



## Test Report

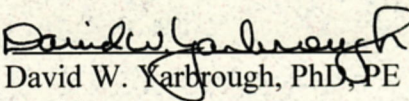
### Thermal Resistance Measurements for Astro-Safe Reflective Insulation Used as Duct Insulation

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Report: RD05103

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December 30, 2004

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# Thermal Resistance Measurements for Astro-Safe Reflective Insulation Used as Duct Insulation

## Description of Duct Insulation System

Thermal resistance measurements have been made for aluminum foil-faced polyester fiber-core reflective duct insulation manufactured by Innovative Energy Inc. located in Lowell, IN. The Innovative Energy, Inc. insulation system was tested at six power input values for a total of six R-value measurements. The duct insulation was nominal one-inch-thick reflective insulation installed around the test duct without spacers. The foil-faced side of the insulation was installed with the foil on the exterior. The insulation was slightly compressed along the edges of the duct. The perimeter of the duct is 40 inches. The duct insulation was 42.25 inches so that there was an air space between the duct and the insulation. The results of the tests are inside surface-to-outside-air resistances and inside surface-to-outside surface R-values (  $\text{ft}^2 \cdot \text{hr} \cdot ^\circ\text{F} / \text{Btu}$  ). The details of the measurements are contained in the attached test reports. Table 1 contains the measured R-values for the insulation assemblies between the walls of the air-handling duct and the surrounding air.

**Table 1. Astro-Safe Duct Insulation Thermal Results  
No Spacers**

<u>Duct Temperature (<math>^\circ\text{F}</math>)</u>	<u>Insulation System Temperature (<math>^\circ\text{F}</math>)</u>	<u><math>R_{\text{surface-to-air}}</math></u>
99.3	88.1	5.71
100.1	87.8	5.59
105.5	91.6	5.44
116.3	97.5	5.17
134.3	109.7	4.85
142.1	115.1	4.85

## Discussion of Results

The Method of Least Squares was applied to the above data set to produce an equation for  $R_{\text{surface-to-air}}$  as a function of the average of the duct wall temperature and the

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outside insulation surface temperature,  $T_{ave}$ . The correlation is given by the following equation. The “ $r^2$ ” value for the representation of the data is 0.94.

$$R_{\text{surface-to-air}} = 8.317 - 0.03099 \cdot T_{ave} \quad (1)$$

Equation (1) was used to calculate  $R_{\text{surface-to-air}}$  at evenly spaced values of  $T_{ave}$ . These values are shown in Table 2. The 75 °F value is included since building insulations are labeled at this temperature.

**Table 2. Values for  $R_{\text{surface-to-air}}$  at  $T_{ave}$  from 75 to 115 °F**

<u>Temperature (°F)</u>	<u><math>R_{\text{surface-to air}}</math></u>
75	6.0
80	5.8
85	5.7
90	5.5
95	5.4
100	5.2
105	5.1
110	4.9
115	4.8

### Conclusion

The Astro-Safe reflective duct insulation installed without spacers yields an **R-value of 6.0 ft<sup>2</sup>·hr·°F/Btu at 75 °F** for the region from the outside surface of the duct to the surrounding air. Insulation material 42.25 inches wide was installed around a 40-inch perimeter duct.

R&D Services, Inc.  
December 28, 2004

## Duct Insulation Test Report

### Description of Assemble

AstroSafe installed without spacers. The perimeter of the duct is 40 inches. The length of AstroSafe was 42.25 inches. There was an airspace between the duct wall and the AstroSafe

### R&D Services Specimen Number

### Test Results

Power to Heater	18	watts
Power to fans	21	watts
Ave. Duct Temp.	99.31	F
Outside Surface	76.84	F
Air Temperature	67.16	F
End Section	81.12	F

### Calculations

Average temperature of end guard insulation	90.22 F
T Duct - T Insulation Surface	22.47 F
T Duct - T Air	32.15 F
Delta T across guard	18.19 F
R of end guard	12.68 ft <sup>2</sup> .h.F/Btu
End loss	0.56 watts
Heat loss across duct insulation	38.44 watts
Heat flux across the duct insulation	5.63 Btu/h.ft <sup>2</sup>
Average temperature of insulation assemble	88.08 F
R exterior air film	1.72
R surface to surface	3.99 ft <sup>2</sup> .h.F/Btu
<b>R surface to air</b>	<b>5.71 ft<sup>2</sup>.h.F/Btu</b>

12/28/2004

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