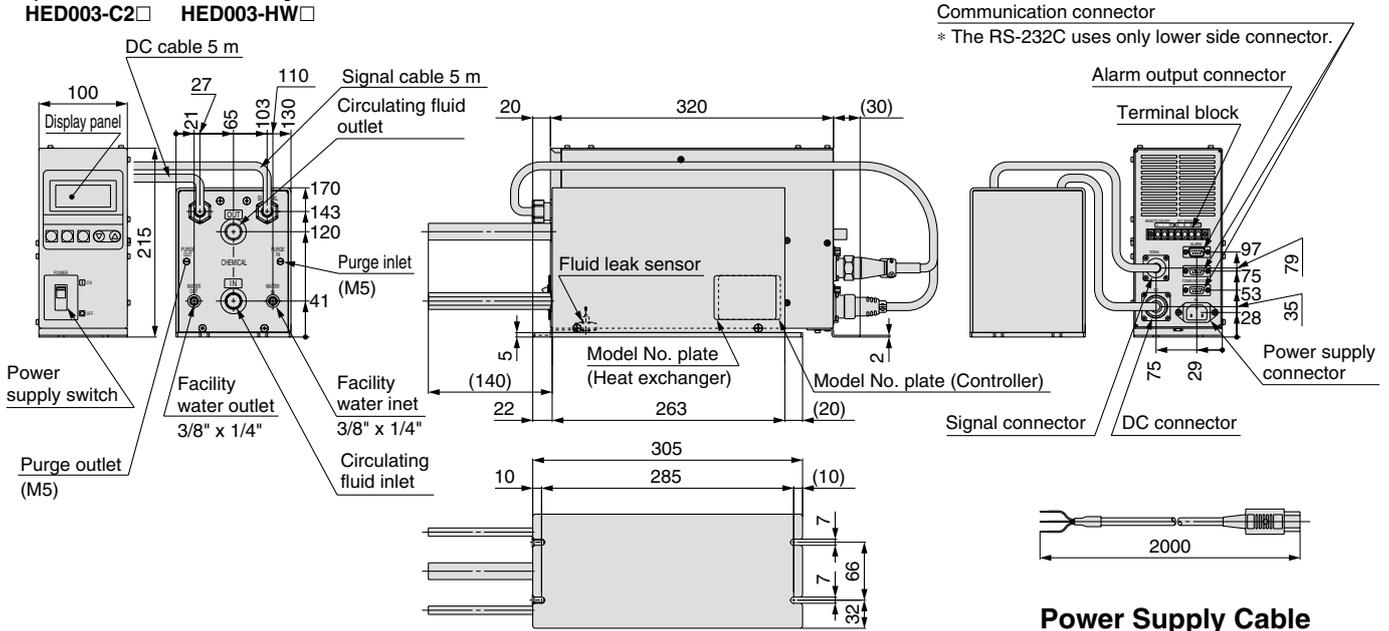


Series HED

Dimensions

HED003-W2□□

Temperature controller Heat exchanger
HED003-C2□ HED003-HW□



Circulating Fluid Tube Size

Heat exchanger model	Circulating fluid tube size
HED003-HW13	1/2" x 3/8"
HED003-HW19	3/4" x 5/8"

