

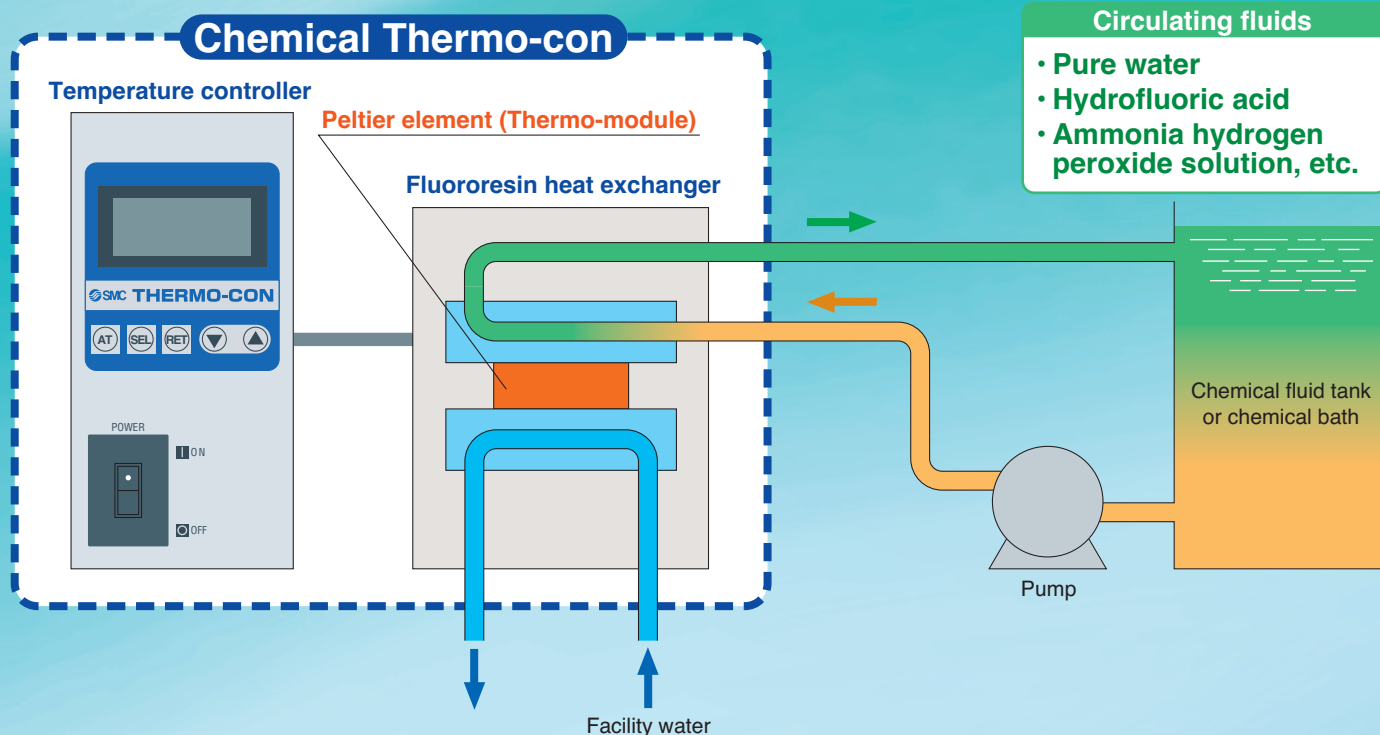
Peltier-Type Temperature Control System for Chemicals

Chemical Thermo-con   

SEMI Standard
S2-0706, F47-0706

(Excluding HED009)

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, 900 w**



Series HED

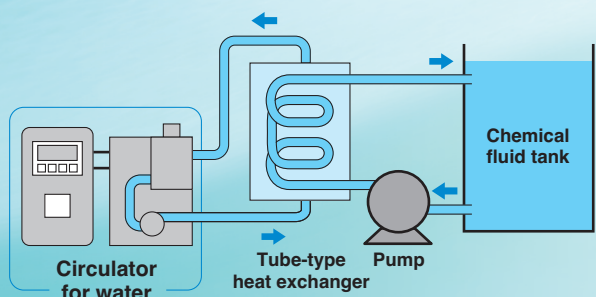


CAT.EUS40-54Aa-UK

Allows direct control of chemical temperature.

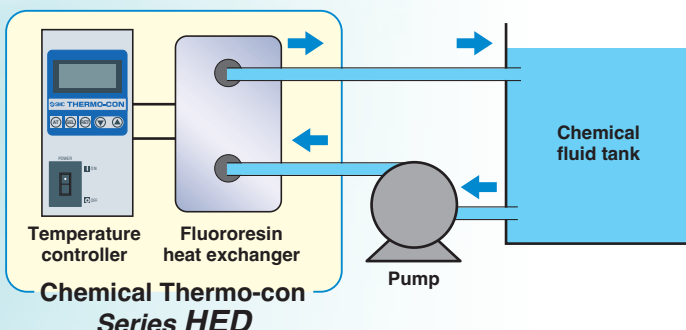
- PFA wetted material prevents contamination from metal ion elution.
- No need of a tube-type heat exchanger.

Indirect temperature control



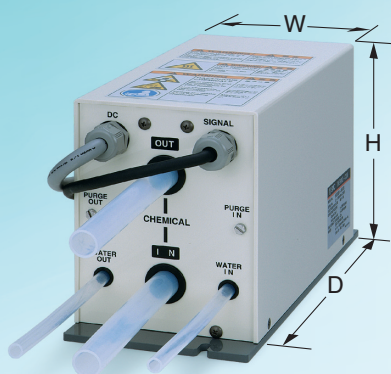
Direct temperature control

Direct control of chemicals temperature



Compact/Lightweight

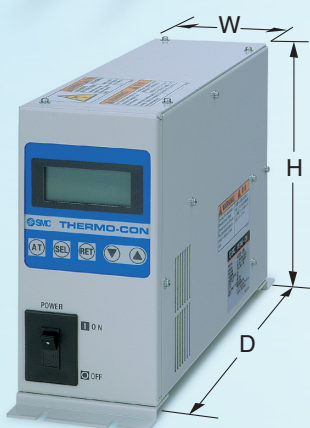
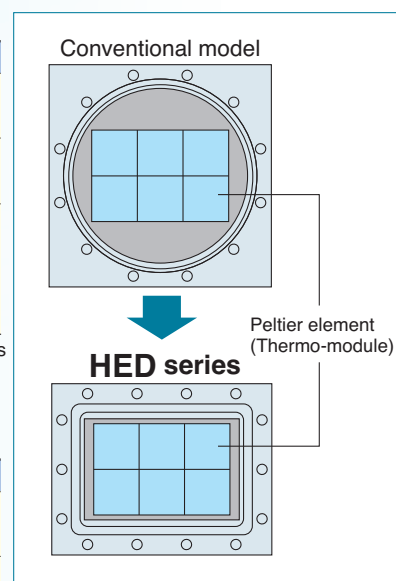
- Self-developed heat exchanger matched to the configuration of the Peltier element (Thermo-module). Compact and light weight



Heat Exchanger

Model	W	D	H	Weight
HED003	130 mm (5.12")	263 mm (10.4")	170 mm (6.69")	8 kg (17.6 lb)
HED005				14 kg (30.8 lb)
HED007	150 mm (5.91")	294 mm (11.6")	222 mm (8.74")	15 kg (33 lb)
HED009				

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



Temperature Controller

Model	W	D	H	Weight
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)
HED009				

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

● Applications

For Semiconductor industry

Cleaning equipment

Plating equipment

Wet etching equipment, etc.

