



Report on the

**HOT SURFACE PERFORMANCE OF A  
FOIL/COTTON DUCT LINER**

**Prepared for:**

**Innovative Energy, Inc.  
10653 West 181<sup>st</sup> Avenue  
Lowell, Indiana 46356**

**Prepared by:**

**Testing Services Division  
Netzsch Instruments, Inc.**

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Submitted By:

A handwritten signature in black ink, appearing to read "Timothy J. Kunz", written over a horizontal line.

Timothy J. Kunz  
Testing Services Project Manager

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## Report on the Hot Surface Performance of a Foil/Cotton Duct Liner

NETZSCH was contracted by Innovative Energy, Inc. to evaluate a foil/cotton duct liner for hot surface performance at 121°C (250°F).

The sample was submitted as a blanket specimen approximately dimensioned 600 mm (24 inches) square by 19 mm (0.8 inches) thick and was identified as "1" Astro-Safe". For testing, three specimens approximately dimensioned 450 mm by 150 mm (18 inches by 6 inches) were cut from the blanket.

The test results are given after a description of the experimental procedure.

### Experimental Procedure for Testing by ASTM C 411-97

Testing was performed in accordance with ASTM C 411-97, *Hot Surface Performance of High Temperature Thermal Insulation*. The sample consisted of three specimens (each approximately dimensioned 18 inches long by 6 inches wide) per layer tested. The specimens were placed in the center of a 24 inch square flat plate at 75°F. Additional sample "guard" material was used to surround the specimens. Seven thermocouples were embedded in the plate near the surface to measure temperature.

The plate was heated to the test temperature at a rate of approximately 150°C (270°F) per hour by a heater system placed on the back side of the plate. The temperature was maintained for 96 hours by a precision set point controller. During the test period, the temperatures at various points on the plate were obtained from thermocouple readings. The plate was then allowed to cool. Observations of the sample conditions were made upon heatup and removal from the plate and are given in Table 1.



TABLE 1.

**THE HOT SURFACE PERFORMANCE OF  
A SPECIMEN OF DUCT LINER INSULATION**

<u>Specimen:</u>	1" Astro-Safe
<u>Type:</u>	Foil/Cotton Duct Liner
<u>Number of Layers:</u>	1
<u>Size Each Layer:</u>	460 mm square (18 inches square)
<u>Thickness Each Layer:</u>	19.10 mm (.752 in.)
<u>Application:</u>	Three sections, each dimensioned 460 mm by 150 mm (18 inches by 6 inches), were positioned side by side. Aluminum foil facing placed against the hot face.
<u>Test Temperature:</u>	122 °C (251°F)
<u>Warpage:</u>	None
<u>Delamination:</u>	None
<u>Cracking:</u>	None
<u>Observations Upon Heatup:</u>	No evidence of ignition, smoking, or smoldering.
<u>Observations Upon Removal:</u>	The sample remained intact with approximately 2.1% expansion in thickness. There was no significant color change observed. Mass loss: 0.3 %.
<u>Test Duration:</u>	96 Hours