



NATIONAL CERTIFIED TESTING LABORATORIES

FIVE LEIGH DRIVE • YORK, PENNSYLVANIA 17406 • TELEPHONE (717) 846-1200
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www.nctlinc.com

CARDINAL COMMERCIAL PRODUCTS NFRC THERMAL TEST SUMMARY REPORT

Report No: NCTL-110-17179-1S
Revision Date: 12/19/14

Test Specimen		<u>NFRC Code</u>
Manufacturer:	Cardinal Commercial Products	
Series/Model:	Series "CCW725"	
Window Type:	Glazed Wall System	GWCW
Frame Composition:	Aluminum	AL
Sash/Vent/Panel Composition:	Not Applicable	
Thermal Break Mat'l:	Not Applicable	
Overall Size:	2000.25 mm (78.75") wide by 2000.25 mm (78.75") high	
Glazing Description		
	0.960" Overall w/ Low E	
No. of Glazing Layers (including films):	2	2
Primary Glazing:	Double Glazed	DG
Spacer Type:	Aluminum	A1-D
Gap Fill 1:	Air	AIR
Gap Fill 2:	Not Applicable	
Glass/Film Thicknesses (ext to int):	0.226", 0.226"	
Air Gap 1:	0.508"	
Air Gap 2:	Not Applicable	
Secondary Glazing:	Not Applicable	
Low Emissivity Coatings:		
Surface 2:	0.215	

Procedure: Standardized Thermal Transmittance (U_{st}) was determined using the NFRC 102-2014 procedure with a temperature of $69.8^{\circ}\pm 0.5^{\circ}\text{F}$ on the room side of the specimen and $-0.4^{\circ}\pm 0.5^{\circ}\text{F}$ on the weather side of specimen. The net air leakage across the test specimen was 0.0 cfm.

Test Results: Results of the test period 0106-0506 on 08/13/14 using the Equivalent CTS Method:

Thermal transmittance at test conditions (U_s):	0.58	BTU/hr/ft ² /°F
Standardized thermal transmittance of test specimen (U_{st}):	0.53	BTU/hr/ft²/°F

Reference should be made to Thermal Performance Test Report Number NCTL-110-17179-1 for complete specimen description and test data.

National Certified Testing Laboratories

Performed By:


DIGITAL SIGNATURE

Zachary Mundorff
Technician

Reviewed By:


DIGITAL SIGNATURE

Steven H. Coble
Person In Responsible Charge



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Report Number NCTL-110-17179-1
Report Date 10/06/2014
Revision Date 12/19/2014
Report To Cardinal Commercial Products
4915 Heller Street
Louisville, KY 40218
Test Start Date 08/12/2014
Test End Date 08/13/2014
Specification NFRC 102-2014 "Procedure for Measuring the Steady-State Thermal Transmittance of Fenestration Systems"

Description of Sample Tested

Note: All dimensions are in the order (Width x Height x Thickness) unless otherwise noted.

Model/Type: "CCW725"
Configuration Captured Curtain Wall
Frame Size 2000.25 mm x 2000.25 mm (78.75" x 78.75")
Viewing Area (2) 927.1 mm x 1873.25 mm (36.5" x 73.75")
Frame Type Extruded aluminum
Joint Construction Frame
Butt-type
Glazing Components
Overall 24.38 mm (0.960") Nominal
Glass Thickness (2) Lites of 6 mm (0.226") tempered glass
Coating A PPG "Sungate500" pyrolitic-type low emissivity coating (e=0.215 per client) was applied to glazing surface no. 2.
Spacer Type/ Size 12.9 mm (0.508") Aluminum spacer (Type A1-D)
Fill Air
Glazing System Exterior glazed with a kerf-mounted single-leaf gasket back-bedding and a screwed-in-place pressure plate with gasket and was fastened with (10) screws at the verticals, and (5) at the horizontals
Weatherstrip No weatherstrip employed
Operating Hardware No operating hardware employed
Auxiliary No auxiliary items employed
Reinforcement No reinforcement employed

Weep Description	No apparent weeps employed
Interior & Exterior Surface Finish	Painted aluminum
Sealant	No sealant applied
Insect Screen	No screen employed
Nail Fin	Not applicable/ No nail fin

SPECIMEN PREPARATION PRIOR TO TEST

The test specimen was pre-conditioned at ambient laboratory conditions prior to the test. The surround panel-to-specimen interfaces were sealed with a non-reflective tape. The specimen was sealed on the interior with a caulk sealant resulting in a measured net air leakage of 0.0 cfm per square foot.

