ASTM C -236 Testing for a "R" rating. Post Test Review

We have discovered that having an "R" rating means the material absorbs heat and is a measure of how long it can absorb and hold heat before it can migrate through it.

In the effort to answer the question of how do we measure up to an "R" rated material as in fiberglass, we took on the ASTM C-236 testing for measuring R values.

This test specifies a 3" fiberglass board be used as the control panel and tested.
Then the board is tested with one coat of SUPER THERM applied to one side.
Another board is tested with a coat on each side of the board.

The board with one coat of SUPER THERM was tested first and gave a .31** numerical value.

The board with two sides coated with the SUPER THERM gave a .21** numerical value.

Then the control board of the same 3" of fiberglass was tested and gave a .52** numerical value.

A note of importance was discovered by our personnel when working with the labs to do the testing and comparison against the fiberglass. First, all fiberglass testing must be performed at 70 degrees F. Why, because this is the optimum temperature that the fiberglass can test and give the best results. When asked why this is the situation, it was stated that if the temperature drops below or rises above 70 degrees F, the fiberglass will suddenly drop in heat conductance value and therefore drop in it's R value very quickly. This seems very odd that an entire industry would accept such a material that only works best at one level of temperature and then base all the insulation requirements on a temperature level that is rarely achieved on any constant basis.

This gives a different meaning to the numbers reported on the test results. When SUPER THERM improved the performance of the fiberglass by 68% with only one coat, this was a the 70 degree F level. Since the SUEPR THERM has performed worldwide at all temperature levels from -60 F up to 120 F and gave the same insulation value (see reports and testing results in notebook). According to the labs (VTEC and NATIONAL CERTIFIED TESTING LABORATORIES (NCTL)), the percentage of improvement in R value when SUPER THERM is coated over the fiberglass above and below the 70 degree F level will increase dramatically to give the SUEPR THERM, as a single insulation film, the comparison of a minimum of R 19 as tested in the BTU conductance testing with another national lab and the field studies. SUPER THERM reduced BTU heat conduction from 367.20 BTU/sq.ft./hour/F down to 3.99 BTU/sq.ft./hour/F in the ASTM E1269 Specific Heat and ASTM E1461-92 Thermal Diffusivity and conductance

testing. This result is written as being the same for metal or concrete surfaces which is to say, any substrate.

The lower the number the better – to note the importance.

The 3" fiberglass is rated at 3.846 R value per inch for high density fiberglass used in test labs requiring minimum thickness for performing tests in Hot Box testing. Therefore, 3" would be R 11.5.
Normal density fiberglass used in the insulation industry is not rated 3.846 R value per inch nor having a .52 conductance value. It is much less effective for R value and therefore requiring 8" – 10" thickness to achieve the R19 rating. Also, the moisture content of normal industry fiberglass cannot have more than 1 ½% moisture in the material to test at it's reported R value. Above 1 ½% moisture content and the reported R value will immediately reduce by 35% as tested by industry results (Innovative Insulation, Inc. magazine report). This would mean that the fiberglass on the shelves at home depot or others would have a minimum of 1 ½% moisture and more already in the material before you purchased the material meaning it would not be more than R 12 if it was a reported R19 stamped on the packing.
Here again, SUPER THERM is not affected by moisture in any form to reduce it's effectiveness as shown in the testing and field studies (see reports).

Based on the high density fiberglass board and figuring the math on a linear* basis:

One side coated with SUPER THERM being .31 is 1.68 improvement and applied to R 11.5 X 1.68 = **R 19.3** (possible combination result compounding to R 30).

Two side coated with SUPER THERM being .21 is 2.47 improvement and applied to R 11.5 X 2.47 = **R 28.5** (possible combination result compounding to R 45).

* the results are greater than the linear result as insulation is a **compounding value** and not just linear. The migration of heat and the blocking of the heat flow through resistant materials is a compounding formula, but for now the linear math will give you the minimum of what can be expected.

We have three more tests to perform on different applications:

a. 1 1/2" plywood board with SUPER THERM and HOT PRIME on one side.
b. Fiberglass board with SUPER THERM and HOT PRIME on one side.

The tests are to answer questions about other substrates.

The applications on the test panels were made by VTEC labs in New York.
The ASTM Testing is done by NATIONAL CERTIFIED TESTING LABORATORIES in Pennsylvania certified by ASTM.

This testing was asked for by Bombardier in Mexico City for Train Cars to find a better material than fiberglass to use for insulation on their train cars. The resistance from other engineering groups was that a known and accepted ASTM test had not be performed to compare the “R” values.

Now, this has been done and we show to be the R value that we have always stated in our literature from the compound formula results. This test was performed for the specific reason to prove that the SUPER THERM is an insulation material used in the building and construction industry.

** These are exact numbers for BTU heat conduction per sq. ft. / hour / F.

VTEC Laboratories Inc.

October 31, 2002

Mr. Francisco Morales Véliz
Bombardier Transportation
Domicilio Conocido, Zona Industrial
Cd. Sahagún, Edo. De Hgo C.P. 43990 México

RE: Comparison of completed ASTM C236 Tests

Dear Mr. Véliz,

Below is the summary of the results from the referenced job files. The percentages listed for the "Sample" fiberglass panels are compared to the "Control" panel; the "Plywood Laminate" and "Stainless Steel" panels did not have a "control" sample available for comparison. For specific test specimen data and test conditions please refer to the appropriate test report.

Report Number (NCTL-110-)	Test Specimen (24" x 48")	Thermal Conductance (Excluding Air Films)	R-Value (Per inch of thickness)	Percent Increase (from Control)
8373-01	Control – 3" Fiberglass with no coatings	0.52	1.92	-
8373-02	System 2 – 3" Fiberglass with 10 mil Super Therm coating on interior	0.31	3.23	68%
8373-05	System 4 – 3" Fiberglass with 50 mil Hot Therm and 10 mil Super Therm coating on interior	0.28	3.57	86%
8373-03	System 1 – 3" Fiberglass with 10 mil Super Therm coating on both sides	0.21	4.76	148%
8373-06	Plywood laminate with 50 mil Hot Therm and 10 mil Super Therm coating on interior	0.79	1.27	

If you have any questions, please contact me at your convenience.

Neil Schultz

212 Manida Street • Bronx, New York 10474 • (718) 542-8248 • Fax: (718) 542-8759 • www.vteclabs.com

VTEC LABORATORIES, INC.

THERMAL PERFORMANCE TEST REPORT

3" Fiberglass Core Panel

NCTL-110-8373-1

NATIONAL CERTIFIED TESTING LABORATORIES

FIVE LEIGH DRIVE • YORK, PENNSYLVANIA 17402 • TELEPHONE (717) 846-1200
FAX (717) 767-4100
www.nctlinc.com

THERMAL PERFORMANCE TEST REPORT

Report No: NCTL-110-8373-1
Test Date: 09/26/02
Report Date: 10/28/02
Expiration Date: 09/30/06

Client: *VTEC Laboratories, Inc.*
212 Manida Street
Bronx, NY 10474

Test Specimen: *VTEC's 3" Fiberglass Core Panel.*

Test Method: *ASTM C236-89 (93) "Standard Test Method for Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box".*

TEST SPECIMEN DESCRIPTION

General: *The test specimen was a 3" thick fiberglass core panel measuring 24" wide by 48" high. No coating was applied to the panel.*

SPECIMEN PREPARATION PRIOR TO TEST

The test specimen was pre-conditioned at ambient laboratory conditions prior to the test. The surround panel-to-specimen interfaces were sealed with a non-reflective tape resulting in a measured net air leakage of 0.000 CFM per square foot.

TEST PARAMETERS

Tests to determine the thermal transmittance (U) of the specimen were performed in the guarded hot box apparatus located at the York, PA facility. The most recent calibration of the hot box apparatus was in May, 2002. The thermal performance evaluations were completed in accordance with ASTM C236-89 (93) using a dynamic wind perpendicular to the specimen on the weather side and simulated natural convection on the room side. A zero static pressure differential was maintained across the specimen during the test by pressurizing the metering box on the room side. Data was collected over successive 1 hour periods for a minimum duration of 8 hours after steady state conditions were achieved. Steady state conditions were considered established when, over a 4 hour period; a) the 1-hour averages of the surface thermocouples did not vary more than 0.1°F or change unidirectionally; and b) the 1-hour averages of the power input to the metering box did not vary more than ± 1% or change unidirectionally.

Measured Areas

Total Specimen Projected Area:	8.00 ft^2
Metering Box Opening Area :	54.39 ft^2
Metering Box Baffle Area :	46.44 ft^2
Surround Panel Interior Exposed Area :	24.11 ft^2
Area of Mods for Surround Panel Opening:	22.29 ft^2

THERMAL TRANSMITTANCE & CONDUCTANCE

The test chamber environmental systems were initiated at 1556 on 09/25/02. The test conditions were considered stable for two consecutive four hour test periods from 0746 to 0946 and 0946 to 1146 on 09/26/02. The thermal performance test results were derived from the 0946-1146 test period.