And for any other industry ...

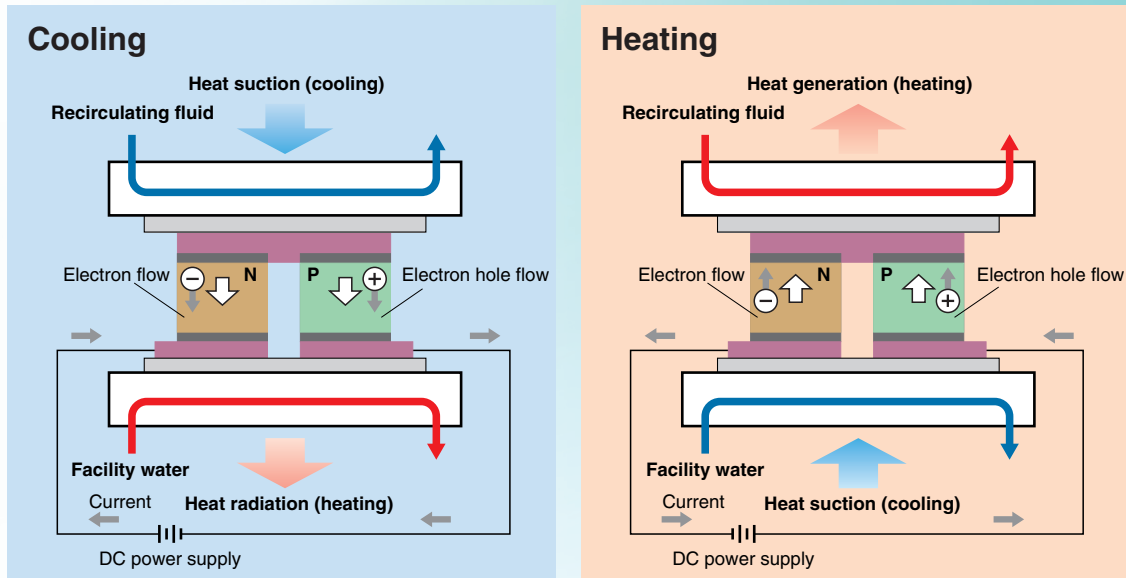
● Applicable Fluid Example

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		

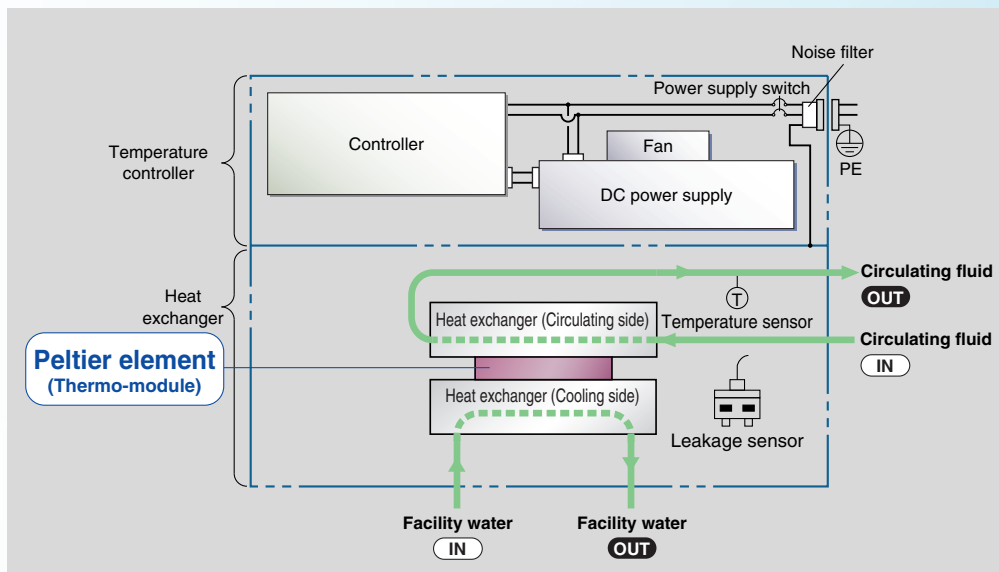
Note) Chemical Thermo-con is not designed explosion proof, so it is not suitable for flammable fluids.

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

The Peltier element is a plate-shape solid state element with P type and N type semiconductor, arrayed alternately. When direct current is supplied to the element, heat moves from one surface to another with electron flow in N type semiconductor and electron hole in P type semiconductor. As a result of the movement heat, one surface of the element absorbs heat and decreases temperature; and other surface heats up. When the DC current is switched to reverse direction, the heat movement will also be in 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 energise the Peltier elements and outputs appropriate DC power to the peltier elements based on a differential between set point and a value of temperature sensor. The temperature sensor is installed in the heat exchanger, and the leakage sensor is installed in the heat exchanger to detect unexpected water or chemical leakage..

Series HED

Model Selection

Model Selection Guide

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.

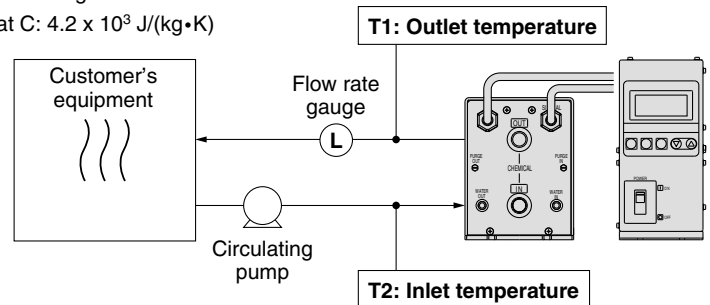
Heat generation amount Q	: Unknown
Circulating fluid temperature difference ($\Delta T (= T_2 - T_1)$)	: 1.0°C (1.0 K)
Circulating fluid outlet temperature (T1)	: 20°C (293.15 K)
Circulating fluid inlet temperature (T2)	: 21°C (294.15 K)
Circulating fluid flow rate (L)	: 7 ℓ/min
Circulating fluid	: Water
	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.

