

**NFRC 102-2010 THERMAL PERFORMANCE
TEST REPORT**

Rendered to:

UNITED STATES ALUMINUM

SERIES/MODEL: HP3252 Curtain Wall

TYPE: Glazed Wall Systems (Site-built)

Summary of Results	
Standardized Thermal Transmittance (U-Factor)	
0.27	
Unit Size	78-3/4" x 78-3/4" (2000 mm x 2000 mm) (Model Size)
Layer 1	1/4" Cardinal LoE 272 (e=0.042*, #2)
Gap 1	0.25" Gap, Coated Steel Spacer (CS-D), 95% Krypton-Filled*
Layer 2	0.003 Southwall Technologies TC88 Heat Mirror (e=0.127*, #3 / 0.109*, #4)
Gap 2	0.25" Gap, Coated Steel Spacer (CS-D), 95% Krypton-Filled*
Layer 3	1/4" Clear

Reference must be made to Report No. 99979.01-201-46, dated 10/12/10 for complete test specimen description and data.



NFRC 102-2010 THERMAL PERFORMANCE TEST REPORT

Rendered to:

UNITED STATES ALUMINUM
200 Singleton Drive
Waxahachie, Texas 75165

Report Number: 99979.01-201-46
Test Date: 08/16/10
Report Date: 08/16/10
Revision 1 Date: 10/12/10
Test Record Retention Date: 08/16/14

Test Sample Identification:

Series/Model: HP3252 Curtain Wall

Type: Glazed Wall Systems (Site-built)

Overall Size: 78-3/4" x 78-3/4" (2000 mm x 2000 mm) (Model Size)

NFRC Standard Size: 78.7" x 78.7" (2000 mm wide x 2000 mm high)

Test Sample Submitted by: Client

Test Sample Submitted for: Validation for Initial Certification (Prototype only) no
Plant Qualification

Test Procedure: U-factor tests were performed in a Guarded Hot Box in accordance with NFRC 102-2010, *Procedure for Measuring the Steady-State Thermal Transmittance of Fenestration Systems*.

Test Results Summary:

Standardized U-factor (U_{st}): 0.27 Btu/hr·ft²·F CTS Method

Test Sample Description:

CONSTRUCTION	Frame
Size (in.)	78-3/4 x 78-3/4
Daylight Opening (in.)	35-1/2 x 73-1/4 (x2)
CORNERS	Butt
Fasteners	Screws
Sealant	Yes
MATERIAL	AT (0.24")
Color Exterior	Gray
Finish Exterior	Paint
Color Interior	Gray
Finish Interior	Paint
GLAZING METHOD	Pressure

Glazing Information:

Layer 1	1/4" Cardinal LoE 272 (e=0.042*, #2)
Gap 1	0.25" Gap, Coated Steel Spacer (CS-D), 95% Krypton-Filled*
Layer 2	0.003 Southwall Technologies TC88 Heat Mirror (e=0.127*, #3 / 0.109*, #4)
Gap 2	0.25" Gap, Coated Steel Spacer (CS-D), 95% Krypton-Filled*
Layer 3	1/4" Clear
Gas Fill Method	Evacuated Chamber*

**Stated per Client/Manufacturer*

N/A Non-Applicable

See Description Table Abbreviations

Test Sample Description: (Continued)

COMPONENTS			
	Type	Quantity	Location
WEATHERSTRIP			
	No weatherstrip		
HARDWARE			
	No hardware		
DRAINAGE			
	No drainage		

Thermal Transmittance (U-factor)

Measured Test Data

Heat Flows

1. Total Measured Input into Metering Box (Q_{total})	952.15 Btu/hr
2. Surround Panel Heat Flow (Q_{sp})	47.33 Btu/hr
3. Surround Panel Thickness	8.00 inches
4. Surround Panel Conductance	0.0272 Btu/hr·ft ² ·F
5. Metering Box Wall Heat Flow (Q_{mb})	33.49 Btu/hr
6. EMF vs Heat Flow Equation (equivalent information)	0.0201*EMF + 18.190
7. Flanking Loss Heat Flow (Q_{fl})	30.49 Btu/hr
8. Net Specimen Heat Loss (Q_s)	840.84 Btu/hr

Areas

1. Test Specimen Projected Area (A_s)	43.07 ft ²
2. Test Specimen Interior Total (3-D) Surface Area (A_h)	65.07 ft ²
3. Test Specimen Exterior Total (3-D) Surface Area (A_c)	50.61 ft ²
4. Metering Box Opening Area (A_{mb})	68.75 ft ²
5. Metering Box Baffle Area (A_{bl})	60.57 ft ²
6. Surround Panel Interior Exposed Area (A_{sp})	25.68 ft ²

Test Conditions

1. Average Metering Room Air Temperature (t_h)	69.73 F
2. Average Cold Side Air Temperature (t_c)	-0.12 F
3. Average Guard/Environmental Air Temperature	71.00 F
4. Metering Room Average Relative Humidity	12.68 %
5. Metering Room Maximum Relative Humidity	12.95 %
6. Metering Room Minimum Relative Humidity	12.40 %
7. Measured Cold Side Wind Velocity (Perpendicular Flow)	14.36 mph
8. Measured Static Pressure Difference Across Test Specimen	0.00" ± 0.04"H ₂ O

Results

1. Thermal Transmittance of Test Specimen (U_s)	0.28 Btu/hr·ft ² ·F
2. Standardized Thermal Transmittance of Test Specimen (U_{st})	0.27 Btu/hr·ft ² ·F

