

## Insertion Temperature Controller T675A, T678A

T675A and T678A Temperature Controllers are applied to control air and liquid temperatures in ducts, pipes, or tanks, and enable automation of solenoid/motor valves, electric heaters, or compressor motors of air control devices, heating devices such as boilers, or cooling devices.

- 1. Electric Two-Position Control**  
 Both T675A and T678A have accurate microswitches which open or close the electric circuits.
- 2. Wide Temperature Setting Range**  
 Temperature setting ranges are available at  $-15$  to  $35$  °C,  $15$  to  $75$  °C, or  $75$  to  $125$  °C.
- 3. Heating and Cooling Control**  
 T675A has one SPDT microswitch and can be used for both heating and cooling control.  
 T678A has two SPDT microswitches that operate in sequence. It can independently open or close two heating or two cooling control circuits, enabling two-stage heating or two-stage cooling control.
- 4. Liquid-Filled Temperature Sensor**  
 Both T675A and T678A have temperature sensors filled with liquid having high expansion coefficients which are sensitive to temperature changes and operate the microswitches at the desired set temperatures.  
 As shown in the photograph on the upper right, the body of the controller and the temperature sensor are in a remote insertion mounting structure, connected with a thin capillary tube.  
 The tube is available in two lengths, 1.5 m or 6 m.
- 5. Accurate Temperature Control**  
 Accurate control is enabled by a highly precise microswitch with mica used for opening and closing of the circuit, a liquid-filled temperature sensor, and an ambient temperature compensation mechanism.
- 6. Easy Temperature Setting and Differential Adjustment**  
 Temperature is easily set by manually turning the setting knob on the front surface to the desired set point. T675A has a differential adjustment mechanism which enables operation suited for the device.  
 With T678A, the differential is fixed for each switch. Differential between switches is easily set by an adjusting mechanism which enables sequence control suited for the device.



- 7. Easy Installation and Wiring**  
 The controller is placed in a small metal case which makes mounting easy with no restriction in the direction. For mounting the temperature sensing bulb, a support fitting is used for ducts, and a pressure fitting or separable walls are used for insertion into tanks and pipes. It can also be installed outside in the shade with a weatherproof enclosure.

### Model

Model	Temperature setting range* (°C)	Maximum bulb temperature (°C)	Switch
T675A	-15 to 35	52	One SDPT microswitch
	15 to 75	93	
	75 to 125	138	
T678A	-15 to 35	52	Two SDPT microswitches
	15 to 75	93	
	—	—	

\* The set point of T675A is at the upper end of the differential.  
 The set point of T678A is at the upper end of the differential of the right switch (which operates first with temperature rise).

## Specifications

Item	Specification		
Differential	T675A	Adjustable at approx. 1.7 to 5.6 deg.	
	T678A	Differential of each switch: Fixed at approx. 1.7 deg. Differential between switches: Adjustable at approx. 1.7 to 5.6 deg.	
Switch action	See Fig. 3, Fig. 5, and the "Actions" section.		
	T675A	Terminals R-W close, terminals R-B open on temperature rise Terminals R-W open, terminals R-B close on temperature fall	
T678A	On temperature rise, terminals R-W close, terminals R-B open on No. 1 switch. On further temperature rise, terminals R-W close, terminals R-B open on No. 2 switch. On temperature fall, terminals R-W open, terminals R-B close on No.2 switch. On further temperature fall, terminals R-W open, terminals R-B close on No. 1 switch.		
Switch Contact Rating	Motor load	120 V AC	240 V AC
	Full load	8 A	5.1 A
	Locked rotor	48 A	30.6 A
Maximum ambient temperature	52 °C		
Sensing bulb	Size	12.7 DIA. × 112 mm	
	Material	Copper	
	Maximum pressure	333 kPa (on direct insertion)	
Capillary tubing	Length	For both T675A and T678A, 1.5 m or 6 m are available for each temperature range. However, only 1.5 m is available for the range 15 to 75 °C for T678A.	
	Material	Copper	
Mounting	Mounted from the mounting holes on the back surface of the case. Can be mounted in any direction.		
Wiring	Connected to the terminal screws on the microswitch.		
Weight	T675A	.....0.65 kg	
	T678A	.....0.8 kg	
Coating	Cover	.....Gray enamel	
	Case	.....Zinc (chromate processed)	
Attachments: for mounting	1. 3 small circle screws (M4, length 12 mm) 2. 3 hexagonal nuts (M4)		
Accessories (optional)	1) Separable walls: 112624AA-J, PT1/2 screw, SUS304 (See Fig. 11 and instruction sheet AB-4074) 2) Sensing bulb holder: DY3002A1001 (engineering material) See Fig. 13 3) Pressure fitting: 104484C, 1/2NPT screw, brass See Fig. 12 4) Weatherproof enclosure: Q615A		

## Safety Instructions

Please read instructions carefully and use the product properly. Please keep this instruction on hand for reference at any time.

