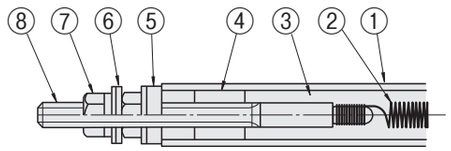
Sheathed Heaters for Liquid Heating - Overview

■Features

- Excellent corrosion resistance because the liquid contacting parts are made of SUS316L and SUS304.
- It is easy to mount in narrow space.
- Maximum Operating Temperature: 160°C (Liquid Temperature)

■Basic Structure

- This is a heater having Nickel-chrome wires filled in a stainless steel pipe with magnesia.



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

■How to Mount

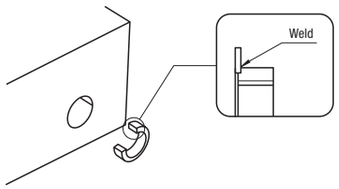
・Mounting of Sheathed Heaters for Liquid Heating (Plug (PF Thread) Heater, Flanged Type)

■Plug Type (PF Thread)

* For PT Thread Type,see **P.1639**.

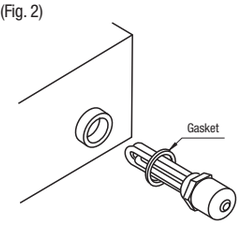
① Determine the mounting position of the heater on the water tank and open the hole of Ø70 ~ 71.
② Insert the socket for plug heater mounting (part number: MSHTS) into the mounting hole, and weld it. (Fig. 1)

(Fig. 1)

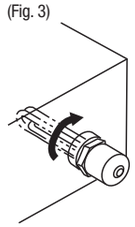


③ Install the included gasket on the thread, grasp the hex part with a pipe wrench and screw the heater into the tank. (Fig. 2) (Fig. 3)

(Fig. 2)



(Fig. 3)

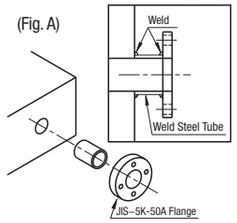


*Confirm that there is no liquid leakage after tightening.

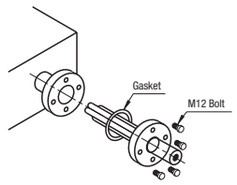
■Flanged Type

① Determine the mounting position of the heater on the water tank.
② Attach the JIS-5K-50A steel pipe inserting welding flange to 50A socket and weld it to water tank. (Fig. A)

(Fig. A)



(Fig. B)



③ Insert the included gasket into the sheathed part, and tighten the flange with M12 screw and nut. (Fig. B)
*Confirm that there is no liquid leakage after tightening.
④ Connection Method: Connect the wires with three terminals. (Fig. 4) (Fig. C)

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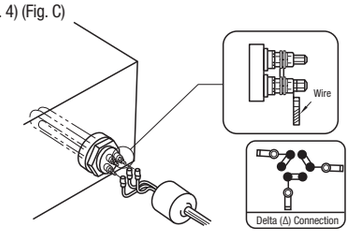


The current (I) of the delta (△) connection is $I=\frac{W}{\sqrt{3}xV}$.

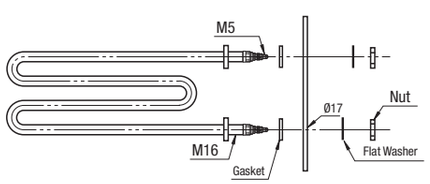
Ex.) Plug Heater of 200V and 10kW, $I=\frac{10000}{\sqrt{3}x200}=28.9(A)$

・Mounting of Heaters of Respective Shapes

① Determine the mounting position of the heater on the water tank, and drill Ø17 holes with proper pitch at two places.

