



Whitepaper

# Comparing Mica and Cartridge Heaters

A Guide to Specs, Use Cases, and Drawbacks

## Introduction

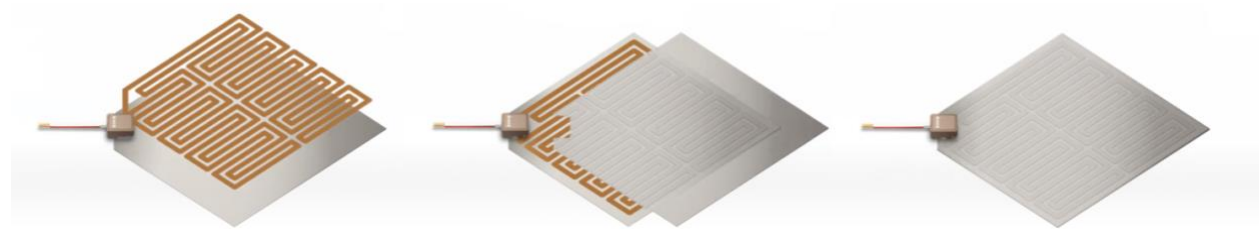
Finding the right heater for your application takes a lot of consideration. In industrial heating, there are often many paths to the same destination. Many times, you can combine products, arrangements, and modes of integration in different ways to achieve the same goal.

Even once you've filtered down by fit, capacity, and other vital specifications, you might be left with a few different options that seem equally viable. The right choice can come down to any number of factors, including components, shape, application, and how the heater actually transfers heat from the heating element to the surface.

With so many options to choose from, it's important to pick the right heater for your application to ensure long life, accurate heating, and the precision and control you need. To help make that decision a little easier, this guide offers a **simple comparison of mica heaters and cartridge heaters**, their advantages and disadvantages, and use cases where each may be appropriate.

## Mica Heaters at a Glance

Mica thermofoil heaters are constructed with an etched foil heating element sandwiched between layers of mica—a silicate material—and are clamped to heat sinks (rather than being adhered or taped).



Mica is an ideal material for industrial heating because it helps heating elements heat up quickly and evenly, and also cool down quickly. Its high electrical resistance and resistance to light and moisture have made mica a great insulator in industrial heating applications, and you'll often find it used in consumer electronics like toasters and space heaters. While mica heaters are often supplied flat, they can be pre-formed or curved to fit non-standard heating surfaces, like the inside of a pipe.

### **DID YOU KNOW?**

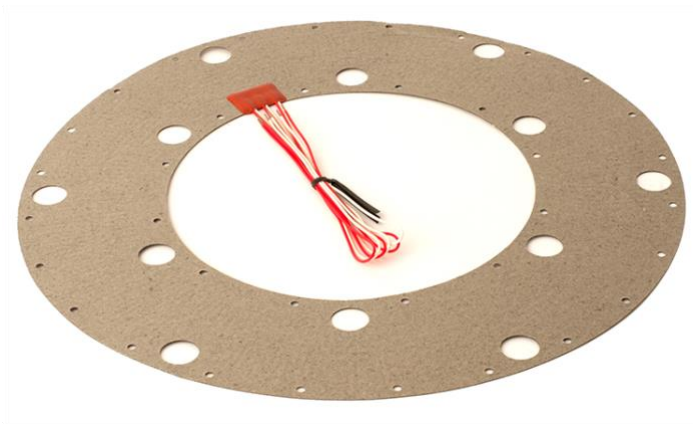
*Mica isn't one distinct mineral—it's the name used for a group of minerals. Mica's atomic structure can include atoms such as aluminum, magnesium, iron, and more.*

One of the unique features of a mica heater is that it's clamped to the heat sink rather than secured with adhesives or tape. Clamping helps the mica distribute heat from the heating element more evenly, but it's also the only method for securing mica heaters to a heat sink. This is because mica is porous and can reach temperatures higher than what's considered safe for adhesive usage.

