



Battery Heater Mat Application Manual

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Introduction

The purpose of this Manual is to provide general guidelines for installation of Battery Heater Mats (BHM) to ensure optimal performance and reliability.

Alpha does not recommend the use of Alpha BHMs in non-Alpha/ 3rd party enclosures. BHMs are used in conjunction with enclosures, electronics and batteries to constitute an integrated powering solution and Alpha's BHMs are specifically engineered for Alpha-designed enclosures, electronics and batteries and are tested for specific applications.

Warning: Improper installation of an Alpha BHM in a non-Alpha designed enclosure may result in permanent damage to batteries, BHM, and other equipment.

Battery Heater Mat Characteristics

(a) Non-Insulated BHMs

May be installed in both UP position or DOWN position (Figure 1) with no impact on performance

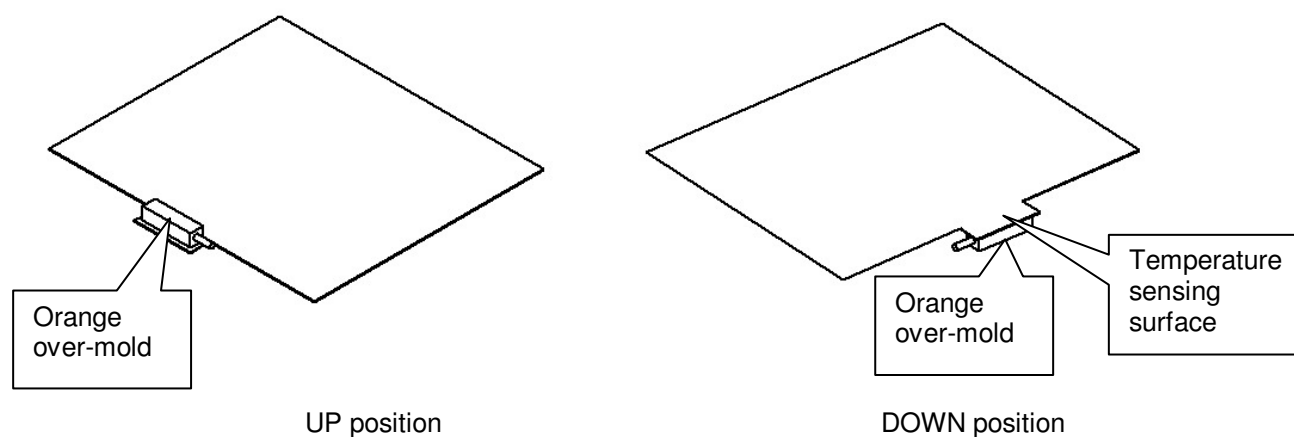


Figure 1 – Sample BHM Orientation

(b) Insulated BHM

- ONLY install with heating elements facing UP (Figure 2)
- Orange over-mold (Figure 3) may be on top or bottom of BHM,

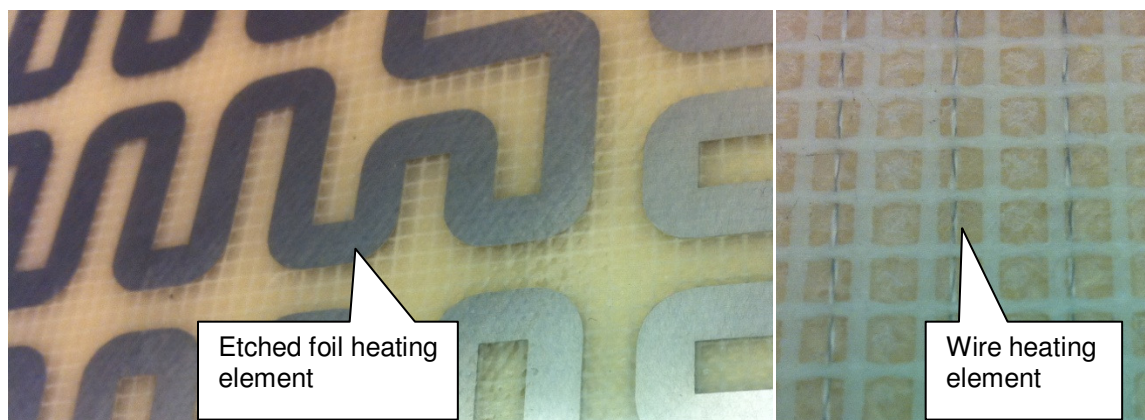
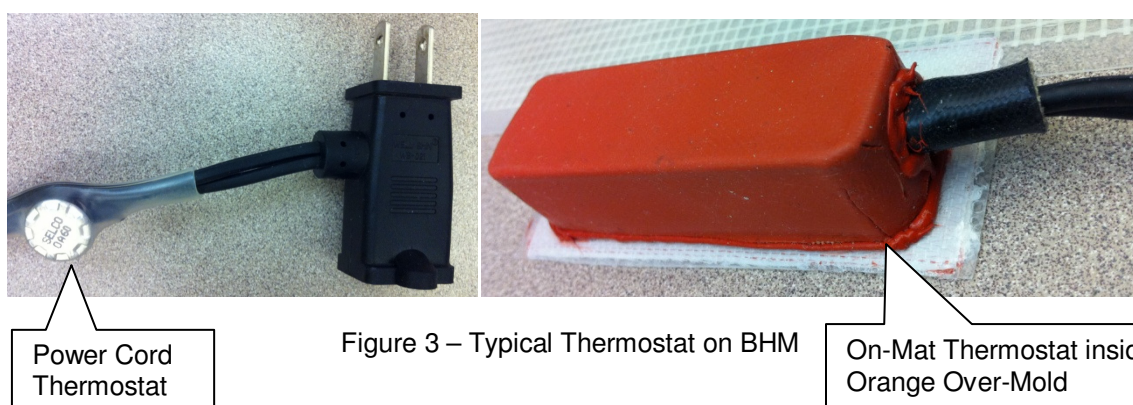


