

**AAMA 1503-09 THERMAL PERFORMANCE  
TEST REPORT**

**Rendered to:**

**UNITED STATES ALUMINUM**

**SERIES/MODEL: 4250 Curtain Wall**  
**TYPE: Glazed Wall Systems (Site-built)**

Summary of Results	
Thermal Transmittance (U-Factor)	0.49
Condensation Resistance Factor - Frame (CRF <sub>f</sub> )	62
Condensation Resistance Factor - Glass (CRF <sub>g</sub> )	63
Unit Size	78-7/8" x 78-3/4" (2003 mm x 2000 mm)
Layer 1	1/4" AGC Comfort TiAC 36 (e=0.034*, #2) Tempered
Gap 1	0.50" Gap, Aluminum Spacer (A1-D), Air-Filled*
Layer 2	1/4" Clear Tempered

Reference must be made to Report No. 94234.02-116-46, dated 11/24/09 for complete test specimen description and data.

**AAMA 1503-09 THERMAL PERFORMANCE TEST REPORT**

Rendered to:

UNITED STATES ALUMINUM  
200 Singleton Drive  
Waxahachie, Texas 75165

Report Number: 94234.02-116-46  
Test Date: 10/28/09  
Report Date: 11/24/09  
Expiration Date: 10/28/13

**Test Sample Identification:**

**Series/Model:** 4250 Curtain Wall

**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 <sub>f</sub> ) | 62   |
| Condensation resistance factor - Glass (CRF <sub>g</sub> )    | 63   |
| 2. Thermal transmittance due to conduction (U <sub>c</sub> )  | 0.49 |
| (U-factors expressed in Btu/hr·ft <sup>2</sup> ·F)            |      |

**Test Sample Description:**

<b>CONSTRUCTION</b>	<b>Frame</b>
Size (in.) Non-Standard	78-7/8" x 78-3/4"
Daylight Opening (in.)	35-1/2" x 73-5/8" (x2)
<b>CORNERS</b>	Butted
Fasteners	Screws
Sealant	No
<b>MATERIAL</b>	AU (0.15") Skipped and Debridged*
Color Exterior	Gray
Finish Exterior	Anodized
Color Interior	Gray
Finish Interior	Anodized
<b>GLAZING METHOD</b>	Interior

\* Measurements for the skipped and debridged were: 1-1/2" Skip and 18" on-center .

**Glazing Information:**

<b>Layer 1</b>	1/4" AGC Comfort TiAC 36 (e=0.034*, #2) Tempered
<b>Gap 1</b>	0.50" Gap, Aluminum Spacer (A1-D), Air-Filled*
<b>Layer 2</b>	1/4" Clear Tempered
<b>Gas Fill Method</b>	N/A*
<b>Desiccant</b>	Yes

*\*Stated per Client/Manufacturer*

*NA Non-Applicable*

*See Description Table Abbreviations*

**Test Sample Description:** (Continued)

<b>COMPONENTS</b>			
	<b>Type</b>	<b>Quantity</b>	<b>Location</b>
<b>WEATHERSTRIP</b>			
	EPDM wedge gasket	1 row	Interior glazing perimeter
	Foam compression gasket	1 row	Exterior glazing perimeter
<b>HARDWARE</b>			
	Horizontal face cap	4	Exterior horizontals
	Vertical face cap	1	Exterior verticals
	(1.00" x 0.75") Wood blocks	6	Four horizontals, two verticals
<b>DRAINAGE</b>			
	No visible weeps		

### Test Duration:

1. The environmental systems were started at 07:00 hours, 10/27/09.
2. The thermal performance test results were derived from 13:04 hours, 10/28/09 to 17:04 hours, 10/28/09.

### 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)	43.21 F
$FT_r$	=	Average of roving thermocouples (4)	38.05 F
$W$	=	$(FT_p - FT_r) / [FT_p - (T_c + 10)] \times 0.40$	0.061
$FT$	=	$FT_p(1-W) + W (FT_r)$ = Frame Temperature	42.90 F
$GT$	=	Glass Temperature	43.89 F
$CRF_g$	=	Condensation resistance factor – Glass	63
		$CRF_g = (GT - T_c) / (T_h - T_c) \times 100$	
$CRF_f$	=	Condensation resistance factor – Frame	62
		$CRF_f = (FT - T_c) / (T_h - T_c) \times 100$	