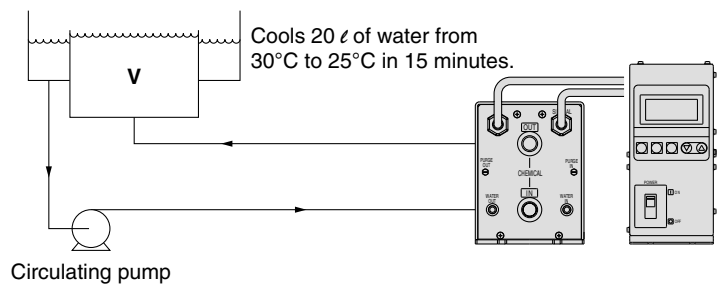
Total volume of the object being cooled down (V)	: 20 ℓ
Cooling time (h)	: 15 min
Cooling temperature difference (ΔT)	: 5°C (5 K)
Circulating fluid	: Water
	Density γ : $1 \times 10^3 \text{ kg/m}^3$
	Specific heat C: $4.2 \times 10^3 \text{ J/(kg} \cdot \text{K)}$

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

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

$$= 467 \text{ W}$$

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



Model Selection Precautions

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

Set Part number (Temperature controller + Heat exchanger)

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

HED 007 - W 2 B 13 -

Chemical Thermo-con

Cooling capacity

003	300 W
005	500 W
007	750 W
009	900 W

Radiating method

W Water-cooled

Communication

A	RS-485
B	RS-232C

Power supply

2 Single-phase: 180 to 242 VAC 50/60 Hz

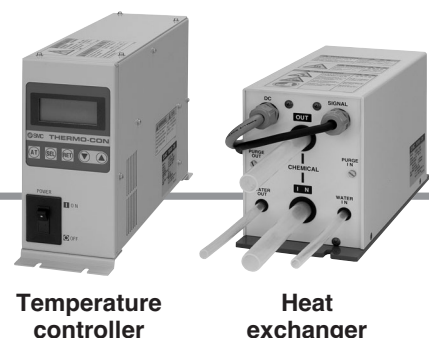
Tube size

13	1/2" x 3/8"	HED003, 005, 007
19	3/4" x 5/8"	
25	1" x 7/8"	HED009

Option

-	None
Y	For high-concentration chemicals

* Only the HED009 can be selected for high-concentration chemicals.



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

HED 007 - H W 13 -

Cooling capacity

003	300 W
005	500 W
007	750 W
009	900 W

Heat exchanger

Tube size

13	1/2" x 3/8"	HED003, 005, 007
19	3/4" x 5/8"	
25	1" x 7/8"	HED009

* The tube size should be specified when ordering.

Radiating method

W Water-cooled

Option

-	None
Y	For high-concentration chemicals

* Only the HED009 can be selected for high-concentration chemicals.

Temperature controller

HED 007 - C 2 B

Cooling capacity

003	300 W
005	500 W
007	750 W
009	900 W

Communication

A	RS-485
B	RS-232C

Power supply

2 Single-phase: 180 to 242 VAC 50/60 Hz

Temperature controller

Main Specifications (For details, please refer to our “Product Specifications” information.)**Heat Exchanger Specifications**

Heat exchanger model		HED003-HW13	HED003-HW19	HED005-HW13	HED005-HW19	HED007-HW13	HED007-HW19	HED009-HW25
Cooling capacity (Water)*1		300 W		500 W		750 W		900 W
Heating capacity (Water)*1		600 W		1000 W		1800 W		2300 W
Cooling/Heating method		Peltier device (Thermoelectric device, Thermo-module)						
Radiating method		Water-cooled						
Operating temperature range		10.0 to 60.0°C (depending on the type of circulating fluid)						
*3, *6 Circulating fluid	Applicable fluid*2	Deionised water, Hydrofluoric acid, Ammonia hydrogen peroxide solution, etc.						Hydrofluoric acid, Ammonia hydrogen peroxide solution, etc.
	Fluid contact material	PFA						PFA, SiC
	Operating pressure	0 (atmospheric pressure) to 0.35 MPa*3						0 (atmospheric pressure) to 0.35 MPa (0.5 MPa)*5
	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"	1" x 7/8"
*7 Facility water	Temperature	10 to 35°C (no condensation)						
	Fluid contact material	FEP, Stainless steel 304, Stainless steel 316						
	Max. operating pressure	0.5 MPa						
	Tube size	IN/OUT: FEP tube 3/8" x 1/4"						
	Flow rate	5 to 10 l/min						
Ambient temperature/humidity		Temperature: 10 to 35°C, Humidity: 35 to 80%RH (no condensation)						
Dimensions*4		W130 mm x D263 mm x H170 mm		W150 mm x D294 mm x H222 mm		W150 mm x D294 mm x H222 mm		W150 mm x D294 mm x H222 mm
Weight		Approx. 8 kg		Approx. 14 kg		Approx. 15 kg		Approx. 15 kg
Applied temperature controller		HED003-C2A HED003-C2B		HED005-C2A HED005-C2B		HED007-C2A HED007-C2B		HED009-C2A HED009-C2B

*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

*2 For the compatibility between the circulating fluid and materials, refer to “Applicable Fluids”.

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

*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 user.

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

*5 0.5 MPa can only be used at circulating fluid temperature temperatures below 50°C or less.

*6 Never operate the circulation pump when it stopped or at a very low circulation flow rate (7 l/min or less for water).

Temperature may not be controlled accurately, and also the life of the thermo module may be significantly reduced due to repeated cooling and/or heating operations.

*7 If the facility water is provided beyond the specification, noises or vibrations may occur, and facility water may become hot.

Temperature Controller Specifications

Temperature controller model		HED003-C2A	HED003-C2B	HED005-C2A	HED005-C2B	HED007-C2A	HED007-C2B	HED009-C2A	HED009-C2B
Communication		RS-485	RS-232C	RS-485	RS-232C	RS-485	RS-232C	RS-485	RS-232C
Control method		Cooling/Heating automatic shift PID control							
Operating temperature range		10.0 to 60.0°C (no condensation)							
Temperature stability*1		Within $\pm 0.1^\circ\text{C}$ (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 user.							
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/humidity		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	3 A		5 A		14 A		14 A	
Dimensions*2		W100 mm x D320 mm x H215 mm		W140 mm x D350 mm x H215 mm		W165 mm x D447 mm x H215 mm		W165 mm x D447 mm x H215 mm	
Weight		Approx. 6 kg		Approx. 8 kg		Approx. 13 kg		Approx. 13 kg	
Applied heat exchanger*3		HED003-HW13 HED003-HW19		HED005-HW13 HED005-HW19		HED007-HW13 HED007-HW19		HED009-HW25	

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

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

*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.)

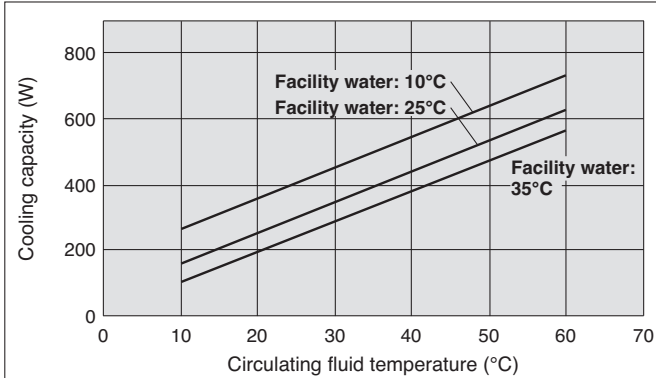


● For the combination of the heat exchanger and temperature controller, refer to “Combination in Set.”

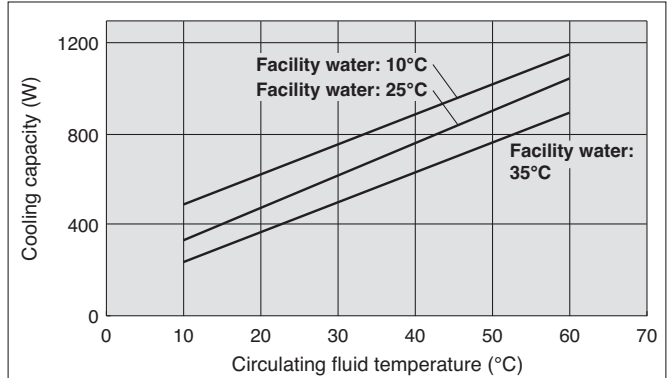
The values shown on the performance chart are representative and not guaranteed. Allow a safety margin when choosing the product.

