

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

Rendered to:

CARDINAL COMMERCIAL PRODUCTS

SERIES/MODEL: Series CF451T Thermal Storefront

TYPE: Glazed Wall Systems (Site-built)

Summary of Results	
Standardized Thermal Transmittance (U-Factor)	0.43
Unit Size:	78-3/4" x 78-3/4" (2000 mm x 2000 mm) (Model Size)
Layer 1: 1/4"	Clear Tempered
Gap 1: 0.56"	A1-D: Aluminum Spacer 100% Air*
Layer 2: 1/4"	PPG Sungate 500 (e=0.215*, #3) Tempered

Reference must be made to Report No. C8825.01-116-46, dated 06/11/13 for complete test specimen description and data.

NFRC 102-2010 THERMAL PERFORMANCE TEST REPORT

Rendered to:

CARDINAL COMMERCIAL PRODUCTS
3795 Shepherdsville Road
Louisville, Kentucky 40218

Report Number: C8825.01-116-46
Test Date: 05/31/13
Report Date: 06/11/13

Test Sample Identification:

Series/Model: Series CF451T Thermal Storefront

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 (Production Line Unit) &
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}): 0.43 Btu/hr·ft²·F (CTS Method)

Test Sample Description:

Frame:

Material:	AT (0.24"): Aluminum with Thermal Breaks - All Members		
Size:	78-3/4" x 78-3/4" (Model Size)		
Daylight Opening:	36-3/8" x 74-3/4" (x2)	Glazing Method:	Exterior
Exterior Color:	Bronze	Exterior Finish:	Anodized
Interior Color:	Bronze	Interior Finish:	Anodized
Corner Joinery:	Square Cut / Screws / Unsealed		

Glazing Information:

Layer 1:	1/4"	Clear Tempered	
Gap 1:	0.56"	A1-D: Aluminum Spacer	100% Air*
Layer 2:	1/4"	PPG Sungate 500 (e=0.215*, #3) Tempered	
Gas Fill Method:	N/A*		

**Stated per Client/Manufacturer*

N/A Non-Applicable

Test Sample Description: (Continued)

Weatherstripping:

Description	Quantity	Location
EPDM glazing gasket	1 row	Interior and exterior glazing perimeter

Hardware:

Description	Quantity	Location
Aluminum glass stop	2	Exterior sill
AT (0.24") pocket filler	2	Jambs
(1.00" x 0.56") Wood block	2	Jambs

Drainage:

Drainage Method	Size	Quantity	Location
No visible weeps			

Thermal Transmittance (U-factor)

Measured Test Data

Heat Flows

1. Total Measured Input into Metering Box (Q_{total})	1440.05 Btu/hr
2. Surround Panel Heat Flow (Q_{sp})	49.87 Btu/hr
3. Surround Panel Thickness	8.00 inches
4. Surround Panel Conductance	0.0226 Btu/hr·ft ² ·F
5. Metering Box Wall Heat Flow (Q_{mb})	4.94 Btu/hr
6. EMF vs Heat Flow Equation (equivalent information)	0.0115*EMF + -0.017
7. Flanking Loss Heat Flow (Q_n)	7.59 Btu/hr
8. Net Specimen Heat Loss (Q_s)	1377.64 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)	54.52 ft ²
3. Test Specimen Exterior Total (3-D) Surface Area (A_c)	54.52 ft ²
4. Metering Box Opening Area (A_{mb})	75.11 ft ²
5. Metering Box Baffle Area (A_{bi})	70.84 ft ²
6. Surround Panel Interior Exposed Area (A_{sp})	32.04 ft ²

Test Conditions

1. Average Metering Room Air Temperature (t_h)	69.80 F
2. Average Cold Side Air Temperature (t_c)	-0.40 F
3. Average Guard/Environmental Air Temperature	71.25 F
4. Metering Room Average Relative Humidity	8.06 %
5. Metering Room Maximum Relative Humidity	8.20 %
6. Metering Room Minimum Relative Humidity	7.94 %
7. Measured Cold Side Wind Velocity (Perpendicular Flow)	12.66 mph
8. Measured Warm Side Wind Velocity (Parallel Flow)	NA mph
9. Measured Static Pressure Difference Across Test Specimen	0.00" ± 0.04"H ₂ O