While mica heaters are capable of uniform heating, our design and manufacturing processes can tailor the heating profile of a mica thermfoil heater to make one part of the heater hotter than another by varying the width of the etched element between the mica.

## Cartridge Heaters at a Glance

Cartridge heaters are usually straight, cylindrical heating elements that fit inside a bore and fill the space while radiating heat to the heating surface. Cartridge heaters most often consist of resistive wiring and electrical insulation encased in an outer metal enclosure (or “sheath”).



Because they’re common in industrial heating, cartridge heaters come in a variety of standard options and sizes (including swaged, flanged, thermocouple, square, threaded, and split sheath) to help them supply heat efficiently where it’s needed within a drilled bore. Some cartridge heaters expand when heating up and contract when cooling, making them easier to remove in case of maintenance or failure.

## Comparing Mica and Cartridge Heaters

The differences between mica and cartridge heaters may seem to be limited to their materials and shapes, but their unique qualities mean they’re individually suited to different applications.

Often, depending on the scale, we find customers are not using the most efficient heating solution available to them. When we look at your specs, priorities, and budget, you might find that the benefits of one type of heater quickly outweigh any potential drawbacks.

### **Mica Heaters Pros and Cons:**

- Distribute heat evenly
- Can be customized to supply heat to zones where it's needed
- Are very customizable to fit applications of unusual size or shape
- Can be pre-formed to curves (like the inside of a pipe)
- Are attached with clamps, which provide better heat distribution than adhesives or tape
- Make it easier to achieve higher heating surface watt densities
- Can be more cost-effective by streamlining assembly costs in production
- Often require custom design for clamping plate, which can make them more expensive in small batches
- Are porous and less flexible than other heater types
- Sometimes require outgassing, depending on the end use

### **Cartridge Heaters Pros and Cons:**

- Distribute heat evenly
- Can be customized to supply heat to zones where it's needed
- Come in a wide array of standard sizes and power options
- Feature a continuous coil to reduce cold spots
- Can be easy to replace when damaged
- Are generally more cost-effective than mica heaters (but not always)
- Make it easier to create a vacuum or fluid seal around the heating element to lead wire exit
- Run at higher temperatures than mica, which can lead to failure
- Require a thicker heat sink to accept boring and allow heat to spread out
- Need a very tight fit for maximum heat transfer
- Can seize due to an overly tight fit in the bore

## **Choosing Cartridge or Mica**

Pros and cons can get you only so far. When choosing between heater options, it wise to consider how you're going to use them first and then compare their suitability.

Cartridge heaters enjoy ubiquity in many industrial applications, including metalworking, plastic molding, medical equipment, semiconductor wafer processing, hot runner molds, heating liquids and gasses, and laminating presses.

Mica heaters are practical in industries like semiconductor processing; packaging, strapping, and sealing equipment; DNA thermocycling; food service appliances; and plastics and rubber molding.

#### **Consider Using Mica Heaters:**

- If the heat sink in your application is too thin for insertion holes.
- If your specs call for temperature uniformity in a unique or unusual shape.

#### **Consider Using Cartridge Heaters:**

- If the application is of a standard size.
- If the application is vacuum-sealed.
- If you need very few heaters.

## **Make the Right Choice for Your Business**

As with most purchasing decisions, there are advantages and drawbacks to both cartridge and mica heaters. To make the right choice, you'll want to consider your needs, and how the available options can be customized to meet your industrial heating needs. That's where Minco fits in.

Minco's extensive experience in engineering, designing, and manufacturing industrial heating solutions makes us an industry leader. Our wide selection of heating products makes us a supplier of choice for applications where thermal control matters most. And our Engineer-to-Engineer (E2E) approach makes us an innovation partner to manufacturers of all sizes, from those with the most exacting specifications to those who only know their desired end state.

Learn more about our industrial heating options and how the minds at Minco can help you select, customize, and integrate the heating solutions you need for better, lighter, longer-lasting performance.

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