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

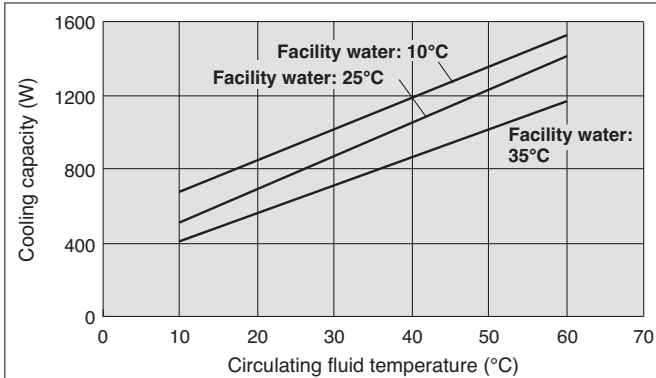
HED003



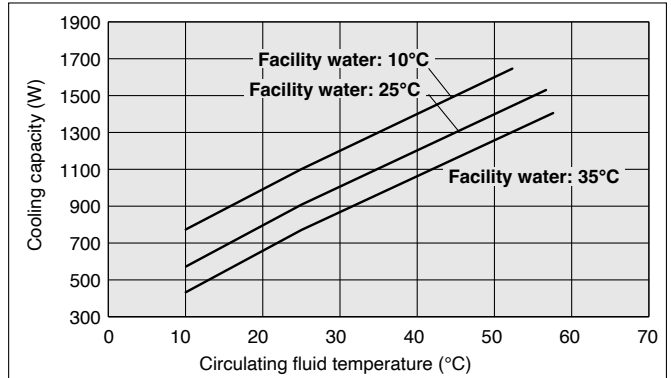
HED005



HED007

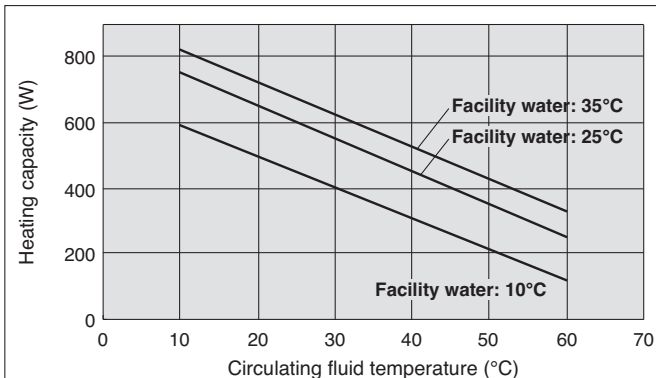


HED009

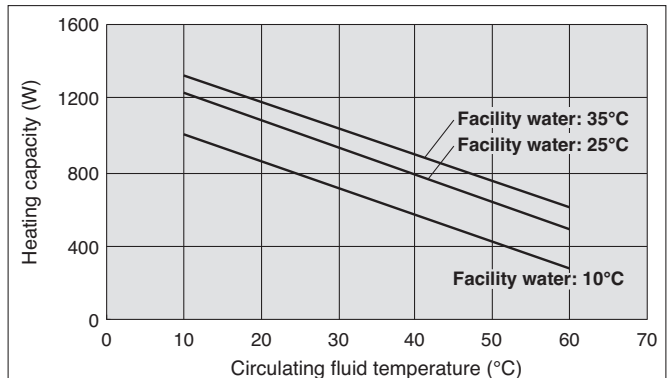


Heating Capacity <Conditions> Circulating fluid: Water; Circulating fluid flow rate: 15 l/min; Facility water flow rate: 5 l/min

