



# NATIONAL CERTIFIED TESTING LABORATORIES

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## THERMAL TEST SUMMARY REPORT

**CARDINAL COMMERCIAL PRODUCTS**  
**AAMA 1503-09**

Report No: NCTL-110-17178-2S

**Test Specimen:** Cardinal Commercial Products Series "CWW451T" Glazed Wall System measuring 2006.6 mm (79") wide by 2006.6 mm (79") high overall; **Thermal Break:** Urethane; **Glazing:** 24.38 mm (0.960") nominal overall, (2) lites of 6 mm (0.226") nominal tempered glass; **Coating:** A PPG "Sungate 500" pyrolitic-type low emissivity coating (e=0.215 per lite) was applied to glazing surface no. 2; **Spacer Type/Size:** Aluminum (A1-D) 12.9 mm (0.508"); **Fill:** Air; **Glazing System:** Sandwich glazed with an exterior and interior single-leaf kerf-mounted rubber gasket.

**Procedure:** Condensation Resistance Factor (CRF) and Thermal Transmittance (U Factor) were determined in accordance with AAMA 1503-09 with a temperature of 70.0± 0.5°F on the room side of the specimen and 0.0± 0.5°F plus a 15 mph dynamic wind on the weather side of specimen. The test specimen was sealed to produce a net air leakage of 0.0 cfm during the test.

### Test Results:

- |   |         |
|---|---------|
| 1. Average warm side air temperature (t <sub>i</sub> ):         | 70.1 °F |
| 2. Average cold side air temperature (t <sub>o</sub> ):         | -0.3 °F |
| 3. Average weighted frame temperature (FT):                     | 43.8 °F |
| 4. Average glass temperature (GT):                              | 50.1 °F |
| 5. Condensation Resistance Factor of Frame (CRF <sub>f</sub> ): | 63      |
| 6. Condensation Resistance Factor of Glass (CRF <sub>g</sub> ): | 72      |
| 7. Condensation Resistance Factor of Specimen (CRF):            | 63      |

**Thermal transmittance (U Factor) @ 15 mph exterior wind velocity: 0.53 BTU/hr/ft<sup>2</sup>/°F**

Reference should be made to thermal performance test report number NCTL-110-17178-1 dated 10/06/2014 for complete specimen description and test data.

### National Certified Testing Laboratories

#### Performed By:

Zachary Mundorff  
Technician

#### Reviewed By:

Steven H. Coble  
Person In Responsible Charge



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## THERMAL PERFORMANCE TEST REPORT

**Report Number** NCTL-110-17178-2  
**Client** Cardinal Commercial Products  
4915 Heller Street  
Louisville, KY 40218  
**Starting Test Date** 08/13/14  
**Ending Test Date** 08/14/14  
**Report Date** 10/06/14  
**Specification:** AAMA 1503-09, "Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections".

### Description of Sample Tested

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Note: All dimensions are in the order (Width x Height x Thickness) unless otherwise noted.

**Model/Type:** CWW451T  
**Configuration** Glazed Wall System  
**Frame Size** 2006.6 mm x 2006.6 mm (79" x 79")  
**Viewing Area** (2) 920.75 mm x 1917.9 mm (36.25" x 75.5")  
**Frame Type** Extruded aluminum with poured urethane thermal breaks  
**Joint Construction** Frame  
(2) Screw butt-type  
**Glazing Components**  
Overall 24.38 mm (0.96") Nominal  
Glass Thickness (2) Lites of 6 mm (0.226") tempered glass  
Coating A PPG "Sungate 500" pyrolitic-type low emissivity coating (e=0.215 per client) was applied to glazing surface no. 2.  
**Spacer Type/ Size** 12.9 mm (0.508") Aluminum spacer (Type A1-D)  
Fill Air  
**Glazing System** Sandwich glazed with an exterior and interior single-leaf kerf-mounted rubber gasket  
**Weatherstrip** No weatherseals employed  
**Operating Hardware** No operating hardware employed  
**Auxiliary** No auxiliary items employed  
**Reinforcement** No reinforcement employed

<b>Weep Description</b>	No apparent weeps employed
<b>Interior &amp; Exterior Surface Finish</b>	Painted aluminum
<b>Sealant</b>	No apparent sealant applied
<b>Insect Screen</b>	No screen employed
<b>Nail Fin</b>	Not applicable/ No nail fin

**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. Per section 9.3.4 the specimen was sealed on the exterior with a caulk sealant resulting in a net air leakage of 0.0 cfm per square foot.