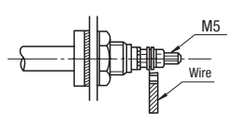
② Insert the included gasket and washers onto the screw section, and then insert them into the mounting hole.
Fix the heater with included nuts from outside of the tank. (Fig. 5)

(Fig. 5)



③ Connection Method: Connect wires on two terminals. (Fig. 6)

(Fig. 6)



* Confirm that there is no liquid leakage after tightening.
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

- Do not let the heaters run idle in the atmosphere. It may cause fires and broken wire.
- Prevent heater terminals from getting wet. Otherwise, leakage or short circuit may be caused.
- If a heater is used for a long time, its surfaces collect mineral and carbon deposits. Clean the surfaces periodically to avoid corrosions and element damages.
- Pay attention to the current contact conditions to connect wire terminals properly.
- Use heat resistant wire.
- 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.
- Heater will slightly inflate by heating. Make room between the mounting part and the end surface.

■Selecting Method

① **Determine the heat quantity (W) required for the heater.** Based on the mass, thermal capacity, temp. rise, and time required to reach the targeted temperature of the heated object, the following formula is used for the calculation.

$$\text{Calories Required for The Heater (kW)} = \frac{\text{Weight of Heated Product (kg)} \times \text{Specific Heat of Heated Product (kcal/kg°C)} \times \text{Increased Temperature (°C)}}{860 \times \text{Heating Time (h)} \times \text{Efficiency } (\eta)}$$

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

・Specific Gravity and Specific Heat of Water and Oil

Substance	Specific Gravity (g/cm³)	Specific Heat (kcal/kg°C)
Water	1.00	1.00
Lubricant	0.87	0.46
Spindle Oil	0.85	0.46
Olive Oil	0.91	0.40

The values of oils are at 40°C.

Ex.) When 50ℓ water is heated to a temperature of 50°C.
(It is assumed that the temperature of water is 20°C, and the heating time until the set temperature is 60 minutes.)

$$\text{Calories Required for The Heater (kW)} = \frac{50x1.00x(50-20)}{860x1.00x0.5} = 3.5(kW) = 3500(W)$$

* Efficiency is assumed to be 0.5.
* Time of Increasing Temperature for Each Electric Power (Electrical Power Density): See Below

②**Determine the number of heaters and the quantity of heat (W) per one heater.**
Determine how to mount the heater, and the number of heaters and calories per heater, so the total calories becomes the required calorie for the heated products.

・Selection of Sheathed Heater

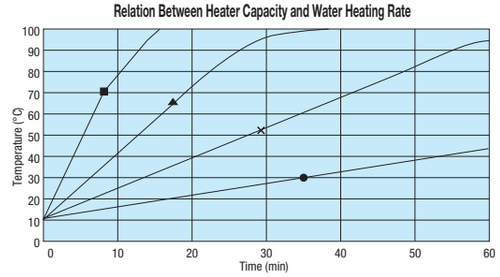
Ex. 1) Use one Plug Type Heater (for Water Heating).
→MSHPW4 (4000W)

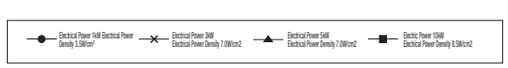
Ex. 2) Use two M Type heaters for water heating.
→MSHM2 (2000x2=4000W)

In this case, because it is difficult to calculate the efficiency (η) precisely, select the heater that has larger calories (W) than the calculated value.
(Check that the length of the heater (L dimension) and the operating voltage (V) are appropriate.)

・Actual Measurement Data: Time of Increasing Temperature for Each Electric Power (Electrical Power Density)

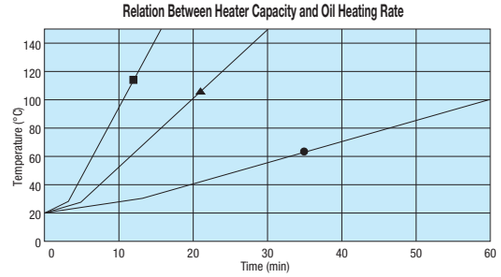
Relation Between Heater Capacity and Water Heating Rate

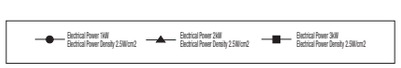




* Used Heater : MSHPW
* Heated Object : Water (15ℓ)

Relation Between Heater Capacity and Oil Heating Rate





* Used Heater : MSHPL
* Heated Object : Olive Oil (20ℓ)