

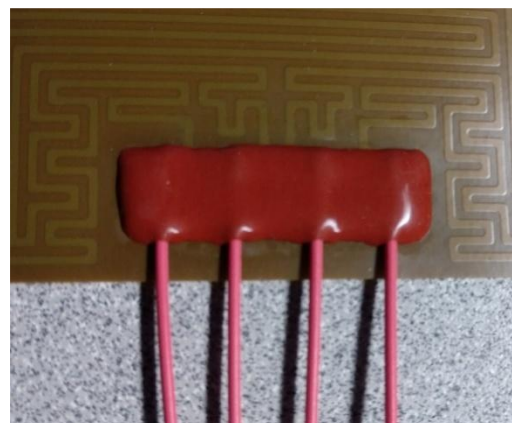


Minco Custom All-Polyimide Heater with Flexible Lead Wire Encapsulation

Designed to NASA S-311-P-841 with Custom Flexible Lead Wire Encapsulation

Overview

The Minco Custom Flexible Polyimide (AP) Heater is engineered to meet the rigorous requirements of NASA S-311-P-841, providing reliable thermal control in the demanding environments of space applications. This heater features a unique lead termination encapsulated in Minco's proprietary flexible lead wire encapsulation—developed as a specialized revision to specification section 3.4.1.5—to enhance strain relief, maintain performance through thermal cycling, and reduce the risk of cracking or delamination on curved surface when conformability is required. With its low outgassing materials, precise resistance tolerances, and lightweight construction, this heater is ideal for spaceborne instruments, electronics, and structures requiring dependable, uniform heating.



Features

- **NASA S-311-P-841 compliant**, including all standard electrical, mechanical, and outgassing requirements
- **More conformability** than the alternative hardened epoxy
- **Custom flexible epoxy** per revised Spec 3.4.1.5, offering superior strain relief and durability in extreme environments
- **Lightweight, low-mass design** ideal for spacecraft and satellite integration
- **Uniform surface heating** with precision resistance tolerances
- **Flexible polyimide substrate** offers excellent thermal stability and chemical resistance
- **Available in custom sizes, shapes, and wattages** to meet mission-specific requirements

Custom Flexible Lead Wire Encapsulation

In accordance with NASA S-311-P-841 Spec 3.4.1.5 (Minco Revision), the lead termination on this heater replaces the standard hardened epoxy with Minco's proprietary flexible lead wire encapsulation, designed to:

- Enhance strain relief in dynamic or vibration-prone environments

- Maintain flexibility and adhesion across extreme temperature cycles
- Resist cracking or delamination over long mission durations
- Meet or exceed outgassing requirements (Total Mass Loss < 1.0%, Collected Volatile Condensable Material < 0.1%)

This custom epoxy encapsulation is unique to Minco and engineered specifically for spaceborne heater applications with rigorous mechanical and environmental constraints.

Specifications

Parameter	Value / Description
Substrate Material	Polyimide (Minco Type AP)
Heater Thickness	0.005–0.010 in (0.13–0.25 mm) typical
Power Density	120W/in ² , 40W/in ² with aluminum backing and PSA, 20W/in ² with PSA only
Operating Temperature	-115°C to 220°C – mounting method will affect temperature range
Resistance Tolerance	±10% standard; ±5% or ±2% available on request
Voltage Rating	5 V to 120 V, depending on size and resistance
Lead Wire Options	Kapton-insulated, Teflon-insulated, custom cables
Lead Termination	Low Outgassing flexible epoxy encapsulation
Vacuum Suitability	Designed for low outgassing (per ASTM E595)
Mounting Options	Pressure-sensitive adhesive (space-rated), mechanical clamping, or bonded installation

Compliance and Testing

- **NASA S-311-P-841 compliant**
 - Successfully completed S-311-P-841 Group A Quality Conformance Inspection, including visual inspection, resistance, insulation resistance, voltage conditioning and thermal shock, and dielectric strength testing.
 - Successfully completed S-311-P-841 Group B Qualification Testing, including voltage conditioning, thermal shock, low-temperature operation, lead pull, life testing with all required electrical testing.
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- **Outgassing per ASTM E595**
- **Electrical tests:** Insulation resistance, dielectric strength, and resistance
- **Thermal cycling and mechanical testing** available on request

Applications

- Deep space probes and planetary landers
- Avionics thermal control
- Optical instrument thermal conditioning
- Battery and propulsion system warming
- Any mission requiring high-reliability, low-outgassing flexible heaters

Ordering Information

Minco Custom Flexible AP Heaters are built to your exact specifications. Contact your Minco sales representative or email custserv@minco.com to get started on your custom design!