

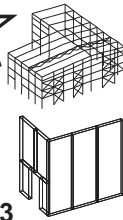


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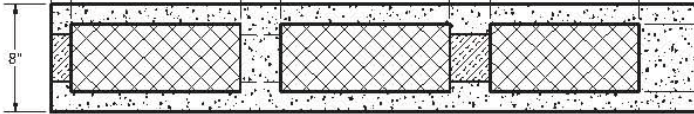
952-935-1113 Fax 952-935-1473



**HTK-2016-241**

Subject: FABCON R-Value for 8" VC+ Green = 13.6.

Date: July 22, 2016



Sample Representative End View



Sample Representative Isometric View


HavTek created an ANSYS model to perform a finite element analysis of thermal heat flow through an assembly in compliance with ASHRAE 90.1, Appendix A. Section A1.2 allows assemblies not adequately represented by Sections A2-A8 to use Section A9 for analysis. This assembly resides in the requirements of Section A9.2 b.1, where testing or two dimensional calculations are acceptable methods to determine heat flow. The guidelines for the calculations are in section A9.4. Air films were used as per section A9.4.1 to be applied to the overall assembly.

The ANSYS modeling used thermal convection properties with exterior temperature of 100F and interior temperature of 70F. This temperature range has been used in hot box testing, ASTM C1363. Comparisons of results on a known sample were performed to validate the ANSYS modeling to ASTM C1363 testing. Results were within 1%. The heat flow thru the assembly was determined by ANSYS and the overall Thermal Resistance, R value, was then computed.

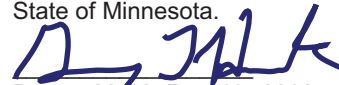
For the 8" VC+ Green panel using the Ansys result computes to an overall Thermal Resistance, **R-value, of 13.6 (ft<sup>2</sup> \*F\*hr/BTU).**

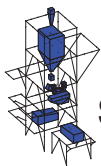
In Conclusion, this method of determining the R-value is acceptable by ASHREA 90.1. The value listed is to be used for comparison to required values of the various Climate Zones as identified in ASHRAE Figure B1-1 and within software models for building envelop performance comparisons.

Respectfully:

  
Gregory J. Havlik P.E.  
President

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Registered Professional Engineer under the laws of the State of Minnesota.

  
Date 7-22-16 Reg. No.22085  
GREGORY J HAVLIK

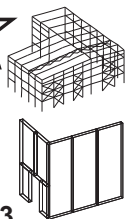


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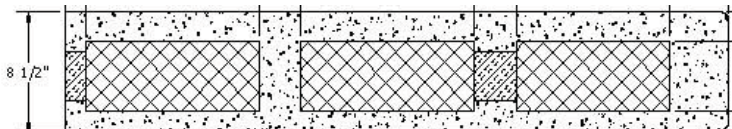
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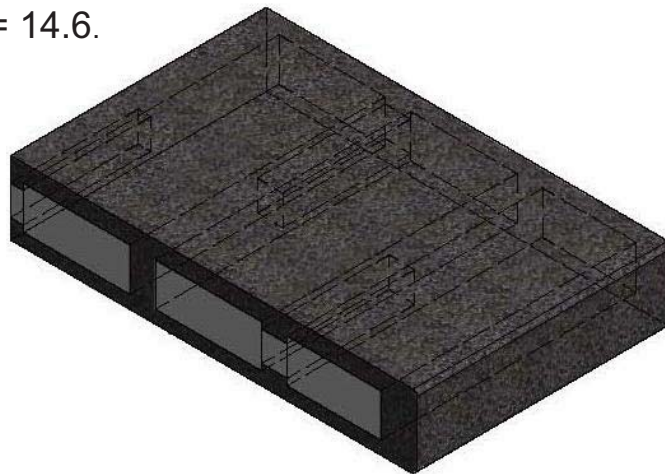
**HTK-2016-242**

Subject: FABCON R-Value for 8.5" VC+ Green = 14.6.