Thermal Transmittance (U-factor)

Calculated Test Data

CTS Method

1. Emittance of Glass (e_i)	0.84
2. Cold Side Emittance of Glass	0.84
3. Warm Side Frame Emittance	0.90
4. Cold Side Frame Emittance	0.90
5. Warm Side Sash/Panel/Vent Emittance	N/A
6. Cold Side Sash/Panel/Vent Emittance	N/A
7. Warm Side Baffle Emittance (e_{bi})	0.92
8. Equivalent Warm Side Surface Temperature	55.04 F
9. Equivalent Cold Side Surface Temperature	3.77 F
10. Warm Side Baffle Surface Temperature	69.96 F
11. Measured Warm Side Surface Conductance (h_h)	1.33 Btu/hr·ft ² ·F
12. Measured Cold Side Surface Conductance (h_c)	5.03 Btu/hr·ft ² ·F
13. Test Specimen Thermal Conductance (C_s)	0.38 Btu/hr·ft ² ·F
14. Convection Coefficient (K_c)	0.28 Btu/(hr·ft ² ·F ^{1.25})
15. Radiative Test Specimen Heat Flow (Q_{ri})	490.41 Btu/hr
16. Conductive Test Specimen Heat Flow (Q_{ci})	350.43 Btu/hr
17. Radiative Heat Flux of Test Specimen (q_{ri})	11.39 Btu/hr·ft ² ·F
18. Convective Heat Flux of Test Specimen (q_{ci})	8.14 Btu/hr·ft ² ·F
19. Standardized Warm Side Surface Conductance (h_{sth})	1.19 Btu/hr·ft ² ·F
20. Standardized Cold Side Surface Conductance (h_{stc})	5.28 Btu/hr·ft ² ·F
21. Standardized Thermal Transmittance (U_{st})	0.27 Btu/hr·ft ² ·F

Test Duration

1. The environmental systems were started at 14:30 hours, 08/15/10.
2. The test parameters were considered stable for two consecutive four hour test periods from 23:16 hours, 08/15/10 to 07:16 hours, 08/16/10.
3. The thermal performance test results were derived from 03:16 hours, 08/16/10 to 07:16 hours, 08/16/10.

The reported Standardized Thermal Transmittance (U_{st}) was determined using CTS Method, per Section 8.2(A) of NFRC 102.

Glazing Deflection (in):

	Left Glazing	Right Glazing
Edge Gap Width	0.25 / 0.25	0.25 / 0.25
Estimated center gap width upon receipt of specimen in laboratory (after stabilization)	0.30 / 0.30	0.30 / 0.30
Center gap width at laboratory ambient conditions on day of testing	0.30 / 0.30	0.30 / 0.30
Center gap width at test conditions	0.24 / 0.23	0.25 / 0.23

Glass collapse determined using a digital glass and air space meter

The sample was inspected for the formation of frost or condensation, which may influence the surface temperature measurements. The sample showed no evidence of condensation/frost at the conclusion of the test.

A calibration of the Architectural Testing Inc. 'thermal test chamber' (ICN N000235) in St. Paul, Minnesota was conducted in October 2009 in accordance with Architectural Testing Inc. calibration procedure.

"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."

"Ratings included in this report are for submittal to an NFRC-licensed IA for certification purposes and are not meant to be used for labeling purposes. Only those values identified on a valid Certification Authorization Report (CAR) are to be used for labeling purposes."

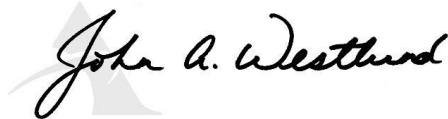
The test sample was installed in a vertical orientation, the exterior of the specimen was exposed to the cold side. The direction of heat transfer was from the interior (warm side) to the exterior (cold side) of the specimen.

ANSI/NCSL Z540-2-1997 type B uncertainty for this test was 1.73%.

Detailed drawings, data sheets, representative samples of test specimens, a copy of this report, or other pertinent project documentation will be retained by Architectural Testing, Inc. for a period of four years from the original test date. At the end of this retention period such materials shall be discarded without notice and the service life of this report by Architectural Testing will expire. Results obtained are tested values and were secured by using the designated test methods. This report does not constitute certification of this product nor an opinion or endorsement by this laboratory. Ratings included in this report are for submittal to an NFRC licensed IA for certification purposes and are not meant to be used for labeling purposes. Only those values identified on a valid Certification Authorization Report (CAR) are to be used for labeling purposes. It is the exclusive property of the client so named herein and relates only to the specimen(s) tested. This report may not be reproduced, except in full, without the written approval of Architectural Testing, Inc.

For ARCHITECTURAL TESTING, INC.

Tested By:



Digitally Signed by: John A. Westlund

John A. Westlund
Technician

Reviewed By:



Digitally Signed by: Michael Resech

Michael P. Resech
Senior Project Manager
Individual-In-Responsible-Charge

JAW:jaw
99979.01-201-46

Attachments (pages): This report is complete only when all attachments listed are included.

Appendix-A: Description Table Abbreviations (1)

Appendix-B: Submittal Form and Drawings (11)

Revision Log

Rev. #	Date	Page(s)	Revision(s)
0	08/16/10	All	Original Report Issue. Work requested by Don Willard of United States Aluminum.
1	10/12/10	Appendix B	Revised Report Issue. Report revised to remove skip-debridge notes from drawings. Work requested by Don Willard of United States Aluminum.