Architectural Testing

AAMA 1503-09 THERMAL PERFORMANCE TEST REPORT

Rendered to:

CMI ARCHITECTURAL PRODUCTS, INC.

SERIES/MODEL: 450TB - Center Glazed
TYPE: Glazed Wall Systems (Site-built)

Summary of Results			
Thermal Transmittance (U-Factor)			0.37
Condensation Resistance Factor - Frame (CRF_f)			64
Condensation Resistance Factor - Glass (CRF_g)			72
Unit Size:		78-7/8" x 78-1/2"	
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. C5085.02-201-46, 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

Architectural Testing

AAMA 1503-09 THERMAL PERFORMANCE TEST REPORT

Rendered to:

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

Report Number:	C5085.02-201-46
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)

Test Sample Submitted by: Client

Test Procedure: The condensation resistance factor (CRF) and thermal transmittance (U) were determined in accordance with AAMA 1503-09, *Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections*

1. Average warm side ambient temperature	69.80 F
2. Average cold side ambient temperature	-0.39 F
3. 15 mph dynamic wind applied to test specimen exterior.	
4. 0.0" $\pm$0.04" static pressure drop across specimen.	

Test Results Summary:

1. Condensation resistance factor - Frame (CRF_f)	64
Condensation resistance factor - Glass (CRF_g)	72
2. Thermal transmittance due to conduction (U)	0.37
(U-factors expressed in Btu/hr·ft^2·F)	

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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"		
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*	
Desiccant:		Yes	

**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			

Test Duration:

1. The environmental systems were started at 14:25 hours, 12/10/13.

2. The thermal performance test results were derived from 03:05 hours, 12/11/13 to 07:05 hours, 12/11/13.

Condensation Resistance Factor (CRF):

The following information, condensed from the test data, was used to determine the condensation resistance factor:

T_h	=	Warm side ambient air temperature	69.80 F
T_c	=	Cold side ambient air temperature	-0.39 F
FT_p	=	Average of pre-specified frame temperatures (14)	44.53 F
FT_r	=	Average of roving thermocouples (4)	40.60 F
W	=	$[(FT_p - FT_r) / (FT_p - (T_c + 10))] \times 0.40$	0.045
FT	=	$FT_p(1-W) + W (FT_r)$ = Frame Temperature	44.31 F
GT	=	Glass Temperature	49.88 F
CRF_g	=	Condensation resistance factor – Glass	72
		$CRF_g = (GT - T_c) / (T_h - T_c) \times 100$	
CRF_f	=	Condensation resistance factor – Frame	64
		$CRF_f = (FT - T_c) / (T_h - T_c) \times 100$	

The CRF number was determined to be 64 (on the size as reported). When reviewing this test data, it should be noted that the frame temperature (FT) was colder than the glass temperature (GT) therefore controlling the CRF number. Refer to the 'CRF Report' page and the 'Thermocouple Location Diagram' page of this report.

Thermal Transmittance (U_c):

T_h	=	Average warm side ambient temperature	69.80	F
T_c	=	Average cold side ambient temperature	-0.39	F
P	=	Static pressure difference across test specimen 15 mph dynamic perpendicular wind at exterior	0.00	psf
Nominal sample area			43.00	ft^2
Total measured input to calorimeter			1231.65	Btu/hr
Calorimeter correction			108.32	Btu/hr
Net specimen heat loss			1123.34	Btu/hr
U	=	Thermal Transmittance	0.37	$Btu/hr \cdot ft^2 \cdot F$

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"

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.