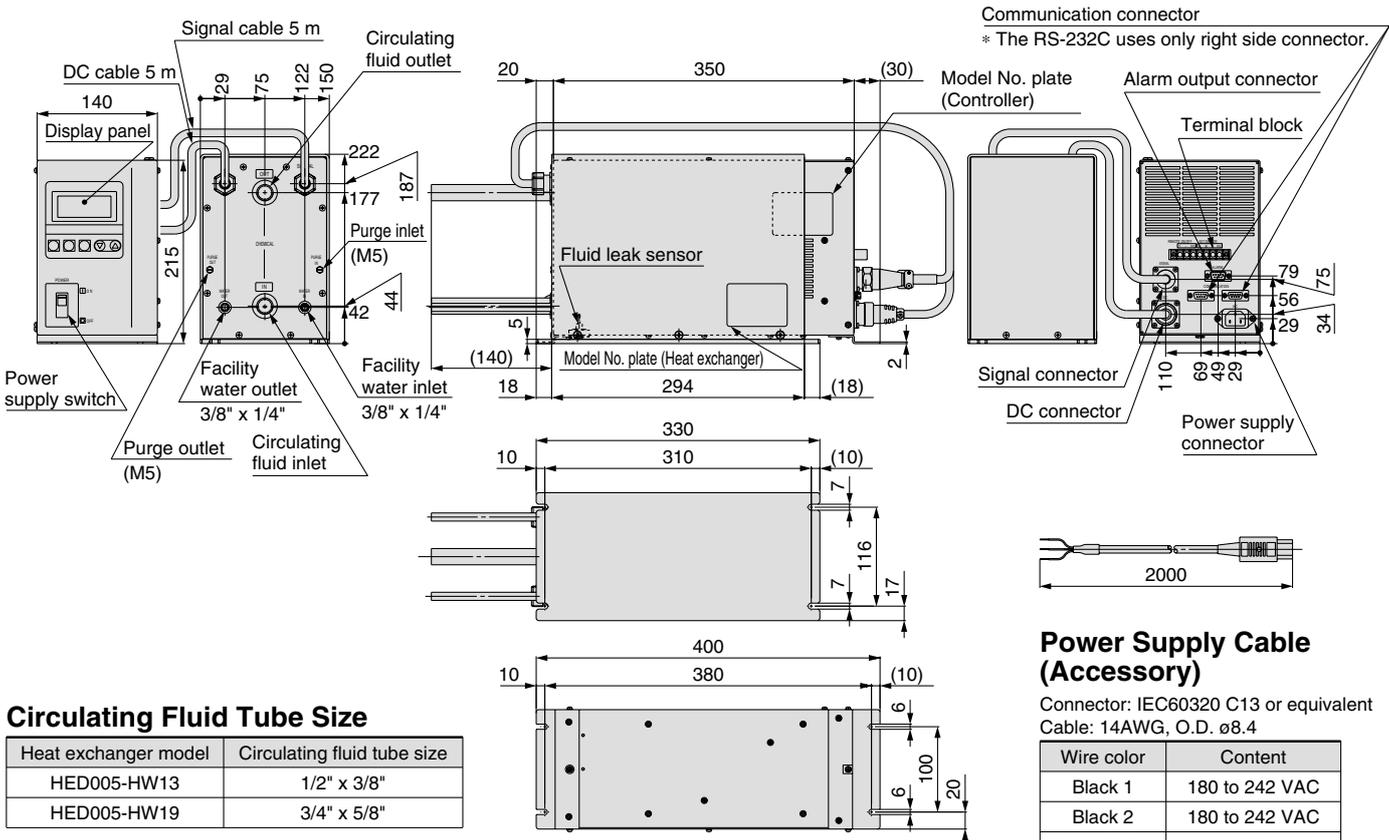
Power Supply Cable (Accessory)

Connector: IEC60320 C13 or equivalent
Cable: 14AWG, O.D. ø8.4

Wire color	Content
Black 1	180 to 242 VAC
Black 2	180 to 242 VAC
Green/Yellow	PE

HED005-W2□□

Temperature controller Heat exchanger
HED005-C2□ HED005-HW□



Circulating Fluid Tube Size

Heat exchanger model	Circulating fluid tube size
HED005-HW13	1/2" x 3/8"
HED005-HW19	3/4" x 5/8"