**TEST PARAMETERS**

Tests to determine the thermal transmittance (U-factor) of the specimen were performed in the guarded hot box apparatus located at the York, PA facility. The thermal performance evaluations were completed in accordance with the referenced test methods using a dynamic wind perpendicular to the specimen on the cold side and simulated natural convection on the warm side. A zero static pressure differential (0.00" ± 0.04" H<sub>2</sub>O) was maintained across the specimen during the test by pressurizing the metering box on the room side. Data was collected over a 2 hour evaluation period after 4 hours of steady state conditions as defined in section 9.3.8 of the AAMA 1503-09 test procedure were achieved. The test was considered completed when the data of the 2 hour evaluation period also satisfied the criteria defined in section 9.3.8 of the AAMA 1503-09 test procedure.

**Glass Thickness and Glazing Deflection:**

	Glass Thicknesses	Glazing Deflection Before Test	Glazing Deflection After Test
Left Lite	0.221", 0.225"	0.01"	0.12"
Right Lite	0.221", 0.225"	0.05"	0.09"

**Projected Frame Dimensions Of Members:**

Member:	Left Head	Left Jamb	Left Sill	Meeting Stile	Right Head	Right Jamb	Right Sill
Dimension:	2.25"	2.25"	1.75"	2.5"	2.25"	2.25"	1.75"

**Test Duration:**

The test chamber environmental systems were initiated at 0839 on 8/13/14. The test conditions were considered stable for five (5) one hour test periods from 2124 to 0224 on 08/14/14. The test chamber was shut down at 0224 on 08/14/2014.

**Areas:**

Test Specimen Projected Area (A <sub>s</sub> ):	43.20	ft <sup>2</sup>
Test Specimen Interior Exposed (Wetted) Surface Area (A <sub>int</sub> ):	50.54	ft <sup>2</sup>
Test Specimen Exterior Exposed (Wetted) Surface Area (A <sub>ext</sub> ):	44.91	ft <sup>2</sup>
Metering Box Opening Area (A <sub>mb</sub> ):	54.39	ft <sup>2</sup>
Metering Box Baffle Area (A <sub>b1</sub> ):	46.44	ft <sup>2</sup>
Surround Panel Interior Exposed Area (A <sub>sp</sub> ):	11.19	ft <sup>2</sup>

**Test Conditions:**

Average Room Side Air Temperature:	70.1	°F
Average Weather Side Air Temperature:	-0.3	°F
Average Guard Box Air Temperature:	72.3	°F
Metering Box Average Relative Humidity:	11.0	%
Measured Weather Side Wind Velocity:	14.3	mph
Static Pressure Difference Across Specimen:	-0.20	" H <sub>2</sub> O

**Heat Flows:**

Heat Input Rate to Metering Box ( $Q_{total}$ ):	1703.1	BTU/hr
Surround Panel Heat Flow ( $Q_{sp}$ ):	18.3	BTU/hr
Surround Panel Thickness:	8.468	Inches
Surround Panel Conductance:	0.0253	BTU/hr/ft <sup>2</sup> /°F
Metering Box Heat Flow ( $Q_{mb}$ ):	93.3	BTU/hr
Flanking Loss Heat Flow ( $Q_{fl}$ ):	-12.6	BTU/hr
Net Test Specimen Heat Flow ( $Q_s$ ):	1604.1	BTU/hr

**Surface Temperature Data**

Specimen Area-Weighted Room Side Surface Temperature ( $t_1$ ):	49.5	°F
Specimen Area-Weighted Weather Side Surface Temperature ( $t_2$ ):	4.2	°F
Area-Weighted Room Side Frame Surface Temperature:	44.7	°F
Area-Weighted Weather Side Frame Surface Temperature:	7.8	°F
Area-Weighted Room Side Edge-of-Glass Surface Temperature:	49.3	°F
Area-Weighted Weather Side Edge-of-Glass Surface Temperature:	4.1	°F
Area-Weighted Room Side Center-of-Glass Surface Temperature:	51.6	°F
Area-Weighted Weather Side Center-of-Glass Surface Temperature:	3.3	°F

**Test Results & Calculated Test Data:****Condensation Resistance Factor (CRF)**

Average of Pre-specified Frame Thermocouples ( $FT_p$ ):	44.3	°F
Average of Cold Point Thermocouples ( $FT_r$ ):	37.5	°F
Calculated Weighting Factor:	0.078	
Weighted Frame Temperature (FT):	43.8	°F
Average Glazing Temperature, (GT):	50.1	°F
Condensation Resistance Factor of Frame ( $CRF_f$ ):	63	
Condensation Resistance Factor of Glass ( $CRF_g$ ):	72	
Condensation Resistance Factor of Specimen ( $CRF$ ):	63	

