BCE APPLICATION NOTE

ELECTRIC HEATING ELEMENTS

VACUUM FEEDTHROUGHS

CUSTOM THERMAL SYSTEMS

BCE HEM SEALED HEATERS™
OPTIMIZING LIQUID FLOW IN LAUNCHES

Ideally a rocket engine would capitalize on internal heat dissipations to create a self-regulating thermal environment. However, in the majority of instances, maintaining a high flow rate of cold propellants can obstruct the flow path. Thus, it becomes essential to integrate resistive heaters inside the flow path's valves and manifolds. Surface-mounted patch heaters are generally used for this application. These are polyimide/silicone sheathed resistive elements with one side adhered directly to the valves and manifolds. Although patch heaters may present a viable solution, the BCE Hem Sealed Heater™ outperforms as heat flows uniformly from inside the cartridge directly to the heated bodies. This is because they are secured directly to components by the means of an integrated flange. In essence, the BCE Hem Sealed Heater™ incorporates both the cartridge heaters' wire wound resistive element encased in a metal sheath and the vacuum compatibility of a feedthrough. Furthermore, the BCE proprietary epoxy seal allows the heater to pass strict electrical tests ensuring the purity of the dielectric materials and hence, preventing shorting.

BELILOVE COMPANY-ENGINEERS

SCOPE:

The Hermetically Sealed Heaters needed to satisfy the following criteria:

- Easy mounting of heaters into manifolds and valve bodies
- Mounting to be compatible with standard hardware
- 6 to 36V electrical specifications
- Resistance tolerance to be +/-5%
- < 1,500 VDC or greater on the Hi-pot test
- < 4,000 Megohm at 500 to 1000 VDC on the Megohm test
- < .010 sheath thickness
- Sheath can be Inconel or 300 series stainless material
- Sealing Epoxy to meet NASA ASTM E595 Low Outgassing Standard
- Maximum operating temperature of heater <200°C

OUTCOME:

The BCE Hem Sealed Heater™ proved to be the most optimal design for the heating of fast-flowing liquid propellants. The heater incorporated all engineering requirements and was mounted into the manifold through an integrated flange using custom hardware. In addition, the heater's vacuum compatibility was ensured through BCE's proprietary black epoxy meeting NASA ASTM E595. Furthermore, successful rocket launches into lower to high earth orbit validate that the BCE Hem Sealed Heater™ is rocket ready and capable of high vacuum applications. BCE, the ultimate partner for resistive vacuum applications.

Click here for standard Hem Sealed Heater™ Sizes. Click here for cartridge heater composition details.

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