The CRF number was determined to be 62 (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	0.00 psf
		15 mph dynamic perpendicular wind at exterior	
Nominal sample area			43.13 ft <sup>2</sup>
Total measured input to calorimeter			1585.11 Btu/hr
Calorimeter correction			111.10 Btu/hr
Net specimen heat loss			1474.01 Btu/hr
$U_c$	=	Thermal Transmittance	0.49 Btu/hr·ft <sup>2</sup> ·F

**Glazing Deflection (in.):**

	<b>Left Glazing</b>	<b>Right Glazing</b>
Edge Gap Width	0.50	0.50
Estimated center gap width upon receipt of specimen in laboratory (after stabilization)	0.38	0.38
Center gap width at laboratory ambient conditions on day of testing	0.38	0.38
Center gap width at test conditions	0.38	0.38

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 000001) in York, Pennsylvania was conducted in April 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: 15:04 15:34 16:04 16:34 17:04 AVERAGE

### Pre-specified Thermocouples - Frame

1	40.60	40.55	40.51	40.49	40.46	40.52
2	40.49	40.47	40.44	40.44	40.26	40.42
3	40.36	40.32	40.27	40.24	40.04	40.25
4	46.40	46.43	46.44	46.44	46.38	46.42
5	47.13	47.13	47.14	47.12	47.13	47.13
6	46.52	46.46	46.43	46.53	46.46	46.48
7	43.02	43.03	42.95	42.86	42.78	42.93
8	44.32	44.30	44.31	44.16	44.10	44.24
9	41.44	41.08	41.82	41.58	41.55	41.49
10	42.68	42.49	42.50	42.48	42.80	42.59
11	40.02	40.24	40.16	40.28	40.20	40.18
12	39.64	39.56	39.63	39.80	39.74	39.68
13	48.69	48.67	48.65	48.80	48.85	48.73
14	44.09	44.07	43.75	43.66	44.17	43.95
FTP	43.24	43.20	43.21	43.21	43.21	43.21

### Pre-specified Thermocouples - Glass

15	33.57	33.42	33.34	33.28	33.37	33.40
16	52.44	52.40	52.41	52.38	52.37	52.40
17	40.23	40.24	40.24	40.23	40.20	40.23
18	41.89	41.89	41.94	41.90	41.90	41.91
19	53.95	53.97	53.93	53.94	53.94	53.95
20	41.57	41.51	41.46	41.47	41.41	41.48
GT	43.94	43.91	43.89	43.87	43.87	43.89

### Cold Point (Roving) Thermocouples

21	36.40	36.40	36.40	36.40	36.40	36.40
22	38.50	38.50	38.50	38.50	38.50	38.50
23	38.60	38.60	38.60	38.60	38.60	38.60
24	38.70	38.70	38.70	38.70	38.70	38.70
FT <sub>R</sub>	38.05	38.05	38.05	38.05	38.05	38.05
W	0.06	0.06	0.06	0.06	0.06	0.06
FT	42.92	42.88	42.90	42.89	42.89	42.90