Date: July 22, 2016



Sample Representative End View



Sample Representative Isometric View

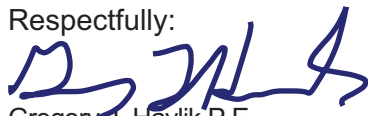
HavTek created an ANSYS model to perform a finite element analysis of thermal heat flow through an assembly in compliance with ASHRAE 90.1, Appendix A. Section A1.2 allows assemblies not adequately represented by Sections A2-A8 to use Section A9 for analysis. This assembly resides in the requirements of Section A9.2 b.1, where testing or two dimensional calculations are acceptable methods to determine heat flow. The guidelines for the calculations are in section A9.4. Air films were used as per section A9.4.1 to be applied to the overall assembly.

The ANSYS modeling used thermal convection properties with exterior temperature of 100F and interior temperature of 70F. This temperature range has been used in hot box testing, ASTM C1363. Comparisons of results on a known sample were performed to validate the ANSYS modeling to ASTM C1363 testing. Results were within 1%. The heat flow thru the assembly was determined by ANSYS and the overall Thermal Resistance, R value, was then computed.

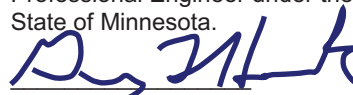
For the 8.5" VC+ Green panel using the Ansys result computes to an overall Thermal Resistance, **R-value, of 14.6 (ft<sup>2</sup> \*F\*hr/BTU).**

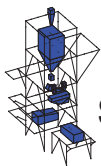
In Conclusion, this method of determining the R-value is acceptable by ASHREA 90.1. The value listed is to be used for comparison to required values of the various Climate Zones as identified in ASHRAE Figure B1-1 and within software models for building envelop performance comparisons.

Respectfully:

  
Gregory J. Havlik P.E.  
President

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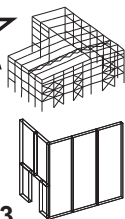


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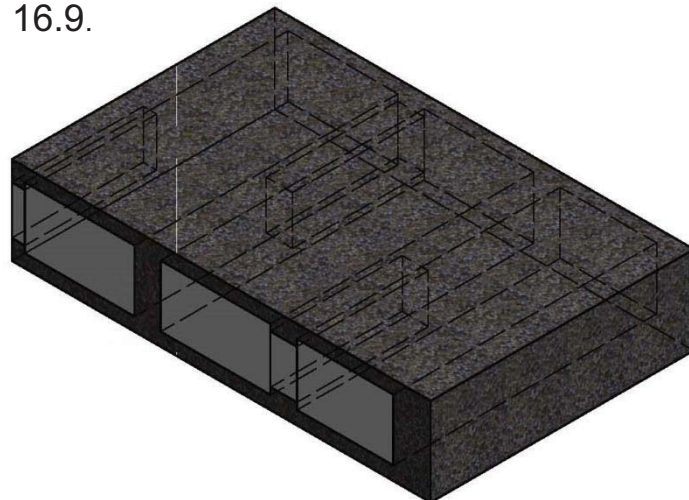
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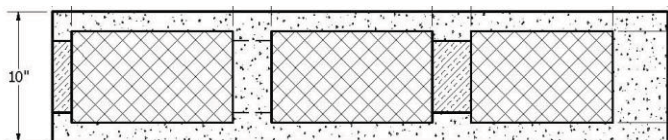
**HTK-2016-243**

Subject: FABCON R-Value for 10" VC+ Green = 16.9.

Date: July 22, 2016



Sample Representative Isometric View



Sample Representative End View

HavTek created an ANSYS model to perform a finite element analysis of thermal heat flow through an assembly in compliance with ASHRAE 90.1, Appendix A. Section A1.2 allows assemblies not adequately represented by Sections A2-A8 to use Section A9 for analysis. This assembly resides in the requirements of Section A9.2 b.1, where testing or two dimensional calculations are acceptable methods to determine heat flow. The guidelines for the calculations are in section A9.4. Air films were used as per section A9.4.1 to be applied to the overall assembly.

The ANSYS modeling used thermal convection properties with exterior temperature of 100F and interior temperature of 70F. This temperature range has been used in hot box testing, ASTM C1363. Comparisons of results on a known sample were performed to validate the ANSYS modeling to ASTM C1363 testing. Results were within 1%. The heat flow thru the assembly was determined by ANSYS and the overall Thermal Resistance, R value, was then computed.