Test Conditions

Average Room Side Air Temperature t_h	70.5 °F
Average Weather Side Air Temperature, t_c	0.1 °F
Average Guard Box Air Temperature	73.1 °F
Metering Box Average Relative Humidity	12 %
Measured Weather Side Wind Velocity	14.3 mph
Static Pressure Difference Across Specimen	0.00 "H_2O

Heat Flows

Heat Input Rate to Metering Box	381.5 BTU/HR
Surround Panel Heat Flow	70.3 BTU/HR
Heat Flow Through Mods to Surround Panel Opening ($k = 0.308$)	102.0 BTU/HR
Sensible Heat from Pressure Balance Air Flow	-47.1 BTU/HR
Metering Box Heat Flow	- 21.4 BTU/HR
Flanking Loss Heat Flow	56.5 BTU/HR
Heat Flow Through Center and Edge Areas	221.2 BTU/HR

Surface Temperature Data

Specimen Area-Weighted Room Side Surface Temperature, t_1	54.8 °F
Specimen Area-Weighted Weather Side Surface Temperature, t_2	1.2 °F

Test Results & Calculated Test Data

Room Side Surface Conductance, h_h	1.77	BTU/HR/FT²/°F
Weather Side Surface Conductance, h_c	26.08	BTU/HR/FT²/°F
Panel Thermal Conductance, C	0.52	BTU/HR/FT²/°F
Panel Thermal Resistance, R (without surface films)	1.92	HR*FT²*°F/BTU
Room Side Surface Resistance, r_h	0.56	HR*FT²*°F/BTU
Weather Side Surface Resistance, r_c	0.04	HR*FT²*°F/BTU
Overall Panel Thermal Resistance, R_u (including surface films)	2.56	HR*FT²*°F/BTU
Panel Thermal Transmittance, U (including surface films)	0.39	BTU/HR/FT²/°F

Based on the listed test results, the thermal conductance (C) of the Panel area (excluding surface films) was determined to be 0.52 BTU/HR/FT²/°F at the described test conditions. The Panel thermal resistance (R) without surface films was determined to be 1.92 HR*FT²*°F/BTU at the described test conditions.

Attachment 1 to this report lists the measured surface temperature data as well as the area information used to calculate the area-weighted surface temperatures. Attachment 2 to this report is a drawing showing surface thermocouple measurement locations corresponding to the data on Attachment 1.

This test method does not include procedures to determine the heat flow due to either air movement through the specimen or solar radiation effects. As a consequence, the thermal transmittance results obtained do not reflect performances which may be expected from field installations due to not accounting for solar radiation, air leakage effects, and the thermal bridge effects that may occur due to the specific design and construction of the fenestration system opening. Therefore, it should be recognized that the thermal transmittance results obtained from this test method are for ideal laboratory conditions and should only be used for product comparisons and as input to thermal performance analyses which also include solar, air leakage, and thermal bridge effects.

A copy of this report along with representative sections of the test specimen will be retained by NCTL for a period of four (4) years. The results obtained apply only to the specimen tested. This report may not be reproduced, except in full, without the written approval of National Certified Testing Laboratories. Testing described in this report was conducted in full compliance with the requirements of the referenced test method.

NATIONAL CERTIFIED TESTING LABORATORIES

PATRICK D. HEIN
Engineering Manager
Person-in-Responsible Charge

PDH/amb

ATTACHMENT 1

SURFACE TEMPERATURE MEASUREMENTS AND AREA INFORMATION

VTEC Laboratories, Inc. *NCTL-110-8373-1* *0946-1146* *09/26/02*

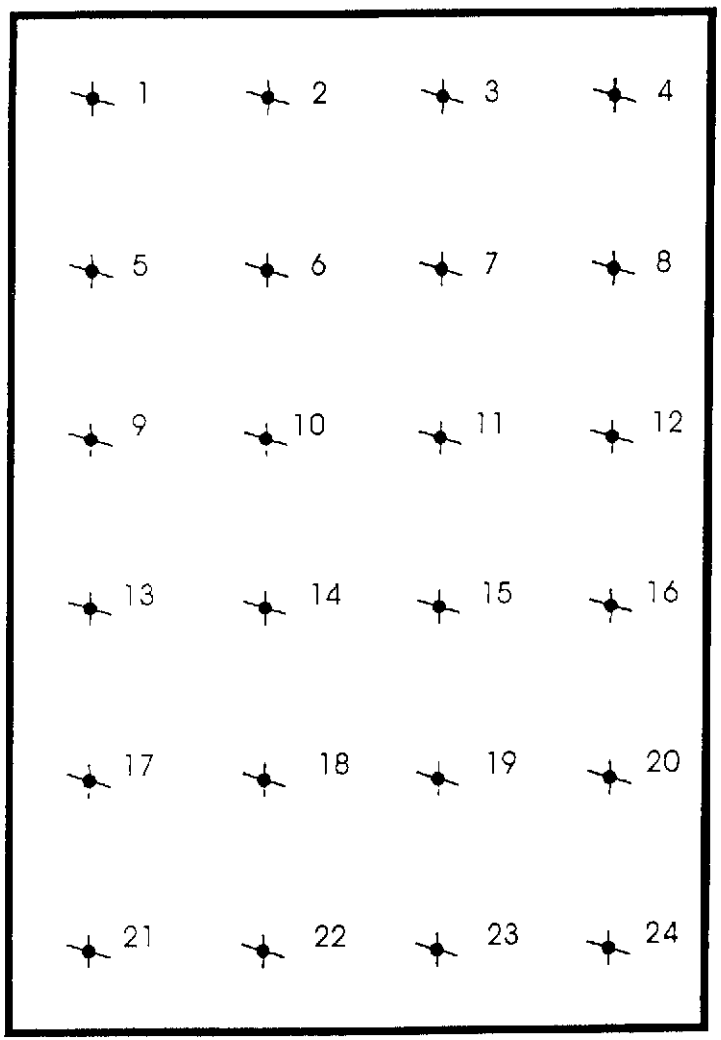
Thermocouple Location #	*Individual Average Surface Temperatures (°F)*		*Assigned 3-D Areas Per Thermocouple Location (ft²)*	
	Room Side	*Weather Side*	*Room Side*	*Weather Side*
1	*69.6*	*4.9*	*0.33*	*0.33*
2	*68.1*	*2.3*	*0.33*	*0.33*
3	*69.4*	*4.7*	*0.33*	*0.33*
4	*69.6*	*7.3*	*0.33*	*0.33*
5	*67.8*	*1.5*	*0.33*	*0.33*
6	*64.7*	*0.6*	*0.33*	*0.33*
7	*67.3*	*1.1*	*0.33*	*0.33*
8	*68.8*	*2.5*	*0.33*	*0.33*
9	*57.1*	*-0.6*	*0.33*	*0.33*
10	*60.7*	*-0.6*	*0.33*	*0.33*
11	*55.5*	*-0.6*	*0.33*	*0.33*
12	*64.1*	*-0.9*	*0.33*	*0.33*
13	*41.2*	*0.3*	*0.33*	*0.33*
14	*48.9*	*0.6*	*0.33*	*0.33*
15	*28.0*	*0.4*	*0.33*	*0.33*
16	*49.5*	*0.7*	*0.33*	*0.33*
17	*31.4*	*-0.4*	*0.33*	*0.33*
18	*54.5*	*0.2*	*0.33*	*0.33*
19	*42.5*	*0.4*	*0.33*	*0.33*
20	*55.8*	*1.1*	*0.33*	*0.33*
21	*36.3*	*0.3*	*0.33*	*0.33*
22	*47.5*	*0.3*	*0.33*	*0.33*
23	*42.4*	*0.2*	*0.33*	*0.33*
24	*55.5*	*1.5*	*0.33*	*0.33*
	Total Area		*8.00*	*8.00*