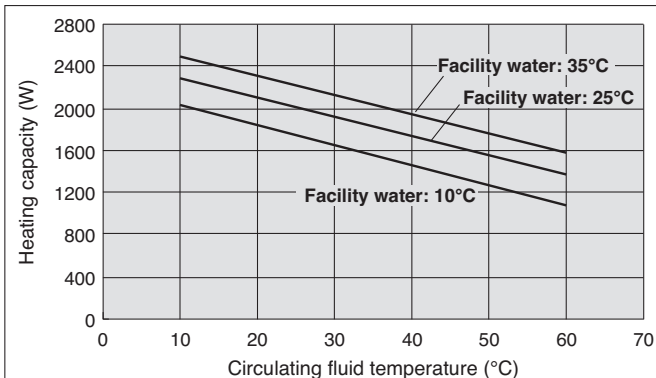
HED003



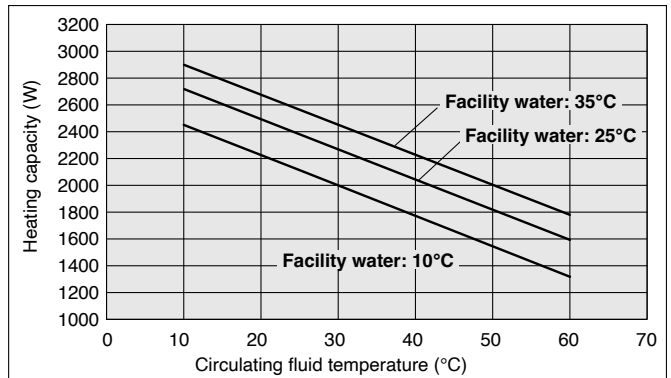
HED005



HED007

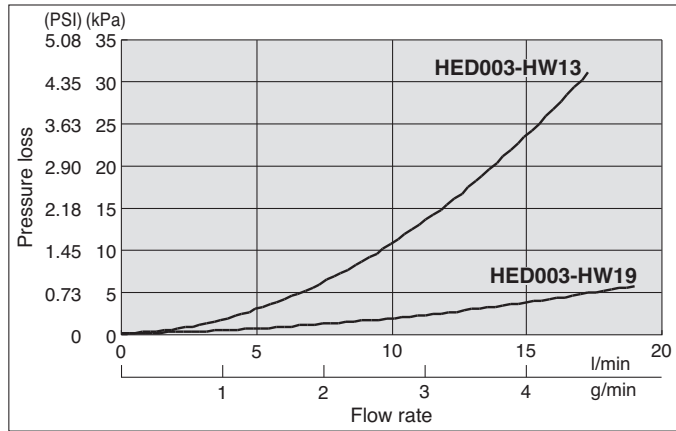


HED009

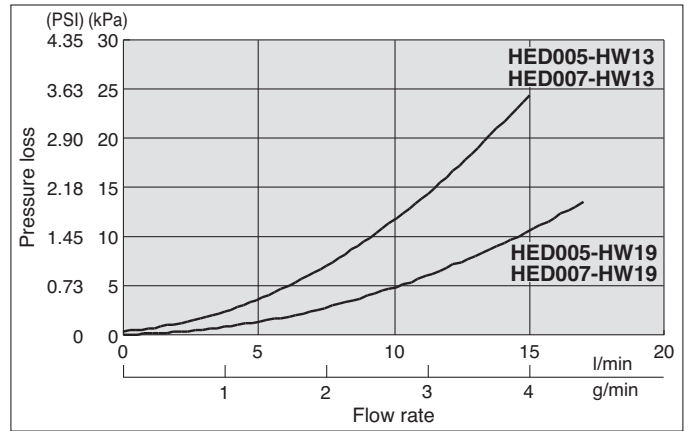


Pressure Loss in Circulating Fluid Circuit <Condition> Water

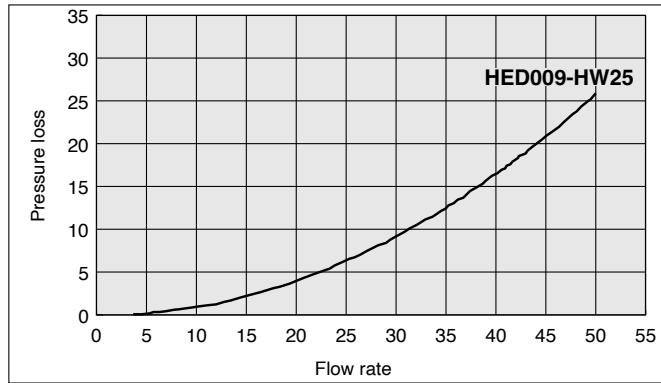
HED003



**HED005
HED007**

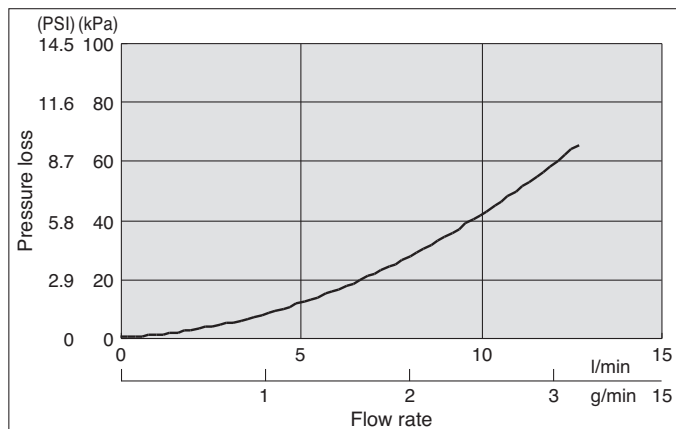


HED009

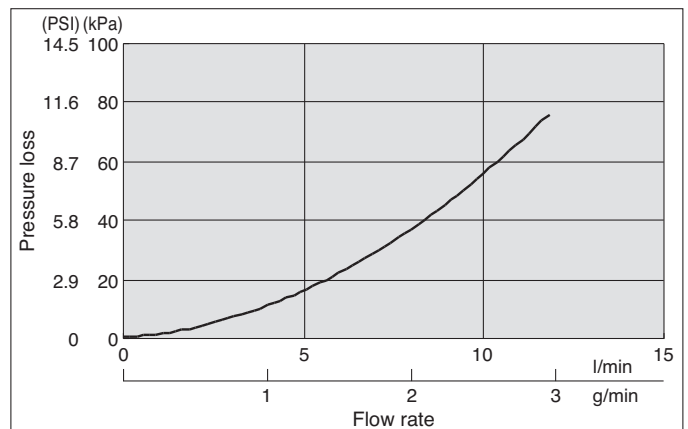


Pressure Loss in Facility Water Circuit <Condition> Water

HED003



**HED005
HED007**



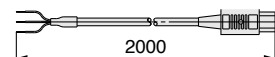
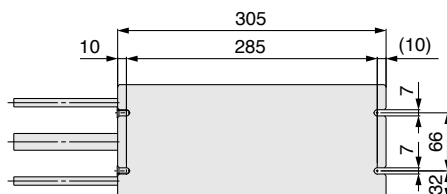
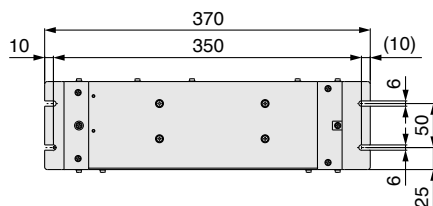
Series *HED*

Dimensions

HED003-W2□□

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 Cable (Accessory)

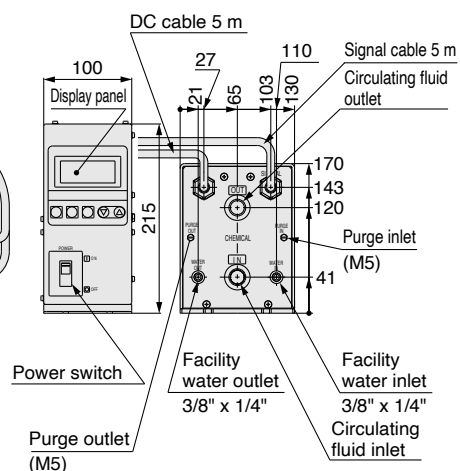
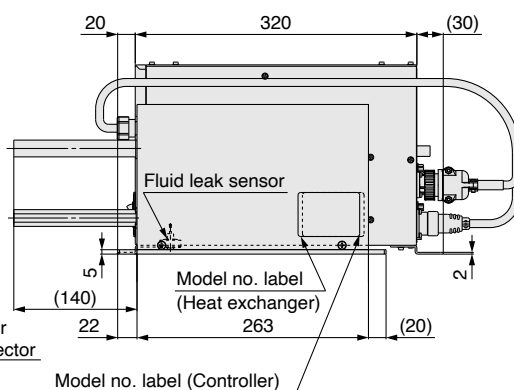
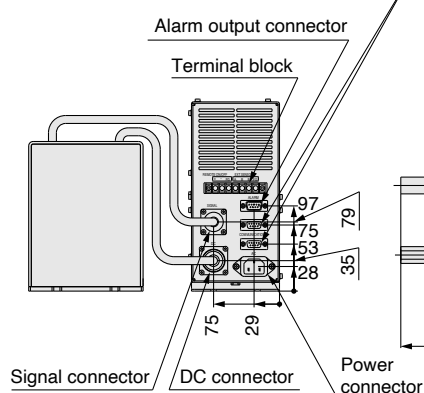
Connector: IEC 60320 C13 or equivalent
Cable: 14AWG, O.D. ø8.4

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

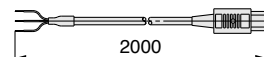
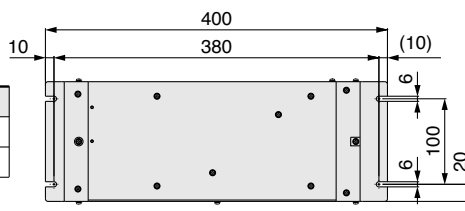
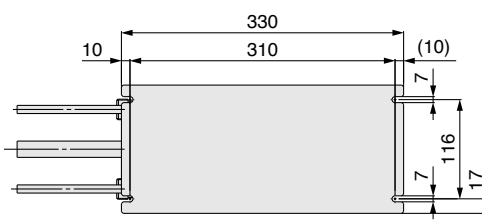
Temperature controller Heat exchanger
HED003-C2 ☐ HED003-HW ☐

Communication connector

* The RS-232C uses only lower side connector.