**Thermal Transmittance (U Factor)**

Measured Room Side Surface Conductance ( $h_i$ ):	1.80	BTU/hr/ft <sup>2</sup> /°F
Measured Weather Side Surface Conductance ( $h_{ii}$ ):	8.15	BTU/hr/ft <sup>2</sup> /°F
Test Specimen Thermal Conductance ( $C_s$ ):	0.82	BTU/hr/ft <sup>2</sup> /°F

**Test Specimen Standardized Thermal Transmittance (U):** **0.53** BTU/hr/ft<sup>2</sup>/°F

Attachment 1 to this report lists the average measured surface temperatures from the two-hour evaluation period of the test. Attachment 2 to this report is an isometric 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 fenestration product comparisons and as input to thermal performance analyses which also include solar, air leakage, and thermal bridge effects.

Detailed drawings were available for laboratory records and compared to the test specimen at the time of this report. 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 test specimen was supplied to NCTL by the above named client. 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. NCTL is a testing lab NCTL is a testing lab accredited by A2LA to ISO/IEC 17025 and assumes that all information provided by the client is accurate and does not guarantee or warranty any product tested or installed. This report does not constitute certification or approval of the product, which may only be granted by a certification program validator or recognized approval entity. Testing described in this report was conducted in full compliance with AAMA 1503-09 requirements.

**National Certified Testing Laboratories**

**Performed By:**

A digital signature of Zachary Mundorff, featuring a stylized cursive script and a circular NCTL logo with the text "DIGITAL SIGNATURE" below it.

Zachary Mundorff  
Technician

**Reviewed By:**

A digital signature of Steven H. Coble, featuring a stylized cursive script and a circular NCTL logo with the text "DIGITAL SIGNATURE" below it.