Average Room Side Area-Weighted Surface Temperature (°F) *54.8*

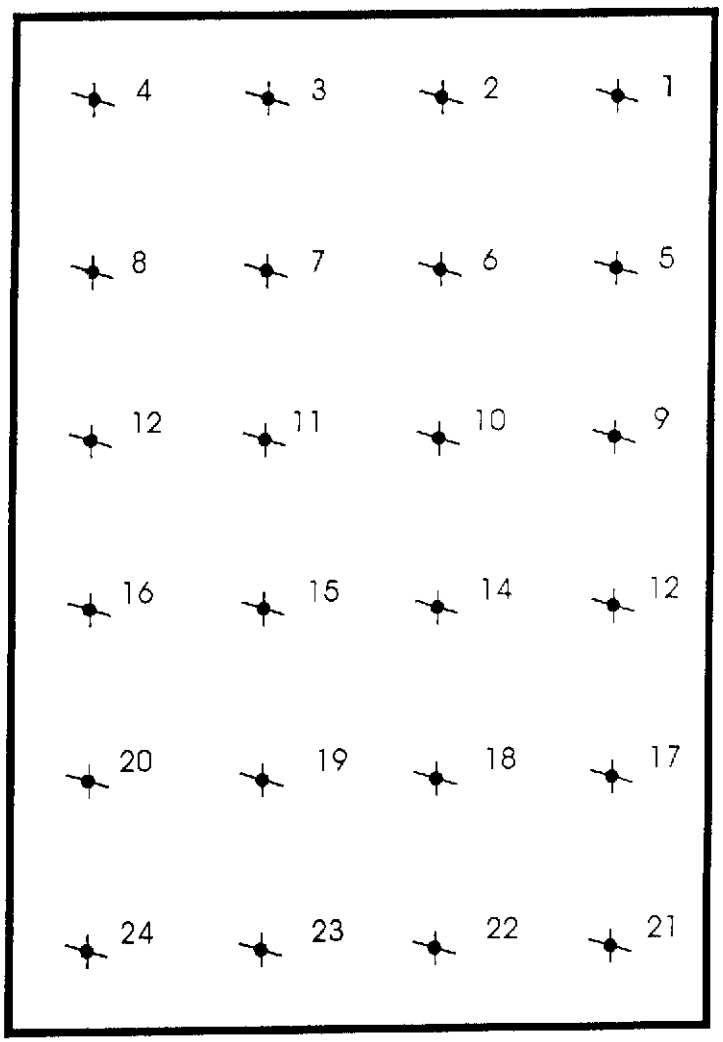
Average Weather Side Area-Weighted Surface Temperature (°F) *1.2*

SURFACE TEMPERATURE LOCATIONS

INTERIOR SIDE



EXTERIOR SIDE



VTEC LABORATORIES, INC.
NCTL - 110 - 8373 - 1
09/26/02

VTEC LABORATORIES, INC.

THERMAL PERFORMANCE TEST REPORT

3" Fiberglass Core Panel
Super Therm on Interior

NCTL-110-8373-2

NATIONAL CERTIFIED TESTING LABORATORIES

FIVE LEIGH DRIVE • YORK, PENNSYLVANIA 17402 • TELEPHONE (717) 846-1200
FAX (717) 767-4100
www.nctlinc.com

THERMAL PERFORMANCE TEST REPORT

Report No: *NCTL-110-8373-2*
Test Date: *09/24/02*
Report Date: *10/28/02*
Expiration Date: *09/30/06*

Client: *VTEC Laboratories, Inc.*
212 Manida Street
Bronx, NY 10474

Test Specimen: *VTEC's 3" Fiberglass Core Panel with 10 mil. Super Therm on the Interior Side.*

Test Method: *ASTM C236-89 (93) "Standard Test Method for Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box".*

TEST SPECIMEN DESCRIPTION

General: *The test specimen was a 3" thick fiberglass core panel measuring 24" wide by 48" high. 10 mil. of Super Therm was applied to the interior side.*

SPECIMEN PREPARATION PRIOR TO TEST

The test specimen was pre-conditioned at ambient laboratory conditions prior to the test. The surround panel-to-specimen interfaces were sealed with a non-reflective tape resulting in a measured net air leakage of 0.000 CFM per square foot.

TEST PARAMETERS

Tests to determine the thermal transmittance (U) of the specimen were performed in the guarded hot box apparatus located at the York, PA facility. The most recent calibration of the hot box apparatus was in May, 2002. The thermal performance evaluations were completed in accordance with ASTM C236-89 (93) using a dynamic wind perpendicular to the specimen on the weather side and simulated natural convection on the room side. A zero static pressure differential was maintained across the specimen during the test by pressurizing the metering box on the room side. Data was collected over successive 4 hour periods for a minimum duration of 8 hours after steady state conditions were achieved. Steady state conditions were considered established when, over a 4 hour period; a) the 1-hour averages of the surface thermocouples did not vary more than 0.1°F or change unidirectionally; and b) the 1-hour averages of the power input to the metering box did not vary more than ± 1% or change unidirectionally.

Measured Areas

Total Specimen Projected Area:	8.00 ft^2
Metering Box Opening Area :	54.39 ft^2
Metering Box Baffle Area :	46.44 ft^2
Surround Panel Interior Exposed Area :	24.11 ft^2
Area of Mods for Surround Panel Opening:	22.29 ft^2

THERMAL TRANSMITTANCE & CONDUCTANCE

The test chamber environmental systems were initiated at 1542 on 09/23/02. The test conditions were considered stable for two consecutive four hour test periods from 0203 to 0403 and 0403 to 0603 on 09/24/02. The thermal performance test results were derived from the 0403-0603 test period.

Test Conditions

Average Room Side Air Temperature t_h	70.4 °F
Average Weather Side Air Temperature, t_c	0.0 °F
Average Guard Box Air Temperature	73.1 °F
Metering Box Average Relative Humidity	11 %
Measured Weather Side Wind Velocity	14.3 mph
Static Pressure Difference Across Specimen	-0.01 "H_2O

Heat Flows

Heat Input Rate to Metering Box	296.5 BTU/HR
Surround Panel Heat Flow	70.6 BTU/HR
Heat Flow Through Mods to Surround Panel Opening (k = 0.308)	86.7 BTU/HR
Sensible Heat from Pressure Balance Air Flow	-48.9 BTU/HR
Metering Box Heat Flow	- 24.9 BTU/HR
Flanking Loss Heat Flow	56.5 BTU/HR
Heat Flow Through Center and Edge Areas	156.5 BTU/HR

Surface Temperature Data

Specimen Area-Weighted Room Side Surface Temperature, t_1	63.4 °F
Specimen Area-Weighted Weather Side Surface Temperature, t_2	0.4 °F

Test Results & Calculated Test Data

Room Side Surface Conductance, h_h	2.80	BTU/HR/FT²/°F
Weather Side Surface Conductance, h_c	52.87	BTU/HR/FT²/°F
Panel Thermal Conductance, C	0.31	BTU/HR/FT²/°F
Panel Thermal Resistance, R (without surface films)	3.23	HR*FT²*°F/BTU
Room Side Surface Resistance, r_h	0.36	HR*FT²*°F/BTU
Weather Side Surface Resistance, r_c	0.02	HR*FT²*°F/BTU
Overall Panel Thermal Resistance, R_u (including surface films)	3.70	HR*FT²*°F/BTU
Panel Thermal Transmittance, U (including surface films)	0.27	BTU/HR/FT²/°F

Based on the listed test results, the thermal conductance (C) of the Panel area (excluding surface films) was determined to be 0.31 BTU/HR/FT²/°F at the described test conditions. The Panel thermal resistance (R) without surface films was determined to be 3.23 HR*FT²*°F/BTU at the described test conditions.

Attachment 1 to this report lists the measured surface temperature data as well as the area information used to calculate the area-weighted surface temperatures. Attachment 2 to this report is a drawing showing surface thermocouple measurement locations corresponding to the data on Attachment 1.

This test method does not include procedures to determine the heat flow due to either air movement through the specimen or solar radiation effects. As a consequence, the thermal transmittance results obtained do not reflect performances which may be expected from field installations due to not accounting for solar radiation, air leakage effects, and the thermal bridge effects that may occur due to the specific design and construction of the fenestration system opening. Therefore, it should be recognized that the thermal transmittance results obtained from this test method are for ideal laboratory conditions and should only be used for product comparisons and as input to thermal performance analyses which also include solar, air leakage, and thermal bridge effects.

A copy of this report along with representative sections of the test specimen will be retained by NCTL for a period of four (4) years. The results obtained apply only to the specimen tested. This report may not be reproduced, except in full, without the written approval of National Certified Testing Laboratories. Testing described in this report was conducted in full compliance with the requirements of the referenced test method.