HED005-W2□□

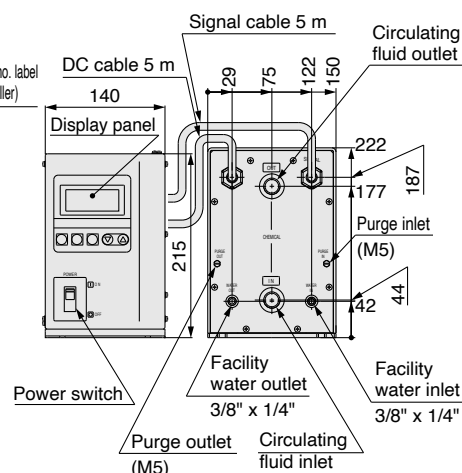
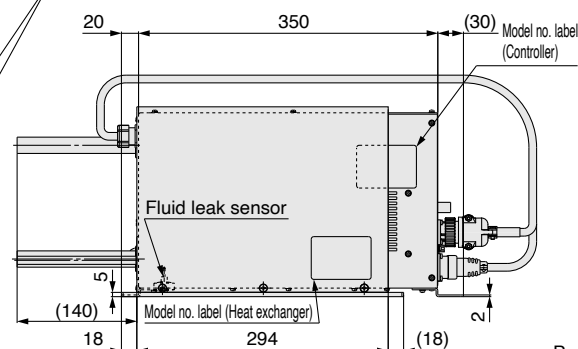
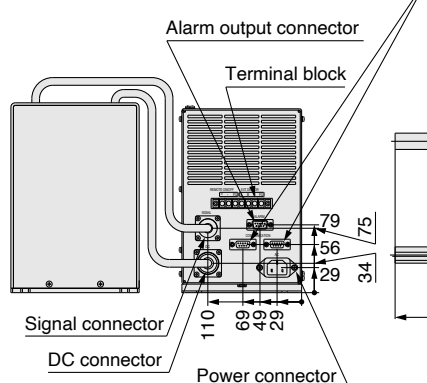


Circulating Fluid Tube Size

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

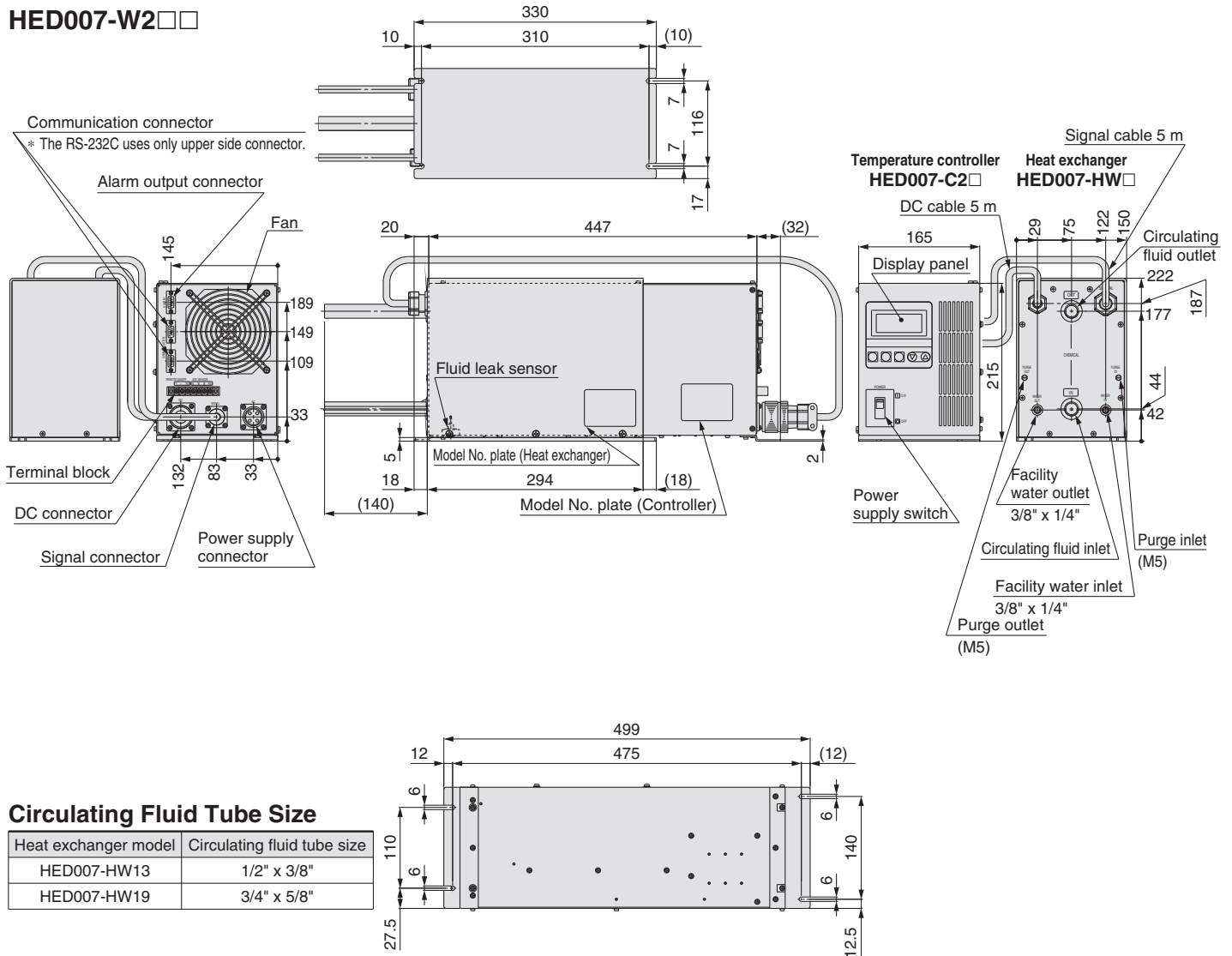
Communication connector

* The RS-232C uses only right side connector.



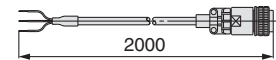
Dimensions

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)