### Warm Side - Room Ambient Air Temperature

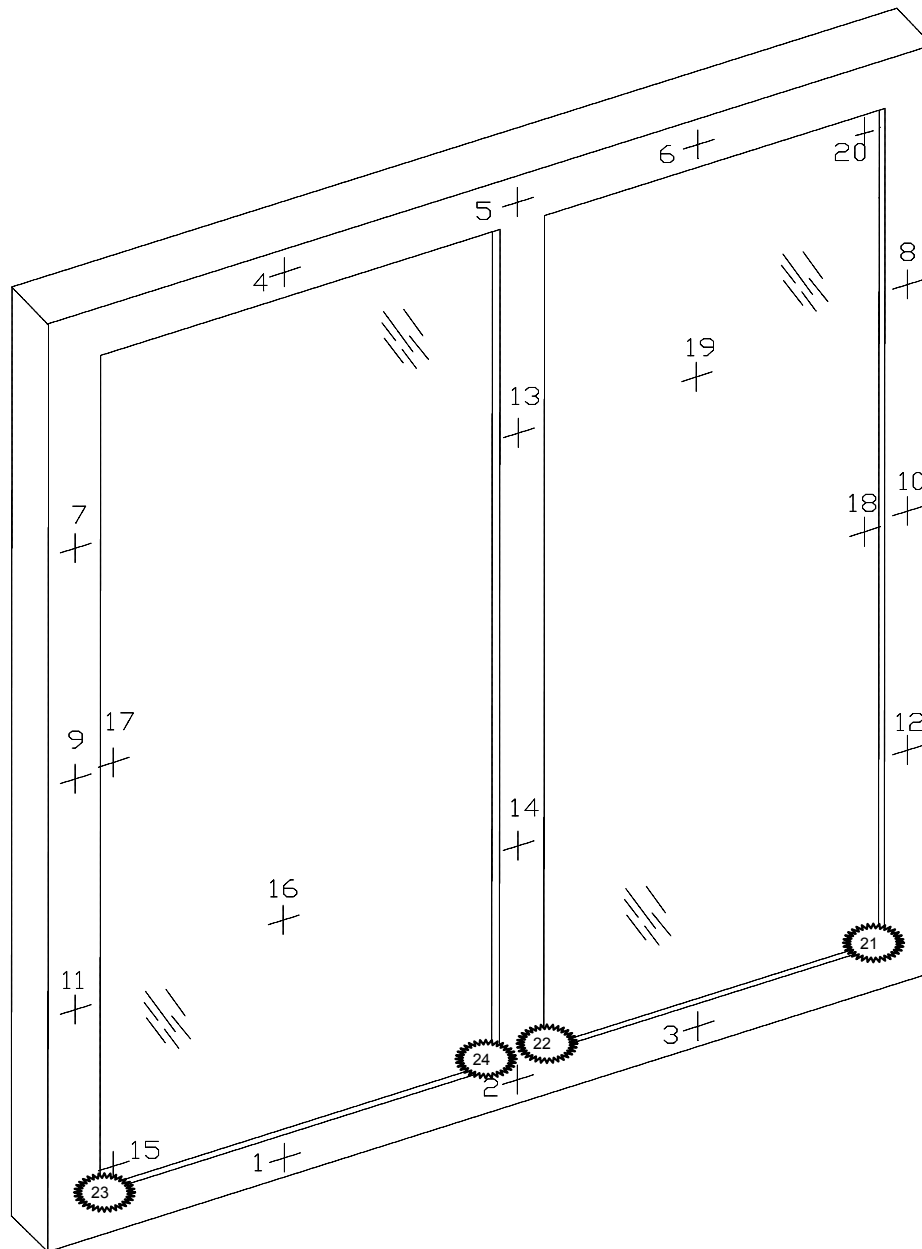
69.81	69.81	69.81	69.81	69.80	69.81
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### Cold Side - Room Ambient Air Temperature

-0.39	-0.39	-0.42	-0.38	-0.43	-0.40
-------	-------	-------	-------	-------	-------

CRF <sub>f</sub>	62	62	62	62	62	62
CRF <sub>g</sub>	63	63	63	63	63	63

### Thermocouple Location Diagram



#### Cold Point Locations

21	21. 36.40
22	22. 38.50
23	23. 38.60
24	24. 38.70



Detailed drawings, data sheets, representative samples of the test specimens, a copy of this report, or other pertinent project documentation will be retained by Architectural Testing, Inc. until 10/28/2013. At the end of this retention period such materials shall be discarded without notice and the service life of this report by Architectural Testing, Inc. 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: Ryan P. Moser

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Ryan P. Moser  
Technician



Digitally Signed by: Shon W. Einsig

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

RPM:kmm  
94234.02-116-46

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

Appendix-A: Description Table Abbreviations (1)

Appendix-B: Drawings (11)

### Revision Log

<b>Rev. #</b>	<b>Date</b>	<b>Page(s)</b>	<b>Revision(s)</b>
.02R0	11/24/09	All	Original Report Issue. Work requested by Terry Hopgood of United States Aluminum.

## 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 Hexafluoride
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 $\geq 1"$

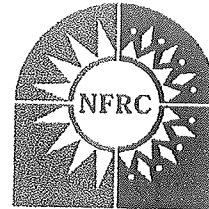
CODE	Thermal Breaks
F	Foam
U	Urethane
V	Vinyl
FB	Fiberglass
O	Other
AB	ABS
NE	Neoprene
AI	Air
N	Not Applicable
P	Polyamide