Average Surface Temperatures

1. Metering Room Surround Panel	68.63 F
2. Cold Side Surround Panel	-0.16 F

Results

1. Thermal Transmittance of Test Specimen (U_s)	0.46 Btu/hr·ft ² ·F
2. Standardized Thermal Transmittance of Test Specimen (U_{st})	0.43 Btu/hr·ft ² ·F

Thermal Transmittance (U-factor)

Calculated Test Data

CTS Method

1. Warm Side Emittance of Glass (e_i)	0.84
2. Cold Side Emittance of Glass	0.84
3. Warm Side Frame Emittance*	0.80
4. Cold Side Frame Emittance*	0.80
5. Warm Side Sash/Panel/Vent Emittance*	N/A
6. Cold Side Sash/Panel/Vent Emittance*	N/A
7. Warm Side Baffle Emittance (e_{b1})	0.92
8. Cold Side Baffle Emittance (e_{b2})	N/A
9. Equivalent Warm Side Surface Temperature	46.91 F
10. Equivalent Cold Side Surface Temperature	5.74 F
11. Warm Side Baffle Surface Temperature	68.33 F
12. Cold Side Baffle Surface Temperature	N/A F
13. Measured Warm Side Surface Conductance (h_h)	1.40 Btu/hr·ft ² ·F
14. Measured Cold Side Surface Conductance (h_c)	5.22 Btu/hr·ft ² ·F
15. Test Specimen Thermal Conductance (C_s)	0.78 Btu/hr·ft ² ·F
16. Convection Coefficient (K_c)	0.32 Btu/(hr·ft ² ·F ^{1.25})
17. Radiative Test Specimen Heat Flow (Q_{ri})	684.85 Btu/hr
18. Conductive Test Specimen Heat Flow (Q_{ci})	692.79 Btu/hr
19. Radiative Heat Flux of Test Specimen (q_{ri})	15.90 Btu/hr·ft ² ·F
20. Convective Heat Flux of Test Specimen (q_{ci})	16.09 Btu/hr·ft ² ·F
21. Standardized Warm Side Surface Conductance (h_{sth})	1.21 Btu/hr·ft ² ·F
22. Standardized Cold Side Surface Conductance (h_{stc})	5.28 Btu/hr·ft ² ·F
23. Standardized Thermal Transmittance (U_{st})	0.43 Btu/hr·ft ² ·F

Test Duration

1. The environmental systems were started at 16:36 hours, 05/30/13.
2. The test parameters were considered stable for two consecutive four hour test periods from 23:57 hours, 05/30/13 to 07:57 hours, 05/31/13.
3. The thermal performance test results were derived from 03:57 hours, 05/31/13 to 07:57 hours, 05/31/13.

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

**Stated per NFRC 101*

Glazing Deflection:

	Left Glazing	Right Glazing
Edge Gap Width	0.56"	0.56"
Estimated center gap width upon receipt of specimen in laboratory (after stabilization)	0.50"	0.47"
Center gap width at laboratory ambient conditions on day of testing	0.50"	0.47"
Center gap width at test conditions	0.38"	0.35"

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.

“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 are expected from field installations due to not accounting for solar radiation, air leakage effects, and the thermal bridge effects that have the potential to occur due to the specific design and construction of the fenestration system opening. The latter can only be determined by in-situ measurements. Therefore, it is important to recognize 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.”

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. The ratings were rounded in accordance to NFRC 601, NFRC Unit and Measurement Policy. The data acquisition frequency is 5 minutes.

ANSI/NCSL Z540-2-1997 type B uncertainty for this test was 1.52%.

Required annual calibrations for the Architectural Testing Inc. 'thermal test chamber' (ICN 000001) in York, Pennsylvania were last conducted in May 2013 in accordance with Architectural Testing Inc. calibration procedure. A CTS Calibration verification was performed June 2012. A Metering Box Wall Transducer and Surround Panel Flanking Loss Characterization was performed December 2012.

"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."