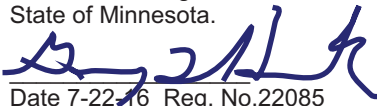
For the 10" VC+ Green panel using the Ansys result computes to an overall Thermal Resistance, **R-value, of 16.9 (ft<sup>2</sup> \*F\*hr/BTU).**

In Conclusion, this method of determining the R-value is acceptable by ASHREA 90.1. The value listed is to be used for comparison to required values of the various Climate Zones as identified in ASHRAE Figure B1-1 and within software models for building envelop performance comparisons.

Respectfully:

  
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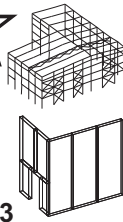


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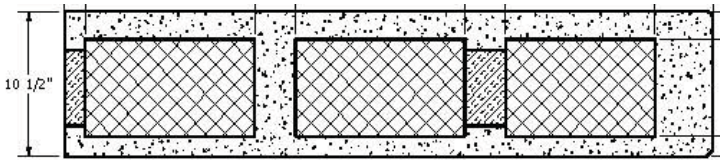
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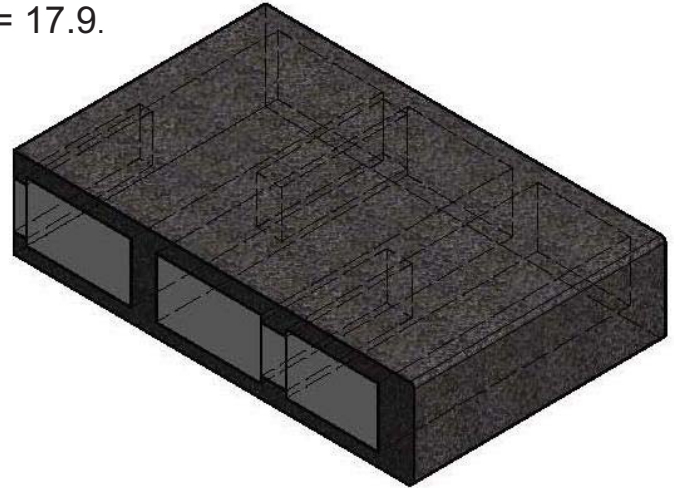
**HTK-2016-244**

Subject: FABCON R-Value for 10.5" VC+ Green = 17.9.

Date: July 22, 2016



Sample Representative End View



Sample Representative Isometric View

HavTek created an ANSYS model to perform a finite element analysis of thermal heat flow through an assembly in compliance with ASHRAE 90.1, Appendix A. Section A1.2 allows assemblies not adequately represented by Sections A2-A8 to use Section A9 for analysis. This assembly resides in the requirements of Section A9.2 b.1, where testing or two dimensional calculations are acceptable methods to determine heat flow. The guidelines for the calculations are in section A9.4. Air films were used as per section A9.4.1 to be applied to the overall assembly.

The ANSYS modeling used thermal convection properties with exterior temperature of 100F and interior temperature of 70F. This temperature range has been used in hot box testing, ASTM C1363. Comparisons of results on a known sample were performed to validate the ANSYS modeling to ASTM C1363 testing. Results were within 1%. The heat flow thru the assembly was determined by ANSYS and the overall Thermal Resistance, R value, was then computed.

For the 10.5" VC+ Green panel using the Ansys result computes to an overall Thermal Resistance, **R-value, of 17.9 (ft<sup>2</sup> \*F\*hr/BTU).**

In Conclusion, this method of determining the R-value is acceptable by ASHREA 90.1. The value listed is to be used for comparison to required values of the various Climate Zones as identified in ASHRAE Figure B1-1 and within software models for building envelop performance comparisons.