Figure 2 - Typical Heating Elements

(c) Thermostat Characteristics

BHM with power cord thermostat

- On-mat thermostat inside orange over-mold (Figure 3), 48 °C (120 °F) open and 41 °C (105 °F) close
- Thermal fuse, 82 °C (180 °F).
- Power cord thermostat (Figure 3), 5 °C (40 °F) close and 15 °C (60 °F) open



BHM without power cord thermostat

- On-mat thermostat inside orange over-mold (Figure 3), 5 °C (40 °F) close and 15 °C (60 °F) open
- Thermal fuse, 82 °C (180 °F)

Installation Requirements

(a) Structural

- The BHM must be installed on a rigid, flat metal surface to properly conduct and distribute heat into the batteries
- Ensure this flat metal surface/ shelf is securely mounted into the enclosure to prevent the BHM from buckling or sliding during battery insertion
- If BHM is used in the UP position, ensure the BHM is oriented in a way that the orange over-mold containing the thermostat and thermal fuse is least likely to be damaged by the battery, such as out of the path of battery insertion, orienting the orange over-mold towards the back of the enclosure, and avoid blind operation.
- Proper care must be taken when placing the batteries into the enclosure to prevent the over-mold from getting damaged or crushed by the batteries
- If BHM is used in the DOWN position, be sure to insert a cut-out in the battery support surface for the power cord and orange over-mold to feed through

(b) Thermal

- Ensure the temperature sensing surface under the orange over-mold (Figure 1) is either in direct contact or thermally connected to the battery or the hottest part of the BHM
- The Battery Temperature Sensor (BTS) probe (Figure 6) of the UPS (if applicable) should be secured on the battery's side between 2 batteries, approximately 1 to 2 inches above the BHM. This can be done with mechanical clip, adhesive tape or zip tie
 - Alpha Battery Spacer Clip (BSC) (Alpha PN 189-084-19, Figure 5) may be used to hold the BTS in its optimal location and maintain battery spacing in Case 27 and Case 31 batteries, i.e. AlphaCells 165GXL, 195GXL, 220GXL, 3.5 HP and 4.0 HP batteries



Figure 5 – BSC spaced out the batteries and secured BTS

- If tape is used to secure the BTS to the side of battery, the tape must have heat resistant adhesive (50°C) to ensure secure, long term attachment

- If zip tie is used, daisy chain zip tie, create a loop around the battery and hold the BTS against the battery's side
- If batteries are not installed side by side (eg. Individual battery on individual shelf), secure the BTS on one of the batteries and insulate the BTS to ensure accurate temperature measurement
- It is recommended to insulate the BTS from ambient air, in a 3rd party enclosure, to ensure it is measuring the battery temperature accurately. The insulation must be sized to ensure proper temperature measurement, and not to restrict critical battery ventilation. Insulation material must have the flammability rating (UL 94) required in the design standard of the system



Figure 6 – Sample Battery Temperature Sensor

- If batteries are placed in a separate/ 3rd party enclosure, or the power cord thermostat (Figure 3) is in the path of ventilation airflow, relocate the power cord thermostat and secure it on the battery's side between 2 batteries, approximately 1 to 2 inches above the BHM, with an extension cord to ensure proper BHM operation. The flat face of power cord thermostat must touch the battery side (Figure 7). Power cord thermostat may need to be insulated to meet battery temperature requirements listed under section Testing. For additional power cord thermostat relocation information, please consult Alpha Application Engineering.

