

### Design Concepts for High Temperature UHV Sample Heaters

HeatWave Labs offers a complete line of stock high temperature 1200°C substrate heaters. They are designed for high vacuum applications and offer high reliability and long life. Standard packages are available for large area, high temperature, corrosive atmospheres and other difficult applications. The following is a description of some of the many design concepts that are frequently used in the industry. This is meant only as an aid to the design engineer to help generate ideas for quality and reliable products. For final details, HeatWave Labs offers complete technical service to help you meet your needs.



Figure 1

For low cost, stock applications, HeatWave Labs offers a simple cartridge package design as shown in Figure 1. This consists of an all molybdenum can with a resistive heater potted into it. These are available from stock in sizes from  $\varnothing.134$ " to  $\varnothing1.000$ ". These standard sizes are detailed on TB-175 and at our website, [www.cathode.com](http://www.cathode.com). The button style package in Figure 2 is also a stock heater and provides low mass and convenient mounting stem. The stem is thick wall at the base for mounting and thin wall between the base and the heated top for thermal isolation.



Figure 2



Figure 3

Figure 3 shows a few common techniques to improve ease of insulation and reliability. Brazed on legs are shown which provide good thermal isolation and mounting design flexibility. These are available on the Figure 1 style units from stock. Both heater leads are shown overwound with heater wire. This adds some strength but more importantly allows the heater lead to run cooler and lifetime is increased. The other lead can be "grounded" to the body to minimize power connections, feedthrus, etc. Note that in Figure 6 the heater lead is grounded under the alumina potting.

As shown in Figure 4, thin Molybdenum or Moly-Rhenium sleeves are a very common method of mounting and providing thermal isolation as well as thermal shielding. Sleeves can be made to any length and can have holes and/or slots. Base flanges can be added to sleeves as shown in Figure 5. These bases can include mounting holes or weld flanges. Figure 6 shows a thin wall shield added to the base to decrease radiation to the surrounding structures. Heat shield "packs" can be added behind the heater to serve the same function.



Figure 4

Large area heaters are depicted in Figure 7. This type of design utilizes a "low mass" design, which allows for quicker warm-up and higher efficiency. Note that this design incorporates a thin wall support, wrapped heater lead, and grounded heater lead, heat shields and a base with mounting holes. Truly a "plug in" package!

Other features (not shown) can include special non-inductive heater coils to improve beam quality and noise generation, non reactive construction for oxidizing and reactive atmospheres, extra details for grid attachment and thermocouple mounting, and sample holders.

Requirements for mounting, thermal isolation, thermal efficiency, heater impedance, atmosphere compatibility, vibration and cost can be left up to HeatWave Labs engineers who can provide a complete package for your needs. Make a list of all your requirements and questions then contact us for consultation and quoting.



Figure 5

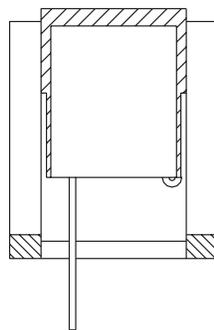


Figure 6



Figure 7

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