### Usage Restrictions

This product is targeted for general air conditioning. Do not use this product in a situation where human life may be affected. If this product is used in clean rooms or places where reliability or control accuracy is particularly required, please contact Yamatake's sales representatives. Yamatake Building Systems Co., Ltd. bears no responsibility for any benefit, or lack of benefit, derived from the operation by the customer.

### ⚠ WARNING



- Disconnect the power supply before beginning wiring to prevent electrical shock or equipment damage.



- Do not remove or disassemble the cover except for wiring or part replacement. Equipment damage or electrical shock may result.



- Check for loose wiring to prevent heat generation or equipment damage.

### ⚠ CAUTION



- Installer must be a trained, experienced technician.



- Check the ratings given in this instructions to prevent equipment damage.



- Check the environmen given in this instructions herein to prevent equipment damage.



- All wiring must comply with local codes and ordinances.



- Use crimp contacts with insulation jackets for wire terminals.

## Dimensions (mm)

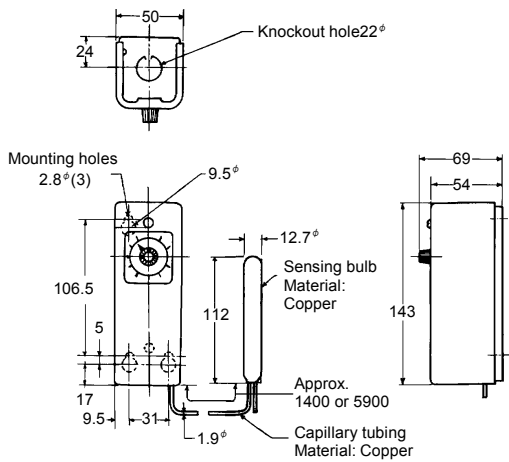


Fig. 1 Approximate dimensions of T675A and T678A (mm)

## Instructions

The body and the sensing bulb of T675A or T678A are installed first, followed by wiring and setup. When all stages are complete, it can operate as an automatic controller. Follow the instructions below for correct usage.

## Installation

For correct installation of T675A or T678A, follow the diagram below. (Note: When using the weatherproof enclosure Q615A, follow the instruction sheet for weatherproof enclosure accordingly.)

