

# Rubber Heaters - Overview

## Feature

- Flexible and thin silicon rubber, which fits the heating plane firmly, is used.
- They are suitable for generating uniform heating over the heating plane.
- Maximum operating temperature of heater surface is 220°C. (Selectable Type: 200°C, High Temperature Type: 250°C)

## Basic Structure

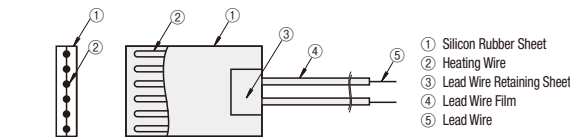
A resistance element is placed between two top and bottom sheets, and internal air is removed, and the structure is formed from assembled thin sheet.

## How to Mount

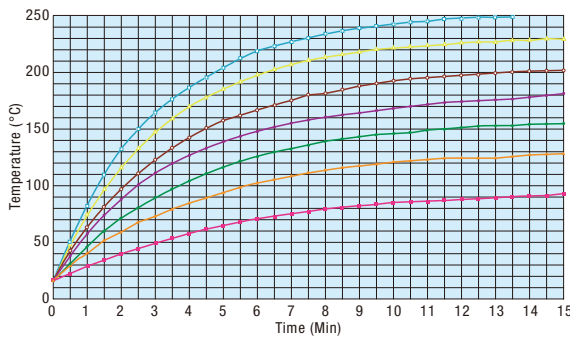
- Clamp (Metal Retainer)**: Sandwiches the rubber heater between a metal plate and a heating product. Allowable pressure against the heater plate is 1.47MPa (15kgf/cm<sup>2</sup>).
- Silicon Adhesive**: Applies the special silicon adhesive to rubber heater and bond with the heated object. Maximum Operating Temperature is 180°C.
- Tape Adhesive**: Attach the double-stick tapes to the rear surface of the rubber heater, and bond with the heated product. Maximum Operating Temperature: 150°C.

## Precautions for Use

- Do not let the heaters run idle in the atmosphere. Do not let heater float against the mounting surface. However, idle running is possible in the ordinary temperature atmosphere, when the electric density is 0.5W/cm<sup>2</sup> or less.
- When sandwiching the rubber heater between a metal plate and the heated 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 use in 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 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.
- 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: Time of Increasing Temperature for Each Electric Power (Electrical Power Density)



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

Heater Size	: MRHSS(200x150)
Heated Object	: Aluminum (210x150x1.5)
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

## 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.

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

It is difficult to calculate the Efficiency ( $\eta$ ) 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 Major Materials

Material	Specific Gravity (g/cm <sup>3</sup> )	Specific Heat (kcal/kg°C)
7075 Aluminum Alloy	2.80	0.230
Steel	7.85	0.113
Stainless Steel	7.82	0.110
Brass	8.70	0.100

Ex.) When the heater block of around 0.2kg, 100x100x3 (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.)

$$\text{Calories Required for The Heater (kW)} = \frac{0.2 \times 0.11 \times (150-20)}{860 \times 0.25 \times 0.3} = 0.04 \text{ (kW)} = 40 \text{ (W)}$$

\* Efficiency is assumed to be 0.3.

\* Time of Increasing Temperature for Each Electric Power (Electrical Power Density)  
See above.

## Selection of Rubber Heaters

### 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 (cm<sup>2</sup>) is between 0.2 and 0.8 (W/cm<sup>2</sup>).

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

Ex.) Electrical Power Density (W/cm<sup>2</sup>) =  $\frac{40}{10 \times 10} = 0.4$   
→ Available to produce

### 5. Determine the length of lead wires.

\* Lead wire length is 1000 for square type with thermostats (P1514).

Ex.) MRHSS	-	100	-	100	-	V200	-	W40	-	F700
	(A)		(B)		(V)		(W)		(F)	

## Temperature Controllers

All Rubber Heaters are single-phase. Select temperature controllers (P1560) 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: 20A) to MRHSS-200-200-V100-W210-F1000.

$$\text{The electric current which streams in one cartridge heater} \quad \text{Electric Current (A)} = \frac{\text{Electric Power (W)}}{\text{Voltage (V)}} = \frac{210 \text{ (W)}}{100 \text{ (V)}} = 2.1 \text{ (A)}$$

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

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

# Rubber Heaters

## Square

Be sure to refer to "Precautions for Use" in the Rubber Heaters Overview on the left-hand page.

**RoHS 6**

**Square Type**  
**MRHSS** (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.

When A=101~120, E=20; when A≥400, E=105.

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

(High Temperature)  
 Material: Heat Resistant Silicon Rubber  
 Heater : Heat Resistant Silicon Rubber  
 Lead Wire : Nickel (Ni)  
 Lead Wire Film: Teflon  
 K Thermocouple Wire Film: Fluorine Resin (PFA)

## Rubber Heaters (Selectable)

Part Number Type	A	B	V (Voltage)	W (Electric Power)	F (Lead Wire Length)	Electrical Power Density (W/cm <sup>2</sup> )	Unit Price
(Square) MRHSK	50	50	100 200	20	1000	0.2≤W/cm <sup>2</sup> ≤0.8 W/cm <sup>2</sup> =W/(AB/100)	
	100	50		30			
		75		50			
	125	100		60			
	150	100		80			

## Rubber Heaters (Configurable)

Part Number Type	1mm Increment A	B	V (Voltage)	W (Electric Power) 10W Increment	F (Lead Wire Length) 10mm Increment	Electrical Power Density (W/cm <sup>2</sup> )
MRHSS	50~500	25~400	100 200	10~1600	100~1000	0.2≤W/cm <sup>2</sup> ≤0.8 W/cm <sup>2</sup> =W/(AB/100)
MHRHS						
MRHSSS						
MHRHSS						

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

Days to Ship [Configure Online](#)

Price [Configure Online](#)

A	Unit Price															
	MRHSS						MHRHS									
	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																

A	Unit Price															
	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
100-150																
151-200																
201-250																
251-300																
301-350																
351-400																
401-450																
451-500																

Alterations [Configure Online](#) (TPG, RLE)  
 MRHSS - 100 - 100 - V200 - W40 - F700 - TPG1  
 MRHSSS - 101 - 100 - V200 - W40 - F700 - RLE1

Alterations	Code	Spec.	No.	Price Adder	Alterations	Code	Spec.	No.	Price Adder
With Double-sided Tape	TPG	Affix double-sided tape to the rear surface of the rubber heater. Shipped with tape affixed. Tape Thickness 0.3mm. Maximum operating temperature for rubber heaters with tapes is 150°C. Double-sided Tapes are not sold separately. Attaching Double-sided Tapes is not applicable to Selectable Type.	1 2 3		Length of Thermocouple Wire	RLE	Changes length of thermocouple wire from 1000mm to 2000mm.	1 2	