Architectural Testing

NFRC 102-2010 THERMAL PERFORMANCE TEST REPORT

Rendered to:

CMI ARCHITECTURAL PRODUCTS, INC.

SERIES/MODEL: 450TB - Center Glazed

TYPE: Glazed Wall Systems (Site-built)

Summary of Results			
Standardized Thermal Transmittance (U-Factor)			0.36
Unit Size:		78-7/8" x 78-1/2" (2003 mm x 1994 mm) (Model Size)	
Layer 1:	1/4"	SolarBan 60 Low-E (e=0.035*, #2)	
Gap 1:	0.50"	A1-D: Aluminum Spacer	90% Argon*
Layer 2:	1/4"	Clear	

Reference must be made to Report No. C5085.01-201-46, dated 12/11/13 for complete test specimen description and data.

849 Western Avenue North
St. Paul, MN 55117
phone: 651-636-3835
fax: 717-764-4129
www.archtest.com

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NFRC 102-2010 THERMAL PERFORMANCE TEST REPORT

Rendered to:

CMI ARCHITECTURAL PRODUCTS, INC.
2800 Freeway Blvd Ste 205
Minneapolis, Minnesota 55430

Report Number:	C5085.01-201-46
Test Date:	12/11/13
Report Date:	12/11/13
Test Record Retention End Date:	12/11/17

Test Sample Identification:

Series/Model: 450TB - Center Glazed

Type: Glazed Wall Systems (Site-built)

Overall Size: 78-7/8" x 78-1/2" (2003 mm x 1994 mm) (Model Size)
NFRC Standard Size: 78.7" x 78.7" (2000 mm wide x 2000 mm high)

Test Sample Submitted by: Client

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}): 0.36 Btu/hr·ft^2·F (CTS Method)

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Test Sample Description:

Frame:

Material:	AT (0.212"): Aluminum with Thermal Breaks - All Members		
Size:	78-7/8" x 78-1/2" (Model Size)		
Daylight Opening:	36-1/8" x 74-1/8" (x2)	**Glazing Method:**	Exterior
Exterior Color:	Gray	**Exterior Finish:**	Paint
Interior Color:	Gray	**Interior Finish:**	Paint
Corner Joinery:	Square Cut / Screws / Unsealed		

Glazing Information:

Layer 1:	1/4"	SolarBan 60 Low-E (e=0.035*, #2)	
Gap 1:	0.50"	A1-D: Aluminum Spacer	90% Argon*
Layer 2:	1/4"	Clear	
Gas Fill Method:		Single-Probe Method*	

**Stated per Client/Manufacturer*
N/A Non-Applicable

Test Sample Description: (Continued)

Weatherstripping:

Description	Quantity	Location
No weatherstrip		

Hardware:

Description	Quantity	Location
No hardware		

Drainage:

Description	Size	Quantity	Location
No drainage			

Thermal Transmittance (U-factor)

Measured Test Data

Heat Flows

1. Total Measured Input into Metering Box (Q_{total})	1231.65	Btu/hr
2. Surround Panel Heat Flow (Q_{sp})	60.86	Btu/hr
3. Surround Panel Thickness	5.00	inches
4. Surround Panel Conductance	0.0354	Btu/hr·ft^2·F
5. Metering Box Wall Heat Flow (Q_{mb})	53.69	Btu/hr
6. EMF vs Heat Flow Equation (equivalent information)	0.0201*EMF + 27.910	
7. Flanking Loss Heat Flow (Q_{fl})	-6.23	Btu/hr
8. Net Specimen Heat Loss (Q_s)	1123.34	Btu/hr

Areas

1. Test Specimen Projected Area (A_s)	43.00	ft^2
2. Test Specimen Interior Total (3-D) Surface Area (A_h)	53.82	ft^2
3. Test Specimen Exterior Total (3-D) Surface Area (A_c)	53.82	ft^2
4. Metering Box Opening Area (A_{mb})	68.75	ft^2
5. Metering Box Baffle Area (A_{b1})	60.57	ft^2
6. Surround Panel Interior Exposed Area (A_{sp})	25.75	ft^2