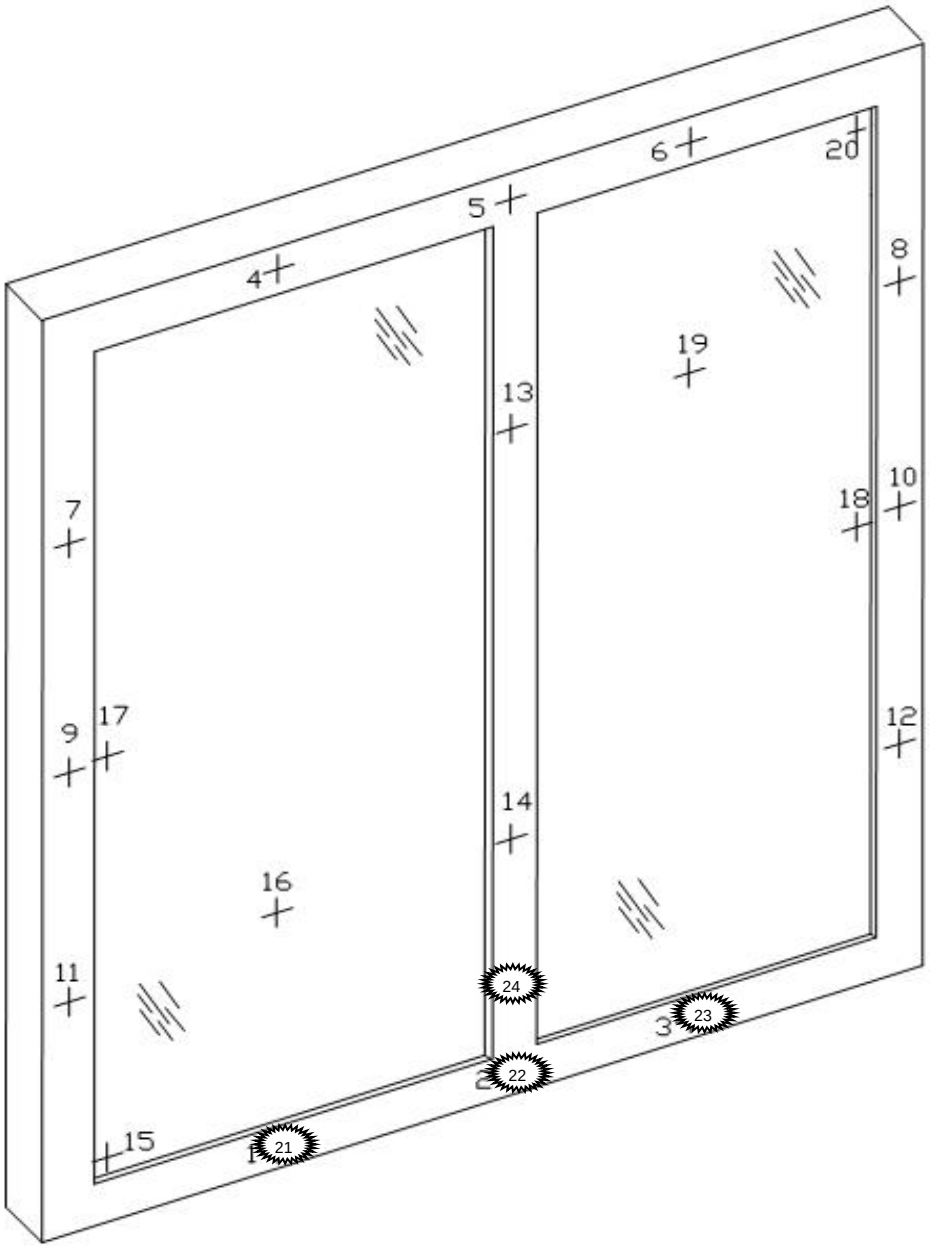
Prior to testing the specimen was sealed with silicone on the interior side and checked for air infiltration per Section 9.3.4.

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.

