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## EFFECTIVE THERMAL RESISTANCE TESTING OF INSULATING BLANKET SAMPLE

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### REVISION NOTES

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## INTRODUCTION

This report presents the results of thermal resistance testing conducted on one sample of insulating blanket. The testing was authorized by Barry Hawer of Midwest Canvas Corp. on December 2, 2019. The testing and data analysis were completed on January 2, 2020. The scope of work was limited to conducting effective thermal resistance tests on the sample submitted and reporting the results.

## CONCLUSIONS

Table 1. Summary of thermal testing results. Complete results are shown in Table 3.

| Sample Identification | Effective "R" Value |                           |
|-----------------------|---------------------|---------------------------|
|                       | m <sup>2</sup> K/W  | °F·ft <sup>2</sup> ·h/Btu |
| A – Center cut        | 0.33                | 1.86                      |

## SAMPLE IDENTIFICATION

Two samples were received for testing on December 4, 2019. Samples were received as one sheet of insulating blanket material, consisting of canvas material sandwiching padding material, sized approximately 24" x 24" x 0.7". The samples have one green canvas face, one yellow canvas face, four plastic fasteners, stitching about one inch in from the edge on all sides and grommets at the stitching intersections. Samples were identified by the client as A and B. After conditioning the samples, one test specimen was sectioned from the center of sample A, sized approximately 12" x 12" x 0.7". The plastic fasteners present in the specimen were removed for testing.

## TEST METHOD

The specimen was allowed to condition to practical equilibrium at standard laboratory conditions of 23 ± 2 °C and 50 ± 5% relative humidity. The thermal resistance testing was conducted using ASTM C518-17 as a procedural guide, as listed in Table 2. The specimen was placed in the heat flow meter in a horizontal position. The samples were positioned with the green side facing the hot plate. Steady-state heat flux measurements were made at a mean temperature of approximately 24 °C. The hot face (top plate) temperature was approximately 38 °C and the cold face (bottom plate) temperature was approximately 10 °C. The heat flux is in the downward direction (hot plate to cold plate). Specimen thermal resistance and thermal conductivity were determined by comparing the heat flux measurements of the specimen to measurements made on a known standard reference material. Resistance values obtained from the heat flow meter are best utilized for homogenous specimens.

Table 2. Test method and parameters of testing.

| Test Method  | Test Method Title   | Deviations from and/or Parameters to Method                  |
|--------------|---|--|
| ASTM C518-17 | Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus | Mean Temperature: 24 °C<br>Temperature Range (Delta ): 28 °C |

**CALIBRATED TEST EQUIPMENT**

Honeywell Temp/RH Chart Recorder, S/N 7852 243000007, ID MM190-024, cal. 02/Jul/19, due 02/Jul/20

MasterForce 8m Tape Measure, ID PT-163-064, cal. 07/Mar/18, due 07/Mar/23

Netsch Heat Flow Meter - HFM 436/3/1ER, S/N 606000788, ID PT163-003, cal. 30/Sep/19, due 30/Sep/20

Sartorius Balance, Model ENTRIS3202i-1S, S/N 34507196, ID PT-163-061, cal. 30/Sep/19, due 30/Sep/20

**STANDARD REFERENCE MATERIAL**

NIST SRM 1450d, High Density Fiberglass

**OTHER TEST EQUIPMENT**

Neslab Chiller, Model RTE-740, S/N 89CML91040-7

**TEST RESULTS**

Table 3. Effective thermal resistance testing results.

| SAMPLE PROPERTIES:               |  | Units                          | A – Center cut      |
|----------------------------------|--|--------------------------------|---------------------|
| Thickness                        |  | cm                             | 1.5168              |
|                                  |  | inches                         | 0.597               |
| Mass Change During Conditioning* |  | Initial, g                     | N/A                 |
|                                  |  | Prior to test, g               | 86.62               |
|                                  |  | % of cond. mass                | N/A                 |
| Mass Change During Testing       |  | Prior to test, g               | 86.62               |
|                                  |  | After test, g                  | 86.49               |
|                                  |  | % of cond. Mass                | -0.15               |
| TEST CONDITIONS:                 |  |                                |                     |
| Temperature Gradient             |  | K/m                            | 1795.10             |
|                                  |  | °F/in                          | 82.07               |
| Mean Temperature                 |  | °C                             | 25.00               |
|                                  |  | °F                             | 77.00               |
| Temperature Range (Delta)        |  | °C                             | 27.23               |
|                                  |  | °F                             | 49.01               |
| Test Time                        |  | hr:min:sec                     | 0:42:15             |
| RESULTS:                         |  |                                |                     |
| Heat Flux                        |  | W/m <sup>2</sup>               | 83                  |
|                                  |  | Btu/(h·ft <sup>2</sup> )       | 26                  |
| Thermal Conductivity             |  | W/m·K                          | 0.04638             |
|                                  |  | Btu·in/(h·ft <sup>2</sup> ·°F) | 0.32155             |
| Thermal Conductance              |  | W/m <sup>2</sup> ·K            | 3.058               |
|                                  |  | Btu/(h·ft <sup>2</sup> ·°F)    | 0.538               |
| Thermal Resistivity              |  | m <sup>2</sup> K/W             | 21.6                |
|                                  |  | °F·ft <sup>2</sup> ·h/Btu/in   | 3.11                |
| Thermal Resistance, "R" Value    |  | m <sup>2</sup> K/W             | 0.33                |
|                                  |  | °F·ft <sup>2</sup> ·h/Btu      | <b>1.86</b> R-Value |

Estimated uncertainty is ± 5% or less.

\*The test specimen was sectioned from sample A after the sample was conditioned to practical equilibrium, thus an initial mass for the test specimen could not be determined.