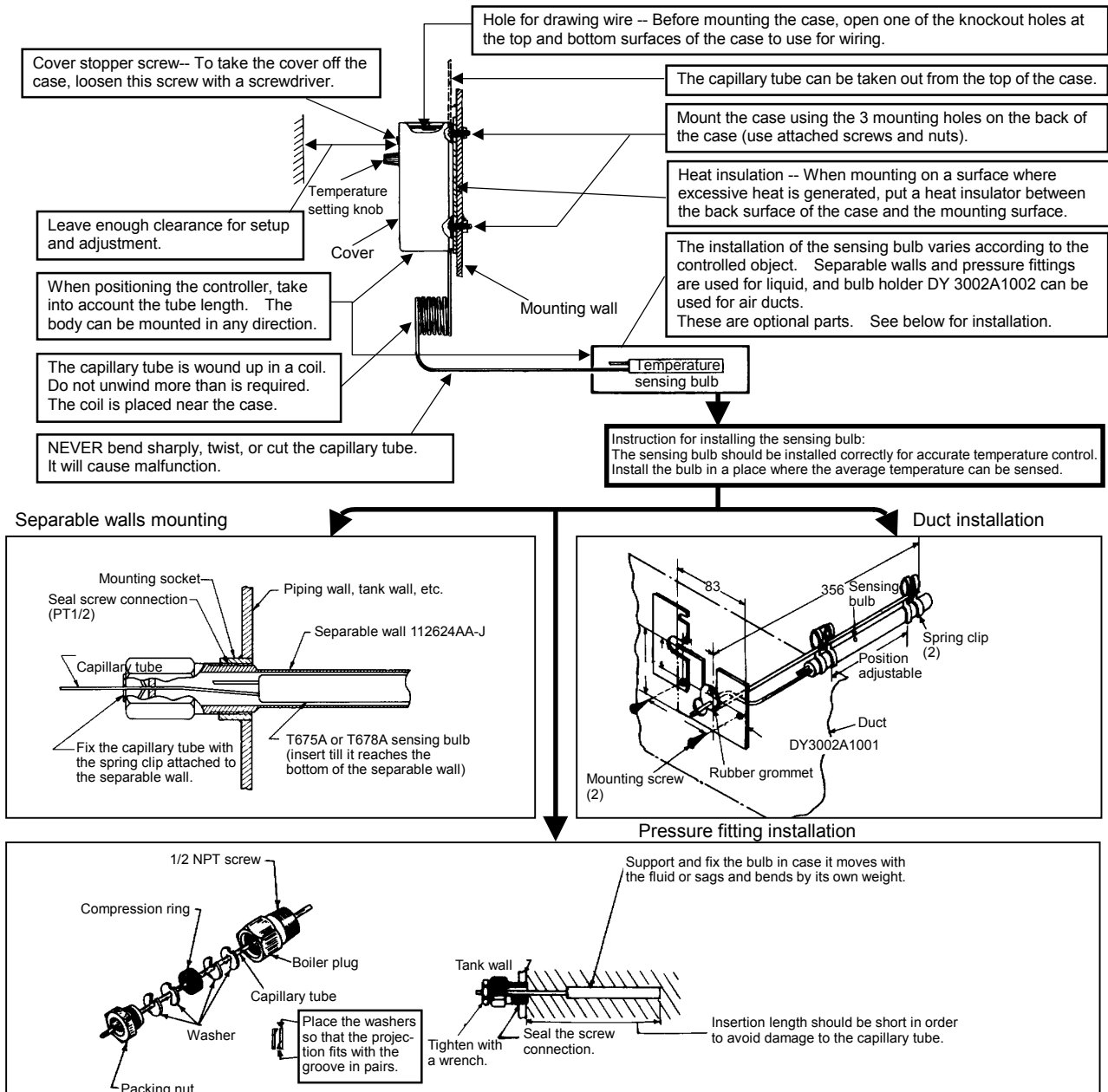
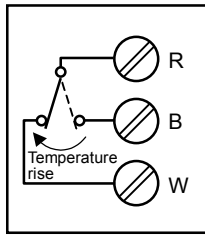


Fig.2 Installation

## Wiring

Switch configurations for T675A and T678A are shown in Fig. 3 and Fig.5 respectively. Draw the wires into the case from the holes at the top and bottom of the case, and connect to the designated terminal screws (marked R, B and W) on the micro switch. Wiring should be done correctly according to wiring regulations. Examples are shown in Fig. 4 and Fig. 6.

### T675A



On temperature rise,  
R-W close  
R-B open

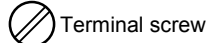


Fig. 3 Switch Configuration

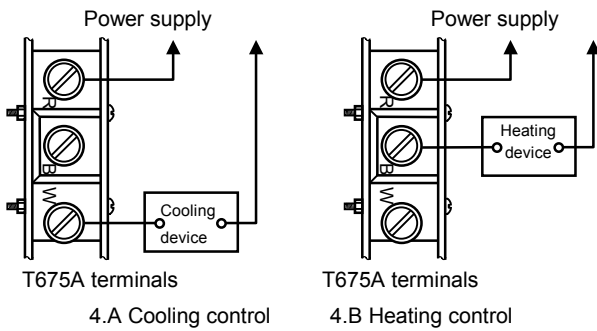
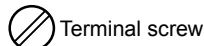
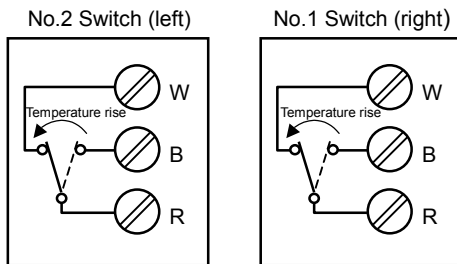


Fig. 4 T675A Wiring Example

### T678A



On temperature rise,  
No.1 switch (right)  
operates first, followed  
by No.2 switch (left).