## **Appendix B: Drawings**

# NFRC PRODUCT CERTIFICATION PROGRAM

## Submittal Form for Test Samples

For use by manufacturers, lineal suppliers and fabricators



National Fenestration  
Rating Council®

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

Manufacturer: USAC Date of sample manufacture: \_\_\_\_\_  
Plant Address where manufactured: 200 Singleton Dr.  
City: Waxahachie State: Texas Zip Code: 75165  
Name of IA: ALI Phone: 800-627-6440 Fax: \_\_\_\_\_

2. Product Information (complete ALL fields):

Product Line ID (CPD) No.: \_\_\_\_\_ Product/Operator Type  
(Table 4-3 of NFRC 100): GWCW  
Series/Model: 42-50 Column Wall

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

- a. ☐ Validation for Initial Certification (prototype only) no plant qualification
- b. ☒ Validation for Initial Certification (production line unit) & plant qualification
- c. ☐ Validation for Recertification (production line unit) & plant qualification
- d. ☐ Plant Qualification Only (production line unit)

I, Terry Hopgood, as the designated agent for USAC  
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 NFRC-accredited  
testing laboratory to send a copy of the test report to the IA identified above for plant qualification purposes  
pursuant to the NFRC Product Certification Program..  
Signature: \_\_\_\_\_ Date: \_\_\_\_\_

### FOR LABORATORY USE ONLY

1. Laboratory: Architectural Testing  
2. Date Sample Received: 10/00/09 File number ID: 94334  
3. Date Sample Tested: 10/08/09 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.]

SUBSIDIARY OF INTERNATIONAL ALUMINUM CORPORATION

THIS SPACE RESERVED FOR STRUCTURAL ENGINEER	
THIS SPACE RESERVED FOR METHOD-DONE USE ONLY	
United States Aluminum 220 Calhoun Street 200 Singleton Drive Walden, TX 75165	
Drawn by DCW	Series 4250
Date 03.12.09	Description Curtain Wall
Approved by	Details
Scale FULL	Sheet 2 OF 6