CRF Report

Time:	05:05	05:35	06:05	06:35	07:05	AVERAGE
Pre-specified Thermocouples - Frame						
1	37.41	37.42	37.42	37.41	37.41	37.42
2	40.65	40.61	40.65	40.66	40.64	40.64
3	40.18	40.19	40.20	40.19	40.19	40.19
4	47.90	47.90	47.94	47.93	47.91	47.92
5	42.46	42.46	42.45	42.50	42.41	42.45
6	46.65	46.66	46.66	46.67	46.67	46.66
7	47.12	47.15	47.14	47.16	47.14	47.14
8	49.09	49.08	49.09	49.09	49.10	49.09
9	45.30	45.31	45.31	45.33	45.30	45.31
10	47.20	47.18	47.20	47.22	47.21	47.20
11	42.90	42.92	42.92	42.96	42.90	42.92
12	44.22	44.21	44.26	44.27	44.28	44.25
13	46.12	46.14	46.14	46.16	46.15	46.14
14	46.07	46.09	46.09	46.10	46.06	46.08
FT_P	44.52	44.52	44.53	44.55	44.53	44.53
Pre-specified Thermocouples - Glass						
15	37.31	37.34	37.36	37.36	37.33	37.34
16	55.33	55.33	55.32	55.35	55.31	55.33
17	46.57	46.58	46.58	46.57	46.56	46.57
18	51.27	51.28	51.27	51.31	51.29	51.28
19	58.19	58.19	58.21	58.18	58.18	58.19
20	50.55	50.63	50.61	50.58	50.62	50.60
GT	49.87	49.89	49.89	49.89	49.88	49.88
Cold Point (Roving) Thermocouples						
21	37.41	37.42	37.42	37.41	37.41	37.41
22	40.65	60.61	40.65	40.66	40.64	44.64
23	40.18	40.19	40.20	40.19	40.19	40.19
24	40.16	40.14	40.13	40.15	40.15	40.15
FT_R	39.60	44.59	39.60	39.60	39.60	40.60
W	0.06	0.00	0.06	0.06	0.06	0.05
FT	44.24	44.52	44.25	44.27	44.25	44.31
Warm Side - Room Ambient Air Temperature						
	69.78	69.79	69.81	69.81	69.81	69.80
Cold Side - Room Ambient Air Temperature						
	-0.40	-0.34	-0.39	-0.41	-0.44	-0.39
CRF_f	64	64	64	64	64	64
CRF_g	72	72	72	72	72	72

Thermocouple Location Diagram



Cold Point Locations

21. 37.41
22. 44.64
23. 40.19
24. 40.15

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. 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.