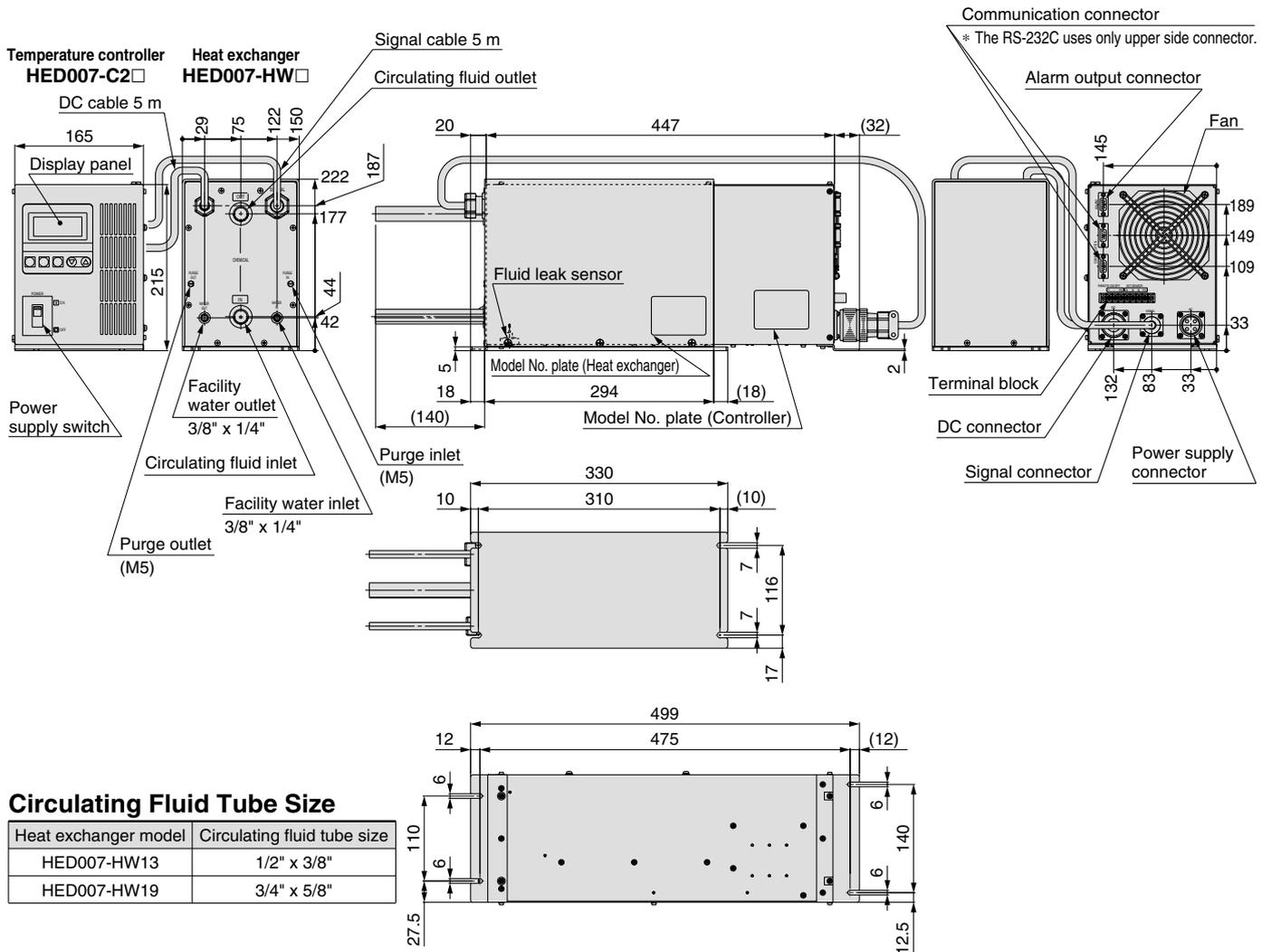
Power Supply Cable (Accessory)

Connector: IEC60320 C13 or equivalent
Cable: 14AWG, O.D. ø8.4

Wire color	Content
Black 1	180 to 242 VAC
Black 2	180 to 242 VAC
Green/Yellow	PE

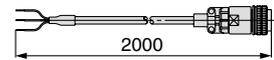
Dimensions

HED007-W2□□



Circulating Fluid Tube Size

Heat exchanger model	Circulating fluid tube size
HED007-HW13	1/2" x 3/8"
HED007-HW19	3/4" x 5/8"



Power Supply Cable (Accessory)