Test Conditions

1. Average Metering Room Air Temperature (t_h)	69.80	F
2. Average Cold Side Air Temperature (t_c)	-0.39	F
3. Average Guard/Environmental Air Temperature	70.99	F
4. Metering Room Average Relative Humidity	4.20	%
5. Metering Room Maximum Relative Humidity	4.23	%
6. Metering Room Minimum Relative Humidity	4.16	%
7. Measured Cold Side Wind Velocity (Perpendicular Flow)	15.06	mph
8. Measured Static Pressure Difference Across Test Specimen	0.00" ± 0.04"H_2O	

Average Surface Temperatures

1. Metering Room Surround Panel	66.83	F
2. Cold Side Surround Panel	0.07	F

Results

1. Thermal Transmittance of Test Specimen (U_s)	0.37	Btu/hr·ft^2·F
2. Standardized Thermal Transmittance of Test Specimen (U_{st})	0.36	Btu/hr·ft^2·F

Thermal Transmittance (U-factor)

Calculated Test Data

CTS Method

1.	Warm Side Emittance of Glass (e_1)	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_{b1})	0.92	
8.	Equivalent Warm Side Surface Temperature	50.93	F
9.	Equivalent Cold Side Surface Temperature	4.66	F
10.	Warm Side Baffle Surface Temperature	69.57	F
11.	Measured Warm Side Surface Conductance (h_h)	1.39	Btu/hr·ft^2·F
12.	Measured Cold Side Surface Conductance (h_c)	5.17	Btu/hr·ft^2·F
13.	Test Specimen Thermal Conductance (C_s)	0.56	Btu/hr·ft^2·F
14.	Convection Coefficient (K_c)	0.31	Btu/(hr·ft^2·F$^{1.25}$)
15.	Radiative Test Specimen Heat Flow (Q_{r1})	603.99	Btu/hr
16.	Conductive Test Specimen Heat Flow (Q_{c1})	519.35	Btu/hr
17.	Radiative Heat Flux of Test Specimen (q_{r1})	14.05	Btu/hr·ft^2·F
18.	Convective Heat Flux of Test Specimen (q_{c1})	12.08	Btu/hr·ft^2·F
19.	Standardized Warm Side Surface Conductance (h_{sth})	1.20	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})	0.36	Btu/hr·ft^2·F

Test Duration

1. The environmental systems were started at 14:25 hours, 12/10/13.
2. The test parameters were considered stable for two consecutive four hour test periods from 23:05 hours, 12/10/13 to 07:05 hours, 12/11/13.
3. The thermal performance test results were derived from 03:05 hours, 12/11/13 to 07:05 hours, 12/11/13.

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

Glazing Deflection:

	Left Glazing	Right Glazing
Edge Gap Width	0.50"	0.50"
Estimated center gap width upon receipt of specimen in laboratory (after stabilization)	0.49"	0.58"
Center gap width at laboratory ambient conditions on day of testing	0.49"	0.58"
Center gap width at test conditions	0.41"	0.57"

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 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."

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.

ANSI/NCSL Z540-2-1997 type B uncertainty for this test was 1.69%.

Required annual calibrations for the Architectural Testing Inc. 'thermal test chamber' (ICN N000235) in St. Paul, Minnesota were last conducted in September 2012 in accordance with Architectural Testing Inc. calibration procedure. A CTS Calibration verification was performed November 2012. A Metering Box Wall Transducer and Surround Panel Flanking Loss Characterization was performed September 2012.