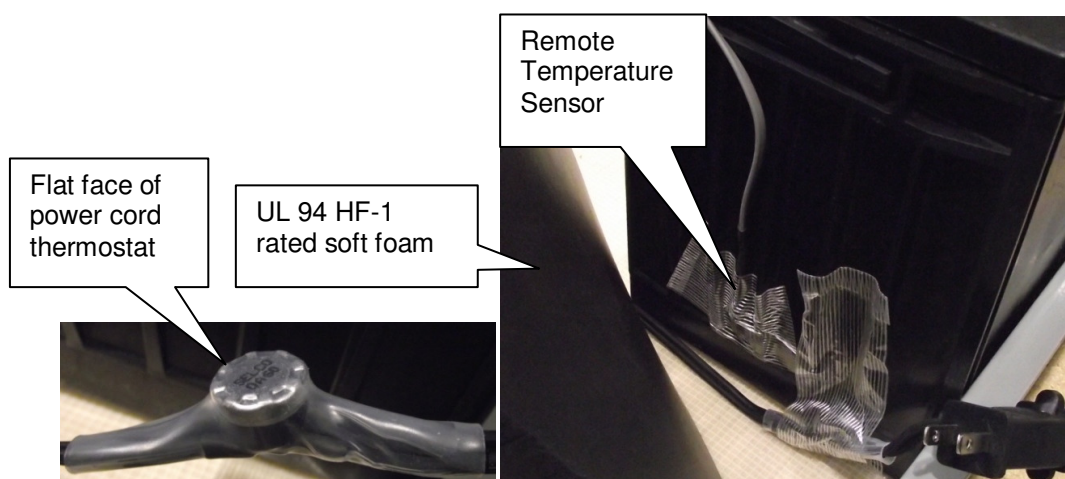


Figure 7 – Typical Power Cord Thermostat Relocation

(c) Testing

- **WARNING: DO NOT use an Alpha BHM in a third party enclosure WITHOUT thermal validation – this can result in battery damage/failure, BHM failure, or a loss in discharge capacity of the batteries.**
- Test the battery and BHM inside the enclosure through the system's designed ambient temperature range, at ramping rate of 1 °C / hour
- Maximum temperature at the bottom of battery must be maintained lower than 50 °C
- Maintain battery terminal temperatures above 0 °C and under outdoor ambient temperature plus 10 °C throughout the system designed ambient temperature range.
- If the battery temperature is out of the above specification, insulating the enclosure or power cord thermostat, or adding insulation between the BHM and the supporting surface may improve the battery temperature profile. ALWAYS test to confirm
- All insulations used must meet flammability requirement (UL 94)
- **WARNING: DO NOT DIRECTLY INSULATE THE BATTERIES – it may prevent offgassing and ventilation and could result in battery or enclosure damage.**
- Once insulation has been applied, retest to confirm adequate heating at low temperature and adequate cooling at high temperature

(d) Battery Installation

- Proper care must be taken when placing the batteries inside the enclosure to prevent the over-mold containing the on-mat thermostat and thermal fuse from getting damaged or crushed by the batteries
- A minimum 0.5 inch/ 12.7mm space between batteries is required for proper ventilation

Preventive Maintenance

The following tasks are to be performed on BHMs on a semi-annual basis

- Visual inspection – replace unit if any crack / chemical corrosion / discoloration of clear polyester cover is apparent
- Test the BHM above 15 °C ambient temperature to confirm the circuit is open, by measuring the resistance across the plug leads of BHM, open circuit should be in the million's ohm range
- Test the BHM below 5 °C ambient temperature to confirm the circuit is close. Close circuit should be in the hundred's ohm range

Warranty

Alpha Technologies Ltd. warrants all equipment manufactured by it to be free from defects in parts and labor, for a period of two years from the date of shipment from the factory. The warranty provides for repairing, replacing or issuing credit (at Alpha's discretion) for any equipment manufactured by it and returned by the customer to the factory or other authorized location during the warranty period. There are limitations to this warranty coverage. The warranty does not provide to the customer or other parties any remedies other than the above. It does not provide coverage for any loss of profits, loss of use, costs for removal or installation of defective equipment, damages or consequential damages based upon equipment failure during or after the warranty period. No other obligations are expressed or implied. Warranty also does not cover damage or equipment failure due to cause(s) external to the unit including, but not limited to, environmental conditions, water damage, power surges or any other external influence.

The customer is responsible for all shipping and handling charges. Where products are covered under warranty Alpha will pay the cost of shipping the repaired or replacement unit back to the customer.

NOTE: Alpha Technologies Ltd. does not warranty Battery Heater Mats (BHMs) installed in non-Alpha designed/ 3rd party enclosures.



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Power