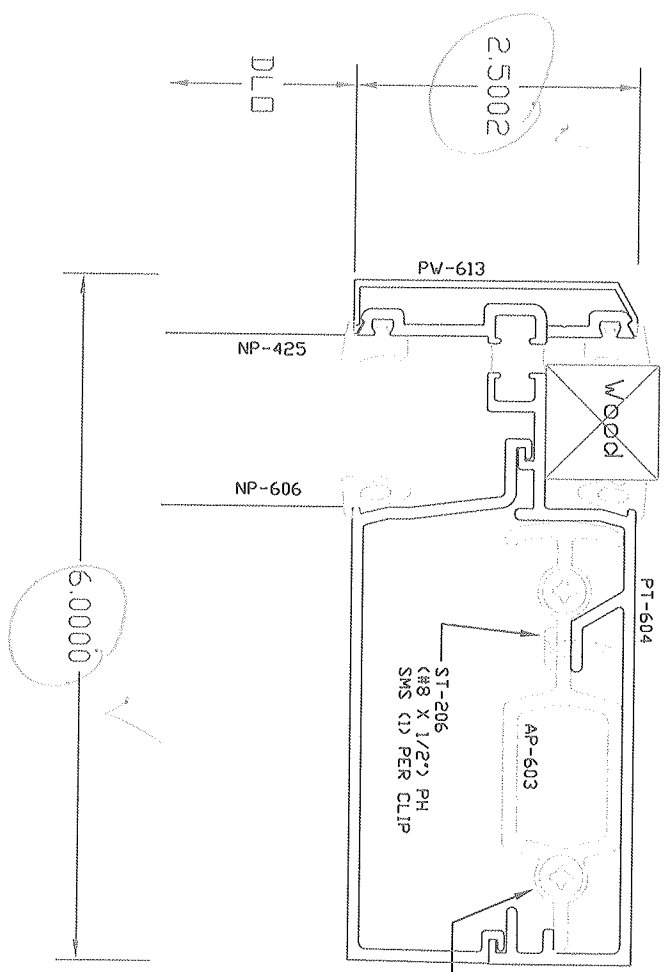


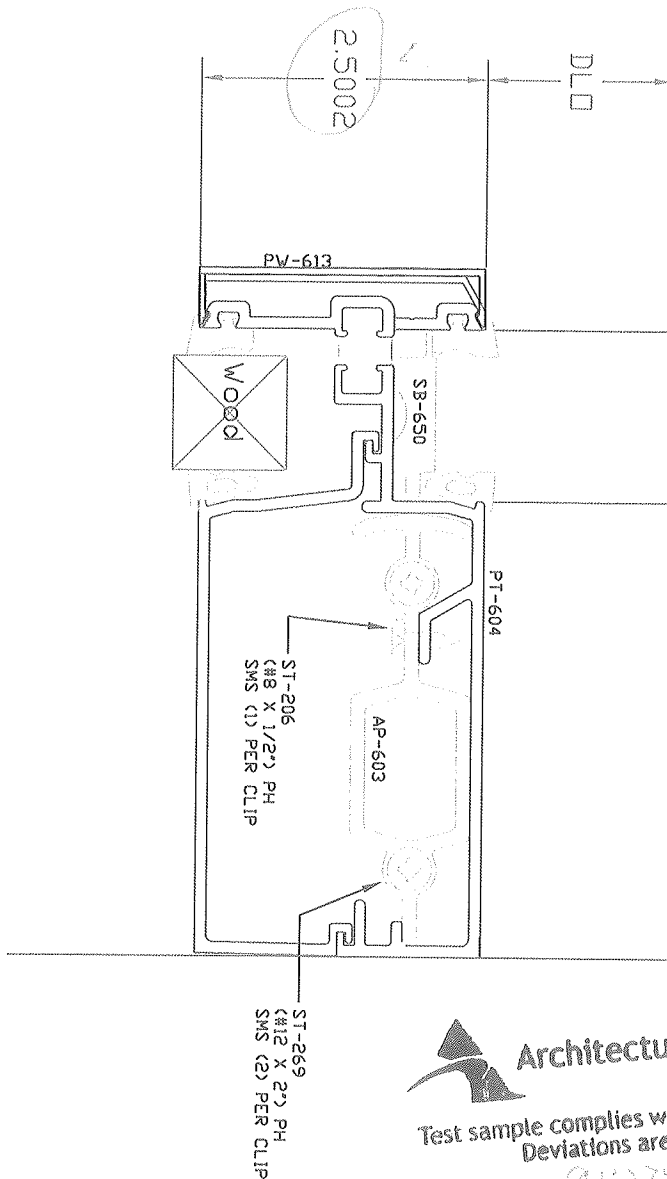
### Architectural Testing

Test sample complies with these details.  
Deviations are noted.

Report# 94234  
Date 11/16/07 Tech RFM

2





**Architectural Testing**

Test sample complies with these details.  
Deviations are noted.

Report# 94034  
Date 4/16/09 Tech RCM

REV	REVISION	DATE	BY

THIS SPACE RESERVED FOR STRUCTURAL ENGINEER

THIS SPACE RESERVED FOR METRO-DADA USE ONLY

United States Aluminum	
720 Cat-River Road Rock Hill, SC 29730 Vancouver, TX 75165	
DRAWN BY DCV	SYSTEM
DATE 03.12.09	SERIES 4250
REVIEW BY	DESCRIPTION Curtain Wall
SCALE FULL	DRAWING NO. USA-3116
	SHEET 3 OF 6