Digitally Signed by: Greg Borchers

Greg S. Borchers
Technician

Digitally Signed by: Michael Resech

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

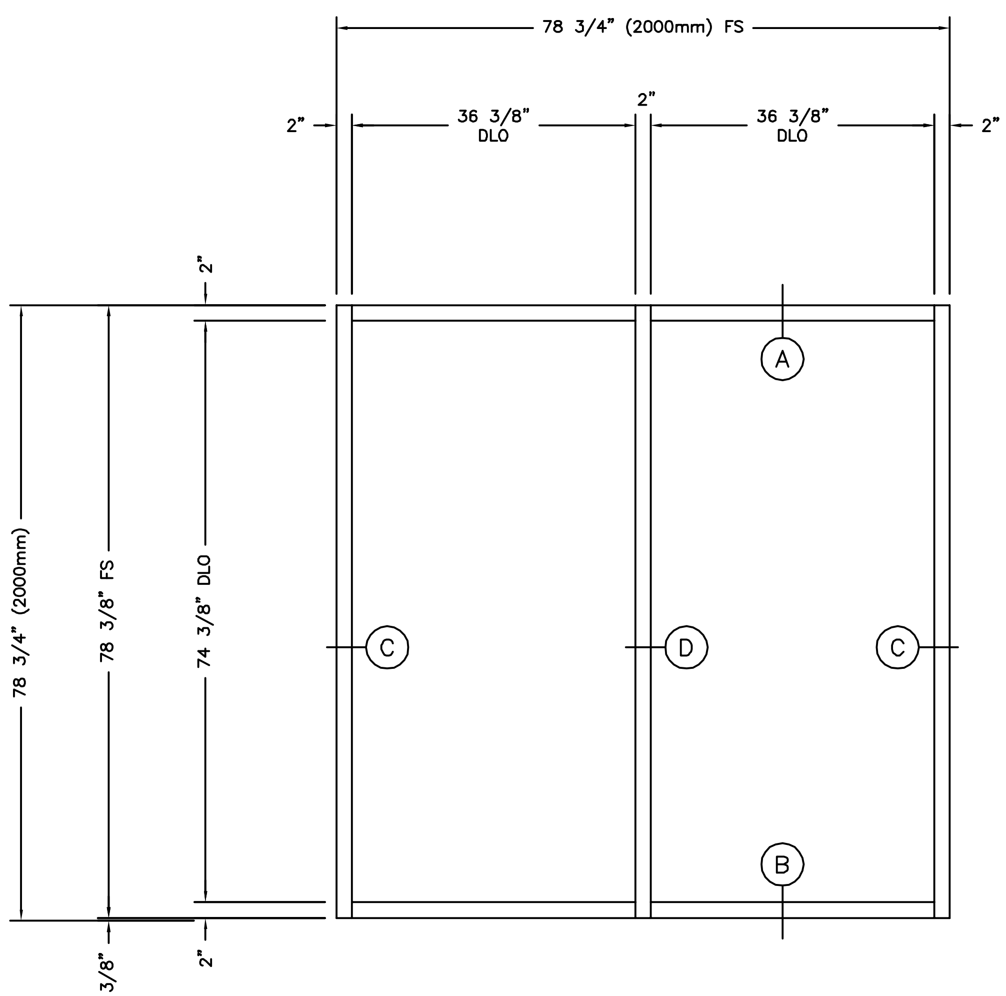
GSB:gsb
C5085.02-201-46

Attachments (pages): This report is complete only when all attachments listed are included.
Appendix-A: Drawings (1)

