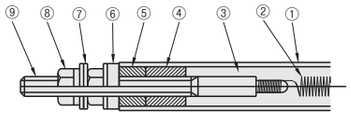
Air Sheathed Heaters - Overview

■Features

- As all the areas exposed to air are made of stainless steel (SUS316L, SUS321, SUS304), it is excellent for corrosion resistance.
- Maximum Operating Temperature: 160°C (Ambient Temperature).

■Basic Structure

- In the center of the metal pipe is the heater, which is made of spiral heat generating body filled with high insulating material.



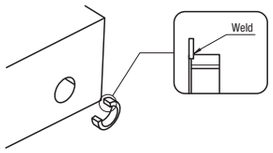
① Stainless Steel Tubes
② Heating Element (Nickel-chrome Wire)
③ Insulation Powder (Magnesia)
④ Insulation Seal Material
⑤ Insulation Sealing on Terminal
⑥ Terminal Section Isolation Material (Ceramic)
⑦ Washer
⑧ Nut
⑨ Terminal

■How to Mount

・Mounting of Plug Heaters (**P.1634**)

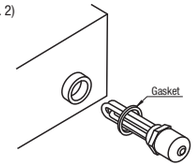
① Decide the location of mounting the heater, and drill a hole of Ø70 ~ 71.
② Insert the socket for plug heater mounting (**P.1641** part number: MSHTS) into the mounting hole, and weld it. (Fig. 1)
(Commercial sockets for piping are also usable.)

(Fig. 1)

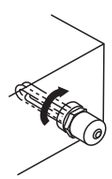


③ Install the included gasket on the thread, grasp the hex part with a pipe wrench and screw the heater into the tank. (Fig. 2) (Fig. 3)

(Fig. 2)



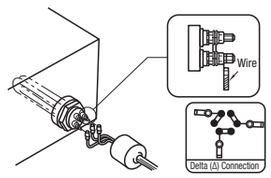
(Fig. 3)



* After tightening, check for air leakages.

④ **Connection Method** Connect wires with three terminals. (Fig. 4)

(Fig. 4)

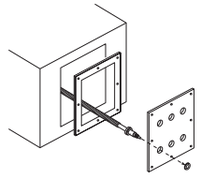


The current (I) of the delta (△) connection is $I=\frac{W}{\sqrt{3}xV}$. (Ex) For Plug Heater of 200V and 5kW, $I=\frac{5000}{\sqrt{3}x200}=14.4(A)$

・Mounting of S Type Fin Heaters (Fixed Type)* For S-shaped Configurable Type, refer to **P.1633**

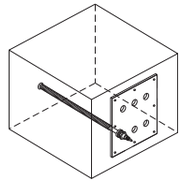
① Decide the location of mounting the heater, and drill a hole of Ø21.
② Place the bushing on the end of the heater. Then insert it into the mounting hole and tighten it with a nut. (Fig. 5)

(Fig. 5)



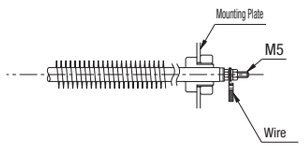
③ Place a bushing on the other end of the heater. Insert the heater into the mounting hole and fix with a nut. (Fig. 6)

(Fig. 6)



④ **Connection Method:** Connect wires with both terminals. (Fig. 7)

(Fig. 7)

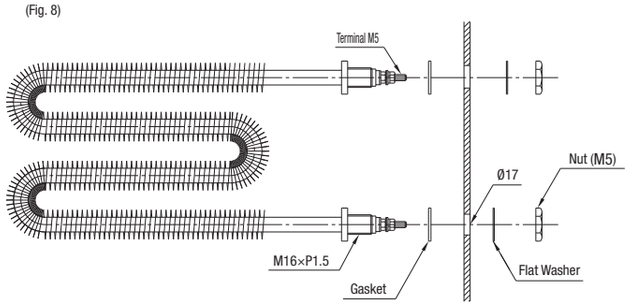


・Mounting of U, M and S Type Fin Heaters (**P.1633**)

① Drill a heater-mounting hole (Ø17) on the heater mounting plate and install the heater.
For every type fin heater, drill the hole with proper pitch.

