Architectural Testing

AAMA 1503-09 THERMAL PERFORMANCE TEST REPORT

Rendered to:

CMI ARCHITECTURAL PRODUCTS, INC.

SERIES/MODEL: CTS Thermal Clip Framing System
TYPE: Glazed Wall Systems (Site-built)

Summary of Results	
Thermal Transmittance (U-Factor)	0.33
Condensation Resistance Factor - Frame (CRF_f)	78
Condensation Resistance Factor - Glass (CRF_g)	76
Unit Size	79" x 79" (2007 mm x 2007 mm)
Layer 1	1/4" PPG Solarban 60 LowE (e=0.035*, #2)
Gap 1	0.50" Gap, Thermo-plastic w/ stainless steel substrate Spacer (TS-D), 90% Argon-Filled*
Layer 2	1/4" Clear

Reference must be made to Report No. A2259.02-201-46, dated 07/28/10 for complete test specimen description and data.

849 Western Avenue North
St. Paul, MN 55117
phone: 651-636-3835
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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:	A2259.02-201-46
Test Date:	06/29/10
Report Date:	07/28/10
Test Record Retention Date:	06/29/14

Test Sample Identification:

Series/Model: CTS Thermal Clip Framing System

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	70.70 F
2. Average cold side ambient temperature	-0.09 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)	78
Condensation resistance factor - Glass (CRF_g)	76
2. Thermal transmittance due to conduction (U)	0.33
(U-factors expressed in Btu/hr·ft^2·F)	

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Test Sample Description:

CONSTRUCTION	**Frame**
Size (in.)	79 x 79
Daylight Opening (in.)	36-3/4 x 75-1/4 (x2)
CORNERS	Butt
Fasteners	Screws
Sealant	Yes
MATERIAL	AT (1.00")
Color Exterior	Gray
Finish Exterior	Anodized
Color Interior	Gray
Finish Interior	Anodized
GLAZING METHOD	Pressure

Glazing Information:

Layer 1	1/4" PPG Solarban 60 LowE (e=0.035*, #2)
Gap 1	0.50" Gap, Thermo-plastic w/ stainless steel substrate Spacer (TS-D), 90% Argon-Filled*
Layer 2	1/4" Clear
Gas Fill Method	Single-Probe Method*
Desiccant	Yes

**Stated per Client/Manufacturer*
NA Non-Applicable
See Description Table Abbreviations

Test Sample Description: (Continued)

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

Test Duration:

1. The environmental systems were started at 14:50 hours, 06/28/10.

2. The thermal performance test results were derived from 05:12 hours, 06/29/10 to 09:12 hours, 06/29/10.

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	70.70 F
T_c	=	Cold side ambient air temperature	-0.09 F
FT_p	=	Average of pre-specified frame temperatures (14)	55.10 F
FT_r	=	Average of roving thermocouples (4)	49.78 F
W	=	$[(FT_p - FT_r) / (FT_p - (T_c + 10))] \times 0.40$	0.047
FT	=	$FT_p(1-W) + W (FT_r)$ = Frame Temperature	54.85 F
GT	=	Glass Temperature	53.54 F
CRF_g	=	Condensation resistance factor – Glass	76
		$CRF_g = (GT - T_c) / (T_h - T_c) \times 100$	
CRF_f	=	Condensation resistance factor – Frame	78
		$CRF_f = (FT - T_c) / (T_h - T_c) \times 100$	

The CRF number was determined to be 76 (on the size as reported). When reviewing this test data, it should be noted that the glass temperature (GT) was colder than the frame temperature (FT) 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	70.70	F
T_c	=	Average cold side ambient temperature	-0.09	F
P	=	Static pressure difference across test specimen	0.00	psf
		15 mph dynamic perpendicular wind at exterior		
Nominal sample area			43.34	ft^2
Total measured input to calorimeter			1098.31	Btu/hr
Calorimeter correction			84.05	Btu/hr
Net specimen heat loss			1014.27	Btu/hr
U	=	Thermal Transmittance	0.33	$Btu/hr \cdot ft^2 \cdot F$

Glazing Deflection (in.):

	Left Glazing	Right Glazing
Edge Gap Width	0.50	0.50
Estimated center gap width upon receipt of specimen in laboratory (after stabilization)	0.54	0.49
Center gap width at laboratory ambient conditions on day of testing	0.54	0.49
Center gap width at test conditions	0.47	0.45

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.