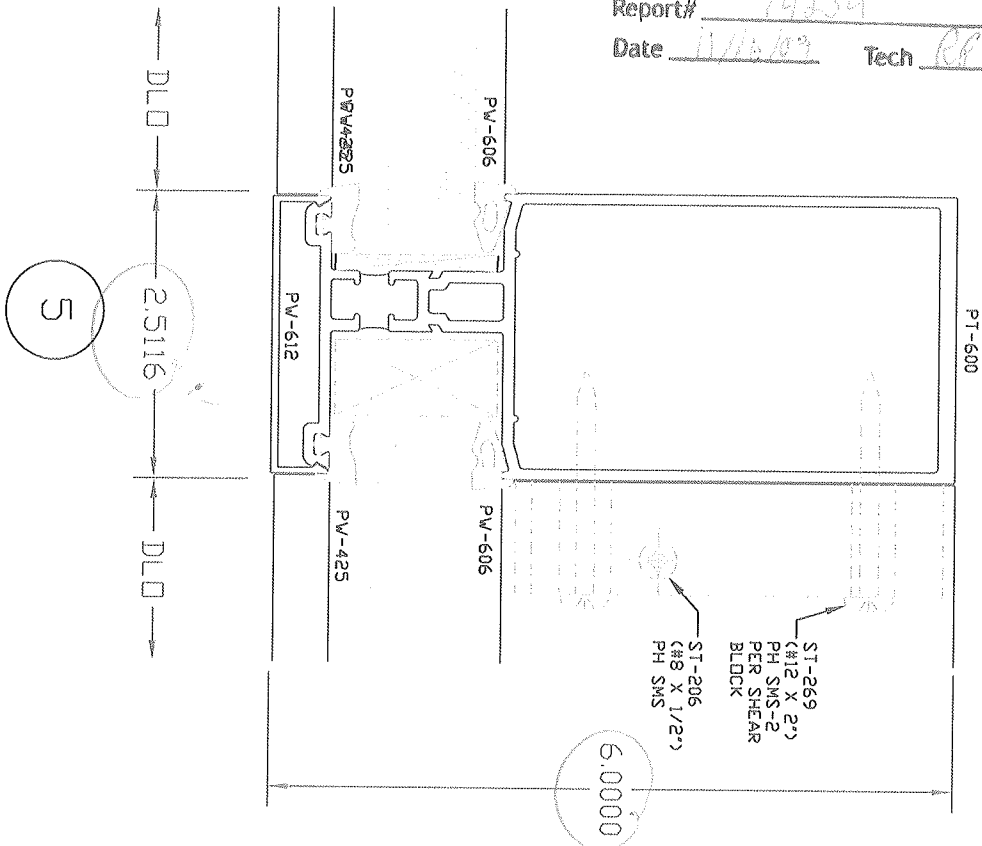
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# Architectural Testing

Test sample complies with these details.  
Deviations are noted.

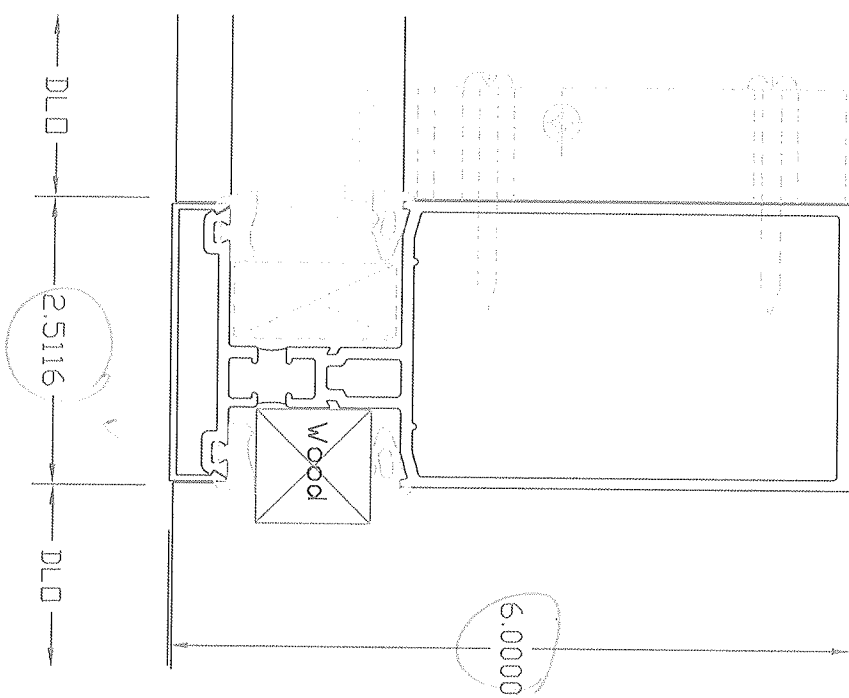
Report# 94234  
Date 11/16/09 Tech RFM



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SIM	REVISION	DATE	BY
THIS SPACE RESERVED FOR STRUCTURAL ENGINEER			
THIS SPACE RESERVED FOR METRO-DAC USE ONLY			
United States Aluminum			
720 Col-River Road			
200 Singleton Drive			
Vero Beach, FL 33463			
DRAWN BY	SYSTEM	SERIES	
DCW		4250	
DATE		Curtain Wall	
03.12.09			
APPROV BY	DESCRIPTION		
	DETAILS		
SCALE	DRAWING NO.	SHEET	
FULL	USA-3116	5 OF 6	





