

HIGH-DENSITY CARTRIDGE HEATERS

Operating temperature versus actual temperature of cartridge

Megawatt cartridge heaters are designed to withstand a sheath temperature of up to 1500° F. The recommended maximum operating temperatures for different applications are much less than that. There are many factors that have a direct effect on the lag between the actual sheath temperature of a cartridge heater and the monitored temperature of a material during the heat-up cycle. In some cases, this temperature lag is so significant that the cartridge will reach its elevated critical temperature even when the surrounding material is monitored to have a relatively much lower temperature level. The most common factors that contribute to the degree of temperature difference are the following:

- Thermal conductivity of the material being heated
- The cartridge sheath watt density
- The tightness of the cartridge inside the hole
- The location of the monitoring sensor
- The alloy of the cartridge sheath material
- Contamination around the cartridge heater

These factors should be taken into consideration while selecting a cartridge for a specific application. One common practice is to use stainless steel cartridge sheathes for temperatures up to 1000° F and Incoloy sheathes for temperatures up to 1400° F.

Another design consideration related to the operating temperature is the electrical termination of a cartridge. Teflon and TGGT leads have 480° F rating while MGT wires can withstand up to 840° F. When cartridges are used at relatively high temperatures, the terminals selected should be either different than the common high temperature lead wires or the design should be done such that the temperature around the lead wires (whether the leads are connected internally or externally to the cartridge) is maintained at a temperature level lower than the critical temperature limit of the lead wire.