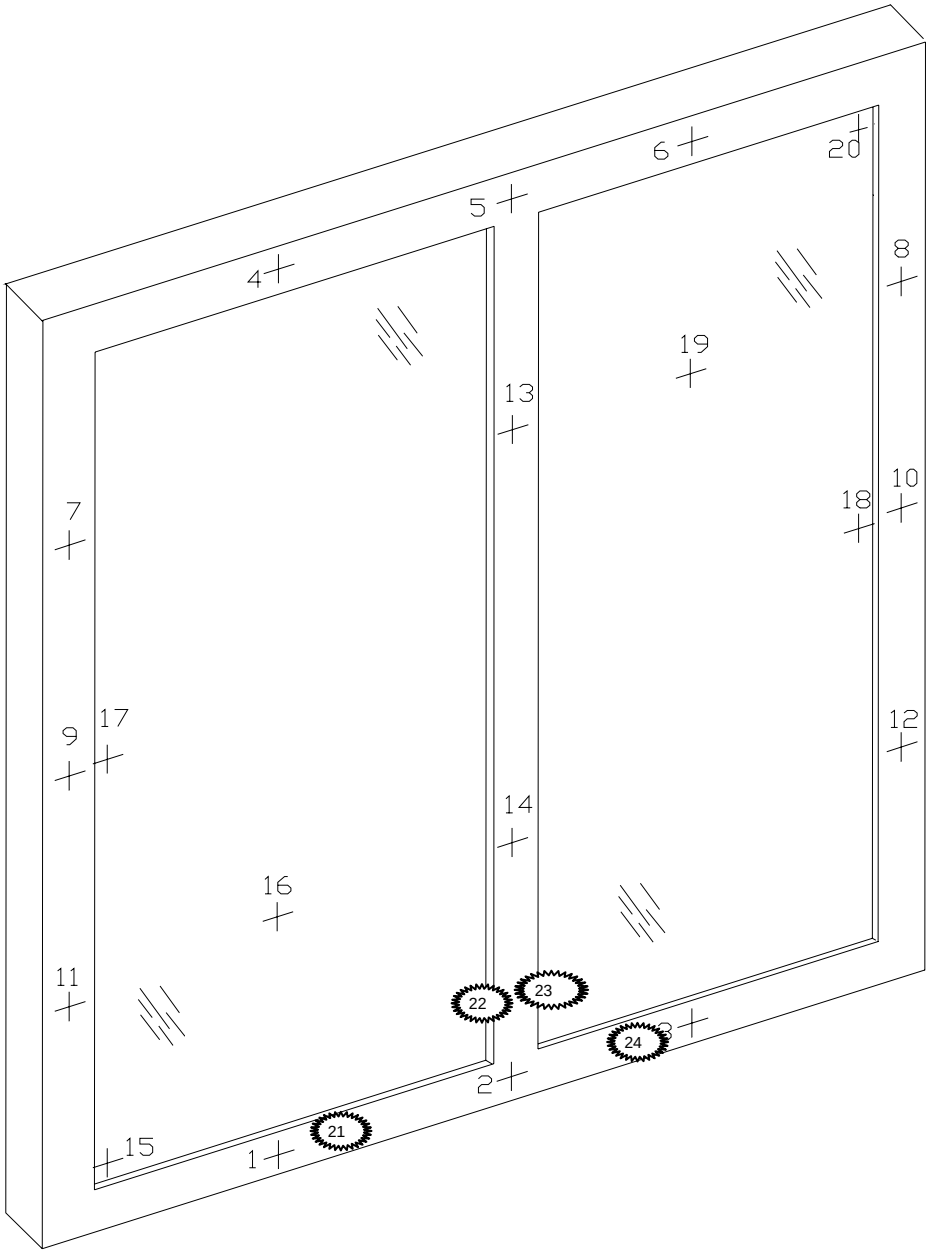
A calibration of the Architectural Testing Inc. 'thermal test chamber' (ICN N000235) in St. Paul, Minnesota was conducted in October 2009 in accordance with Architectural Testing Inc. calibration procedure.