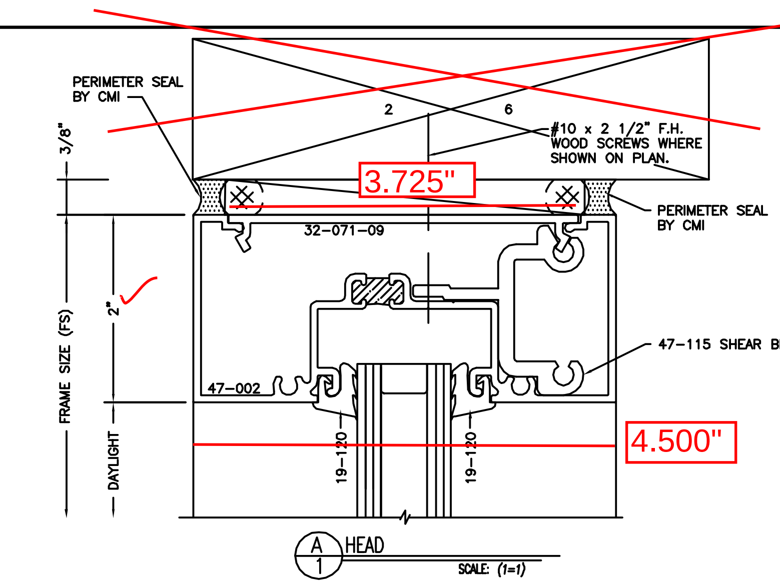
Revision Log

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

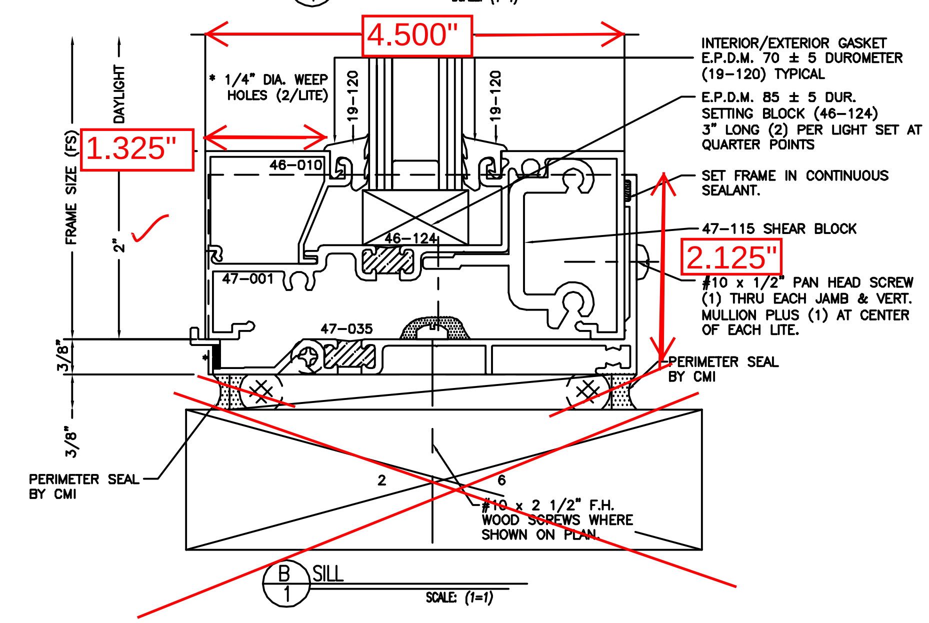
Appendix A: Drawings



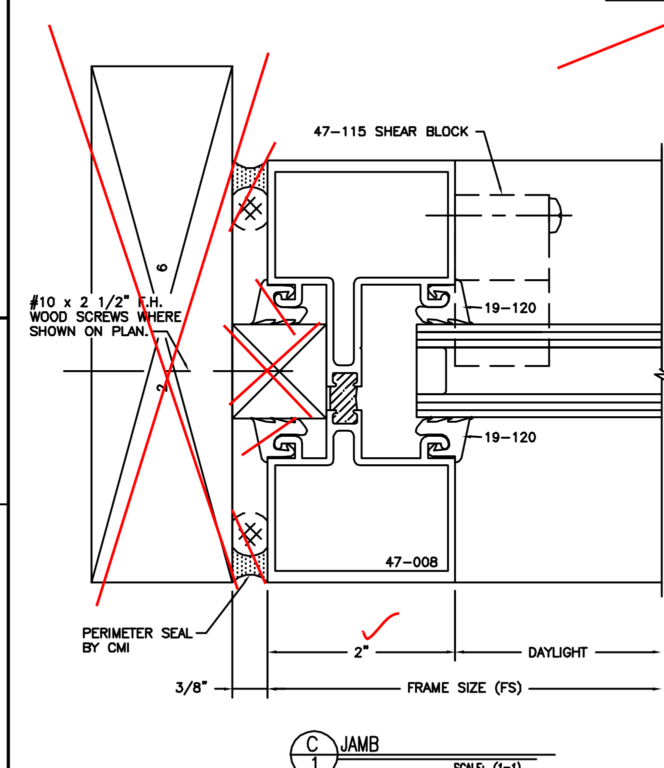
450TB-CG THERMAL TEST — 1" GLAZING
1 THUS
450TB-CG (2" x 4 1/2") — SCALE: 1/2"=1'-0"



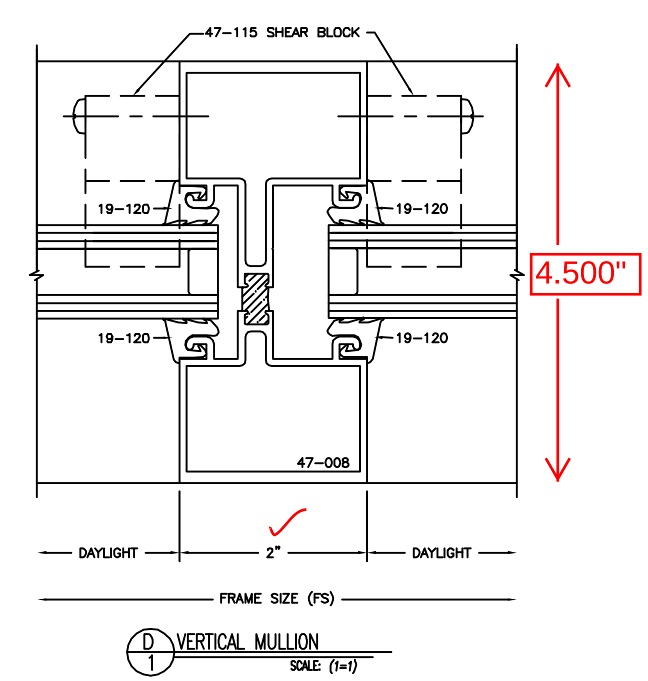
A HEAD 1 — SCALE: (1=1)



B SILL 1 — SCALE: (1=1)



C JAMB 1 — SCALE: (1=1)



D VERTICAL MULLION 1 — 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.

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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