Steven H. Coble  
Person In Responsible Charge

ZM/ drm

**ATTACHMENT 1  
SURFACE TEMPERATURE MEASUREMENTS**

CARDINAL COMMERCIAL PRODUCTS

NCTL-110-17178-2

2124-0224

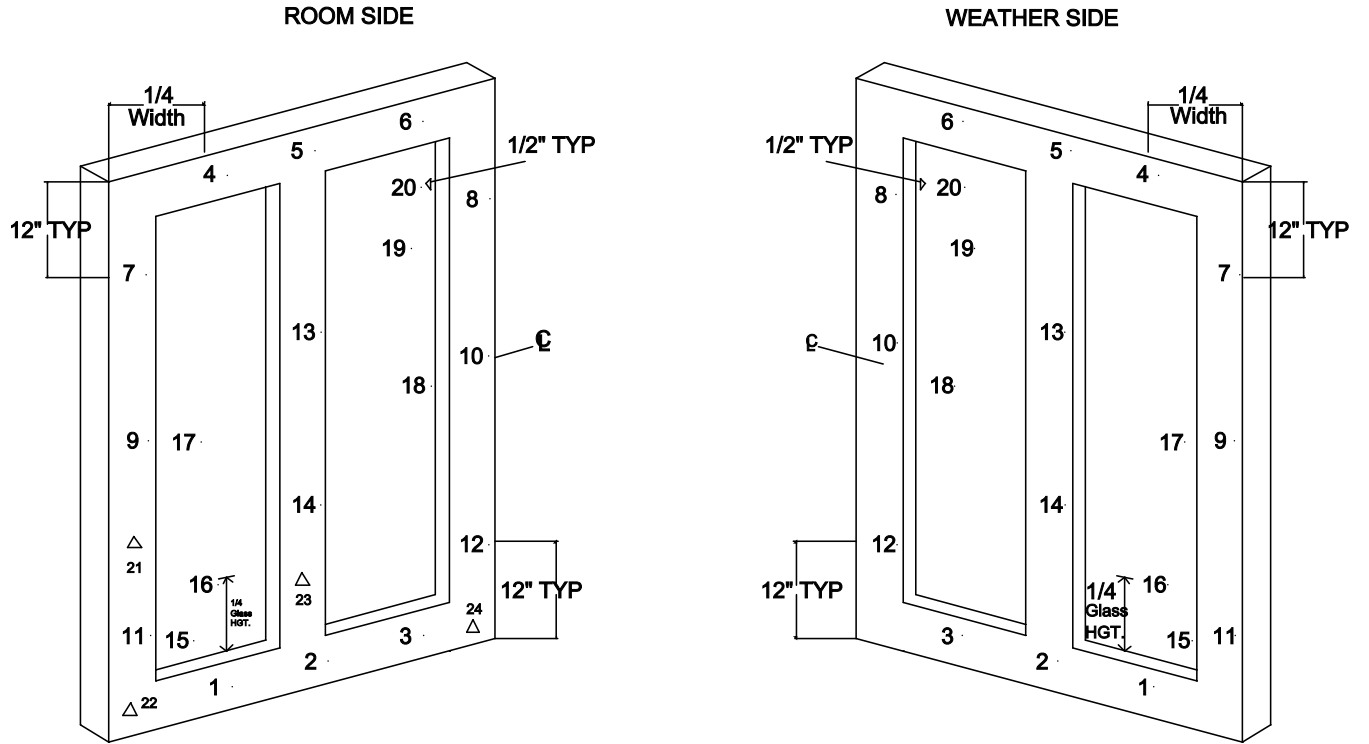
08/14/14

	Thermocouple	Individual Average Surface Temperatures (°F)	
	Location #	Warm Side	Cold Side
FRAME	1	38.4	6.6
	2	42.7	10.5
	3	44.6	6.2
	4	49.3	5.0
	5	49.9	11.3
	6	48.3	5.1
	7	43.7	6.2
	8	45.3	8.2
	9	41.4	5.0
	10	42.0	4.6
	11	37.7	7.9
	12	40.1	7.5
	13	50.7	10.7
	14	46.2	11.0
GLAZING	15	34.1	5.5
	16	51.8	3.9
	17	62.3	2.1
	18	47.1	3.3
	19	51.5	2.7
	20	53.8	5.8
COLD POINTS	21	39.9	
	22	34.2	
	23	44.4	
	24	43.5	

ATTACHMENT 2

CARDINAL COMMERCIAL PRODUCTS  
NCTL-110-17178-2  
08/14/14

SURFACE TEMPERATURE LOCATIONS



**ATTACHMENT 3**

**Section 1:**

Component Drawings, with Applicable Part Numbers, Manufacturing and Modeling Details, were Reviewed (as submitted) for Product Verification  
(Reference: NCTL-110-17178-2)

See Attached Documentation;  
any deviations noted.

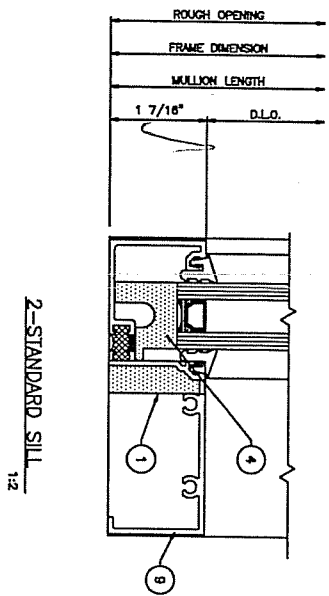
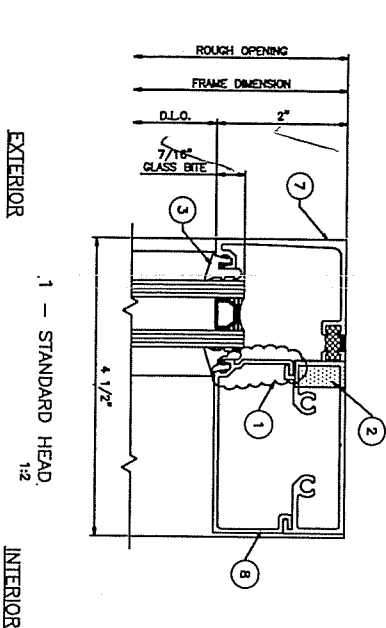
Note: The above referenced component drawings along with representative sections of the test specimen will be retained per procedure by NCTL. This testing facility assumes that all information provided by the client is accurate.