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

CRF Report

Time:	07:12	07:42	08:12	08:42	09:12	AVERAGE
Pre-specified Thermocouples - Frame						
1	49.13	49.14	49.12	49.14	49.08	49.12
2	51.59	51.62	51.60	51.57	51.56	51.59
3	50.31	50.31	50.30	50.31	50.27	50.30
4	55.36	55.32	55.32	55.33	55.31	55.33
5	58.27	58.27	58.32	58.27	58.26	58.28
6	60.28	60.36	60.33	60.32	60.34	60.33
7	56.39	56.41	56.39	56.41	56.37	56.39
8	58.85	58.88	58.87	58.90	58.84	58.87
9	54.62	54.61	54.61	54.62	54.61	54.61
10	55.84	55.86	55.86	55.87	55.83	55.85
11	50.90	50.90	50.89	50.89	50.88	50.89
12	51.65	51.65	51.62	51.65	51.62	51.64
13	60.16	60.14	60.15	60.19	60.13	60.15
14	58.09	58.10	58.09	58.12	58.08	58.10
FT_P	55.10	55.11	55.10	55.11	55.08	55.10
Pre-specified Thermocouples - Glass						
15	42.96	42.99	42.97	42.96	42.96	42.97
16	56.00	55.99	55.97	56.02	55.96	55.99
17	52.30	52.27	52.27	52.28	52.25	52.27
18	54.58	54.61	54.60	54.63	54.63	54.61
19	59.33	59.38	59.34	59.36	59.35	59.35
20	56.02	56.05	56.05	56.07	56.07	56.05
GT	53.53	53.55	53.53	53.55	53.54	53.54
Cold Point (Roving) Thermocouples						
21	49.13	49.14	49.12	49.14	49.08	49.12
22	49.65	49.70	49.70	49.67	49.66	49.68
23	50.01	50.00	50.02	50.00	50.00	50.01
24	50.31	50.31	50.30	50.31	50.27	50.30
FT_R	49.78	49.79	49.79	49.78	49.75	49.78
W	0.05	0.05	0.05	0.05	0.05	0.05
FT	54.85	54.86	54.85	54.86	54.83	54.85
Warm Side - Room Ambient Air Temperature						
	70.69	70.71	70.70	70.71	70.69	70.70
Cold Side - Room Ambient Air Temperature						
	-0.08	-0.08	-0.10	-0.06	-0.13	-0.09
CRF_f	78	78	78	78	78	78
CRF_g	76	76	76	76	76	76

Thermocouple Location Diagram



Cold Point Locations

21. 49.12
22. 49.68
23. 50.01
24. 50.30

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: John A. Westlund

John A. Westlund
Technician

Digitally Signed by: Michael Resech

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

JAW:jaw
A2259.02-201-46

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

Revision Log

Rev. #	Date	Page(s)	Revision(s)
0	07/28/10	All	Original Report Issue. Work requested by Phillip Leonard of CMI Architectural Products, Inc.

Appendix A: Description Table Abbreviations

CODE	Frame / Sash Types
AI	Aluminum w/ Vinyl Inserts (Caps)
AL	Aluminum
AP	Aluminum w/ Thermal Breaks - Partial
AS	Aluminum w/ Steel Reinforcement
AT	Aluminum w/ Thermal Breaks - All Members (≥ 0.21")
AU	Aluminum Thermally Improved - All Members (0.062" - 0.209")
AV	Aluminum / Vinyl Composite
AW	Aluminum-clad Wood
FG	Fiberglass
PA	ABS Plastic w/ All Members Reinforced
PC	ABS Plastic-clad Aluminum
PF	ABS Plastic w/ Foam-filled Insulation
PH	ABS Plastic w/ Horizontal Members Reinforced
PI	ABS Plastic w/ Reinforcement - Interlock
PL	ABS Plastic
PP	ABS Plastic w/ Reinforcement - Partial
PV	ABS Plastic w/ Vertical Members Reinforced
PW	ABS Plastic-clad Wood
ST	Steel
VA	Vinyl w/ All Members Reinforced
VC	Vinyl-clad Aluminum
VF	Vinyl w/ Foam-filled Insulation
VH	Vinyl w/ Horizontal Members Reinforced
VI	Vinyl w/ Reinforcement - Interlock
VP	Vinyl w/ Reinforcement - Partial
VV	Vinyl w/ Vertical Members Reinforced
VW	Vinyl-clad Wood
VY	Vinyl
WA	Aluminum / Wood composite
WD	Wood
WV	Vinyl / Wood composite
WF	Fiberglass/Wood Combination
WC	Composite/Wood Composite (Shaped vinyl/wood composite members)
CW	Copper Clad Wood
CO	Vinyl/Wood Composite Material

