

Rubber Heaters

Guide

Feature

Flexible and thin silicon rubber, which fits the heating plane firmly. They are suitable for generating uniform heating over the heating plane. The Maximum Operating Temperature is 220°C (250°C for High Temperature Type)

Basic Structure

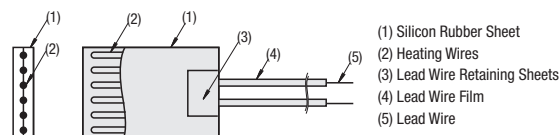
A resistance element is placed between two top and bottom sheets, and internal air is removed before the compression press, and the structure is formed from assembled thin sheet.

Mounting Method

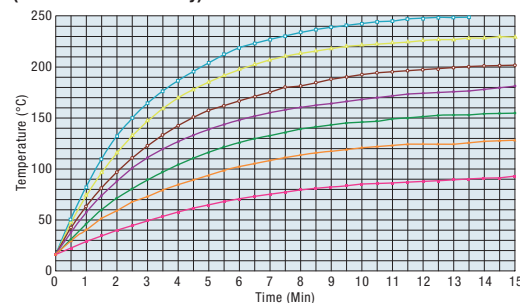
- Clamp : Sandwiches the rubber heater between a metal plate and a heating product. Allowable pressure against the heater plate is 1.47 MPa (15 kgf/cm²).
- Silicon Adhesive : Applies the special silicon adhesive to rubber heater and bonds with the (Metal Retainer) heated object. Maximum operating temperature is 180°C.
- Tape Adhesive : Attaches the double-stick tapes to the rear surface of the rubber heater, and bonds with the heating product. Maximum operating temperature is 150°C.

Precautions for Use

- Do not let heater be in idle running in the atmosphere and float against the heater surface, they may cause ignitions. However, idle running is available in the ordinary temperature atmosphere, when the electric density is 0.5W/cm² or less.
- When sandwiching the rubber heater between a metal plate and a heating product, prevent lead wires and lead wire retaining sheets from touching the metal plate.
- Avoid use in the atmospheres such as in steam, water and corrosive gas.
- Not applicable for to machine holes and not usable when the rubber is damaged.
- Do not bend the heater. The minimum bending angle R (radius) is 25.
- Do not use over the rated voltage (V).
- When the heater is removed from the heat generating body, make sure that the power is turned off. In addition, do not touch the heater immediately after the power is turned off.
- If a gap between heated object and a heater is large, the temperature will increase abnormally. Be very careful about heater setting.
- Keep the lead wire retaining sheets free from pressure.



Actual Measurement Data: Temperature Rise Time / Electrical Power (Electrical Power Density)



Electrical Power Density 0.2W/cm ²	60W	Electrical Power Density 0.3W/cm ²	90W	Electrical Power Density 0.4W/cm ²	120W	Electrical Power Density 0.5W/cm ²	150W
Electrical Power Density 0.6W/cm ²	180W	Electrical Power Density 0.7W/cm ²	210W	Electrical Power Density 0.8W/cm ²	240W		

Heater Size: MRHSS (200 x 150)
 Heated Object: Aluminum (210 x 150 x 1.5)
 Heater Mounting Method: Bonds both sides with adhesives for rubber heater.
 Point of Temperature Measurement: Measured by K thermocouple at the center of aluminum surface.
 Ambient Temperature: Room Temperature 15°C

Specific Gravity and Specific Heat of Major Materials

Materials	Specific Gravity (g/cm ³)	Specific Heat (kcal/kg°C)
Aluminum (7075 Aluminum Alloy P Type)	2.80	0.230
Steel	7.85	0.113
Stainless Steel	7.82	0.110
Brass	8.70	0.100

Selection of Rubber Heater

(1) Determine the shape and size of heaters.

Ex.) MRHSS - 100 - 100
 (A) (B)

(2) Determine the voltage (V) to use.

Ex.) MRHSS - 100 - 100 - V200
 (A) (B) (V)

(3) Determine the calories (W) required for the heating product.

Ex.) MRHSS - 100 - 100 - V200 - W40
 (A) (B) (V) (W)

(4) Available when the calories (W) / the size of a heater (cm²) is between 0.2 and 0.8 (W/cm²).

$$\text{Electrical Power Density (W/cm}^2\text{)} = \frac{\text{Electric Power (W)}}{\text{Surface Area of Rubber (cm}^2\text{)}}$$

(5) Determine the length of lead wires.

*Lead wire length is 1000 for square type with thermostats (P.3728).

$$\text{Ex.) electrical power density (W/cm}^2\text{)} = \frac{40}{10 \times 10} = 0.4 \rightarrow \text{Available to Produce}$$

Selection Method

(1) Determine the calories(W) required for the heater.

Calculate with the following formula by using the weight of heating product, the specific heat of heated product, the increased temperature, and the heating time until the setting temperature.

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

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

Ex.) When the heater block of around 0.2 kg, 100 x 100 x 3 (mm) is heated to 150°C stainless steel (It is assumed that the temperature of the heater block is 20°C, and the increasing time until the set temperature is 15 minutes.)

$$\text{Calories Required for the Heater (kW)} = \frac{0.2 \times 0.11 \times (150 - 20)}{860 \times 0.25 \times 0.3} = 0.04 \text{ (kW)}$$

* Efficiency is assumed to be 0.3.

