SmartHeat SLT™ Heaters

Minco's self-limiting heaters require no sensor or controller

Overview

SmartHeat is the ideal solution for many of today's most demanding heating applications. It provides a plug-and-play heating solution requiring only a power source. Each heater operates to a specific temperature and power based on its unique design. The heating power is applied and modulated at infinite points across the entire heating surface based on the heat load. This allows the heater to provide the required power, up to but never exceeding the designed temperature.

SmartHeat Technology

SmartHeat™ technology consists of a thin silicone matrix loaded with conductive carbon particles. Electrical current moves between the carbon particles via quantum tunnelling of electrons through the non-conductive silicone material. The spacing of the carbon particles determines electrical resistance of the material and the current it can carry at any point. As the silicone warms, thermal expansion drives the carbon particles farther apart and increases resistance point-by-point over the surface of the heater. At the designed set-point temperature the heater effectively becomes an electrical isolator, drawing negligible current, and no longer producing heat. Conversely, if the silicone cools via environmental or load variations, the carbon particles pull closer together, reducing resistance. This allows a localized current-flow increase and the heater produces more heat at that location in order to maintain thermal equilibrium.

These effects drive the self-limiting nature of this technology without the need for external instrumentation and control systems. By controlling the composition of the carbon-silicone matrix in production, the the heater is designed to approach, but not exceed, a specific temperature set point. When a heater is powered, it warms to its designed set point and maintains that temperature within a narrow band.

Applications

Many applications can benefit from the simplicity and reliability of SmartHeat. Some examples include:

- Keeping batteries warm and condensation-free for maximum output
- Humidifying respiratory equipment for patient safety and comfort
- Safe storage of reagents for accurate analysis
- Defrosting of displays for clarity and readability
- Defrosting LEDs for safe, clear lighting
- Deicing infrared lenses for reliable signaling
- Sensor anti-icing for effective function
- Valve warming to maintain liquid flow
- Low-weight deicing of aircraft wings for safe, reliable operation

SmartHeat SLT Heaters

Technical specifications

Specifications

Environment temperature range: -45°C (-49°F) to 100°C (212°F)

Operational set point range: 10°C (50°F) to 70°C (158°F)

Leadwires: 24 AWG

Lot/Batch Variation: +/- 5decC typical

Heater Size Constraint: 7 in x 22 in Maximum (standard construction)

22 in x 42 in Maximum (stitched construction)

Heater thickness: 0.018 in

Features & Benefits

- No risk of overheating due to delamination or environmental changes
- Automated, elevated temperature management and control with consistent thermal outcomes
- Patented materials ensure peak performance in a thin implicit control simplifies device design and reduces product launch cycle

Stability

- From a cold start, SmartHeat initially provides maximum power to quickly reach its designated operating temperature. As it approaches the operating temperature it will sharply reduce power output and slow heating.
- When the operating temperature is reached, SmartHeat provides only the power required to maintain thermal equilibrium, eliminating any temperature overshoot. Once thermal equilibrium is achieved, SmartHeat responds to any changes in the environment to maintain the operating temperature across the entire device surface. The heater will adjust power output as necessary at each point across its surface to maintain uniform temperature.
- A traditional heater, where power output is typically controlled by a single sensor feedback loop, is unable to compensate for localized transient variations and can lead to non-uniform temperatures.

Safety

SmartHeat is self-limiting, meaning it can never exceed the designed safety temperature. This is particularly important in applications in which overheating can damage equipment or impair the operation of the system.

It prevents damage due to heater delamination or drastic changes in environmental heat loads. If a heater becomes delaminated, a traditional heater would over-temp and either create a hot spot or drive to failure. The SmartHeat material on the other hand will simply lower the power output to the delaminated area and maintain its set-point.

This is also true for drastic changes in environmental conditions, such as a sudden loss of liquid in a heated container. If a traditional heater encountered an empty or partially empty container or vessel the reduced heat loss from the heated surface may not be adequate, causing the traditional heater to overheat. This will not happen with the SmartHeat material. It will lower its power output and maintain its design set point.

Loss of heating function can also be risky. Unlike a traditional heater, a damaged SmartHeat heater is unlikely to be completely shut down by physical damage. In most cases physical damage will only shut down the damaged area of the heater, allowing it to continue functioning at a reduced level. In some cases, the functioning area will draw increased power to compensate for the damaged area, which does not heat. Overall, SmartHeat is the better choice for applications in which both heater failure and overheating must be avoided.

Stock SmartHeat SLT Heaters

The stock heaters listed below are available for immediate shipment to support your testing and evaluation.

Notes for Stock Heaters:

- SmartHeat SLT heaters prevent thermal runaways and overtemp conditions
- Patented innerlay polymer self-tunes to load changes to ensure temperature uniformity
- Inherent control reduces or eliminates the need for external regulating electronics
- Thin, lightweight construction provides heat application where it's needed
- Heat, sense, and control in a single package reduces total system cost

Listed control temperatures and safety temperatures are valid for applications with low thermal loading, at the prescribed nominal voltage setting. Applications with high thermal loading or unique environments should be verified experimentally. Contact Mod-tronic to get started.

Size (Inches)		Dia (inches)	Weight (oz.)	Thickness	Control Temp (°C)	Safety Temp Ref (°C)	Lead AWG	Nominal Voltage (V)	Suggested Voltage Range (V)	Model number
X	Y									
2.00	3.00		0.176	0.018	40-60	80	24	12	6-24	HL6500
2.00	3.00		0.176	0.018	40-60	80	24	120	60-240	HL6502
4.00	6.00		0.352	0.018	40-60	80	24	12	6-24	HL6506
4.00	6.00		0.352	0.018	40-60	80	24	48	24-96	HL6507
4.00	6.00		0.352	0.018	40-60	80	24	120	60-240	HL6508
1.00	16.00		0.320	0.018	40-60	80	24	12	6-24	HL6512
1.00	16.00		0.320	0.018	40-60	80	24	48	24-96	HL6513
1.00	16.00		0.320	0.018	40-60	80	24	120	60-240	HL6514
		3.00	0.192	0.018	40-60	80	24	12	6-24	HL6518
		3.00	0.192	0.018	40-60	80	24	48	24-96	HL6519
		3.00	0.192	0.018	40-60	80	24	120	60-240	HL6520
2.00	3.00		0.176	0.018	40-60	80	24	48	24-96	HL6501