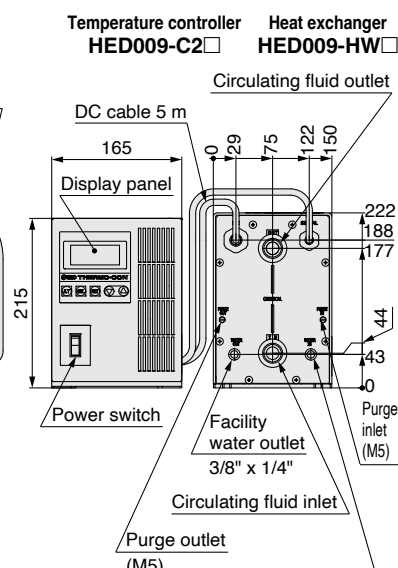
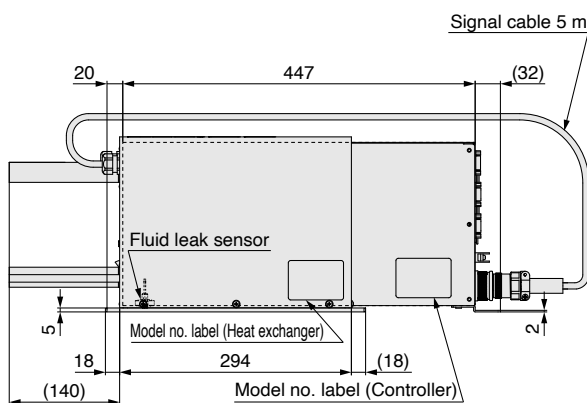
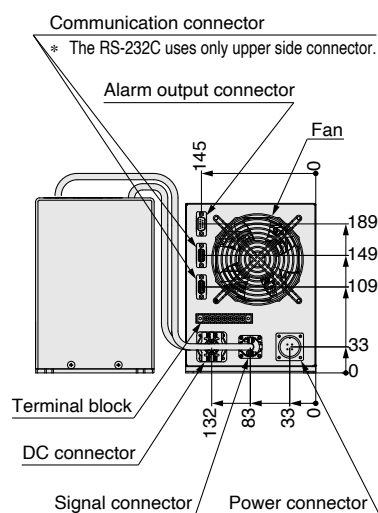
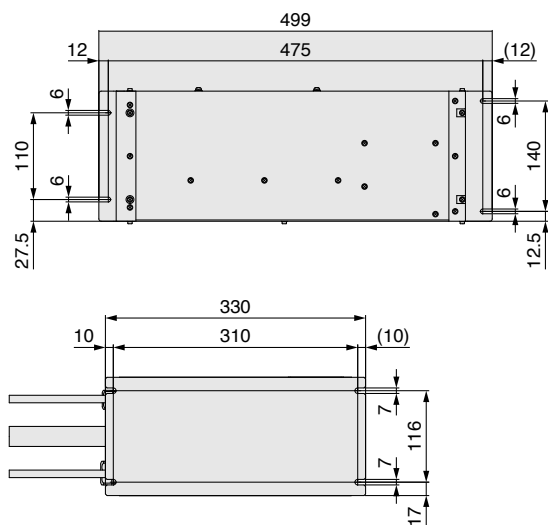
Connector: DDK CE05-6A18-10SD-D-BSS
Cable: 12AWG, O.D. ø11.8

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

Series *HED*

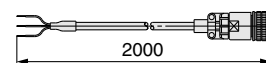
Dimensions

HED009-W2☐☐



Circulating Fluid Tube Size

Heat exchanger model	Circulating fluid tube size
HED009	1" x 7/8"



Power Cable (Accessory)

Connector: DDK CE05-6A18-10SD-D-BSS
Cable: 12AWG, O.D. $\varnothing 11.8$

Wire colour	Contents
Black 1	180 to 242 VAC
Black 2	180 to 242 VAC
Green/Yellow	PE

Connectors

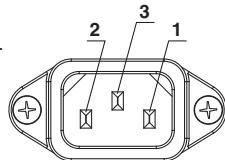
- Use the special power cable included with the temperature controller.
- Connect the DC cable and signal cable that come from the heat exchanger to the DC and signal connectors of the temperature controller.
- Prepare other required connectors and wiring by user.

1. Power connector

<For HED003-C2□, HED005-C2□, HED009-C2□>
IEC 60320 C14 or equivalent

Connect the included special power cable.

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

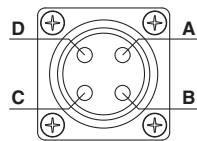


Power connector
(HED003-C2□, HED005-C2□)

<For HED007-C2□, HED009-C2□>
DDK Ltd. CE05-2A18-10PD-D

Connect the included special power cable.

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



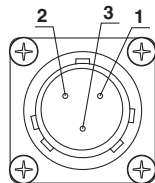
Power connector
(HED007-C2□, HED009-C2□)

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.

Pin No.	Signal contents
1	DC output
2	DC output
3	FG

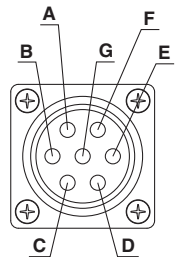


DC connector
(HED003-C2□, HED005-C2□)

<For HED007-C2□, HED009-C2□>
DDK Ltd. D/MS3102A20-15S

Connect the DC cable connector of the heat exchanger.

Pin No.	Signal contents
A	DC output
B	DC output
C	DC output
D	DC output
E	DC output
F	DC output
G	FG



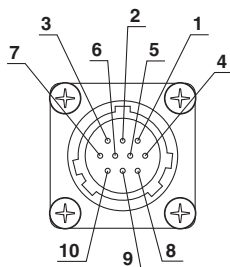
DC connector
(HED007-C2□)

3. Signal connector

<Common to HED003-C2□, HED005-C2□, HED007-C2□, HED009-C2□>
DDK JMR1610FG-36

Connect the signal cable connector of the heat exchanger.

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
Grounding	FG

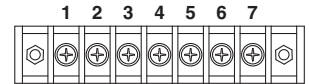


Signal connector

4. Terminal block

<Common to HED003-C2□, HED005-C2□, HED007-C2□, HED009-C2□>
Morimatsu Co., Ltd.: M111A-7A, for holding screw M3
Connection cable: 22AWG or more, max. 10 m

Pin No.	Signal contents
1	Remote ON/OFF +
2	Remote ON/OFF -
3	FG
4	External sensor: Terminal A of resistance temperature detector
5	External sensor: Terminal B of resistance temperature detector
6	External sensor: Terminal B of resistance temperature detector
7	FG



Terminal block

A short pin is installed between No. 1 and No. 2 pins to short-circuit it (Remote ON) when shipped.

Remote ON/OFF signal

Circuit voltage: 24 VDC $\pm 10\%$; passing current: 2.9 to 4.3 mA

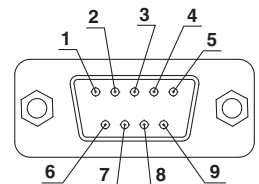
Exterior sensor signal

Applicable sensor: Pt100 Ω ; passing current: 2 mA

5. Alarm output connector: D-sub 9 pin

<Common to HED003-C2□, HED005-C2□, HED007-C2□, HED009-C2□>
OMRON Corp. XM2A-0901 or equivalent, holding screw M2.6
Fixed contact point (load resistance: 125 VAC, 0.3 A; 30 VDC, 2 A)
Connection cable: With shielding 22AWG or more, max. 10 m

Pin No.	Signal contents
1	Contact a for output cut-off alarm (open when alarm occurs)
2	Common for output cut-off alarm
3	Contact b for output cut-off alarm (closed when alarm occurs)
4	Contact a for upper/lower temp. limit alarm (open when alarm occurs)
5	Common for upper/lower temp. limit alarm
6	Contact b for upper/lower temp. limit alarm (closed when alarm occurs)
7-9	Unused



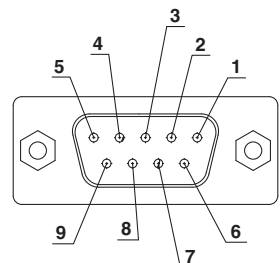
Alarm output connector
D-sub 9 pin (pin type)

6. Communication connector: D-sub 9 pin

OMRON Corp. XM2D-0901 or equivalent, holding screw M2.6
Connection cable: With shielding 22AWG or more

1) Common to HED003-C2A, HED005-C2A, HED007-C2A, HED009-C2A
RS-485

Pin No.	Signal contents
1	RS-485 BUS +
2	RS-485 BUS -
3	Unused
4	Unused
5	SG
6-9	Unused



Communication connector
D-sub 9 pin (socket type)

2) Common to
HED003-C2B, HED005-C2B,
HED007-C2B, HED009-C2B
RS-232C

Pin No.	Signal contents
1	Unused
2	RS-232C RD
3	RS-232C SD
4	Unused
5	SG
6-9	Unused

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 can only be repaired during warranty by returning it to SMC for investigation. The unit has to be completely decontaminated with an appropriate method (such as the use of neutralizing agent) before returning it to SMC.