NATIONAL CERTIFIED TESTING LABORATORIES

PATRICK D. HEIN
Engineering Manager
Person-in-Responsible Charge

PDH/amb

ATTACHMENT 1

SURFACE TEMPERATURE MEASUREMENTS AND AREA INFORMATION

VTEC Laboratories, Inc. *NCTL-110-8373-2* *0403-0603* *09/24/02*

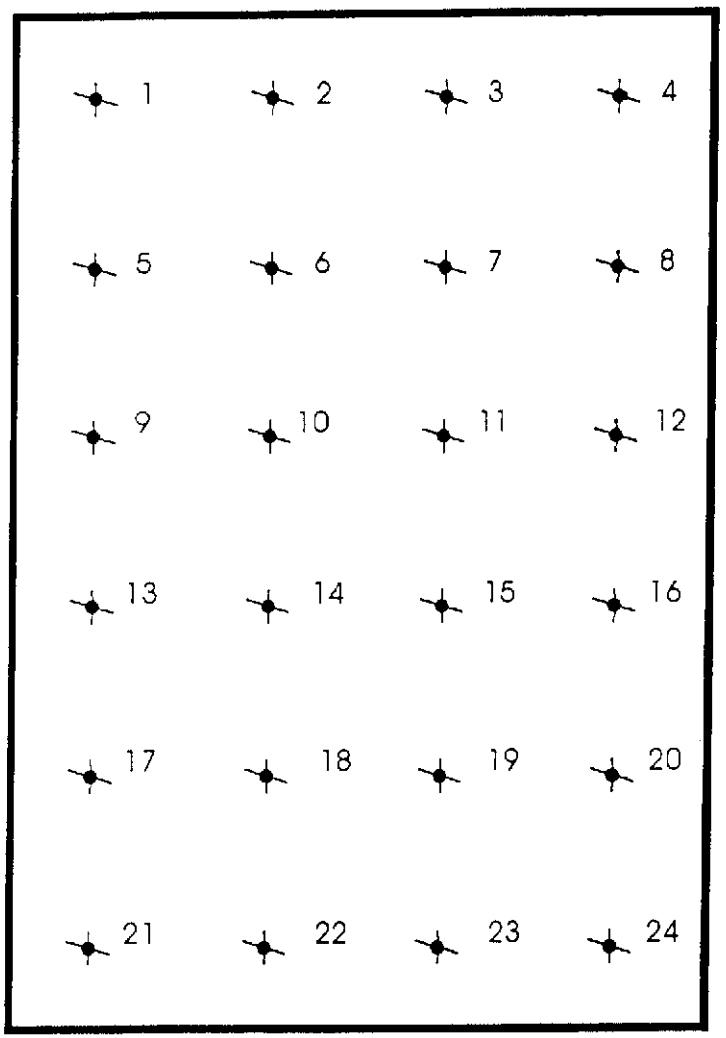
Thermocouple Location #	*Individual Average Surface Temperatures (°F)*		*Assigned 3-D Areas Per Thermocouple Location (ft²)*	
	Room Side	*Weather Side*	*Room Side*	*Weather Side*
1	*67.7*	*1.6*	*0.33*	*0.33*
2	*67.4*	*1.2*	*0.33*	*0.33*
3	*67.9*	*0.7*	*0.33*	*0.33*
4	*68.0*	*3.4*	*0.33*	*0.33*
5	*66.7*	*1.1*	*0.33*	*0.33*
6	*65.7*	*0.4*	*0.33*	*0.33*
7	*65.2*	*0.5*	*0.33*	*0.33*
8	*66.2*	*0.8*	*0.33*	*0.33*
9	*64.4*	*-0.7*	*0.33*	*0.33*
10	*64.4*	*-0.6*	*0.33*	*0.33*
11	*64.6*	*-0.6*	*0.33*	*0.33*
12	*64.9*	*-1.2*	*0.33*	*0.33*
13	*61.3*	*0.1*	*0.33*	*0.33*
14	*62.2*	*0.3*	*0.33*	*0.33*
15	*59.7*	*0.1*	*0.33*	*0.33*
16	*61.4*	*0.4*	*0.33*	*0.33*
17	*58.4*	*-0.6*	*0.33*	*0.33*
18	*60.0*	*-0.1*	*0.33*	*0.33*
19	*62.0*	*0.1*	*0.33*	*0.33*
20	*62.5*	*0.5*	*0.33*	*0.33*
21	*59.4*	*0.9*	*0.33*	*0.33*
22	*58.2*	*0.2*	*0.33*	*0.33*
23	*60.7*	*0.3*	*0.33*	*0.33*
24	*63.2*	*0.1*	*0.33*	*0.33*
	Total Area		*8.00*	*8.00*

Average Room Side Area-Weighted Surface Temperature (°F) *63.4*

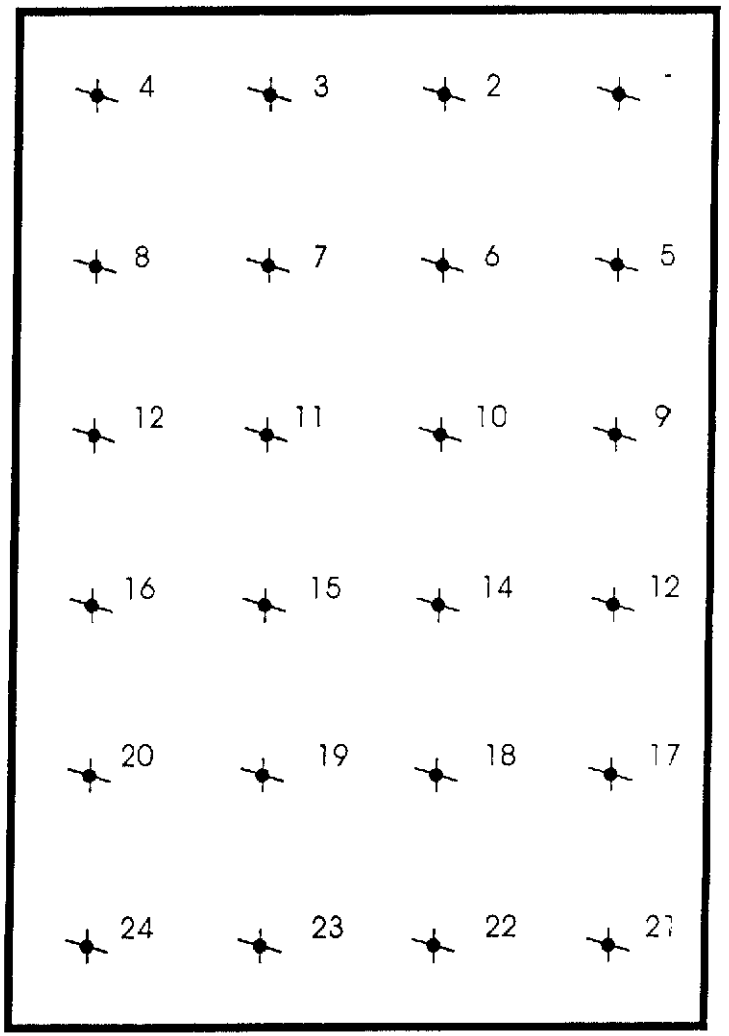
Average Weather Side Area-Weighted Surface Temperature (°F) *0.4*

SURFACE TEMPERATURE LOCATIONS

INTERIOR SIDE



EXTERIOR SIDE



VTEC LABORATORIES, INC.
NCTL - 110 - 8373 - 2
09/24/02

VTEC LABORATORIES, INC.

THERMAL PERFORMANCE TEST REPORT

3" Fiberglass Core Panel
Hot Prime & Super Therm on Interior

NCTL-110-8373-5

NATIONAL CERTIFIED TESTING LABORATORIES

FIVE LEIGH DRIVE • YORK, PENNSYLVANIA 17402 • TELEPHONE (717) 846-1200
FAX (717) 767-4100
www.nctlinc.com

THERMAL PERFORMANCE TEST REPORT

Report No: NCTL-110-8373-5
Test Date: 09/28/02
Report Date: 10/28/02
Expiration Date: 09/30/06

Client: *VTEC Laboratories, Inc.*
212 Manida Street
Bronx, NY 10474

Test Specimen: *VTEC's 3" Fiberglass Core Panel with a Base of 50 mil. dry Hot Prime with 10 mil. Super Therm on the Interior Side.*

Test Method: *ASTM C236-89 (93) "Standard Test Method for Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box".*

TEST SPECIMEN DESCRIPTION

General: *The test specimen was a 3" thick fiberglass core panel measuring 24" wide by 48" high. A base of 50 mil. of dry Hot Prime with 10 mil. of Super Therm was applied on the interior side.*

SPECIMEN PREPARATION PRIOR TO TEST

The test specimen was pre-conditioned at ambient laboratory conditions prior to the test. The surround panel-to-specimen interfaces were sealed with a non-reflective tape resulting in a measured net air leakage of 0.000 CFM per square foot.

TEST PARAMETERS

Tests to determine the thermal transmittance (U) of the specimen were performed in the guarded hot box apparatus located at the York, PA facility. The most recent calibration of the hot box apparatus was in May, 2002. The thermal performance evaluations were completed in accordance with ASTM C236-89 (93) using a dynamic wind perpendicular to the specimen on the weather side and simulated natural convection on the room side. A zero static pressure differential was maintained across the specimen during the test by pressurizing the metering box on the room side. Data was collected over successive 4 hour periods for a minimum duration of 8 hours after steady state conditions were achieved. Steady state conditions were considered established when, over a 4 hour period; a) the 1-hour averages of the surface thermocouples did not vary more than 0.1°F or change unidirectionally; and b) the 1-hour averages of the power input to the metering box did not vary more than ± 1% or change unidirectionally.

Measured Areas

Total Specimen Projected Area:	8.00 ft^2
Metering Box Opening Area :	54.39 ft^2
Metering Box Baffle Area :	46.44 ft^2
Surround Panel Interior Exposed Area :	24.11 ft^2
Area of Mods for Surround Panel Opening:	22.29 ft^2

THERMAL TRANSMITTANCE & CONDUCTANCE

The test chamber environmental systems were initiated at 1558 on 09/26/02. The test conditions were considered stable for two consecutive four hour test periods from 0153 to 0353 and 0353 to 0553 on 09/28/02. The thermal performance test results were derived from the 0353-0553 test period.