# Architectural Testing

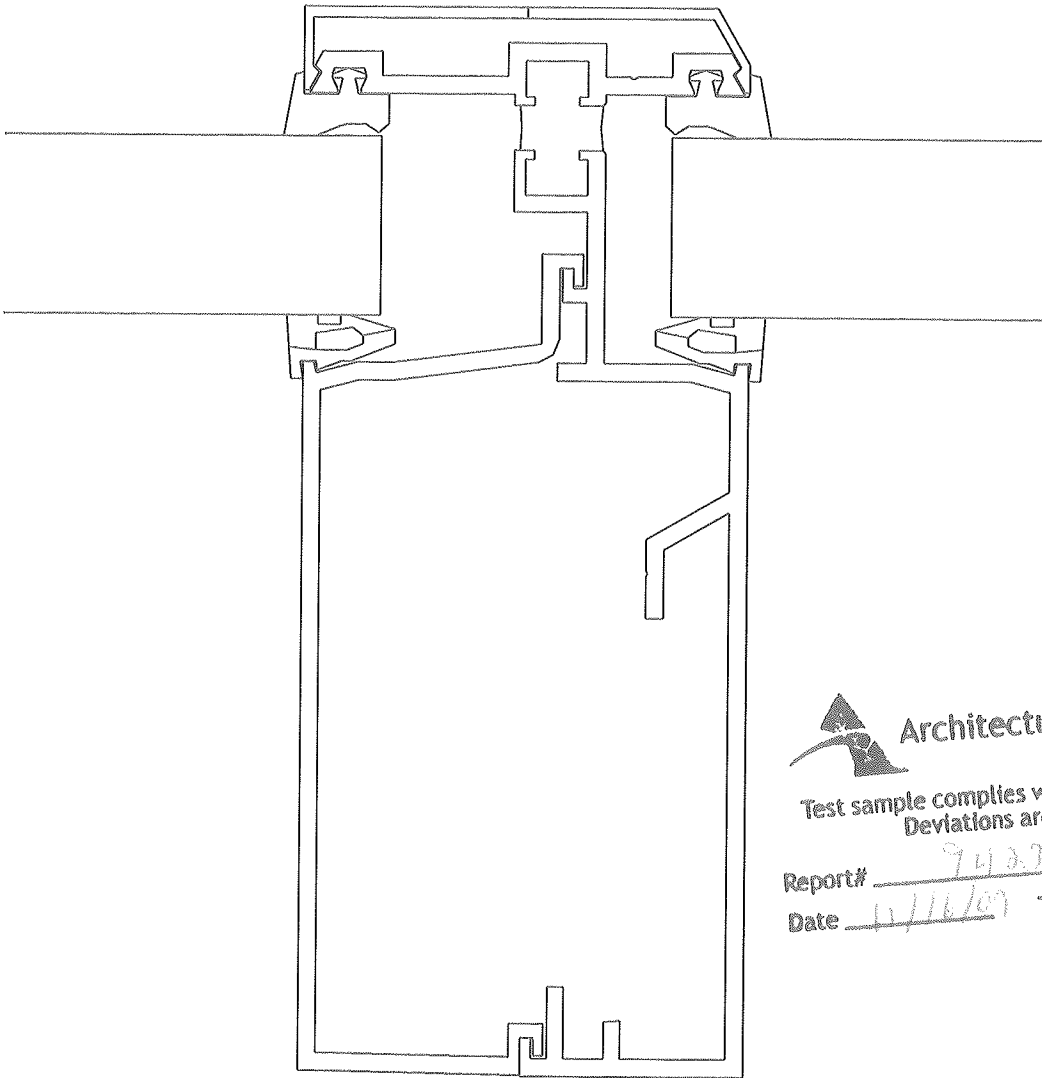
Test sample complies with these details.  
Deviations are noted.

Report# 94234  
Date 11/16/09 Tech RFM

SUBSIDIARY OF INTERNATIONAL ALUMINUM CORPORATION

SYM	REVISION	DATE	BY

THIS SPACE RESERVED FOR STRUCTURAL ENGINEER	
THIS SPACE RESERVED FOR METRO-DARE USE ONLY	
United States Aluminum 720, Col-Singer Road 800 N. 1st St. #9730 Waukegan, IL 60085	
DRAWN BY DCV DATE 03.12.09 APPROV BY	SYSTEM SERIES 4250 Description Curtain Wall DETAILS SCALE FULL DRAWING NO. USA-3116 SHEET 6 OF 6



**Architectural Testing**

Test sample complies with these details.  
Deviations are noted.

Report# 9413.74  
Date 11/16/09 Tech CPM