CODE	Spacer Types (See sealant)
A1	Aluminum
A2	Aluminum (Thermally-broken)
A3	Aluminum-reinforced Polymer
A4	Aluminum / Wood
A5	Aluminum-reinforced Butyl (Swiggle)
A6	Aluminum / Foam / Aluminum
A7	Aluminum U-shaped
A8	Aluminum-Butyl (Corrugated) (Duraseal)
ER	EPDM Reinforced Butyl
FG	Fiberglass
GL	Glass
OF	Organic Foam
P1	Duralite
PU	Polyurethane Foam
SU	Stainless Steel, U-shaped
CU	Coated Steel, U-shaped (Intercept)
S2	Steel (Thermally-broken)
S3	Steel / Foam / Steel
S5	Steel-reinforced Butyl
S6	Steel U-channel w/ Thermal Cap
SS	Stainless Steel
CS	Coated Steel
TP	Thermo-plastic
WD	Wood
ZE	Elastomeric Silicone Foam
ZF	Silicone Foam
ZS	Silicone / Steel
N	Not Applicable
TS	Thermo-plastic w/ stainless steel substrate

CODE	Tint Codes
AZ	Azurlite
BL	Blue
BZ	Bronze
CL	Clear
EV	Evergreen
GD	Gold
GR	Green
GY	Gray
LE	Low 'e' Coating
OT	Other (use comment field)
RC	Solar or Reflective Coating
RG	Roller Shades between glazing
RS	Silver (reflective coating)
SF	Suspended Polyester Film
SR	Silver
BG	Blinds between the Glazing
DV	Dynamic Glazing-Variable
DY	Dynamic Glazing-NonVariable

CODE	Gap Fill Codes
AIR	Air
AR2	Argon/Krypton Mixture
AR3	Argon / Krypton / Air
ARG	Argon/Air
CO2	Carbon Dioxide
KRY	Krypton/Air
SF6	Sulfur Hexaflouride
XE2	Xenon/Krypton/Air
XE3	Xenon/Argon/Air
XEN	Xenon/Air
N	Not Applicable

DOOR DETAILS	
N	Not Applicable
CODE	Door Type
EM	Embossed
FL	Flush
LF	Full Lite
LH	1/2 - Lite
LQ	1/4 - Lite
LT	3/4 - Lite
RP	Raised Panel
CODE	Skin
AL	Aluminum
FG	Fiberglass
GS	Galvanized Steel
ST	Steel
WD	Wood
VY	Vinyl
CODE	Panel
FG	Fiberglass
PL	Plastic
WP	Wood - Plywood
WS	Wood - Solid
CODE	Sub-Structure
GS	Galvanized Steel
ST	Steel
WD	Wood
VY	Vinyl
CODE	Core Fill
CH	Cellular - Honeycomb
EP	Expanded Polystyrene
PI	Polyisocyanurate
PU	Polyurethane
WP	Wood - Plywood
WS	Wood - Solid
XP	Extruded Polystyrene

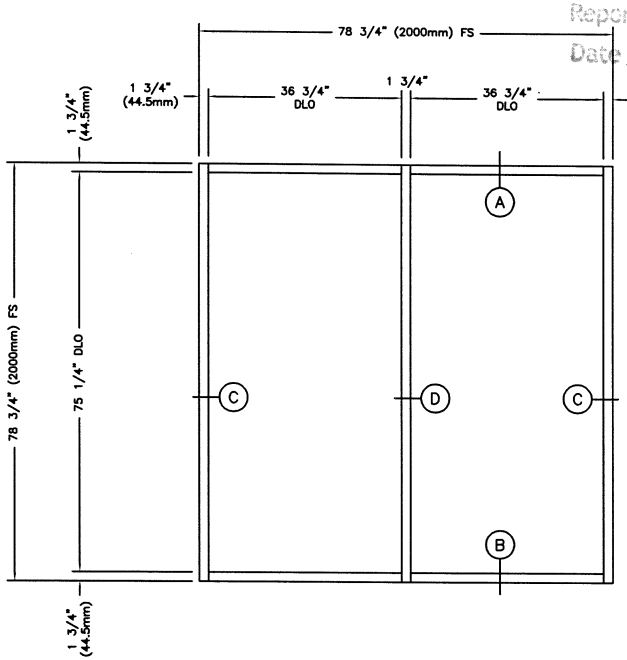
CODE	Spacer Sealant
D	Dual Seal Spacer System
S	Single Seal Spacer System