Test Conditions

Average Room Side Air Temperature t_h	70.0 °F
Average Weather Side Air Temperature, t_c	0.0 °F
Average Guard Box Air Temperature	73.1 °F
Metering Box Average Relative Humidity	10 %
Measured Weather Side Wind Velocity	14.3 mph
Static Pressure Difference Across Specimen	-0.01 "H_2O

Heat Flows

Heat Input Rate to Metering Box	263.4 BTU/HR
Surround Panel Heat Flow	70.1 BTU/HR
Heat Flow Through Mods to Surround Panel Opening ($k = 0.308$)	83.0 BTU/HR
Sensible Heat from Pressure Balance Air Flow	-49.8 BTU/HR
Metering Box Heat Flow	- 25.5 BTU/HR
Flanking Loss Heat Flow	56.5 BTU/HR
Heat Flow Through Center and Edge Areas	140.0 BTU/HR

Surface Temperature Data

Specimen Area-Weighted Room Side Surface Temperature, t_1	*62.7 °F*
Specimen Area-Weighted Weather Side Surface Temperature, t_2	*0.5 °F*

Test Results & Calculated Test Data

Room Side Surface Conductance, h_h	*2.40*	*BTU/HR/FT²/°F*
Weather Side Surface Conductance, h_c	*35.71*	*BTU/HR/FT²/°F*
Panel Thermal Conductance, C	*0.28*	*BTU/HR/FT²/°F*
Panel Thermal Resistance, R (without surface films)	*3.57*	*HR*FT²*°F/BTU*
Room Side Surface Resistance, r_h	*0.42*	*HR*FT²*°F/BTU*
Weather Side Surface Resistance, r_c	*0.03*	*HR*FT²*°F/BTU*
Overall Panel Thermal Resistance, R_u (including surface films)	*3.85*	*HR*FT²*°F/BTU*
Panel Thermal Transmittance, U (including surface films)	*0.26*	*BTU/HR/FT²/°F*

Based on the listed test results, the thermal conductance (C) of the Panel area (excluding surface films) was determined to be 0.28 BTU/HR/FT²/°F at the described test conditions. The Panel thermal resistance (R) without surface films was determined to be 3.57 HR*FT²*°F/BTU at the described test conditions.

Attachment 1 to this report lists the measured surface temperature data as well as the area information used to calculate the area-weighted surface temperatures. Attachment 2 to this report is a drawing showing surface thermocouple measurement locations corresponding to the data on Attachment 1.

This test method does not include procedures to determine the heat flow due to either air movement through the specimen or solar radiation effects. As a consequence, the thermal transmittance results obtained do not reflect performances which may be expected from field installations due to not accounting for solar radiation, air leakage effects, and the thermal bridge effects that may occur due to the specific design and construction of the fenestration system opening. Therefore, it should be recognized that the thermal transmittance results obtained from this test method are for ideal laboratory conditions and should only be used for product comparisons and as input to thermal performance analyses which also include solar, air leakage, and thermal bridge effects.

A copy of this report along with representative sections of the test specimen will be retained by NCTL for a period of four (4) years. The results obtained apply only to the specimen tested. This report may not be reproduced, except in full, without the written approval of National Certified Testing Laboratories. Testing described in this report was conducted in full compliance with the requirements of the referenced test method.

NATIONAL CERTIFIED TESTING LABORATORIES

PATRICK D. HEIN
Engineering Manager
Person-in-Responsible Charge

PDH/amb

ATTACHMENT 1

SURFACE TEMPERATURE MEASUREMENTS AND AREA INFORMATION

VTEC Laboratories, Inc. *NCTL-110-8373-5* *0353-0553* *09/28/02*

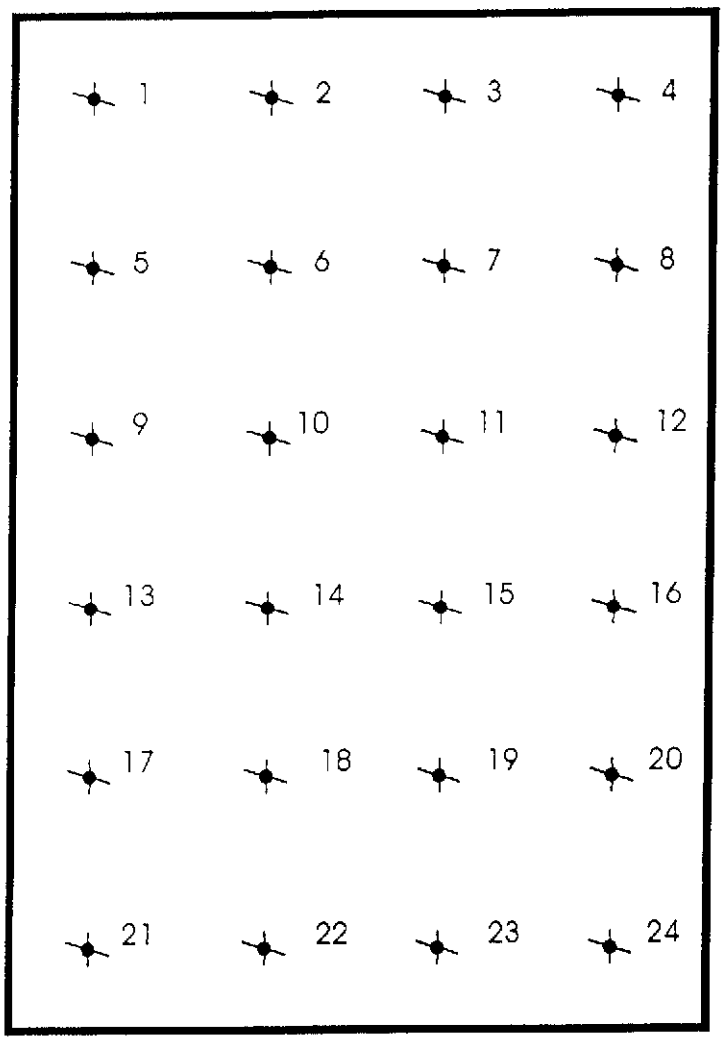
Thermocouple Location #	*Individual Average Surface Temperatures (°F)*		*Assigned 3-D Areas Per Thermocouple Location (ft²)*	
	Room Side	*Weather Side*	*Room Side*	*Weather Side*
1	*67.4*	*1.3*	*0.33*	*0.33*
2	*66.9*	*0.4*	*0.33*	*0.33*
3	*67.2*	*0.9*	*0.33*	*0.33*
4	*67.5*	*4.4*	*0.33*	*0.33*
5	*66.3*	*0.7*	*0.33*	*0.33*
6	*63.7*	*0.4*	*0.33*	*0.33*
7	*65.2*	*0.5*	*0.33*	*0.33*
8	*65.5*	*1.2*	*0.33*	*0.33*
9	*63.3*	*-0.7*	*0.33*	*0.33*
10	*62.2*	*-0.7*	*0.33*	*0.33*
11	*64.4*	*-0.5*	*0.33*	*0.33*
12	*65.0*	*-0.9*	*0.33*	*0.33*
13	*58.8*	*0.3*	*0.33*	*0.33*
14	*59.8*	*0.5*	*0.33*	*0.33*
15	*61.8*	*0.3*	*0.33*	*0.33*
16	*62.5*	*0.8*	*0.33*	*0.33*
17	*54.5*	*-0.5*	*0.33*	*0.33*
18	*59.0*	*-0.1*	*0.33*	*0.33*
19	*62.0*	*0.2*	*0.33*	*0.33*
20	*62.1*	*1.1*	*0.33*	*0.33*
21	*55.9*	*0.3*	*0.33*	*0.33*
22	*59.5*	*0.4*	*0.33*	*0.33*
23	*62.0*	*0.4*	*0.33*	*0.33*
24	*62.7*	*1.1*	*0.33*	*0.33*
	Total Area		*8.00*	*8.00*