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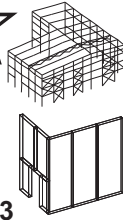


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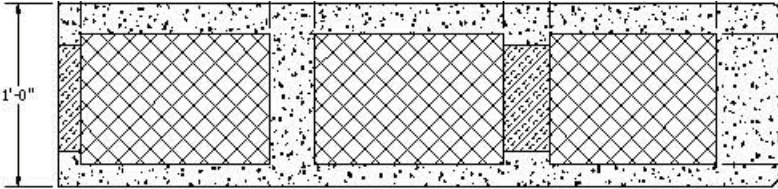
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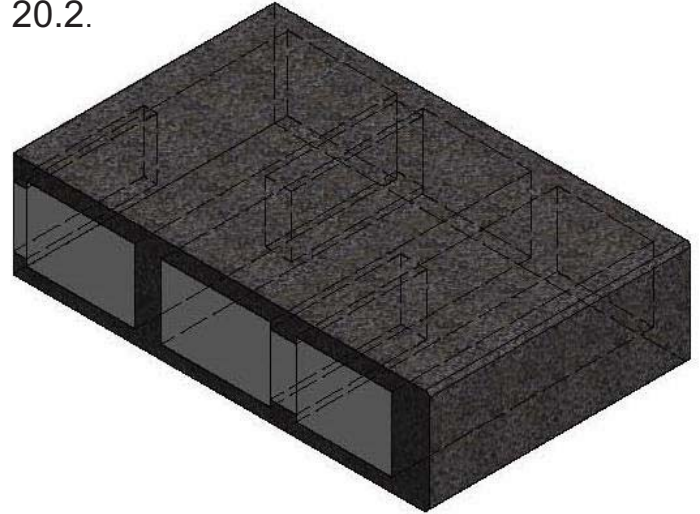
**HTK-2016-245**

Subject: FABCON R-Value for 12" VC+ Green = 20.2.

Date: July 22, 2016



Sample Representative End View



Sample Representative Isometric View

HavTek created an ANSYS model to perform a finite element analysis of thermal heat flow through an assembly in compliance with ASHRAE 90.1, Appendix A. Section A1.2 allows assemblies not adequately represented by Sections A2-A8 to use Section A9 for analysis. This assembly resides in the requirements of Section A9.2 b.1, where testing or two dimensional calculations are acceptable methods to determine heat flow. The guidelines for the calculations are in section A9.4. Air films were used as per section A9.4.1 to be applied to the overall assembly.

The ANSYS modeling used thermal convection properties with exterior temperature of 100F and interior temperature of 70F. This temperature range has been used in hot box testing, ASTM C1363. Comparisons of results on a known sample were performed to validate the ANSYS modeling to ASTM C1363 testing. Results were within 1%. The heat flow thru the assembly was determined by ANSYS and the overall Thermal Resistance, R value, was then computed.


For the 12" VC+ Green panel using the Ansys result computes to an overall Thermal Resistance, **R-value, of 20.2 (ft<sup>2</sup> \*F\*hr/BTU).**

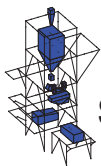
In Conclusion, this method of determining the R-value is acceptable by ASHREA 90.1. The value listed is to be used for comparison to required values of the various Climate Zones as identified in ASHRAE Figure B1-1 and within software models for building envelop performance comparisons.

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Date 7-22-16 Reg. No.22085  
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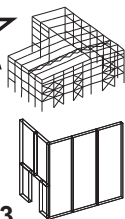


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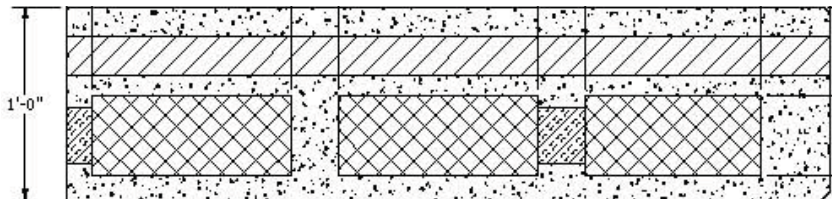
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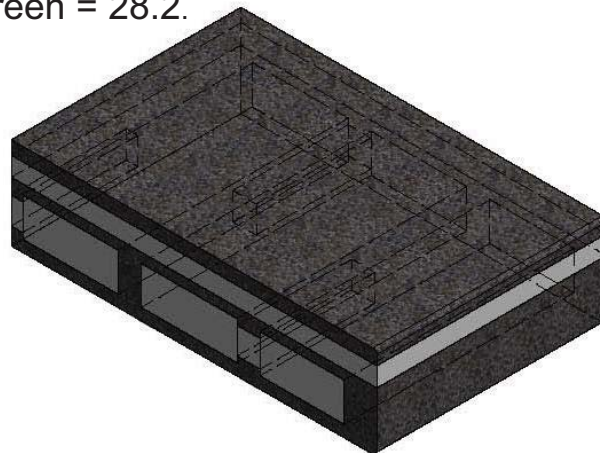
**HTK-2016-246**