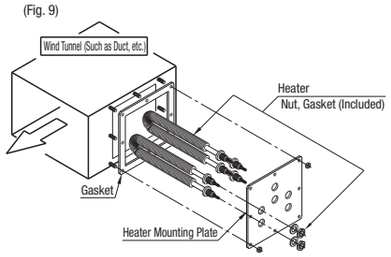
② Insert the included gasket and washers onto the screw section, and then insert them into the mounting hole.
Secure the heater with the included nuts from the other side of the heater mounting plate. (Fig. 8)

(Fig. 8)



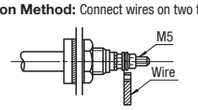
③ Install the heater mounting plate onto the duct, etc. (Fig. 9)

(Fig. 9)



④ **Connection Method:** Connect wires on two terminals. (Fig. 10)

(Fig. 10)



* After tightening, check for air leakages.
The heater with two terminals is single-phase. Current (I) is $I=\frac{W}{V}$.
Ex.) For the heater of 100V and 500W, $I=\frac{500}{100}=5(A)$

■Precautions for Use

- Prevent heater terminals from getting wet. Otherwise, leakage or short circuit may be caused.
- Pay attention to the current contact conditions to connect wire terminals properly.
- Do not use over the rated voltage (V).
- When removing the heater from the heated object, make sure the power is turned off. Do not touch the heater immediately after the power is turned off.
- Use the temperature controller for safety.
- Heater will slightly inflate by heating. Make room between the mounting part and the end surface.

■Selecting Method

① When heating a uniform volume of air (Fig. 11)

$$\text{Calories Required for The Heater (kW)} = \frac{\text{Volume of Air (m}^3\text{)} \times \text{Specific Gravity (kg/m}^3\text{)} \times \text{Specific Heat (kcal/kg°C)} \times \text{Increased Temperature (°C)}}{860 \times \text{Heating Time (h)} \times \text{Efficiency } (\eta)}$$

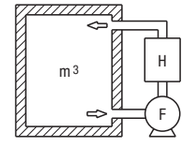
It is difficult to calculate the Efficiency precisely because it varies by heat retention, insulation, arrangement of heater but the suitable value is generally about 0.2 ~ 0.5.

Ex.1) When 5m^3 of air is heated to a temperature of 120°C
(Air temperature is 20°C, increasing time is 60 minutes until the setting temperature.)

$$\text{Calories Required for The Heater (kW)} = \frac{5x1.16x0.24x(120-20)}{860x1x0.3} = 0.54(kW)$$

* Efficiency is assumed to be 0.3.

(Fig. 11)
When heating a uniform volume of air
(Heating room or furnace)



m^3 Volume of Air
H Heaters
F Fan

② When heating flowing air (Fig. 12)

$$\text{Calories Required for The Heater (kW)} = \frac{\text{Flow Volume of Air (Nm}^3\text{/hr)} \times \text{Specific Gravity (kg/m}^3\text{)} \times \text{Specific Heat (kcal/kg°C)} \times \text{Increased Temperature (°C)}}{860 \times \text{Efficiency } (\eta)}$$

It is difficult to calculate the Efficiency precisely because it varies by heat retention, insulation, arrangement of heater but the suitable value is generally about 0.2 ~ 0.5.

Ex.2) When air flowing at 2Nm^3/min is heated to a temperature of 70°C
(Temperature is assumed to be 20°C)

* In the example below, convert the time unit from minute (min) to hour (hr). 2Nm^3/minx60min=120Nm^3/hr

$$\text{Calories Required for The Heater (kW)} = \frac{120x1.16x0.24x(70-20)}{860x0.5} = 3.9(kW)$$

* Efficiency is assumed to be 0.5.

(Fig. 12)
When heating flowing air
(Hot air generator, etc.)

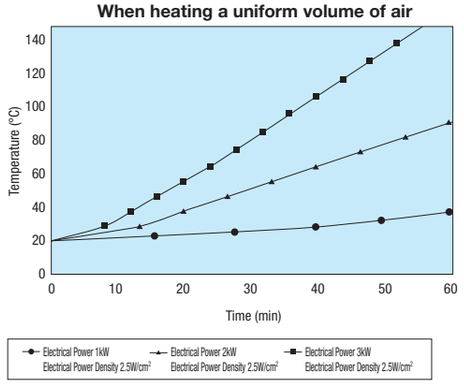
Nm^3/min Air Volume
H Heaters
F Fan

・Specific Heat and Specific Gravity of Air

Substance	Specific Gravity (kg/m^3)	Specific Heat (kcal/kg°C)
Air	1.16	0.24

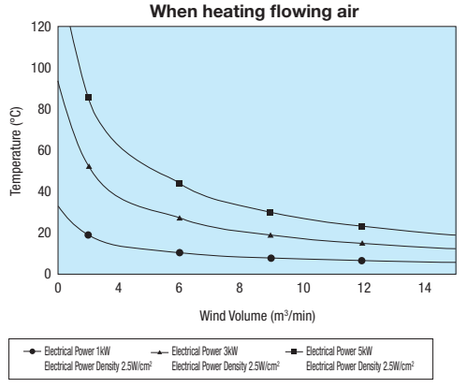
・Actual Measurement Data: Time of Increasing / Decreasing Temperature for Each Electric Power

When heating a uniform volume of air



* Used Heater: MAHP
* Volume of Air: 100m^3

When heating flowing air



* Used Heater: MAHP