CODE	Grid Description
N	No Muntins
G	Grids between glass
S	Simulated Divided Lites
T	True Muntins

CODE	Grid Size Codes
	Blank for no grids
0.75	Grids < 1"
1.5	Grids >= 1"

CODE	Thermal Breaks
F	Foam
U	Urethane
V	Vinyl
FB	Fiberglass
O	Other
AB	ABS
NE	Neoprene
AI	Air
N	Not Applicable
P	Polyamide

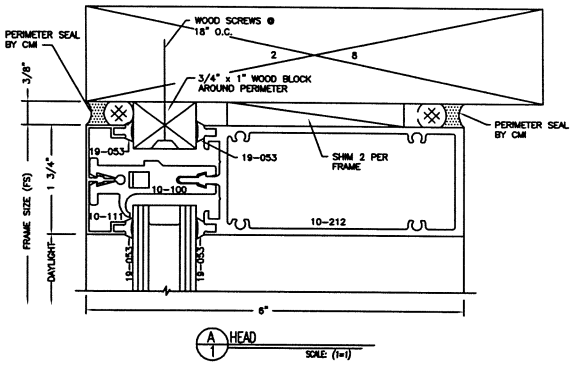
Appendix B: Drawings



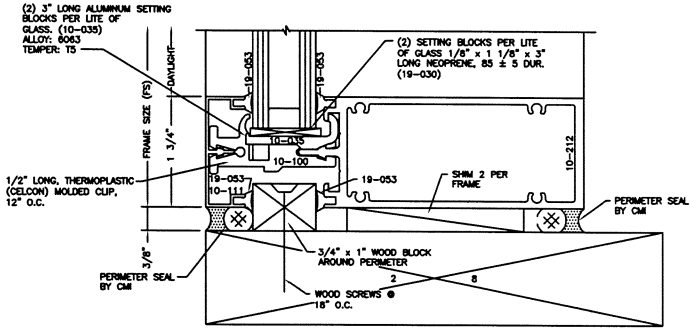
1 3/4"x6" CTS THERMAL TEST — 1" GLAZING

1 THUS
CTS (1 3/4" x 6")

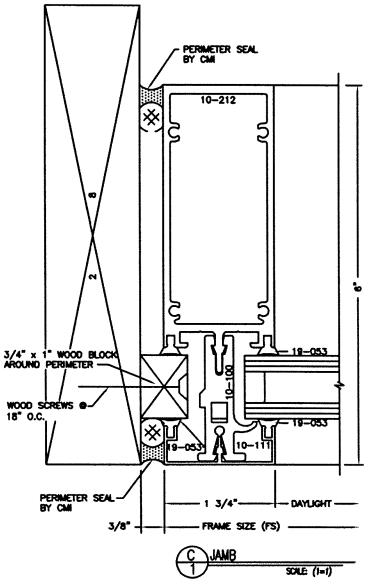
SCALE: 1/2"=1'-0"



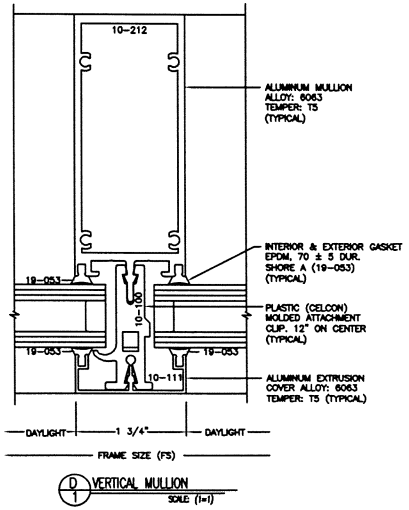
A 1 HEAD
SCALE: (1=1)



B 1 SILL
SCALE: (1=1)



C 1 JAMB
SCALE: (1=1)



D 1 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 – TECHNOFORM I-SPACER WARM EDGE SPACER / 90% ARGON FILLED
1/4" CLEAR ANNEALED

GLASS SIZE = 2 PIECES 37 3/4" x 76 1/4"

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 PRODUCTS, INC.
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PROJECT: CMI THERMAL TEST
CTS THERMAL WINDOW TEST

ARCHITECT:

GLAZING CONTRACTOR:

REVISIONS

REV	INT'L	DATE

DATE DRAWN: 2-23-10
DRAWN BY: BEW
SOLD BY: PJL
PO#:
SCALE: AS NOTED
PROJECT MGR.
CMI S.O.#
SHEET: 1