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: Greg Borchers

Greg S. Borchers
Technician

Reviewed By:

Digitally Signed by: Michael Resech

Michael P. Resech
Manager - Simulations and Thermal Testing
Individual-In-Responsible-Charge

GSB:gsb
C5085.01-201-46

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 (1)

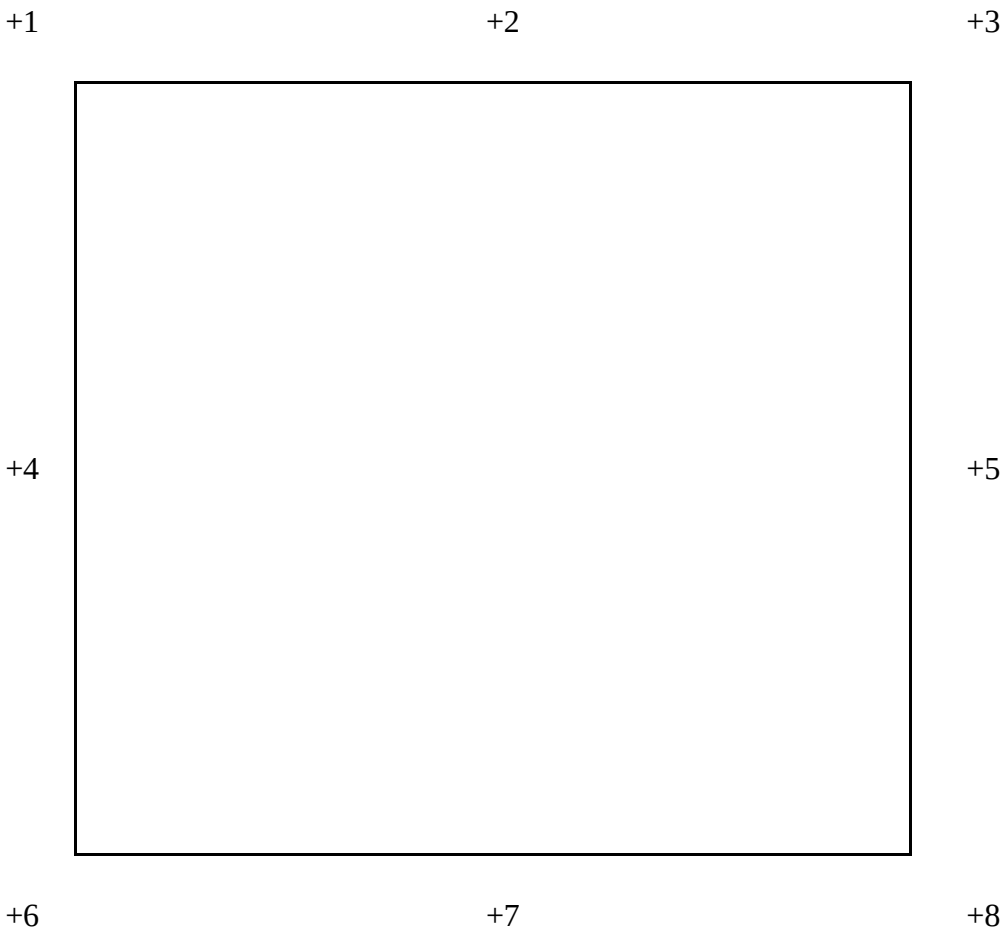
Revision Log

Rev. #	Date	Page(s)	Revision(s)
01-R0	12/11/13	All	Original Report Issue. Work requested by Philip Leonard of CMI Architectural Products, Inc.

Appendix A: CTS Calibration Data

1.	CTS Test Date	10/15/13	
2.	CTS Size	43.05	ft^2
3.	CTS Glass/Core Conductance	0.40	$Btu/hr \cdot ft^2 \cdot F$
4.	Warm Side Air Temperature	69.92	F
5.	Cold Side Air Temperature	-0.20	F
6.	Warm Side Average Surface Temperature	55.01	F
7.	Cold Side Average Surface Temperature	3.76	F
8.	Convection Coefficient (K_c)	0.31	$Btu/(hr \cdot ft^2 \cdot F^{1.25})$
9.	Measured Cold Side Surface Conductance (h_c)	5.17	$Btu/hr \cdot ft^2 \cdot F$
10.	Measured Thermal Transmittance	0.29	$Btu/hr \cdot ft^2 \cdot F$