Subject: FABCON R-Value for 12" Sandwich VC+ Green = 28.2.

Date: July 22, 2016



Sample Representative End View



Sample Representative Isometric View

HavTek created an ANSYS model to perform a finite element analysis of thermal heat flow through an assembly in compliance with ASHRAE 90.1, Appendix A. Section A1.2 allows assemblies not adequately represented by Sections A2-A8 to use Section A9 for analysis. This assembly resides in the requirements of Section A9.2 b.1, where testing or two dimensional calculations are acceptable methods to determine heat flow. The guidelines for the calculations are in section A9.4. Air films were used as per section A9.4.1 to be applied to the overall assembly.

The ANSYS modeling used thermal convection properties with exterior temperature of 100F and interior temperature of 70F. This temperature range has been used in hot box testing, ASTM C1363. Comparisons of results on a known sample were performed to validate the ANSYS modeling to ASTM C1363 testing. Results were within 1%. The heat flow thru the assembly was determined by ANSYS and the overall Thermal Resistance, R value, was then computed.

For the 12" Sandwich VC+ Green panel using the Ansys result computes to an overall Thermal Resistance, **R-value, of 28.2 (ft<sup>2</sup> \*F\*hr/BTU).**

In Conclusion, this method of determining the R-value is acceptable by ASHREA 90.1. The value listed is to be used for comparison to required values of the various Climate Zones as identified in ASHRAE Figure B1-1 and within software models for building envelop performance comparisons.

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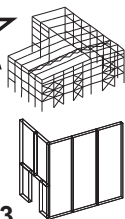


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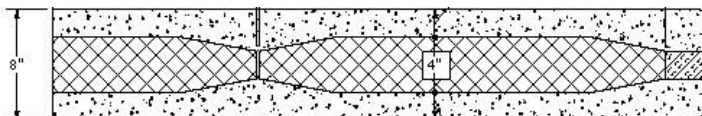
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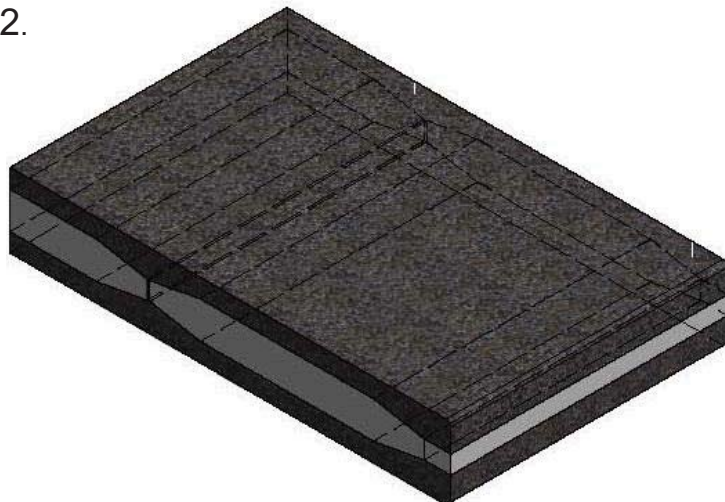
**HTK-2016-247**

Subject: FABCON R-Value for 8" Edge = 16.2.

Date: July 22, 2016



Sample Representative End View



Sample Representative Isometric View

HavTek created an ANSYS model to perform a finite element analysis of thermal heat flow through an assembly in compliance with ASHRAE 90.1, Appendix A. Section A1.2 allows assemblies not adequately represented by Sections A2-A8 to use Section A9 for analysis. This assembly resides in the requirements of Section A9.2 b.1, where testing or two dimensional calculations are acceptable methods to determine heat flow. The guidelines for the calculations are in section A9.4. Air films were used as per section A9.4.1 to be applied to the overall assembly.