Connector: DDK CE05-6A18-10SD-D-BSS
Cable: 12AWG, O.D. ø11.8

Wire color	Content
Black 1	180 to 242 VAC
Black 2	180 to 242 VAC
Green/Yellow	PE

Alarm

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

Alarm no.	Alarm description	Operation condition	Main reason
WRN	Upper/lower temp. limit alarm	Continue	The temperature has exceeded the upper or lower limit of the set temperature.
WRN	Remote OFF alarm	Stop	The remote ON/OFF contact is set to be off. (This alarm is not generated by the relay output.)
ERR00	CPU hung-up	Stop	The CPU has crashed due to noise, etc.
ERR01	CPU check failure	Stop	The contents of the CPU cannot be read out correctly when the power supply is turned on.
ERR03	Back-up data error	Stop	The contents of the back-up data cannot be read out correctly when the power supply is turned on.
ERR04	EEPROM writing error	Stop	The data cannot be written to EEPROM.
ERR05	EEPROM input over time error	Stop	The number of times of writing to EEPROM has exceeded the maximum value.
ERR11	DC power voltage failure	Stop	Momentary loss of AC power supply, DC power supply has excessive temperature, or the thermo-module has been short-circuited.
ERR12	Internal sensor value is high.	Stop	The internal temperature sensor has exceeded the upper limit where the Chemical Thermo-con is set to stop.
ERR13	Internal sensor value is low.	Stop	The internal temperature sensor has exceeded the lower limit where the Chemical Thermo-con is set to stop.
ERR14	Thermostat alarm	Stop	The thermostat has been activated due to insufficient flow rate of the circulating fluid or facility water or high temperature.
ERR15	Output failure alarm	Continue	The temperature cannot be changed even at 100% output, due to overload or disconnection of the thermo-module.
ERR17	Cutoff/short of internal sensor	Stop	The internal temperature sensor has been disconnected or short-circuited.
ERR18	Cutoff/short of external sensor	Continued by normal control	The external temperature sensor has been disconnected or short-circuited. (Only detected when in learning control, auto-tuning operation 2, or external sensor control)
ERR19	Auto-tuning failure	Stop	Auto-tuning has not been completed within 60 minutes.
ERR21	Fan alarm	Stop	The air-cooled fan alarm of the power supply has been activated.
ERR22	Leak alarm	Stop	The fluid leak sensor has detected leakage of fluid.

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

Description	Expected life	Possible failure
Fan	5 to 10 years	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.
DC power supply	5 to 10 years	End life of electrolytic condenser. It will generate DC power supply alarm.
Display panel	50,000 hours (approx. 5 years)	End life of backlight of LCD display.



Applicable Fluids

Chemical Compatibility Table against the Wetted Material in Chemical Thermo-con

Chemical	Operating temperature range	Compatibility
Hydrofluoric acid	10 to 40°C	○ Note 2)
Buffered hydrogen fluoride	10 to 40°C	○ Note 2)
Hydrofluoric acid and Nitric acid mixture		△
Nitric acid (except fuming nitric acid)		△
Hydrochloric acid		△
Copper sulfate solution	10 to 50°C Note) HED007 10 to 30°C	○ Note 2)
Sulfuric acid (except fuming sulfuric acid)	10 to 50°C Note) HED007 10 to 30°C	○ Note 2)
Ozone	10 to 60°C	◎
Ammonium hydroxide	10 to 60°C	○ Note 2)
Ammonia hydrogen peroxide solution	10 to 60°C	○ Note 1) 2)
Sodium hydroxide	10 to 60°C	○ Note 2)
Pure water	10 to 60°C	○ Note 1)
Ultra pure water	10 to 60°C	○ Note 1)

◎ : Excellent No effect
○ : Good Minor effect/Conditional service
△ : Fair Moderate effect—Consult SMC.



The table is to be used as a general guide only. SMC is not responsible for the accuracy of this data and assumes no obligation of liability in connection with its use. Therefore, SMC insists that all customers test and evaluate the suitability for use of the Chemical Thermo-con in its particular application before using the unit.

Note 1) Static electricity may be generated by dynamic friction with the fluid. It may make a malfunction of electric components. Any countermeasures have to be taken. An example is use of conductive PFA tube or use of metal piping with ground wire.