Architectural Testing, Inc. will service this report for the entire test record retention period. Test records that are retained such as detailed drawings, datasheets, representative samples of test specimens, or other pertinent project documentation will be retained by Architectural Testing, Inc. for the entire test record retention period. The test record retention end date for this report is May 31, 2017.

This report does not constitute certification of this product nor an opinion or endorsement by this laboratory. It is the exclusive property of the client so named herein and relates only to the specimen tested. This report may not be reproduced, except in full, without the written approval of Architectural Testing, Inc.

For ARCHITECTURAL TESTING, INC.

Tested By:

Reviewed By:


Ryan P. Moser
Technician

Shon W. Einsig
Senior Technician
Individual-In-Responsible-Charge

RPM:amg
C8825.01-116-46

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

- Appendix-A: CTS Calibration Data (1)
- Appendix-B: Surround Panel Wiring Diagram (1)
- Appendix-C: Baffle Wiring Diagram (1)
- Appendix-D: Submittal Form and Drawings (6)

	Architectural Testing, Inc. is accredited by the International Accreditation Service (IAS) under the specific test methods listed under lab code TL-144, in accordance with the recognized International Standard ISO/IEC 17025:2005. The laboratory's accreditation or test report in no way constitutes or implies product certification, approval, or endorsement by IAS.
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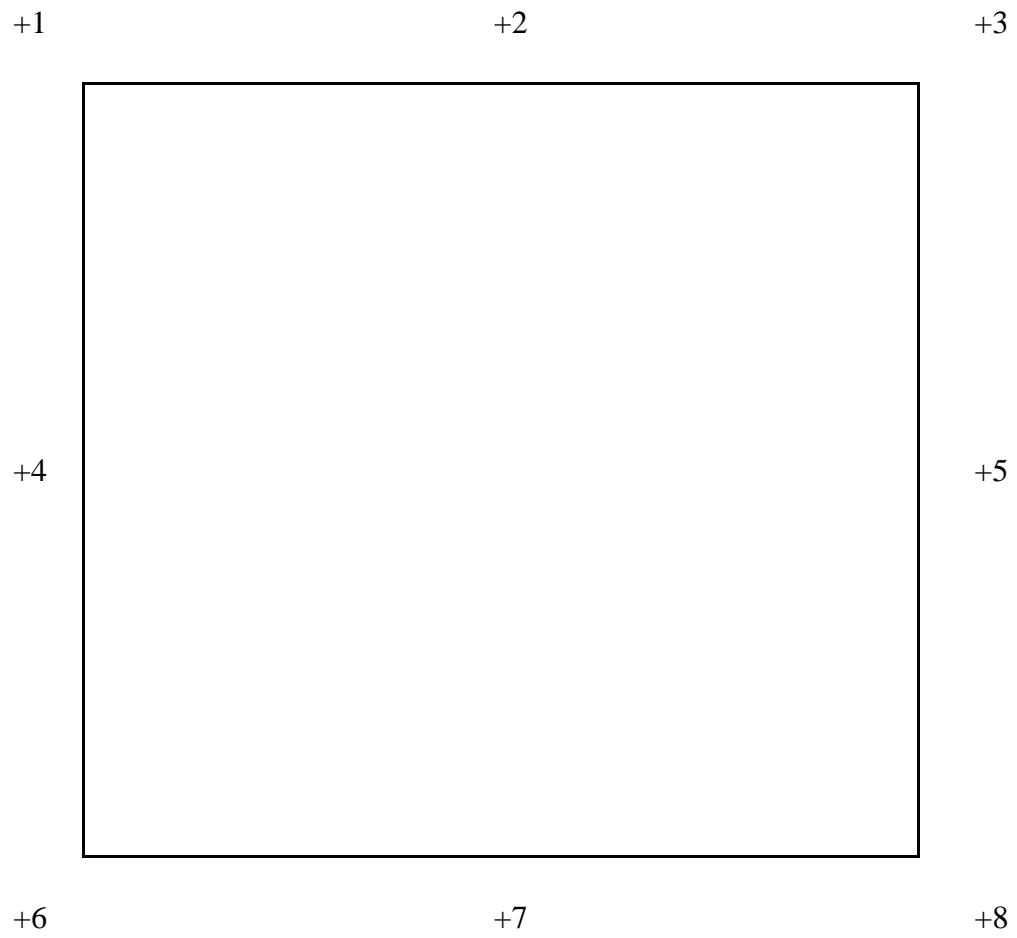
Revision Log