Average Room Side Area-Weighted Surface Temperature (°F) *62.7*

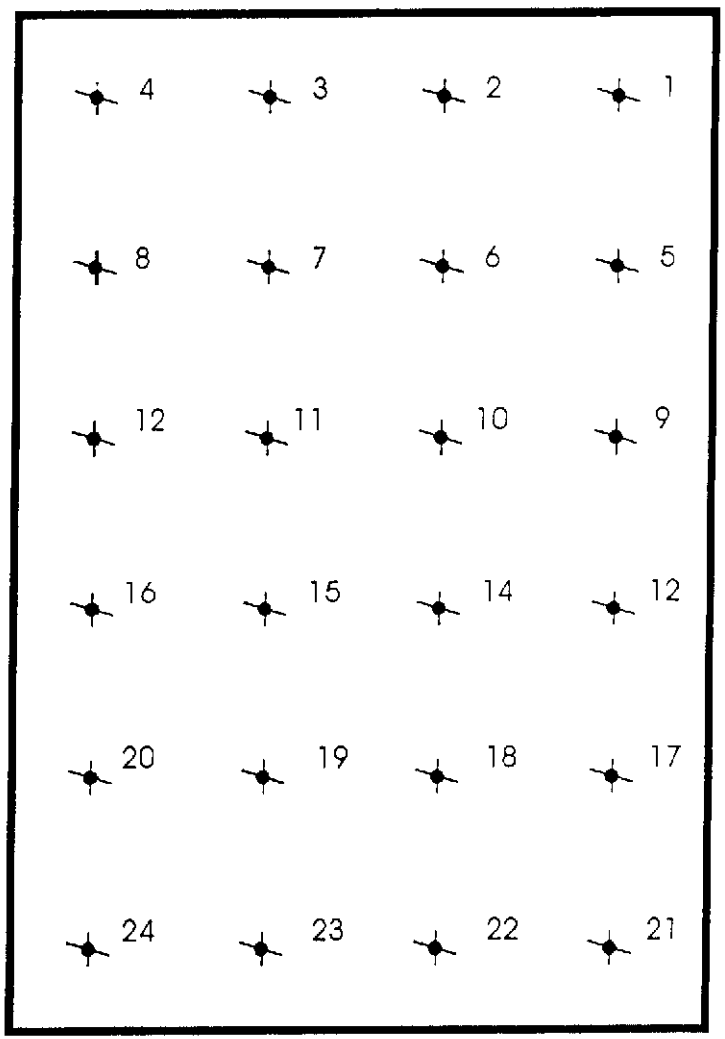
Average Weather Side Area-Weighted Surface Temperature (°F) *0.5*

SURFACE TEMPERATURE LOCATIONS

INTERIOR SIDE



EXTERIOR SIDE



VTEC LABORATORIES, INC.
NCTL - 110 - 8373 - 5
09/28/02

VTEC LABORATORIES, INC.

THERMAL PERFORMANCE TEST REPORT

3" Fiberglass Core Panel
Super Therm on Both Sides

NCTL-110-8373-3

NATIONAL CERTIFIED TESTING LABORATORIES

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FAX (717) 767-4100
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THERMAL PERFORMANCE TEST REPORT

Report No: NCTL-110-8373-3
Test Date: 09/23/02
Report Date: 10/28/02
Expiration Date: 09/30/06

Client: *VTEC Laboratories, Inc.*
212 Manida Street
Bronx, NY 10474

Test Specimen: *VTEC's 3" Fiberglass Core Panel with 10 mil. Super Therm on Both Sides.*

Test Method: *ASTM C236-89 (93) "Standard Test Method for Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box".*

TEST SPECIMEN DESCRIPTION

General: *The test specimen was a 3" thick fiberglass core panel measuring 24" wide by 48" high. 10 mil. of Super Therm was applied to both sides.*

SPECIMEN PREPARATION PRIOR TO TEST

The test specimen was pre-conditioned at ambient laboratory conditions prior to the test. The surround panel-to-specimen interfaces were sealed with a non-reflective tape resulting in a measured net air leakage of 0.000 CFM per square foot.

TEST PARAMETERS

Tests to determine the thermal transmittance (U) of the specimen were performed in the guarded hot box apparatus located at the York, PA facility. The most recent calibration of the hot box apparatus was in May, 2002. The thermal performance evaluations were completed in accordance with ASTM C236-89 (93) using a dynamic wind perpendicular to the specimen on the weather side and simulated natural convection on the room side. A zero static pressure differential was maintained across the specimen during the test by pressurizing the metering box on the room side. Data was collected over successive 4 hour periods for a minimum duration of 8 hours after steady state conditions were achieved. Steady state conditions were considered established when, over a 4 hour period; a) the 1-hour averages of the surface thermocouples did not vary more than 0.1°F or change unidirectionally; and b) the 1-hour averages of the power input to the metering box did not vary more than ± 1% or change unidirectionally.

Measured Areas

Total Specimen Projected Area:	8.00 ft^2
Metering Box Opening Area :	54.39 ft^2
Metering Box Baffle Area :	46.44 ft^2
Surround Panel Interior Exposed Area :	29.00 ft^2
Area of Mods for Surround Panel Opening:	17.40 ft^2

THERMAL TRANSMITTANCE & CONDUCTANCE

The test chamber environmental systems were initiated at 1336 on 09/20/02. The test conditions were considered stable for two consecutive four hour test periods from 0100 to 0300 and 0300 to 0500 on 09/23/02. The thermal performance test results were derived from the 0300-0500 test period.

Test Conditions

Average Room Side Air Temperature t_h	70.4 °F
Average Weather Side Air Temperature, t_c	-0.1 °F
Average Guard Box Air Temperature	73.2 °F
Metering Box Average Relative Humidity	11 %
Measured Weather Side Wind Velocity	14.3 mph
Static Pressure Difference Across Specimen	-0.01 "H_2O

Heat Flows

Heat Input Rate to Metering Box	234.5 BTU/HR
Surround Panel Heat Flow	84.8 BTU/HR
Heat Flow Through Mods to Surround Panel Opening (k = 0.308)	65.7 BTU/HR
Sensible Heat from Pressure Balance Air Flow	-55.7BTU/HR
Metering Box Heat Flow	- 25.5 BTU/HR
Flanking Loss Heat Flow	56.5 BTU/HR
Heat Flow Through Center and Edge Areas	108.7 BTU/HR

Surface Temperature Data

Specimen Area-Weighted Room Side Surface Temperature, t_1	*65.2 °F*
Specimen Area-Weighted Weather Side Surface Temperature, t_2	*0.4 °F*

Test Results & Calculated Test Data

Room Side Surface Conductance, h_h	*2.61*	*BTU/HR/FT²/°F*
Weather Side Surface Conductance, h_c	*27.18*	*BTU/HR/FT²/°F*
Panel Thermal Conductance, C	*0.21*	*BTU/HR/FT²/°F*
Panel Thermal Resistance, R (without surface films)	*4.76*	*HR*FT²*°F/BTU*
Room Side Surface Resistance, r_h	*0.38*	*HR*FT²*°F/BTU*
Weather Side Surface Resistance, r_c	*0.04*	*HR*FT²*°F/BTU*
Overall Panel Thermal Resistance, R_u (including surface films)	*5.00*	*HR*FT²*°F/BTU*
Panel Thermal Transmittance, U (including surface films)	*0.20*	*BTU/HR/FT²/°F*

Based on the listed test results, the thermal conductance (C) of the Panel area (excluding surface films) was determined to be 0.21 BTU/HR/FT²/°F at the described test conditions. The Panel thermal resistance (R) without surface films was determined to be 4.76 HR*FT²*°F/BTU at the described test conditions.

Attachment 1 to this report lists the measured surface temperature data as well as the area information used to calculate the area-weighted surface temperatures. Attachment 2 to this report is a drawing showing surface thermocouple measurement locations corresponding to the data on Attachment 1.

This test method does not include procedures to determine the heat flow due to either air movement through the specimen or solar radiation effects. As a consequence, the thermal transmittance results obtained do not reflect performances which may be expected from field installations due to not accounting for solar radiation, air leakage effects, and the thermal bridge effects that may occur due to the specific design and construction of the fenestration system opening. Therefore, it should be recognized that the thermal transmittance results obtained from this test method are for ideal laboratory conditions and should only be used for product comparisons and as input to thermal performance analyses which also include solar, air leakage, and thermal bridge effects.