Note 2) Permeation of the chemical may be possible. The permeated chemical may have a moderate corrosion to inside components and it may effect their life time. In case the fluid has a possibility to generate corrosive gas, SMC recommends a nitrogen purge of the enclosure. N2 purge ports are located at the piping connection side of the heat exchanger.



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), Japan Industrial Standards (JIS)*1) and other safety regulations*2).

- * 1) ISO 4414: Pneumatic fluid power – General rules relating to systems.
ISO 4413: Hydraulic fluid power – General rules relating to systems.
IEC 60204-1: Safety of machinery – Electrical equipment of machines. (Part 1: General requirements)
ISO 10218-1992: Manipulating industrial robots -Safety.
JIS B 8370: General rules for pneumatic equipment.
JIS B 8361: General rules for hydraulic equipment.
JIS B 9960-1: Safety of machinery – Electrical equipment of machines. (Part 1: General requirements)
JIS B 8433-1993: Manipulating industrial robots - Safety.
etc.
- * 2) Labor Safety and Sanitation Law, etc.

 **Caution:** Operator error could result in injury or equipment damage.

 **Warning:** Operator error could result in serious injury or loss of life.

 **Danger :** In extreme conditions, there is a possibility of serious injury or loss of life.

Warning

1. The compatibility of the product is the responsibility of the person who designs the equipment or decides its specifications.

Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results. The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product. This person should also continuously review all specifications of the product referring to its latest catalog information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.

2. Only personnel with appropriate training should operate machinery and equipment.

The product specified here may become unsafe if handled incorrectly. The assembly, operation and maintenance of machines or equipment including our products must be performed by an operator who is appropriately trained and experienced.

3. Do not service or attempt to remove product and machinery/equipment until safety is confirmed.

1. The inspection and maintenance of machinery/equipment should only be performed after measures to prevent falling or runaway of the driven objects have been confirmed.

2. When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.

3. Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.

4. Contact SMC beforehand and take special consideration of safety measures if the product is to be used in any of the following conditions.

1. Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.

2. Installation on equipment in conjunction with atomic energy, railways, air navigation, space, shipping, vehicles, military, medical treatment, combustion and recreation, or equipment in contact with food and beverages, emergency stop circuits, clutch and brake circuits in press applications, safety equipment or other applications unsuitable for the standard specifications described in the product catalog.

3. An application which could have negative effects on people, property, or animals requiring special safety analysis.

4. Use in an interlock circuit, which requires the provision of double interlock for possible failure by using a mechanical protective function, and periodical checks to confirm proper operation.



Safety Instructions

Caution

The product is provided for use in manufacturing industries.

The product herein described is basically provided for peaceful use in manufacturing industries.

If considering using the product in other industries, consult SMC beforehand and exchange specifications or a contract if necessary. If anything is unclear, contact your nearest sales branch.

Limited Warranty and Disclaimer/Compliance Requirements

The product used is subject to the following “Limited Warranty and Disclaimer” and “Compliance Requirements”. Read and accept them before using the product.

Limited Warranty and Disclaimer

1. The warranty period of the product is 1 year in service or 1.5 years after the product is delivered.*3)

Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.

2. For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided.

This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.

3. Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalog for the particular products.

*** 3) 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

When the product is exported, strictly follow the laws required by the Ministry of Economy, Trade and Industry (Foreign Exchange and Foreign Trade Control Law).



Temperature Control Equipment Precautions 1

Be sure to read this before handling. Refer to the back of pages 1 and 2 for Safety Instructions and the back of page 5 through to 7 for Specific Product Precautions.

Selection

Warning

1. Confirm the specifications.

Fully understand the applications, environment, fluids and other operating conditions. Use this product within the specified range shown in this catalog. Using outside the specified range cause injury, damage, or malfunction. When in doubt, contact SMC beforehand.

2. Secure the performance margin.

When you consider the product's cooling/heating capacity or flow characteristics, allowance must be made because there are heat loss from the piping, etc. or pressure drop.

Operating Environment / Storage Environment

Warning

1. Observe the operating ambient temperature range.

The operating ambient temperature range must be within the specification range shown in this catalog. Use caution because using beyond the range will lead to damage, breakage or malfunction.