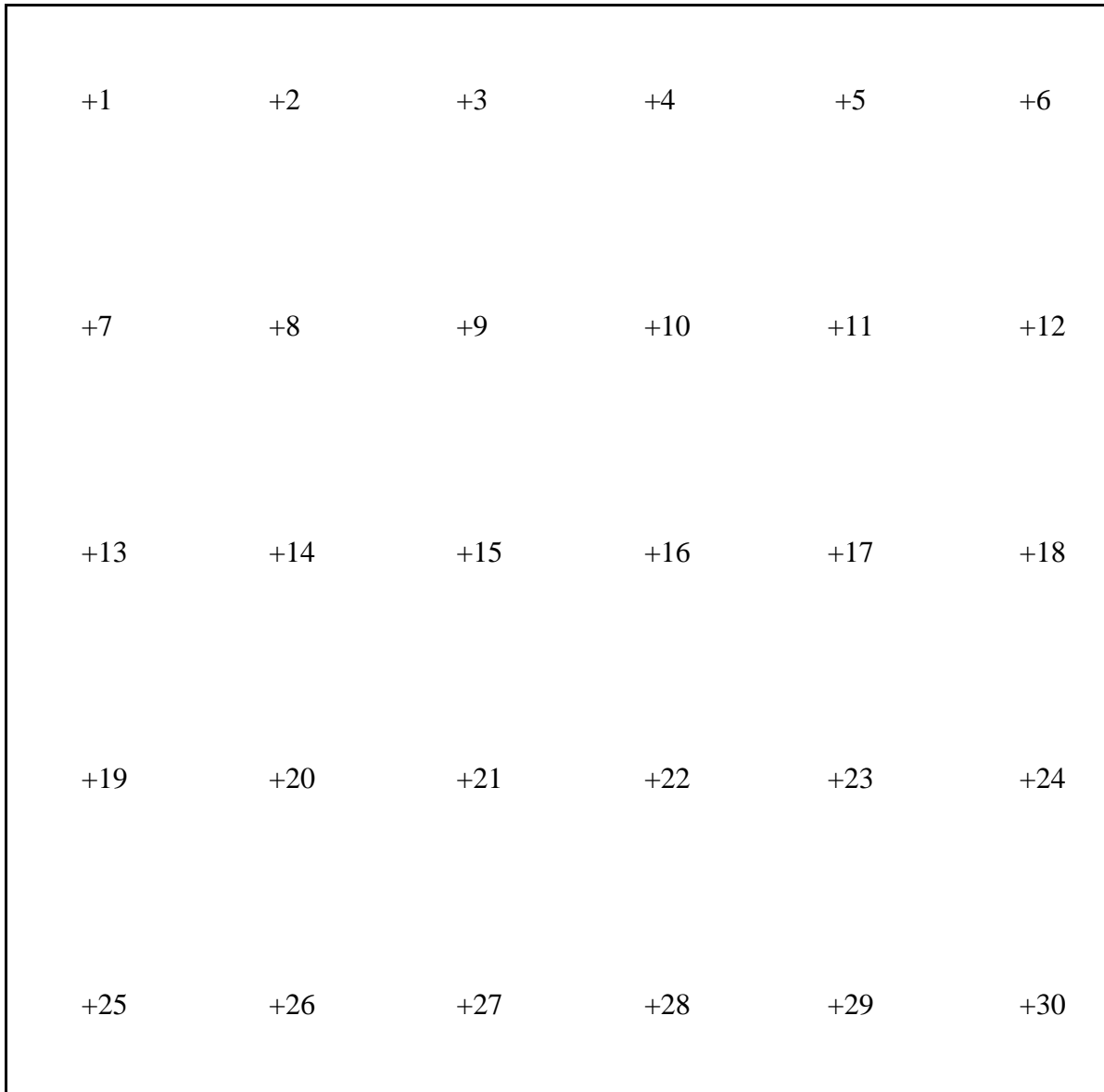
<u>Rev. #</u>	<u>Date</u>	<u>Page(s)</u>	<u>Revision(s)</u>
.01R0	06/11/13	All	Original Report Issue. Work requested by J.D. Williams of Cardinal Commercial Products