Fig. 5 Switch Configuration

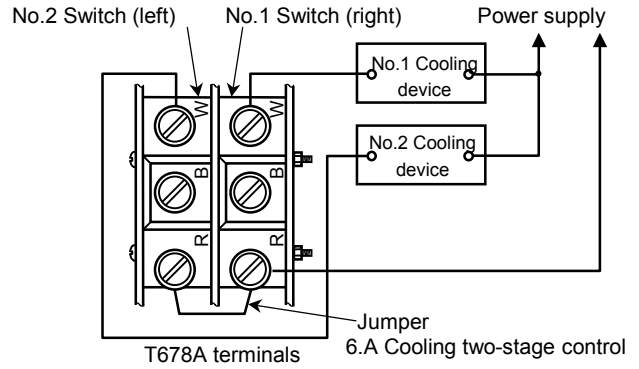


Fig. 6 T678A Wiring Example

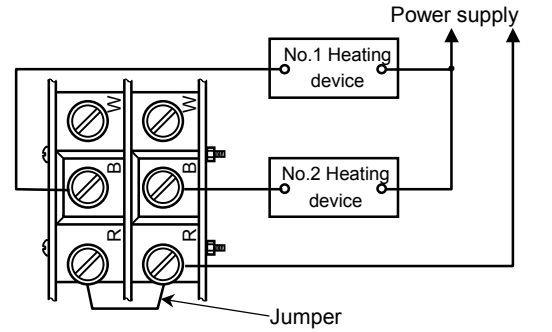


Fig. 6 T678A Wiring Example

## Adjustments

Temperature setting and differential adjustments are made after installation and wiring of the controller.

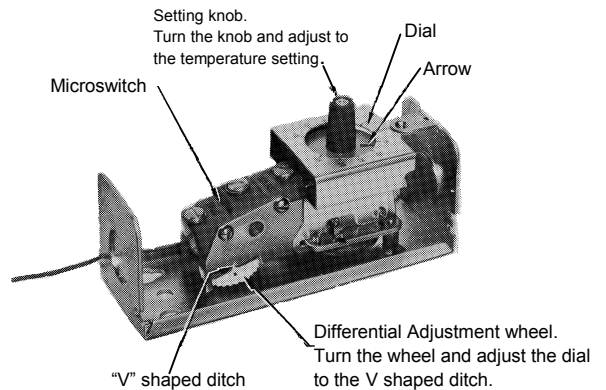


Fig. 7 T675A, Setting, Adjusting

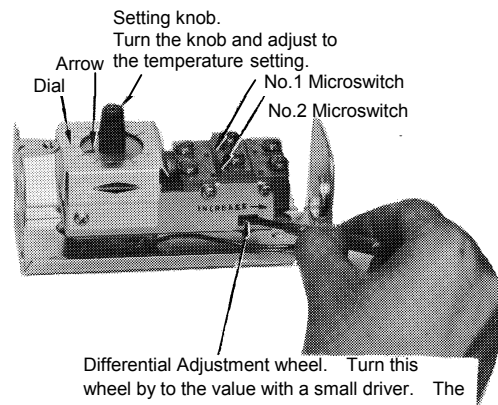


Fig. 8 T678A, Setting, Adjusting

**Actions**

Once the device is set to the desired temperature as mentioned in the "Adjustments" section, it goes into automatic operation when the power is turned on.

**A. T675A**

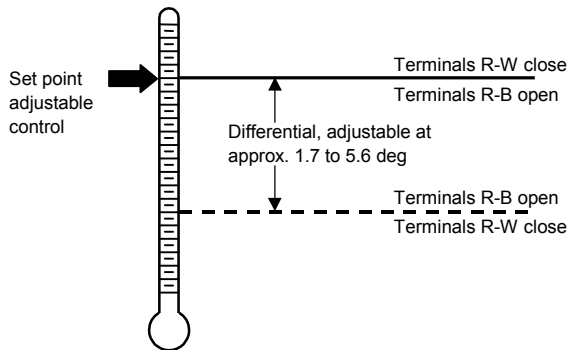


Fig. 9 T675A Relation Between Set Point and Differential

**A.A Cooling Control :**

To take an example of a cooling device as shown in Fig. 4.A (page 4), in which the temperature is set to keep the controlled object at  $-5^{\circ}\text{C}$  and the differential is set to 2 deg:

**A.A.1**

When the temperature of the controlled object rises to the set temperature  $-5^{\circ}\text{C}$ , the internal switch operates and closes terminals R-W, and starts to operate the cooling device.