2. Avoid using and storing in the following environment because it will lead to a malfunction.

1. In locations where water, steam, brine, and oil may splash on the product.
2. In locations where a large amount of particles are airborne.
3. In locations with an atmosphere of corrosive or explosive gases, solvents, or chemicals.
(This product is not explosion proof.)
4. In locations which receive direct sunlight or radiated heat.
(Protect from direct sunshine to avoid the resin from deteriorating by ultraviolet rays or increasing the temperature.)
5. In locations where temperature substantially changes.
6. In locations where there is a heat source nearby and the ventilation is poor.
(Insulate the heat source or ventilate well to avoid damages caused by the heat or temperature increase, such as softening.)
7. In locations where condensation occurs.
8. In locations where strong magnetic noise occurs.
(In locations where strong electric fields, strong magnetic fields and surge voltage occur.)
9. In locations where static electricity occurs, or conditions which make the product discharge static electricity.
10. In locations where high frequency occurs.
11. In locations where damage is likely to occur due to lightning.
12. In locations where impacts or vibrations occur.
13. In conditions where a massive force strong enough to deform the product is applied or a weight from a heavy object is applied.
14. Locations more than 1000 m in altitude (except for storage, transportation).

Fluid

Warning

1. Type of fluids

1. The operating fluids must be used within the specified range shown in this catalog.
Consult with SMC when using the product with other fluids.
2. When foreign matter may be mixed with a fluid, install a filter.

Transportation / Transfer / Movement

Warning

1. Product transfer should be performed by a knowledgeable and experienced person.

Especially, transferring a heavy object is dangerous. Use adequate caution to prevent falling down or dropping accidents from occurring.

2. Avoid transporting in the following environment because it will lead to breakage.

1. In conditions where strong shock and vibrations occur.
2. In operating and storage environments other than those specified.

3. Caution when transferring a heavy object

This product is heavy. Use adequate caution to avoid injury when picking up and setting down the product, and falling and dropping accidents should be avoided.

4. Before moving this product, remove operating fluid, facility water from the inside of this product.

Mounting / Installation

Warning

1. Installation should be performed by a knowledgeable and experienced person.

Especially, installation of a heavy object is dangerous. This product is heavy. Use adequate caution to avoid falling and dropping accidents from occurring.

Caution

1. Provide enough space for ventilation and maintenance.

Provide enough space for the ventilation requirement of each equipment, otherwise a cooling malfunction or operation stoppage may occur. Also, provide space required for maintenance.

2. Confirm the mounting orientation.

Mount and install horizontally.



Temperature Control Equipment Precautions 2

Be sure to read this before handling. Refer to the back of pages 1 and 2 for Safety Instructions and the back of page 5 through to 7 for Specific Product Precautions.

Operation

Warning

- 1. Handle and operate after the safety of this product and the whole system are confirmed.**

For this product and incidental equipment, operate this product by a knowledgeable and experienced person.
- 2. Before operation, confirm the safety of mounting, installation, piping and electric wiring conditions.**
 1. Confirm that the mounting and installation conditions are safe.
 2. Confirm that the circulating fluid is filled and that the fluid level is within the display range.
 3. Confirm whether the valve is open or closed and that the hose and resin tube are not twisted.

It is dangerous when the valve in the piping is closed because the circulating fluid and the facility water will not flow and the fluid pressure will increase.
 4. Confirm the flow direction of the fluid.

Make sure that the flow direction of the fluid (Inlet/Outlet direction) is connected correctly.
 5. Confirm that the electrical wiring condition is safe.

Incorrect wiring will lead to a malfunction or breakage of the product. Confirm that there is no error in wiring before operation.
 6. When using the product with a 3-phase power supply, confirm the connection.

If the phase order is incorrect, the pump, etc. will run in reverse, or the phase-reversal relay will activate and the product will not operate.