TEST PARAMETERS

Tests to determine the Standardized Thermal Transmittance (U_{st}) of the specimen were performed in the guarded hot box apparatus located at the York, PA facility. The most recent calibration of the hot box apparatus was in March 21, 2014. The thermal performance evaluations were completed in accordance with the NFRC 102 procedure using a dynamic wind perpendicular to the specimen on the weather side and simulated natural convection on the room side. A zero static pressure differential ($0.00" \pm 0.04" H_2O$) was maintained across the specimen during the test by pressurizing the metering box on the room side. Data was collected over two successive 2 hour periods after 4 hours of steady state conditions as defined in section 6.1.2 of the NFRC 102 procedure were achieved. The test was considered completed when the data of the successive 2 hour periods also satisfied the criteria defined in section 6.1.2 of the NFRC 102 procedure.

GLASS THICKNESS AND GLAZING DEFLECTION:

	<u>Glass Thickness</u>	<u>Glazing Deflection Before Test</u>	<u>Glazing Deflection After Test</u>
Left Lite:	0.226", 0.226"	<0.01	0.02"
Right Lite:	0.226", 0.226"	0.05	0.05"

PROJECTED FRAME DIMENSIONS OF MEMBERS:

Member:	Left Head	Left Jamb	Left Sill	Meeting Stile	Right Head	Right Jamb	Right Sill
Dimension:	2.5"	2.5"	2.5"	2.5"	2.5"	2.5"	2.5"

TEST DURATION:

The test chamber environmental systems were initiated at 0842 on 08/12/14. The test conditions were considered stable for (2) consecutive (2) hour test periods from 0106-0306 and 0306-0506 on 08/13/14. The thermal performance test results were derived from the 0106-0506 test period.

Areas:

Test Specimen Projected Area (A_s):	43.20	ft ²
Test Specimen Interior Exposed (Wetted) Surface Area (A_{int}):	57.04	ft ²
Test Specimen Exterior Exposed (Wetted) Surface Area (A_{ext}):	45.18	ft ²
Metering Box Opening Area (A_{mb}):	54.39	ft ²
Metering Box Baffle Area (A_{b1}):	46.44	ft ²
Surround Panel Interior Exposed Area (A_{sp}):	11.19	ft ²

Test Conditions:

Average Room Side Air Temperature:	70.0	°F
Average Weather Side Air Temperature:	-0.5	°F
Average Guard Box Air Temperature:	70.4	°F
Average Warm Side Surround Panel Temperature:	61.2	°F
Average Cold Side Surround Panel Temperature:	0.5	°F
Metering Box Average Relative Humidity:	9.1	%
Measured Weather Side Wind Velocity:	14.3	mph
Static Pressure Difference Across Specimen:	-0.14	psf

Heat Flows:

Heat Input Rate to Metering Box (Q_{total}):	1878.7	BTU/hr
Surround Panel Heat Flow (Q_{sp}):	17.2	BTU/hr
Surround Panel Thickness:	8.468	Inches
Surround Panel Conductance:	0.02525	BTU/hr/ft ² /°F
Metering Box Heat Flow (Q_{mb}):	120.9	BTU/hr
Flanking Loss Heat Flow (Q_{fl}):	-12.6	BTU/hr
Net Test Specimen Heat Flow (Q_s):	1753.2	BTU/hr
EMF vs Heat Flow Equation:	EMF=-231.61x-12.588	

Test Results & Calculated Test Data:

Emittance of Glass (e_1):	0.84	
Warm Side Baffle Emittance (e_{b1}):	0.96	
Equivalent Room Side Surface Temperature:	42.5	°F
Equivalent Weather Side Surface Temperature:	6.7	°F
Room Side Baffle Surface Temperature:	68.6	°F
Measured Room Side Surface Conductance (h_h):	1.48	BTU/hr/ft ² /°F
Measured Weather Side Surface Conductance (h_c):	5.67	BTU/hr/ft ² /°F
Test Specimen Thermal Conductance (C_s):	1.13	BTU/hr/ft ² /°F
Convection Coefficient (K):	0.331	
Radiative Test Specimen Heat Flow (Q_{r1}):	855.2	BTU/hr
Convective Test Specimen Heat Flow (Q_{c1}):	898.0	BTU/hr
Radiative Heat Flux of Test Specimen (q_{r1}):	19.79	BTU/hr/ft ²
Convective Heat Flux of Test Specimen (q_{c1}):	20.79	BTU/hr/ft ²
Standardized Room Side Surface Conductance (h_{STh}):	1.22	BTU/hr/ft ² /°F
Standardized Weather Side Surface Conductance (h_{STc}):	5.28	BTU/hr/ft ² /°F

Test Specimen Thermal Transmittance (U_s): **0.58** BTU/hr/ft²/°F

Test Specimen Standardized Thermal Transmittance (U_{ST}): **0.53** BTU/hr/ft²/°F

No apparent condensation was observed on the test specimen at test conditions. 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. An estimate of the experimental uncertainty for these results is available upon request.