*See above for Actual Measurement Data: Time of Increasing Temperature for Each Electric Power (electrical power density)

Temperature Controllers

All Rubber Heaters are single-phase. Select temperature controllers (P.3777) for single-phase (MTCS, MTCD and MTCRM).

For the possible numbers of cartridge heaters to connect one controller, refer to the example below.

(Ex.) When connecting MTCS (Max. allowable electric current: 20 A) to MRHSS-200-200-V100-W210-F1000

The electric current which streams in one cartridge heater

$$\text{Electric Current (A)} = \frac{\text{Electric Power (W)}}{\text{Voltage (V)}} = \frac{210 \text{ (W)}}{100 \text{ (V)}} = 2.1 \text{ (A)}$$

The possible numbers (N) of cartridge heaters to connect one temperature controller (MTCS) $N = \frac{20 \text{ (A)}}{2.1 \text{ (A)}} = 9.5 \rightarrow 9 \text{ pcs.}$

(However, only two cartridge heaters can be connected to a terminal. Please use terminal blocks (P.3775) for branching.)

Rubber Heaters

Square

Rubber Heaters - Square

Square

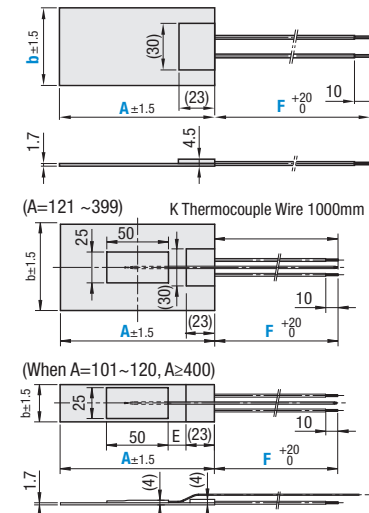
- MRHSK Standard Selectable
- MRHSS Standard Configurable
- MHRHS High Temperature

With Sensor

- MRHSSS Standard Configurable
- MHRHSS High Temperature

- Maximum Operating Temperature Standard Selectable: 200°C
- Standard Configurable: 220°C
- High Temperature Type: 250°C

- A≥B
- When B≤30, the size of the lead wire retaining sheet is same as B.



Standard

Material:
 Heater : Silicon Rubber
 Lead Wire : Nickel (Ni)
 Lead Wire Film : Silicon (MRHSK)
 : Teflon (Others)
 K Thermocouple Wire Film : Fluorine Resin (PFA)

High Temperature

Material:
 Heater : Heat Resistant Silicon Rubber
 Lead Wire : Nickel (Ni)
 Lead Wire Film : Teflon
 Maximum Operating Temperature : 250°C
 K Thermocouple Wire Film : Fluorine Resin (PFA)

Rubber Heaters with Fixed Dimensions

Part Number Type	A	B	V (Voltage)	W (Electrical Power)	F (Lead Wire Length)	Electrical Power Density (W/cm ²)
Square MRHSK	50	50	100	20	1000	0.2≤W/cm ² ≤0.8 ⊖ W/cm ² =W/(AB/100)
	100	50		30		
		75		50		
	125	100		60		
	150	100		80		

Rubber Heaters with Configurable Dimensions

Part Number Type	1mm Increment A	B	V (Voltage)	W (Electrical Power) 10W Increment	F (Lead Wire Length) 10mm Increment	Electrical Power Density (W/cm ²)
MRHSS	50-500	25-400	100	10-1600	100-1000	0.2≤W/cm ² ≤0.8 ⊖ W/cm ² =W/(AB/100)
MHRHS						
MRHSSS						

⊖ Be sure to refer to "cautions for use" stated in the Rubber Heaters Guide on the left page.

Part Number Example: Part Number - A - B - V - W - F
 MRHSK - 100 - 100 - V200 - W60
 MRHSS - 200 - 200 - V200 - W210 - F1000

A	Available Types																															
	MRHSS								MHRHS								MRHSSS								MHRHSS							
	B25-50	B51-100	B101-150	B151-200	B201-250	B251-300	B301-350	B351-400	B25-50	B51-100	B101-150	B151-200	B201-250	B251-300	B301-350	B351-400	B25-50	B51-100	B101-150	B151-200	B201-250	B251-300	B301-350	B351-400	B25-50	B51-100	B101-150	B151-200	B201-250	B251-300	B301-350	B351-400
50-100	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
101-150	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
151-200	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
201-250	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
251-300	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
301-350	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
351-400	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
401-450	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		
451-500	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		

Part Number Alterations: Part Number - A - B - V - W - F - (TPG / RLE)
 MRHSS - 100 - 100 - V200 - W40 - F700 - TPG1
 MRHSSS - 101 - 100 - V200 - W40 - F700 - RLE1

Alterations	Code	Spec.	No.
With Double-Adhesive Tapes	TPG	Affix double-sided tape to the rear surface of the rubber heater.	1
		Shipping with tape affixed. Tape Thickness 0.3 mm.	2
		Maximum operating temperature for rubber heaters with tapes is 150°C.	3

Alterations	Code	Spec.	No.
Length of Thermocouple Wire	RLE	Changes length of thermocouple wire from 1,000-2,000 mm.	1
			2