In this case, after cutting off the main power supply, reverse 2 wires out of the 3 wires and connect them in the correct phase order.
- 3. Do not remove the external panel during energization or operation.**

If removed, there are the dangers of electrical shock, burn, frostbite, injury from a rotating object.
- 4. Avoid operating with a lower flow.**

Avoid operating with a lower flow because the temperature control may become unstable or the service life of the pump may shorten.
- 5. Confirm the safety during the operation.**

During the operation, if an emergency is detected, stop this product immediately and cut the power supply breaker.
- 6. When not used for long periods of time, confirm the safety once again prior to beginning its operation.**

Maintenance

Warning

- 1. Maintenance should be performed according to the procedure indicated in the operating manual.**

Improper handling can cause damage and malfunction of equipment and machinery.
 - 2. Maintenance operations**

Improper handling of compressed air is dangerous. Therefore, in addition to observing the product specifications, replacement of elements and other maintenance activities should be performed by personnel having sufficient knowledge and experience pertaining to equipment.
 - 3. Pre-maintenance inspection**

When removing this product, turn off the electric power, and be certain to shut off the supply pressure and exhaust the compressed air in the system. Proceed only after confirming that all pressure has been released to the atmosphere.
 - 4. Post maintenance inspection**

After installation or repair, reconnect compressed air and electricity and conduct appropriate inspections to confirm proper operation. If there is an audible air leakage, or if the equipment does not operate properly, stop operation and confirm that the equipment is installed correctly.
 - 5. Modification prohibited**

Do not modify or reconstruct the unit.
 - 6. Stopping for long periods of time**

When not using for long periods of time, remove the operating fluid (circulating fluid, facility water) and cut the main power supply.
 - 7. Removal of product**

Take the stop/inspection measures and confirm that there is no danger before the product is removed.

In the event of removing the product, discharge the used fluid and clean the inside of the piping.

When a dangerous fluid or polluted fluid is left, it is likely that the polluted area will be enlarged or an accident will occur.
- 8. Disposal of product**

When the product is disposed, it must be in compliance the ordinance or rules of the local municipality.

Please ask for help from a professional industrial waste disposal company.

In particularly, in case of a refrigerated type product, entrust a company to collect the Freon®, etc.

In that case, the customer may be requested to submit a certificate that is showing the type of operating fluid and whether any quantity is left.

These procedures are the responsibility of the customer.
- 9. Preparation of a backup product**

In order to keep the downtime of a customer's system to a minimum, please kindly prepare a backup product, when necessary.



Series HED Specific Product Precautions 1

Be sure to read this before handling. Refer to the back of pages 1 and 2 for Safety Instructions and the back of page 3 and 4 for Temperature Control Equipment Precautions.

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

Handling

⚠ Warning

1. Thoroughly read the operating manual.

Read the operating manual completely before operation, and keep this manual available whenever 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. Piping must be designed taking the whole system into consideration.

For this product and future equipment, design of the piping system should be performed by a knowledgeable and experienced person.

The fitting is not attached, and should be prepared separately by the customer.

Select a fitting suitable for the material and dimensions of the tube. When connecting the fitting, use a specific tool specified by the fitting manufacturer.

Piping

⚠ Warning

2. 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.

3. 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.

4. 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.

5. 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 pure 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.



Series HED Specific Product Precautions 2

Be sure to read this before handling. Refer to the back of pages 1 and 2 for Safety Instructions and the back of page 3 and 4 for Temperature Control Equipment Precautions.

Electrical Wiring

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 circuit breaker.

As a countermeasure against current leakage, install a ground fault circuit interrupter (GFCI) 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. (grounding resistance of 100 Ω or less)

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, 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"

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

* Electrical 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 more than two chemical thermo-cons are to be connected, increase the number of systems.



Series HED Specific Product Precautions 3

Be sure to read this before handling. Refer to the back of pages 1 and 2 for Safety Instructions and the back of page 3 and 4 for Temperature Control Equipment Precautions.

Installation

⚠ 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

Device to mount	Thread size	Applicable tightening torque N·m
Heat exchanger	M6	1.5 to 2.5
Temperature controller	M5	1.5 to 2.5

Circulating Fluid

⚠ Caution

1. Applicable fluids

For the compatibility between the material of components and fluid, refer to "Applicable Fluids" (page 8). Contact SMC for fluids other than those described on the check list.