Per the client, the test specimen described in this report was a production line unit submitted for initial certification and plant qualification and is described 'as tested'. Detailed drawings were available for laboratory records and compared to the test specimen at the time of this report. A copy of this report along with representative sections of the test specimen will be retained by NCTL for a period of four (4) years. The results obtained apply only to the specimen tested. This report may not be reproduced, except in full, without the written approval of National Certified Testing Laboratories. NCTL is a testing lab accredited by A2LA to ISO/IEC 17025 and assumes that all information provided by the client is accurate and does not guarantee or warranty any product tested or installed. Testing described in this report was conducted in full compliance with NFRC requirements; any deviations are noted. ASTM C1363 and C1199 testing was performed with published NFRC deviations. 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.

National Certified Testing Laboratories

Performed By:



DIGITAL SIGNATURE

Zachary Mundorff
Technician

Reviewed By:



DIGITAL SIGNATURE

Steven H. Coble
Person In Responsible Charge

ZM/ drm

ATTACHMENT 1

Section 1:

Component Drawings, with Applicable Part Numbers, Manufacturing and Modeling Details, were Reviewed (as submitted) for Product Verification
(Reference: NCTL-110-17179-1)

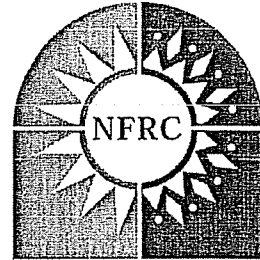
See Attached Documentation;
any deviations noted.

Note: The above referenced component drawings along with representative sections of the test specimen will be retained per procedure by NCTL. This testing facility assumes that all information provided by the client is accurate.

Section 2:

<u>Identification</u>	<u>Date</u>	<u>Page & Revision</u>
Original Issue	10/06/2014	Not Applicable
Revision 01	10/23/2014	Lite thicknesses on Page 3
Revision 02	12/17/2014	Surround panel temperatures, Page 4
Revision 03	12/19/2014	Updated test dates

NFRC PRODUCT CERTIFICATION PROGRAM



National Fenestration
Rating Council®

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 Products Date of sample manufacture: 7-7-14
Plant Address where manufactured: 4915 Heller St.
City: Louisville State: KY Zip Code: 40218
Name of IA: Keystone Certs. Phone: 502.969.4059 x1703 Fax: _____

2. Product Information (complete ALL fields):

Product Line ID No.: CMAST Operator Type (Table 4-3 of NFRC 100): Glazed Wall Curtain Wall O-O
Series/Model: CCW725 Curtain Wall

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

- a. Validation for Initial Certification (prototype only; Section 2.2.1.C of PCP), no plant qualification
- b. Validation for Initial Certification (production line unit; Section 2.2.1.B.ii of PCP) & plant qualification
- c. Validation for Recertification (production line unit; Section 2.2.1.B.ii of PCP) & plant qualification
- d. Plant Qualification Only (production line unit; Section 2.2.1.B.ii of PCP)

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

I, John STELLER, 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 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: [Signature] Date: 10/8/14

FOR LABORATORY USE ONLY

- 1. Laboratory: National Certified Testing Laboratories
- 2. Date Sample Received: 7/8/14 File number ID: 17179-1
- 3. Date Sample Tested: 7/29/14 By: _____
- 4. Modifications made: _____
- 5. Reason for non-testing of sample unit: _____

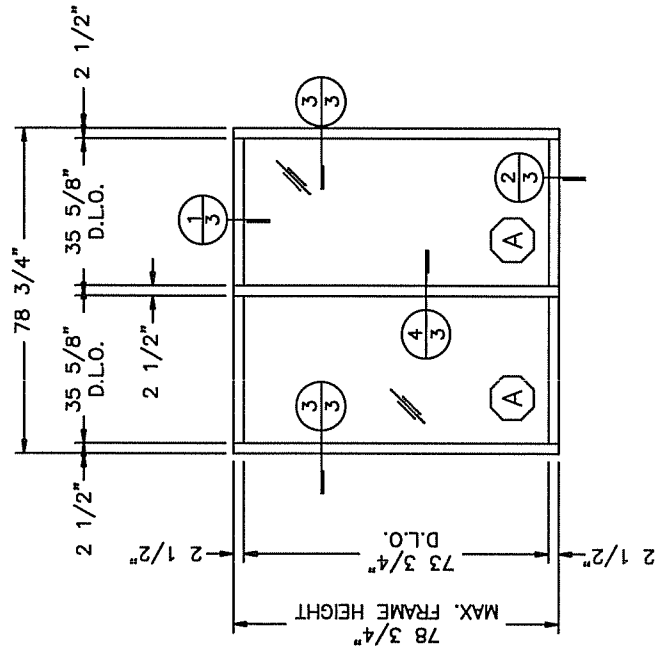
[Note: If the sample submitted can not be tested due to damage prior to testing, a new sample and new form shall be submitted to the testing laboratory. Both forms shall be submitted to the IA when the testing is completed.]