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NATIONAL CERTIFIED TESTING LABORATORIES

PATRICK D. HEIN
Engineering Manager
Person-in-Responsible Charge

PDH/amb

ATTACHMENT 1

SURFACE TEMPERATURE MEASUREMENTS AND AREA INFORMATION

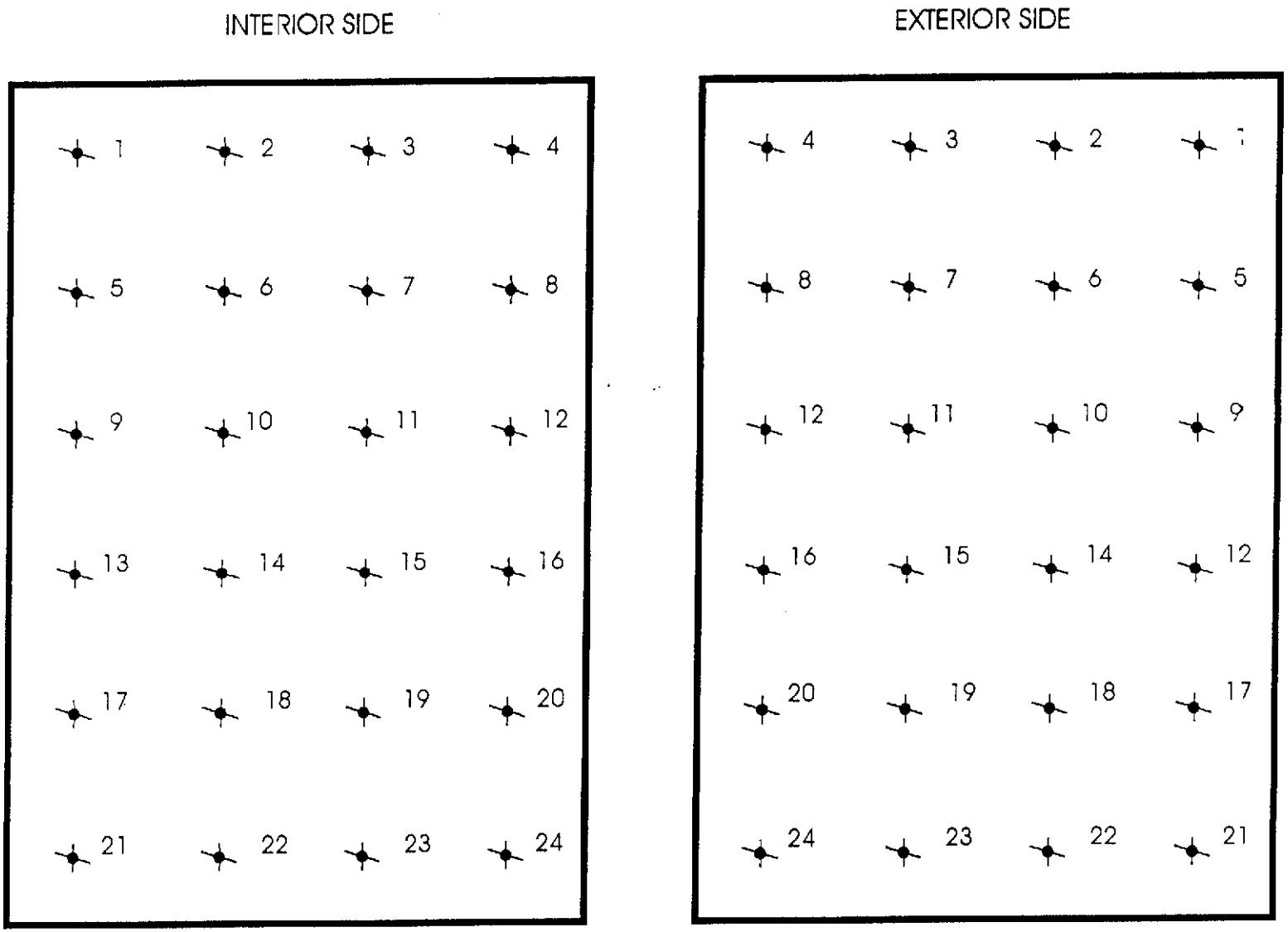
VTEC Laboratories, Inc. *NCTL-110-8373-3* *0300-0500* *09/23/02*

Thermocouple Location #	*Individual Average Surface Temperatures (°F)*		*Assigned 3-D Areas Per Thermocouple Location (ft²)*	
	Room Side	*Weather Side*	*Room Side*	*Weather Side*
1	*67.5*	*0.1*	*0.33*	*0.33*
2	*67.0*	*0.4*	*0.33*	*0.33*
3	*67.1*	*0.4*	*0.33*	*0.33*
4	*67.0*	*0.8*	*0.33*	*0.33*
5	*67.0*	*0.6*	*0.33*	*0.33*
6	*66.5*	*0.9*	*0.33*	*0.33*
7	*66.5*	*1.1*	*0.33*	*0.33*
8	*66.2*	*1.2*	*0.33*	*0.33*
9	*65.2*	*-0.8*	*0.33*	*0.33*
10	*65.2*	*-0.4*	*0.33*	*0.33*
11	*65.3*	*-0.5*	*0.33*	*0.33*
12	*64.9*	*-0.7*	*0.33*	*0.33*
13	*63.1*	*0.2*	*0.33*	*0.33*
14	*64.1*	*0.5*	*0.33*	*0.33*
15	*64.9*	*0.7*	*0.33*	*0.33*
16	*64.1*	*0.9*	*0.33*	*0.33*
17	*62.7*	*-0.5*	*0.33*	*0.33*
18	*70.1*	*0.2*	*0.33*	*0.33*
19	*64.6*	*0.7*	*0.33*	*0.33*
20	*63.7*	*1.0*	*0.33*	*0.33*
21	*60.8*	*0.3*	*0.33*	*0.33*
22	*63.5*	*0.7*	*0.33*	*0.33*
23	*64.4*	*0.8*	*0.33*	*0.33*
24	*63.4*	*1.0*	*0.33*	*0.33*
	Total Area		*6.67*	*6.67*

Average Room Side Area-Weighted Surface Temperature (°F) *65.2*

Average Weather Side Area-Weighted Surface Temperature (°F) *0.4*

SURFACE TEMPERATURE LOCATIONS



VTEC LABORATORIES, INC.
NCTL - 110 - 8373 - 3
09/23/02

VTEC LABORATORIES, INC.

THERMAL PERFORMANCE TEST REPORT

Two (2) Pieces of 3/4" Plywood Laminated with
Hot Prime & Super Therm on Interior

NCTL-110-8373-6

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THERMAL PERFORMANCE TEST REPORT

Report No: NCTL-110-8373-6
Test Date: 10/04/02
Report Date: 10/28/02
Expiration Date: 10/31/06

Client: *VTEC Laboratories, Inc.*
212 Manida Street
Bronx, NY 10474

Test Specimen: *VTEC's A Core of Two (2) Pieces of 3/4" Plywood Laminated Together with a Base of 50 mil. dry Hot Prime with 10 mil. Super Therm on the Interior Side.*

Test Method: *ASTM C236-89 (93) "Standard Test Method for Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box".*

TEST SPECIMEN DESCRIPTION

General: *The test specimen was a core made up of two (2) pieces of 3/4" plywood laminated together measuring 24" wide by 48" high. A base of 50 mil. of dry Hot Prime with 10 mil. of Super Therm was applied to the interior side.*

SPECIMEN PREPARATION PRIOR TO TEST

The test specimen was pre-conditioned at ambient laboratory conditions prior to the test. The surround panel-to-specimen interfaces were sealed with a non-reflective tape resulting in a measured net air leakage of 0.000 CFM per square foot.

TEST PARAMETERS

Tests to determine the thermal transmittance (U) of the specimen were performed in the guarded hot box apparatus located at the York, PA facility. The most recent calibration of the hot box apparatus was in May, 2002. The thermal performance evaluations were completed in accordance with ASTM C236-89 (93) using a dynamic wind perpendicular to the specimen on the weather side and simulated natural convection on the room side. A zero static pressure differential was maintained across the specimen during the test by pressurizing the metering box on the room side. Data was collected over successive 4 hour periods for a minimum duration of 8 hours after steady state conditions were achieved. Steady state conditions were considered established when, over a 4 hour period; a) the 1-hour averages of the surface thermocouples did not vary more than 0.1°F or change unidirectionally; and b) the 1-hour averages of the power input to the metering box did not vary more than ± 1% or change unidirectionally.

Measured Areas

Total Specimen Projected Area:	8.00 ft^2
Metering Box Opening Area :	54.39 ft^2
Metering Box Baffle Area :	46.44 ft^2
Surround Panel Interior Exposed Area :	24.11 ft^2
Area of Mods for Surround Panel Opening:	22.29 ft^2

THERMAL TRANSMITTANCE & CONDUCTANCE

The test chamber environmental systems were initiated at 1541 on 10/02/02. The test conditions were considered stable for two consecutive four hour test periods from 0228 to 0428 and 0428 to 0628 on 10/04/02. The thermal performance test results were derived from the 0428-0628 test period.

Test Conditions

Average Room Side Air Temperature t_h	70.0 °F
Average Weather Side Air Temperature, t_c	-0.2 °F
Average Guard Box Air Temperature	73.2 °F
Metering Box Average Relative Humidity	10 %
Measured Weather Side Wind Velocity	14.3 mph
Static Pressure Difference Across Specimen	-0.01 "H_2O

Heat Flows

Heat Input Rate to Metering Box	409.7 BTU/HR
Surround Panel Heat Flow	70.5 BTU/HR
Heat Flow Through Mods to Surround Panel Opening (k = 0.308)	82.9 BTU/HR
Sensible Heat from Pressure Balance Air Flow	-54.4 BTU/HR
Metering Box Heat Flow	- 26.7 BTU/HR
Flanking Loss Heat Flow	56.5 BTU/HR
Heat Flow Through Center and Edge Areas	280.9 BTU/HR

Surface Temperature Data

Specimen Area-Weighted Room Side Surface Temperature, t_1	48.8 °F
Specimen Area-Weighted Weather Side Surface Temperature, t_2	4.4 °F

Test Results & Calculated Test Data

Room Side Surface Conductance, h_h	1.66	BTU/HR/FT²/°F
Weather Side Surface Conductance, h_c	7.60	BTU/HR/FT²/°F
Panel Thermal Conductance, C	0.79	BTU/HR/FT²/°F
Panel Thermal Resistance, R (without surface films)	1.27	HR*FT²*°F/BTU
Room Side Surface Resistance, r_h	0.60	HR*FT²*°F/BTU
Weather Side Surface Resistance, r_c	0.13	HR*FT²*°F/BTU
Overall Panel Thermal Resistance, R_u (including surface films)	2.04	HR*FT²*°F/BTU
Panel Thermal Transmittance, U (including surface films)	0.49	BTU/HR/FT²/°F

Based on the listed test results, the thermal conductance (C) of the Panel area (excluding surface films) was determined to be 0.79 BTU/HR/FT²/°F at the described test conditions. The Panel thermal resistance (R) without surface films was determined to be 1.27 HR*FT²*°F/BTU at the described test conditions.