The ANSYS modeling used thermal convection properties with exterior temperature of 100F and interior temperature of 70F. This temperature range has been used in hot box testing, ASTM C1363. Comparisons of results on a known sample were performed to validate the ANSYS modeling to ASTM C1363 testing. Results were within 1%. The heat flow thru the assembly was determined by ANSYS and the overall Thermal Resistance, R value, was then computed.

For the 8" Edge panel using the Ansys result computes to an overall Thermal Resistance, **R-value, of 16.2 (ft<sup>2</sup> \*F\*hr/BTU).**

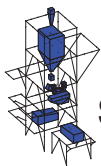
In Conclusion, this method of determining the R-value is acceptable by ASHREA 90.1. The value listed is to be used for comparison to required values of the various Climate Zones as identified in ASHRAE Figure B1-1 and within software models for building envelop performance comparisons.

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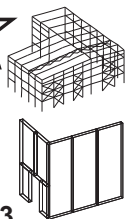


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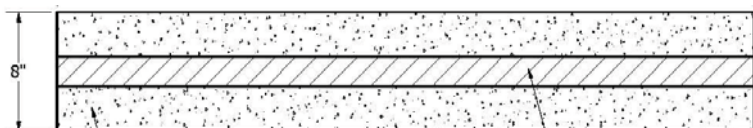
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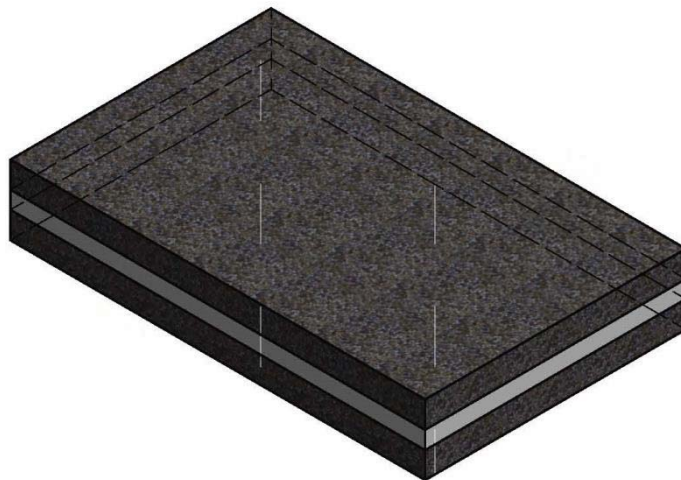
**HTK-2016-248**

Subject: FABCON R-Value for 8" 3-2-3 = 12.8.

Date: July 22, 2016



Sample Representative End View



Sample Representative Isometric View

HavTek created an ANSYS model to perform a finite element analysis of thermal heat flow through an assembly in compliance with ASHRAE 90.1, Appendix A. Section A1.2 allows assemblies not adequately represented by Sections A2-A8 to use Section A9 for analysis. This assembly resides in the requirements of Section A9.2 b.1, where testing or two dimensional calculations are acceptable methods to determine heat flow. The guidelines for the calculations are in section A9.4. Air films were used as per section A9.4.1 to be applied to the overall assembly.

The ANSYS modeling used thermal convection properties with exterior temperature of 100F and interior temperature of 70F. This temperature range has been used in hot box testing, ASTM C1363. Comparisons of results on a known sample were performed to validate the ANSYS modeling to ASTM C1363 testing. Results were within 1%. The heat flow thru the assembly was determined by ANSYS and the overall Thermal Resistance, R value, was then computed.

For the 8" 3-2-3 panel using the Ansys result computes to an overall Thermal Resistance, **R-value, of 12.8 (ft<sup>2</sup> \*F\*hr/BTU).**

In Conclusion, this method of determining the R-value is acceptable by ASHREA 90.1. The value listed is to be used for comparison to required values of the various Climate Zones as identified in ASHRAE Figure B1-1 and within software models for building envelop performance comparisons.

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