**A.A.2**

As the cooling device continues its operation and the temperature of the controlled object falls down to  $-7^{\circ}\text{C}$  (set temperature  $-5^{\circ}\text{C}$  minus differential 2 deg), terminals R-W open and the cooling device stops.

**A.A.3**

The above mentioned actions A.A.1 and A.A.2 are conducted and automatically controlled to the preset temperature.

**A.B Heating Control:**

To take an example of a heating device as shown in Fig. 4.B, in which the temperature is set to keep the controlled object at  $50^{\circ}\text{C}$  and the differential is set to 2 deg :

**A.B.1**

When the temperature of the controlled object falls to  $48^{\circ}\text{C}$  (set temperature  $50^{\circ}\text{C}$  minus differential 2 deg), the internal switch operates and closes terminals R-B, and starts to operate the heating device.

**A.B.2**

As the heating device continues to operate and the temperature of the controlled object rises up to the set temperature ( $50^{\circ}\text{C}$ ), terminals R-B open and the heating device stops.

**A.B.3**

The above mentioned actions A.B.1 and A.B.2 are con-

ducted and automatically controlled to the preset temperature ( $50^{\circ}\text{C}$ ).

Note: When the operation cycle of solenoid valves and compressor motors of cooling devices, or heaters and solenoid valves of heating devices are extremely high, i.e. where on and off times are extremely short, turn the differential adjustment wheel inside T675A and adjust the differential to a greater level.

**B. T678A**

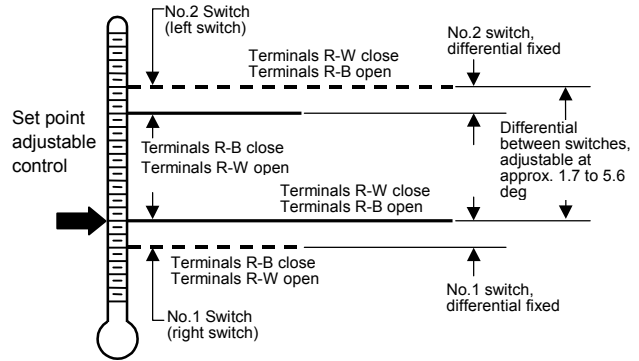


Fig. 10 T678A Relation Between Set Point and Differential

As shown above, the differential of each switch is fixed in T678A. The set point is at the upper end of the No.1 switch (right), and the differential between switches can be adjusted at any point between approx. 1.7 to 5.6 deg.

**B.A Cooling Control :**

To take an example of two cooling devices as shown in Fig. 6.A (page 4), in which the temperature is set to  $-10^{\circ}\text{C}$  and the switch differential is set to 3 deg :

**B.A.1**

When the temperature of the controlled object rises to the set temperature ( $-10^{\circ}\text{C}$ ), the No.1 switch (see Fig.8) operates and closes terminals R-W, and starts to operate the No.1 cooling device. When the temperature of the controlled object falls due to operation of the No.1 cooling device and reaches  $-11.7^{\circ}\text{C}$  (set temperature  $-10^{\circ}\text{C}$  minus differential 1.7 deg), the No.1 cooling device stops. If the temperature of the controlled object continues to rise despite operation of the No.1 device, the B.A.2 action below is conducted.

**B.A.2**

When the temperature of the controlled object continues to rise up to  $-7^{\circ}\text{C}$  (set temperature  $-10^{\circ}\text{C}$  plus switch differential 3 deg), the No.2 switch operates and closes terminals R-W, and starts to operate the No.2 cooling device.

**B.A.3**

When continuous operation of the No.1 and No.2 cooling devices drops the temperature of the controlled object down to  $-8.7^{\circ}\text{C}$  (the temperature which operated the No.2 switch, i.e.  $-7^{\circ}\text{C}$  minus differential 1.7 deg), the No.2 switch stops and the No.1 device operates by itself.

**B.A.4**

When the temperature continues to fall down to  $-11.7\text{ }^{\circ}\text{C}$  (set temperature  $-10\text{ }^{\circ}\text{C}$  minus differential 1.7 deg), the No.1 device also stops. When the temperature rises again from this point, the above mentioned B.A.1 action is automatically started.