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. Caution for the use of pure water

If pure water is used, bacteria and algae may grow in a short period. If the Chemical Thermo-con is operated with bacteria and algae, the performance of the heat exchanger may deteriorate. Exchange all pure water regularly depending on the conditions (once a month as a guide).

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. Operating pressure range of circulating fluid

The operating pressure range is 0 to 0.35 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. 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.

Communication

⚠ Caution

1. The set value can be written to EEPROM, but only up to about 1 million times.

In particular, pay attention to how many of times the writing is performed using the communication function.

Maintenance

⚠ Warning

1. Prevention of electric shock and fire

Do not operate the switch with wet hands. Also, do not operate the Chemical Thermo-con with water or fluid left on it.

2. Action in case of error

If any error such as abnormal noise, smoke, or bad smell occurs, cut off the power at once, and stop supplying facility water. Ask SMC or a sales distributor to repair the Chemical Thermo-con.

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.

- Check of displayed contents.
- Check of temperature, vibration and abnormal sounds in the body of the Chemical Thermo-con.
- Check of the voltage and current of the power supply system.
- Check for leakage and contamination of the circulating fluid and intrusion of foreign matter to it, and subsequent replacement water.
- Check for leakage, quality change, flow rate and temperature of facility water.

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.



Goggles



Mask

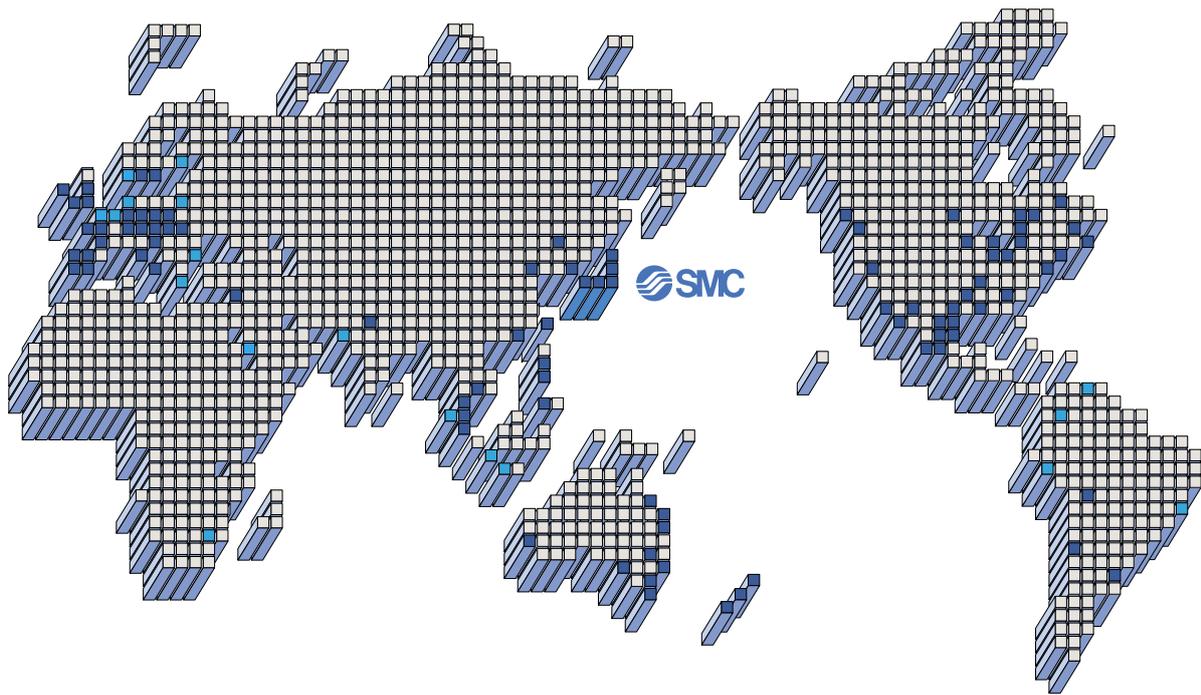


Gloves



Safety shoes

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