**Section 2:**

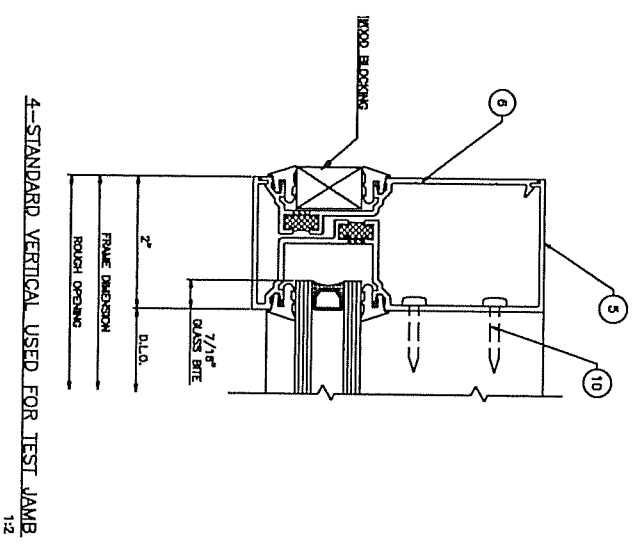
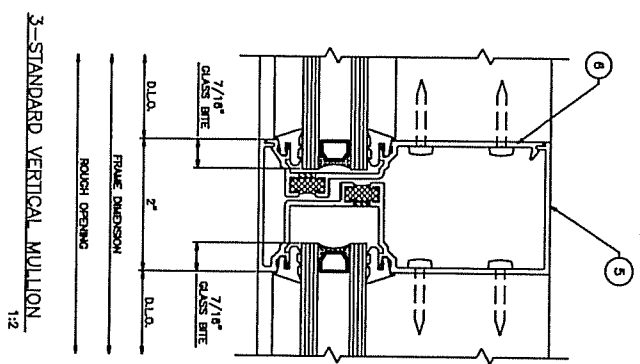
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Original Issue	10/06/14	Not Applicable





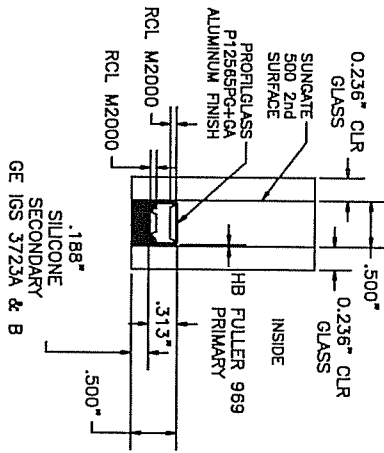


TEST SPECIMEN COMPLIES WITH THESE DETAILS. ANY DEVIATION IS NOTED. REPORT NO. NCTL-110-17178-2 TEST DATE 8/14/14



TEST SPECIMEN COMPLIES  
 WITH THESE DETAILS.  
 ANY DEVIATION IS NOTED.  
 REPORT NO. NCTL-110-1778-2  
 TEST DATE 8/14/14

GLASS TYPE SYMBOL	GLASS TYPE	MANUFACTURER	OLD SIZE	SQUARE FEET
(A)	1/2" TYPEDGED OUTER SURFACE WITH SANDS LOW T <sub>e</sub> COATING ON #2 SURFACE. 1/2" TYPEDGED INNER SURFACE	VARIES	38 3/8 X 75 9/16	18.9



BILL OF MATERIAL

ITEM NO.	PIN	DESCRIPTION	DIMENSIONS	MATERIAL	MANUFACTURER	NOTES
1	995	SILICONE	VARIABLE SPACE	SILICONE	DOW CORNING	USED FOR INTERIOR SEALS
2	GT-1	SEALANT TAPE	0.125 X 0.500 X VARIES	BUTYL AAMA-807.3	SCHIEFEL-MOOREHEAD	HORIZONTAL/VERTICAL JOINT TAPE
3	GSK-1	GLAZING GASKET	0.197 SPACE	EPDM ASTM-C-964	VARIES	
4	SB-11	SETTING BLOCK	0.141 X 1.282 X 4" LONG	EPDM ASTM-C-964	VARIES	
5	CWW451-1T	VERTICAL MULLION	2.000 X 4.500 X 0.090	6063-T6 ALUM	CARDINAL COMMERCIAL PRODUCTS	
6	CWW451-1T	MULLION FILLER	0.960 X 4.142 X 0.090	6063-T6 ALUM	CARDINAL COMMERCIAL PRODUCTS	
7	CWW451-11T	HEAD	2.000 X 4.438 X 0.090	6063-T6 ALUM	CARDINAL COMMERCIAL PRODUCTS	
8	CWW451-12	INTERIOR GLASS STOP	1.202 X 2.614 X 0.620	6063-T6 ALUM	CARDINAL COMMERCIAL PRODUCTS	
9	CWW451-141T	SILL	1.438 X 4.438 X 0.090	6063-T6 ALUM	CARDINAL COMMERCIAL PRODUCTS	
10	AF-12-4	SPLINE SCREW	#12-14 X 1" PH-SODR	STEEL	VARIES	

PROJECT: NCTL THERMAL TEST  
 - CWW451T THERMAL FRAMING SYSTEM  
 DRAWING NO: WRD 5/28/14  
 DATE: 12-1-07  
 CWW451T\_01  
 4 OF 5

PROJECT: NCTL THERMAL TEST  
 - CWW451T THERMAL FRAMING SYSTEM  
 BILL OF MATERIAL AND NOTES

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REVISION	DATE	BY	CHKD