Appendix A: CTS Calibration Data

1. CTS Test Date	06/05/12
2. CTS Size	43.06 ft ²
3. CTS Glass/Core Conductance	0.40 Btu/hr·ft ² ·F
4. Warm Side Air Temperature	69.81 F
5. Cold Side Air Temperature	-0.40 F
6. Warm Side Average Surface Temperature	54.59 F
7. Cold Side Average Surface Temperature	3.52 F
8. Convection Coefficient (K _c)	0.32 Btu/(hr·ft ² ·F ^{1.25})
9. Measured Cold Side Surface Conductance (h _c)	5.22 Btu/hr·ft ² ·F
10. Measured Thermal Transmittance	0.30 Btu/hr·ft ² ·F

Appendix B: Surround Panel Wiring Diagram



Appendix C: Baffle Wiring Diagram

Appendix D: Submittal Form and Drawings



SUBMITTAL FORM for TEST SAMPLES

(for use by manufacturers, lineal suppliers, and fabricators)

1. Information on Production of the Test Sample (complete all fields):

Manufacturer: Cardinal Commercial Product Date of sample manufacture: May 14, 2013
Plant address where manufactured: 4915 Heller Street
City/State/Zip: Louisville Kentucky 40218
Phone/Fax: 502-969-4059 Name of IA: Keystone Certifications Inc.

2. Product Information (complete all fields):

Product Line ID Number: _____ Operator Type (NFRCC 100, Table 1): Thermal Storefront
Series/Model: Series CF451T

3. Test sample is being submitted for (select one):

- a. Validation for Initial Certification (prototype only; NFRCC PCP Section 2.2.A.3), no plant qualification
- b. Validation for Initial Certification (production line unit; NFRCC PCP Section 2.2.A.2.b) and plant qualification
- c. Validation for Recertification (production line unit; NFRCC PCP Section 2.2.A.2.b) and plant qualification
- d. Plant Qualification Only (production line unit; NFRCC PCP Section 2.2.A.2.b)

(Note: If the test only option is to be used, include a copy of the NFRCC-certified simulator's statement and NFRCC approval as required in NFRCC 100 (1997) Sections 6.1. and 6.1.1)

I, John Stelter, as the designated agent for Cardinal Commercial Products, do hereby attest that the foregoing information is true to the best of my information, knowledge, and belief. Further, if the unit is identified in Section 3 as a production line unit, I hereby authorize the NFRCC-accredited testing laboratory to send a copy of the test report to the IA identified above for plant qualification purposes pursuant to the NFRCC Product Certification Program.

Signature: _____ Date: 6/6/13

FOR LABORATORY USE ONLY

- 1. Laboratory name: Architectural Testing
- 2. Date sample received: 5/16/13 File number ID: C8825
- 3. Date sample tested: 5/31/13 By: RPM
- 4. Modifications made: _____
- 5. Reason for non-testing of sample unit: _____

(Note: If the sample submitted can not be tested due to damage prior to testing, a new sample and new form shall be submitted to the testing laboratory. Both forms shall be submitted to the IA when the testing is completed).

ATI THERMAL TEST DWGS - CF451T THERMAL FRAMING SYSTEM -

Architectural Testing
 Test sample complies with these details.
 Test sample complies with these details.
 Deviations are noted.