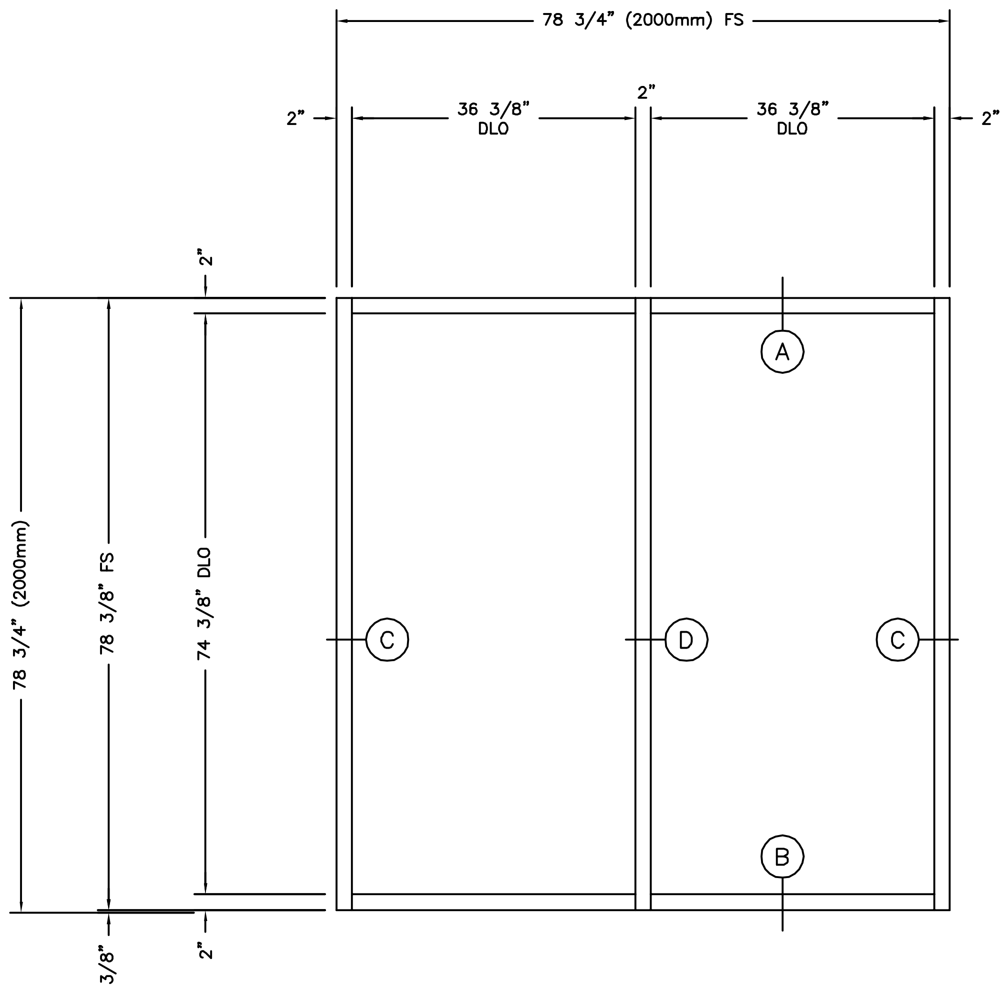
Appendix B: Surround Panel Wiring Diagram



Appendix C: Baffle Wiring Diagram

+1	+2	+3	+4	+5	+6
+7	+8	+9	+10	+11	+12
+13	+14	+15	+16	+17	+18
+19	+20	+21	+22	+23	+24
+25	+26	+27	+28	+29	+30