2) Temperature controller

The temperature controller maintenance is only performed at SMC's site. On the other hand, following parts have a limited life and need to be replaced before th life ends.

Parts Life Expectation

Description	Expected life	Possible failure
Fan	5 to 10 years	Lack of fan cooling because of the bearing life time. It will activate the overheat protection of DC power supply and generate an 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 LCD display backlight.



Series **HED**

Applicable Fluids

Chemical Liquid Compatibility Table against the Fluid Contact Material in Chemical Thermo-con

Chemical	Concentration		Operating temperature range	Compatibility	
	Standard	For high-concentration chemicals		Standard	For high-concentration chemicals
Hydrofluoric acid	HF: 10% or less	HF49% or less	10 to 40°C	○*2	○*2
Buffered hydrogen fluoride	HF: 10% or less	HF49% or less	10 to 40°C	○*2	○*2
Hydrofluoric acid and Nitric acid mixture	HF: 5% or less HNO ₃ : 5% or less	HF49% or less HNO ₃ : 70% or less		△	○
Nitric acid (except fuming nitric acid)	HNO ₃ : 5% or less	HNO ₃ : 70% or less		△	○
Hydrochloric acid	HCl: 5% or less	HCl: 35% or less		△	○
Copper sulfate solution	H ₂ SO ₄ : 96% or less		10 to 50°C * HED007, HED009: 10 to 30°C	○	○*2
Sulfuric acid (except fuming sulfuric acid)	H ₂ SO ₄ : 96% or less		10 to 50°C * HED007, HED009: 10 to 30°C	○	○*2
Ozone	—		10 to 60°C	○	△
Ammonium hydroxide	NH ₃ : 5% or less		10 to 60°C	○*2	○*2
Ammonia hydrogen peroxide solution	NH ₃ : 5% or less H ₂ O ₂ : 20% or less		10 to 60°C	○*1, *2	○*1, *2
Sodium hydroxide	NaOH: 50% or less		10 to 60°C	○*2	○*2
Deionised water	—		10 to 60°C	○*1	△
Ultrapure water	—		10 to 60°C	○*1	△

- 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.

*1 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.

*2 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. N₂ purge ports are located at the piping connection side of the heat exchanger.

*3 Applicable when the high-concentration chemicals option is selected.

How to read the table:

○: Useable

△: Please use this product at your discretion.



Series HED

Specific Product Precautions 1

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

System Design

Warning

This catalogue 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. 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. 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, so avoid it by considering operating conditions.
2. The Chemical Thermo-con is not designed for clean room usage: the fan generates 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 considering the whole system.

Design of the piping system should be performed by a knowledgeable and experienced person.

As the fitting is not attached, it 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 as specified by the fitting manufacturer.

Piping

Warning

2. Work performed on the piping should be done by a knowledgeable and experienced person.
3. Confirm the leakage of fluid.
Fluid leakage can cause dangerous accidents. Be sure 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, for kinks or collapses.
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 both the circulating pump with a hardware interlock, and 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 are cleaned up or air blown (flushing) before piping.
2. Take care over the direction of fluid.
Check the direction “IN” and “OUT” directions for the facility water system and circulating fluid system.
3. Take countermeasures against condensation.
Take countermeasures such as installing insulation material, to avoid condensations.
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 the products. For safety instructions and temperature control equipment precautions, refer to the “Handling Precautions for SMC Products” and the “Operation Manual” on the SMC website: <https://www.smc.eu>.

Electrical Wiring

Warning

1. Electrical wiring 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, and 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 or less): it 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. Use an adequate cable size and terminal.

In the event of attaching a power supply cable, use a cable and terminal size which are 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.

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 when there is no facility water or there is very little flow rate of water 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. First, naturally let it cool down, 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 SMC.

2. Install a filter (20 mesh or equivalent) if any foreign matter can enter the fluid.

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 25C)	6.5 to 8.2
	Electrical conductivity (25C)	100 ^{Note)} to 800 [S/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

Note) Electrical conductivity should be 100 [S/cm] or more.

2. If the temperature of the facility water is too low, it can cause 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. If more 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 the products. For safety instructions and temperature control equipment precautions, refer to the “Handling Precautions for SMC Products” and the “Operation Manual” on the SMC website: <https://www.smc.eu>

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 Nm
Heat exchanger	M6	1.5 to 2.5
Temperature controller	M5	1.5 to 2.5

Circulating Fluid

⚠ Caution

1. Applicable fluids

The customer is responsible for confirming product component materials and the fluid's compatibility by referring to the Applicable Fluids on page 8.

Flammable fluid cannot be used because this equipment is not an explosion proof.

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 when using 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. 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 by also using the remote ON/OFF function.

5. Operating pressure range of circulating fluid

The operating pressure range is 0 to 0.35 MPa. The HED009 series can be used between 0 MPa and 0.50 MPa, only when the product is used at circulating fluid temperature at 50°C or less (including temperature in the return side). Do not use with negative pressure that can cause the Chemical Thermo-con to fail (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. Fluid pulsation prohibition

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.

Pay attention to the number 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, stop supplying facility water and contact SMC or a sales distributor to repair the Chemical Thermo-con.

3. Regular inspection

Check the following items at least once a month, by an operator who has sufficient knowledge and experience:

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

4. Protective clothing

Some fluids can be dangerous when handled incorrectly so 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.



Goggles



Mask



Gloves



Safety shoes

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) ¹⁾, and other safety regulations.

Danger:

Danger indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.

Warning:

Warning indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.

Caution:

Caution indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.

- 1) ISO 4414: Pneumatic fluid power – General rules and safety requirements for systems and their components.
ISO 4413: Hydraulic fluid power – General rules and safety requirements for systems and their components.
IEC 60204-1: Safety of machinery – Electrical equipment of machines. (Part 1: General requirements)
ISO 10218-1: Robots and robotic devices - Safety requirements for industrial robots - Part 1: Robots.
etc.

Warning

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

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

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

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

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

1. The inspection and maintenance of machinery/equipment should only be performed after measures to prevent falling or runaway of the driven objects have been confirmed.
2. When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.
3. Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.

4. Our products cannot be used beyond their specifications.

Our products are not developed, designed, and manufactured to be used under the following conditions or environments.

Use under such conditions or environments is not covered.

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

Caution

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

Use in non-manufacturing industries is not covered.

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

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

Limited warranty and Disclaimer/Compliance Requirements

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

Limited warranty and Disclaimer

1. The warranty period of the product is 1 year in service or 1.5 years after the product is delivered, whichever is first. ²⁾ Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.
 2. For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided. This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.
 3. Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalogue for the particular products.
- 2) Vacuum pads are excluded from this 1 year warranty.
A vacuum pad is a consumable part, so it is warranted for a year after it is delivered. Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty.

Compliance Requirements

1. The use of SMC products with production equipment for the manufacture of weapons of mass destruction (WMD) or any other weapon is strictly prohibited.
2. The exports of SMC products or technology from one country to another are governed by the relevant security laws and regulations of the countries involved in the transaction. Prior to the shipment of a SMC product to another country, assure that all local rules governing that export are known and followed.

Safety Instructions

Be sure to read “Handling Precautions for SMC Products” (M-E03-3) before using.

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