Report# C8825
 Date 5/31/13 Tech RAM

DRAWING INDEX	
1	DRAWING INDEX AND NOTES
2	ELEVATION E3
3	STANDARD FRAMING DETAILS
4	BILL OF MATERIALS/GLASS SCHEDULE
5	PROFILE DRAWINGS

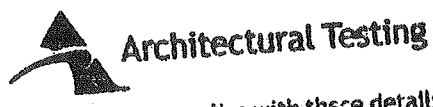
CARDINAL COMMERCIAL PRODUCTS 4795 SHEPHERDSVILLE ROAD LOUISVILLE, KY: 40218 TEL: 502-969-4059 FAX: 800-313-4195	ATI THERMAL TEST - CF451T THERMAL FRAMING SYSTEM DRAWING INDEX AND NOTES																												
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REV.	DATE	DESCRIPTION

CARDINAL COMMERCIAL PRODUCTS
 4795 SHEPHERDSDVILLE ROAD
 LOUISVILLE, KY. 40218
 TEL: 502-969-4059
 FAX: 800-313-4195

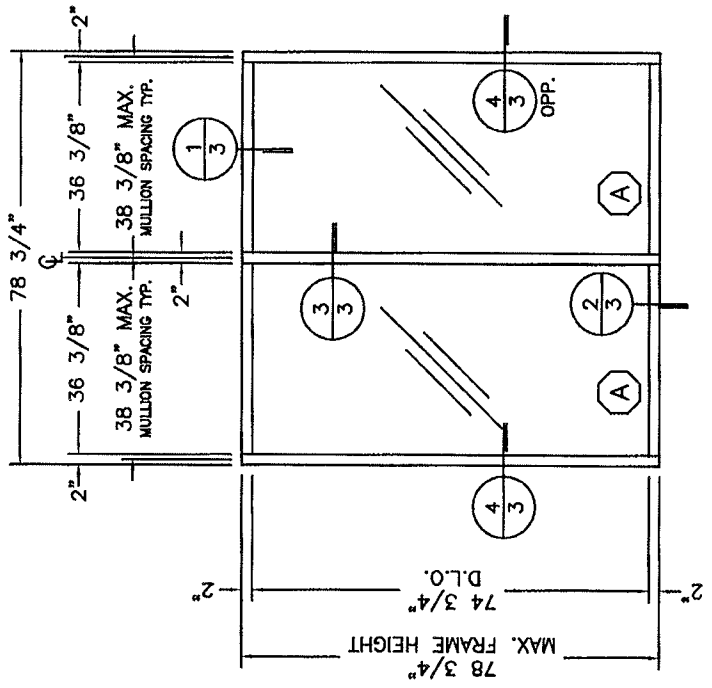
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 -CF451T THERMAL FRAMING SYSTEM
 FRAMING ELEVATION

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 PROJECT: CF451T_04
 SHEET: 2 OF 5



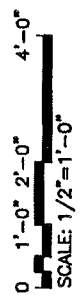
Test sample complies with these details.
 Deviations are noted.

Report# C8825
 Date 5/31/13 Tech RBM



E3
TYPICAL ELEVATION
EXTERIOR GLAZED

- NOTES:
1. TESTING THERMAL
 2. D.L.O.= DAYLIGHT OPENING
 3. GLASS SIZE = D.L.O. + 7/8"

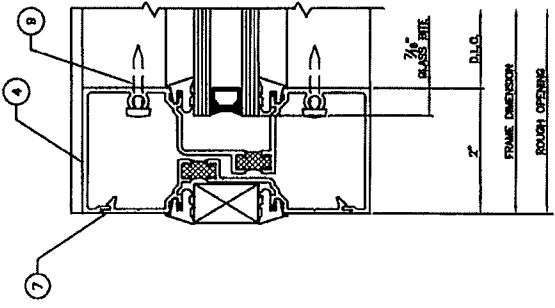


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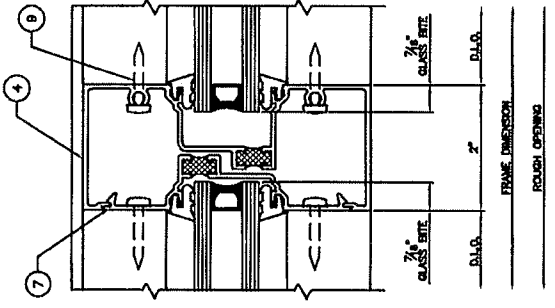
CARDINAL COMMERCIAL PRODUCTS
 4795 SHEPHERDSVILLE ROAD
 LOUISVILLE, KY. 40218
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 FAX: 800-313-4195