Appendix D: Submittal Form and Drawings

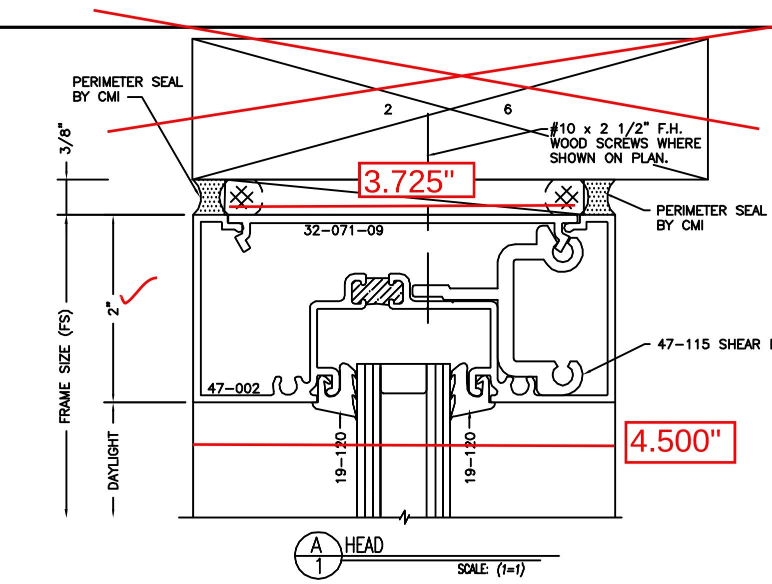


450TB-CG THERMAL TEST

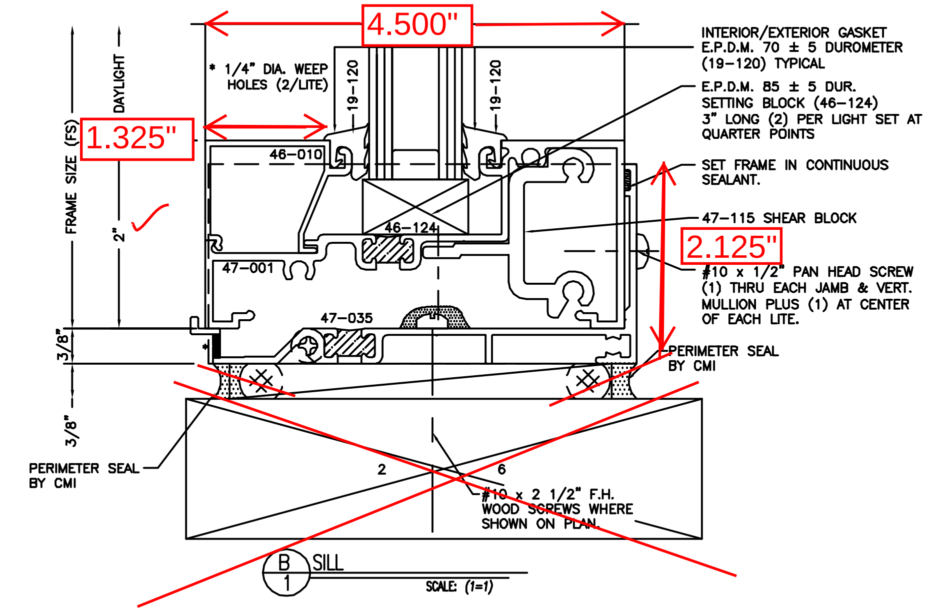
1" GLAZING

1 THUS
450TB-CG (2" x 4 1/2")

SCALE: 1/2"=1'-0"



A HEAD
SCALE: (1=1)