Attachment 1 to this report lists the measured surface temperature data as well as the area information used to calculate the area-weighted surface temperatures. Attachment 2 to this report is a drawing showing surface thermocouple measurement locations corresponding to the data on Attachment 1.

This test method does not include procedures to determine the heat flow due to either air movement through the specimen or solar radiation effects. As a consequence, the thermal transmittance results obtained do not reflect performances which may be expected from field installations due to not accounting for solar radiation, air leakage effects, and the thermal bridge effects that may occur due to the specific design and construction of the fenestration system opening. Therefore, it should be recognized that the thermal transmittance results obtained from this test method are for ideal laboratory conditions and should only be used for product comparisons and as input to thermal performance analyses which also include solar, air leakage, and thermal bridge effects.

A copy of this report along with representative sections of the test specimen will be retained by NCTL for a period of four (4) years. The results obtained apply only to the specimen tested. This report may not be reproduced, except in full, without the written approval of National Certified Testing Laboratories. Testing described in this report was conducted in full compliance with the requirements of the referenced test method.

NATIONAL CERTIFIED TESTING LABORATORIES

PATRICK D. HEIN
Engineering Manager
Person-in-Responsible Charge

PDH/amb

ATTACHMENT 1

SURFACE TEMPERATURE MEASUREMENTS AND AREA INFORMATION

VTEC Laboratories, Inc. *NCTL-110-8373-6* *0428-0628* *10/04/02*

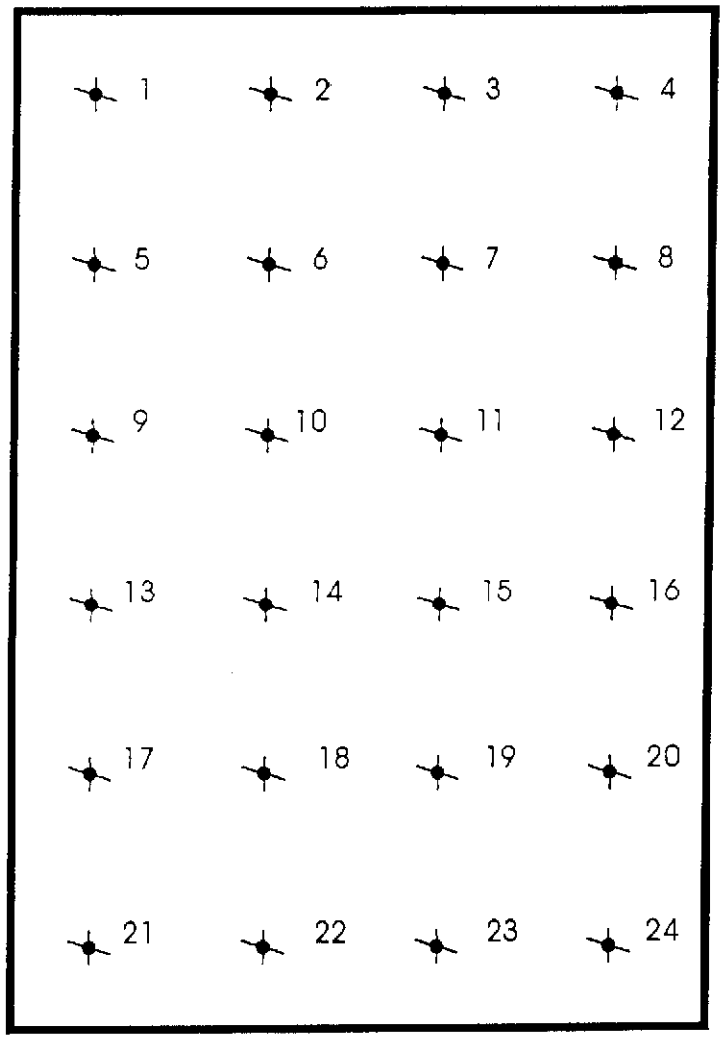
Thermocouple Location #	*Individual Average Surface Temperatures (°F)*		*Assigned 3-D Areas Per Thermocouple Location (ft²)*	
	Room Side	*Weather Side*	*Room Side*	*Weather Side*
1	*49.8*	*4.7*	*0.33*	*0.33*
2	*50.8*	*4.9*	*0.33*	*0.33*
3	*50.3*	*4.9*	*0.33*	*0.33*
4	*52.6*	*4.0*	*0.33*	*0.33*
5	*52.9*	*5.0*	*0.33*	*0.33*
6	*50.7*	*4.8*	*0.33*	*0.33*
7	*50.8*	*5.5*	*0.33*	*0.33*
8	*51.0*	*4.8*	*0.33*	*0.33*
9	*48.9*	*3.9*	*0.33*	*0.33*
10	*48.3*	*4.1*	*0.33*	*0.33*
11	*47.9*	*3.3*	*0.33*	*0.33*
12	*47.5*	*2.0*	*0.33*	*0.33*
13	*48.9*	*4.3*	*0.33*	*0.33*
14	*48.3*	*3.6*	*0.33*	*0.33*
15	*47.1*	*3.4*	*0.33*	*0.33*
16	*48.4*	*4.8*	*0.33*	*0.33*
17	*47.1*	*4.7*	*0.33*	*0.33*
18	*47.6*	*4.5*	*0.33*	*0.33*
19	*47.5*	*4.4*	*0.33*	*0.33*
20	*47.9*	*4.8*	*0.33*	*0.33*
21	*46.8*	*6.0*	*0.33*	*0.33*
22	*46.6*	*4.8*	*0.33*	*0.33*
23	*46.4*	*5.4*	*0.33*	*0.33*
24	*47.0*	*3.5*	*0.33*	*0.33*
	Total Area		*8.00*	*8.00*

Average Room Side Area-Weighted Surface Temperature (°F) *48.8*

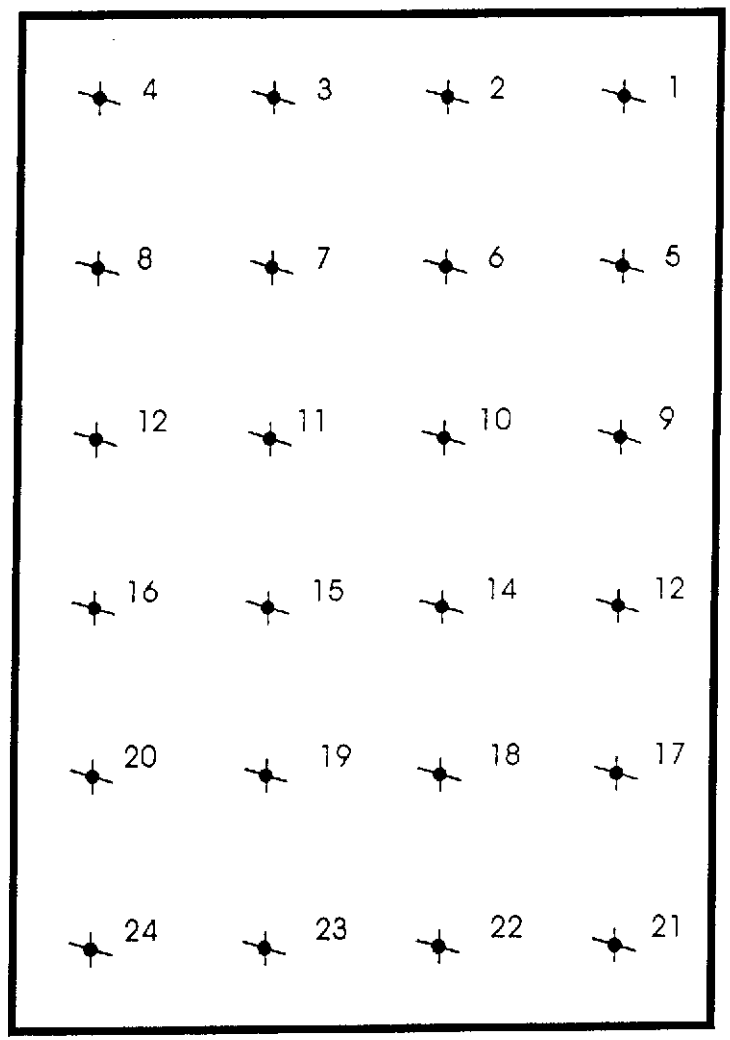
Average Weather Side Area-Weighted Surface Temperature (°F) *4.4*

SURFACE TEMPERATURE LOCATIONS

INTERIOR SIDE



EXTERIOR SIDE



VTEC LABORATORIES, INC.
NCTL - 110 - 8373 - 6
10/04/02