ATI THERMAL TEST
 -CF451T THERMAL FRAMING SYSTEM
 STANDARD DETAILS

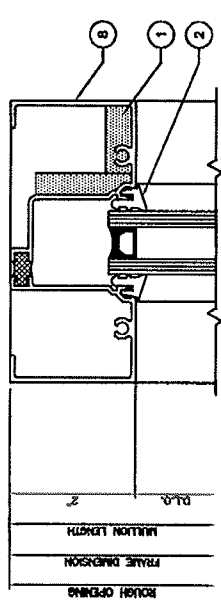
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 3 OF 5



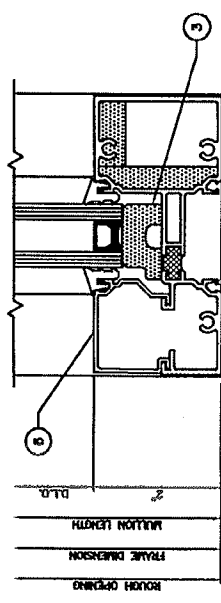
4-STANDARD VERTICAL USED FOR TEST JAMB 1/2



3-STANDARD VERTICAL MULLION 1/2



1 - STANDARD HEAD 1/2



2 - STANDARD SILL 1/2



Test sample complies with these details.
 Deviations are noted.

Report# C 8825
 Date 5/3/13 Tech ERM

NO.	DATE	BY	APP.	REVISION

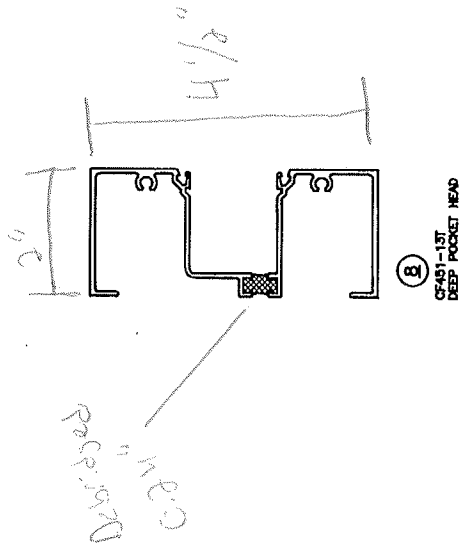
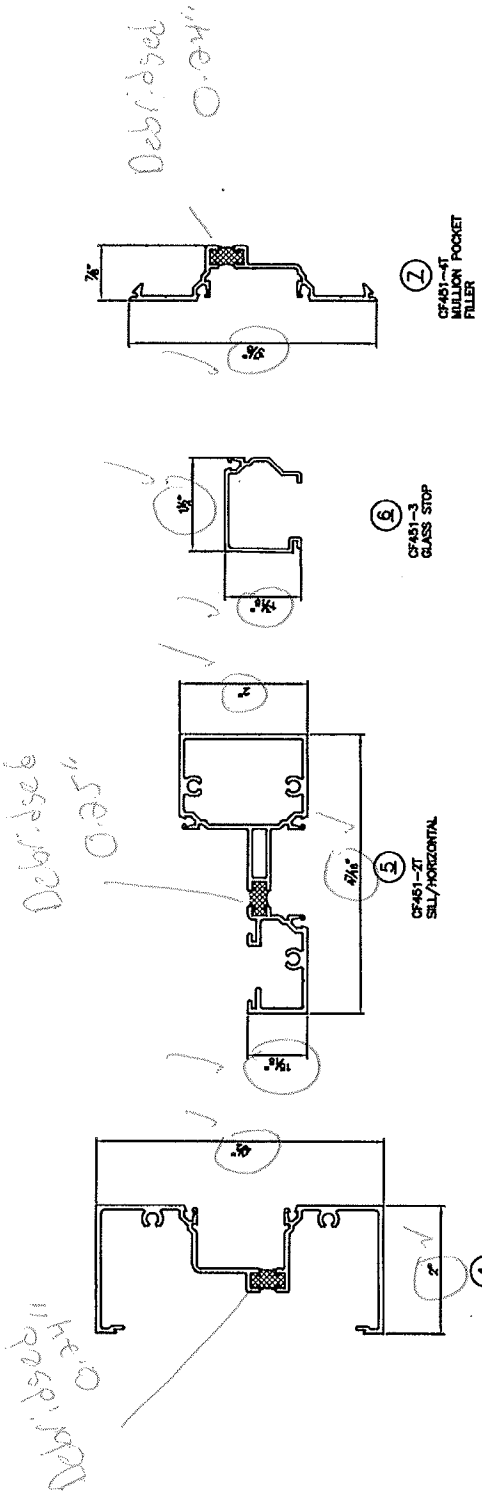
CARDINAL COMMERCIAL PRODUCTS
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ATI THERMAL TEST SYSTEM - CF451T
 PROFILE DRAWINGS
 DRAWN: WRD
 DATE: 6/07/13
 SCALE: 6"=1'-0"
 DRAWING NO.: CF451T_04
 5 OF 5