**B.B Heating Control :**

To take an example of two heating devices as shown in Fig. 6.B, in which the temperature is set to  $50\text{ }^{\circ}\text{C}$  and the switch differential is set to 3 deg:

**B.B.1**

When the temperature falls from  $53\text{ }^{\circ}\text{C}$  (set temperature  $50\text{ }^{\circ}\text{C}$  plus switch differential 3 deg) down to  $51.3\text{ }^{\circ}\text{C}$  ( $53\text{ }^{\circ}\text{C}$  minus differential 1.7 deg), the No.2 switch operates and closes terminals R-B, and starts to operate the No.1 heating device. When continuous heating raises the temperature to  $53\text{ }^{\circ}\text{C}$  (set temperature  $50\text{ }^{\circ}\text{C}$  plus the switch differential 3 deg), the No.1 heating device is stopped. When the temperature falls despite continuous operation of the No.1 heating device, the B.B.2 operation below is conducted.

**B.B.2**

When the temperature continues to fall down to  $48.3\text{ }^{\circ}\text{C}$  (set temperature  $50\text{ }^{\circ}\text{C}$  minus differential 1.7 deg), the No.1 switch operates and closes terminals R-B, and starts to operate the No.2 heating device.

**B.B.3**

When continuous operation of the No.1 and No.2 heating devices raises the temperature to the set temperature, the No.1 switch operates and stops the No.2 device, and the No.1 device operates by itself.

**B.B.4**

When the temperature continues to rise up to  $53\text{ }^{\circ}\text{C}$  (set temperature  $50\text{ }^{\circ}\text{C}$  plus switch differential 3 deg), the No.1 device also stops.

When the temperature falls again, the B.B.1 operation is automatically started.

**Maintenance**

T675A and T678A are precisely adjusted at the factory. Do not alter unless necessary.

**Accessories -- Dimensions in (mm)**

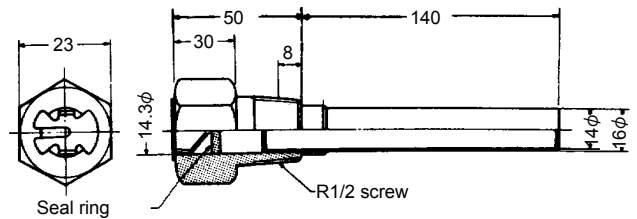


Fig. 11 Dimension of Separable Walls 112624AA-J (optional)

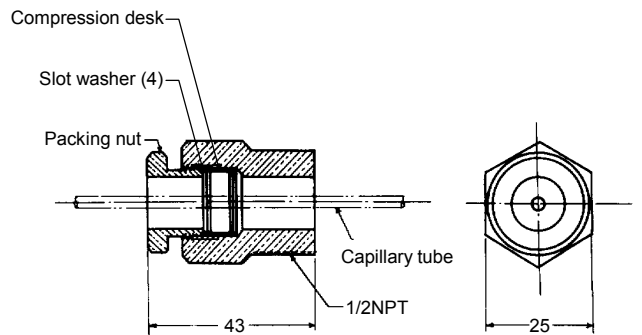


Fig. 12 Dimension of Pressure Fitting 104484C (optional)

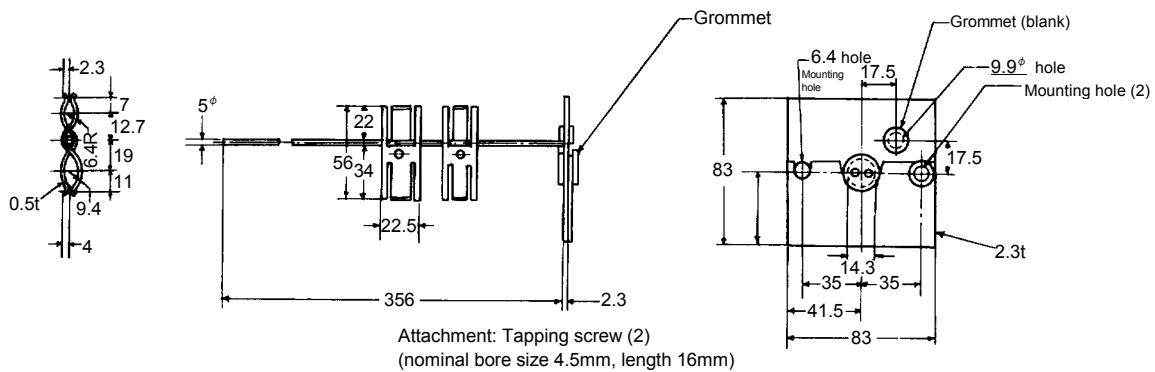


Fig. 13 Dimension of DY3002A1001 (optional)

Specifications are subject to change without notice.



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