Cartridge Heaters - Overview

**Feature**
- This heater has long-life and high-power density, which is perfect for heating metal plates.
- For the maximum operating temperature, refer to specification of each product. A High Temperature Type with maximum operating temperature is up to 800°C is available.

**Basic Structure**
Compression type heater with ceramic core of high temperature property wrapped with Nickel-chrome wires and isolated by magnesium oxide.

**How to Mount**
The clearance of the mounting hole of heated metal block should be as small as possible. Recommended clearance of hole machining is 0.05 or less (one side).

**Precautions for Use**
1. Do not let the heaters run idle in the atmosphere. If the heat generating part of the heater is operated out of the heated objects, the wire may break or ignite due to abnormal heating.
2. Prevent the lead wire of the heater from getting wet. Leakage or short may result.
3. Remove machine oil and grease used at the time of machining of heated parts. It may carbonize and be a cause of abnormal heating.
4. When the ON-OFF cycle is extraordinarily short, it affects the life of a heater. Use of PID control is recommended.

**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.

   \[
   \text{Heat Quantity (W)} = \frac{Q \times \Delta T \times t}{10^5} \text{ (W)}
   \]

   - Where:
     - \(Q\): Heat of Heating Product (kJ)
     - \(\Delta T\): Specific Heat of Heating Product (kJ/kg°C)
     - \(t\): Increase of Temperature (°C)

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

2. **Specific Gravity and Specific Heat of Major Materials**

   - Material
     - Specific Gravity
     - Specific Heat

   - Steel 7.85 0.118
   - Stainless Steel 7.92 0.170
   - Brass 8.67 0.150

3. **The degree of adherence between a heater and heated object affects the life of heater. Also, a large clearance increases the time needed to raise the temperature and creates a slow response speed for temperature control. When the temperature of heating product is 300°C or less, work with drill holes, but never machine holes (H7) for the mounting hole of all heaters are recommended.

4. **Ex.** Using 2 heaters of 550 (W) (Total 1100W).

   - Determine the number of heaters and the quantity of heat (W) per one heater.

   - Determine the number of heaters based on the size of the heated product, and total calories (W) to be the quantity of heat required for heating product.

5. **Fixation of Cartridge Heater**

   - Determine the diameter and length of the heater.

   - Determine the voltage (V) to use.

   - Check if required heater diameter (D), length (L), voltage (V), and calories (W) are available in L dimension - W (electric power) Fixed Type (P1493).

   - MCHS12-200-V200-W550 → L Dimension - Calories (Watt) Standard Type is not available (Go to J). (D) (L) (V) (W)

   - Available for produce when the electrical power density (W/cm²) of heater generating part is between 2 and 15 (W/cm²).

   - Determine the length of wire leads.

   - Ex.) MCHS12-200-V200-W550-P1500 (2000)


   - Temperature Rises

   - Temperature Controllers

   - All cartridge heaters are single-phase. Select temperature controllers (P1566) for single-phase (MTCS, MTCR and MTCRM).

   - For the possible number of cartridge heaters to connect one controller, refer to the manuals.

   - Ex.) When connecting MTCS (Max. allowable electric current: 20A) to MCHK12-150-V100-W300 (for single-phase), the following formula is suggested.

   \[
   N = \frac{W_{\text{total}}}{W_{\text{max}}} \times e \text{ (max. allowable electric current: 20A)}
   \]

   - The possible number (N) of cartridge heaters to connect one temperature controller (MTCS) for single-phase.

   - (However, only 2 cartridge heaters can be connected to a terminal. Please use terminal blocks (P1558) for branching.)