B SILL
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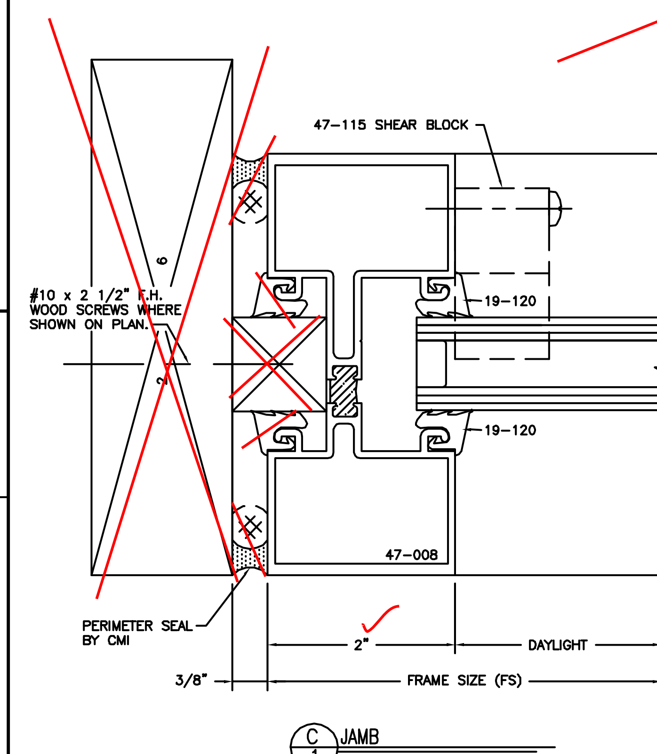
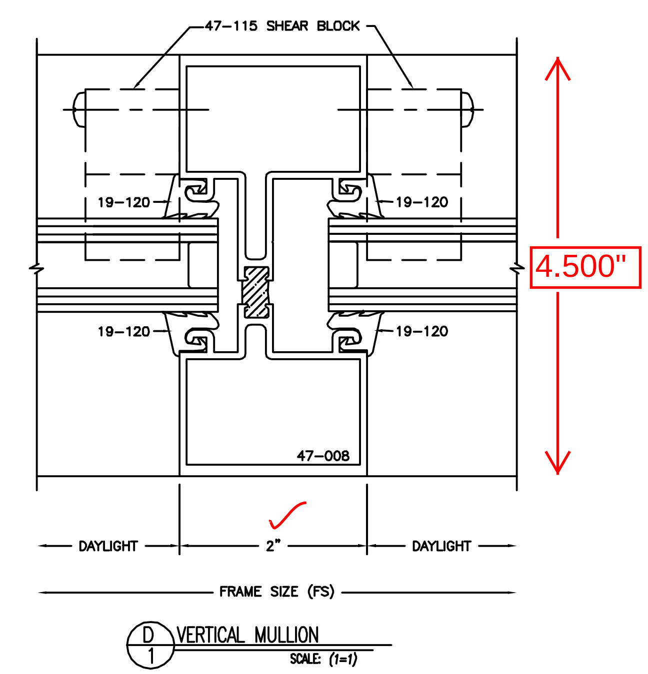


C JAMB
SCALE: (1=1)



D VERTICAL MULLION
SCALE: (1=1)

GLASS TYPE:

CLEAR 1" INSULATED GLASS UNITS
1/4" CLEAR WITH PPG SOLARBAN 60 SOLAR CONTROL LOW-E #2 ANNEALED
1/2" AIRSPACE - ALUMINUM SPACER / 90% ARGON FILLED
1/4" CLEAR ANNEALED

GLASS SIZE = 2 PIECES 37 1/8" x 75 1/8"

TESTING PARAMETERS:

AAMA 1503-09 VOLUNTARY TEST METHOD FOR THERMAL TRANSMITTANCE AND CONDENSATION RESISTANCE OF WINDOWS, DOORS AND GLAZED CURTAIN WALL SECTIONS.

NFRC 102-2010 PROCEDURE FOR MEASURING THE STEADY STATE THERMAL TRANSMITTANCE OF FENESTRATION SYSTEMS.

AAMA 507-03 STANDARD PRACTICE FOR DETERMINING THE THERMAL PERFORMANCE CHARACTERISTICS OF FENESTRATION SYSTEMS INSTALLED IN COMMERCIAL BUILDING.
- STANDARD AAMA 507 INSULATED GLASS UNIT COMPOSITION WITH ALUMINUM SPACER

NOTES:

FACTORY INSTALL FRAME IN WOOD BUCK PERIMETER

FACTORY INSTALL GLAZING

FACTORY INSTALL EXTERIOR AND INTERIOR PERIMETER CAULK SEAL TO WOOD BUCK PERIMETER

FACTORY INSTALL TEMPORARY DIAGONAL WOOD BRACING FOR SHIPPING PROTECTION.

CMI Architectural
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PROJECT: CMI THERMAL TEST
450TB CENTER GLAZED THERMAL WINDOW TEST

ARCHITECT:

GLAZING CONTRACTOR:

REVISIONS

REV	INT'L	DATE
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DATE DRAWN:

DRAWN BY: SOLD BY:

PO#:

SCALE: AS NOTED

PROJECT MGR.

CMI S.O.#

SHEET: 1