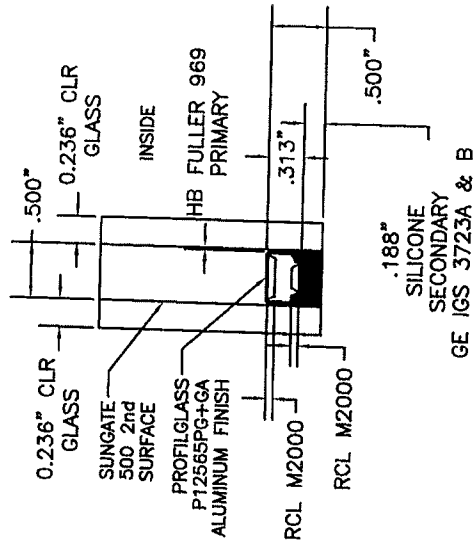
Test sample complies with these details.
 Deviations are noted.

Report# CF451T
 Date 5/31/13 Tech RPM



BILL OF MATERIAL

ITEM NO.	P/N	DESCRIPTION	DIMENSIONS	MATERIAL	MANUFACTURER	NOTES
1	GT-1	SEALANT TAPE	0.125 X 0.500 X VARIES	BUTYL AAMA-807.3	SCHNEE-MOOREHEAD	HORIZONTAL/VERTICAL JOINT TAPE
2	GSK-1	GLAZING GASKET	.197 SPACE	EPDM ASTM-C-864	CARDINAL COMMERCIAL PRODUCTS	
3	SB-3	SETTING BLOCK	0.625 X 1.188 X 4" LONG	EPDM ASTM-C-864	CARDINAL COMMERCIAL PRODUCTS	
4	CF451-1T	VERTICAL MULLION	2.000 X 4.500 X 0.080	6063-T5 ALUM.	CARDINAL COMMERCIAL PRODUCTS	
5	CF451-2T	SILL/HORIZONTAL	2.000 X 4.460 X 0.080	6063-T5 ALUM.	CARDINAL COMMERCIAL PRODUCTS	
6	CF451-3	GLASS STOP	1.204 X 1.530 X 0.055	6063-T5 ALUM.	CARDINAL COMMERCIAL PRODUCTS	
7	CF451-4T	MULLION POCKET FILLER	0.860 X 3.875 X 0.062	6063-T5 ALUM.	CARDINAL COMMERCIAL PRODUCTS	
8	CF451-13T	DEEP POCKET HEAD	2.000 X 4.500 X 0.080	6063-T5 ALUM.	CARDINAL COMMERCIAL PRODUCTS	
9	AF12-4	SPLINE SCREW	#12-14 X 1 1/4" PH-SQDR	STEEL	VARIES	



GLASS SCHEDULE				
GLASS MARK SYMBOL	GLASS TYPE	MANUFACTURER	DLO SIZE	SQUARE FEET
A	X ^o TEMPERED OUTER SURFACE WITH S ^o LOW E ^o COATING ON #2 SURFACE, X ^o AIR SPACE, X ^o TEMPERED INNER SURFACE	VARIES	36 3/8 X 74 3/4	18.9

Architectural Testing
 Test sample complies with these details.
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ATI THERMAL TEST
 -CF451 THERMAL FRAMING SYSTEM
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