DATE	05-27-14
DRAWN	W.R.D.
CHECKED	J.D.W.
APPROVE	
PROJECT NO.	CCW725-02
DRAWING NO.	CCW725-02
SHEET	2 OF 6

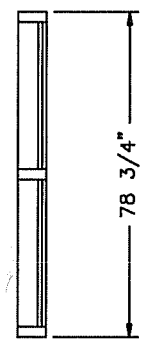
NCTL THERMAL TEST REPORT DRAWING FOR
 CCW725 CAPTURED CURTAIN WALL
 STANDARD EVALUATIONS

CARDINAL
 COMMERCIAL
 PRODUCTS
 PRODUCT DEVELOPMENT

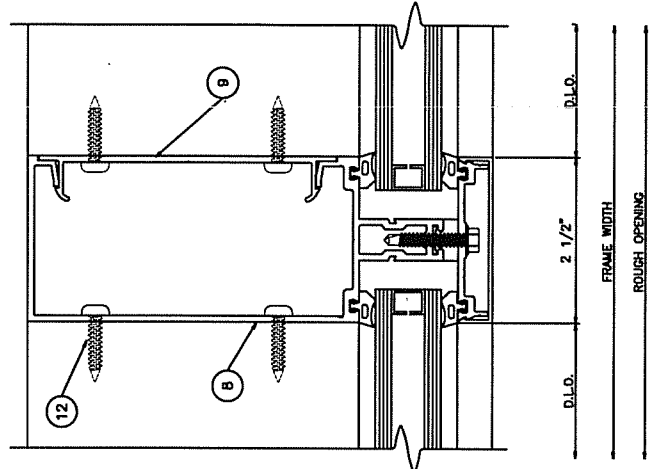
TEST SPECIMEN COMPLIES
 WITH THESE DETAILS.
 ANY DEVIATION IS NOTED.
 REPORT NO. NCTL-110-17179-1
 TEST DATE 7/30/14



ELEVATION E1
 TYPICAL CAPTURED MULLION



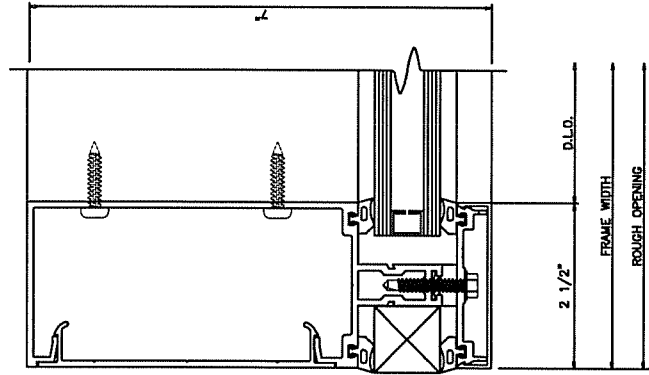
NOTES:
 1. D.L.O. = DAYLIGHT OPENING
 2. GLASS SIZE = D.L.O. + 1"



DETAIL #4 VERTICAL

TEST SPECIMEN COMPLIES WITH THESE DETAILS. ANY DEVIATION IS NOTED.
 REPORT NO. NCTL-110-17129-1
 TEST DATE 7/30/14

INTERIOR IS ON RIGHT HAND SIDE OF VERTICAL SECTION CUTS UNLESS OTHERWISE NOTED



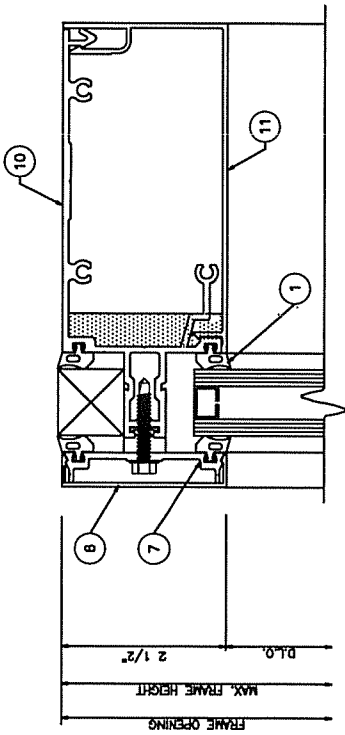
DETAIL #3 JAMB

1 TYPICAL INTERIOR/ EXTERIOR GASKET

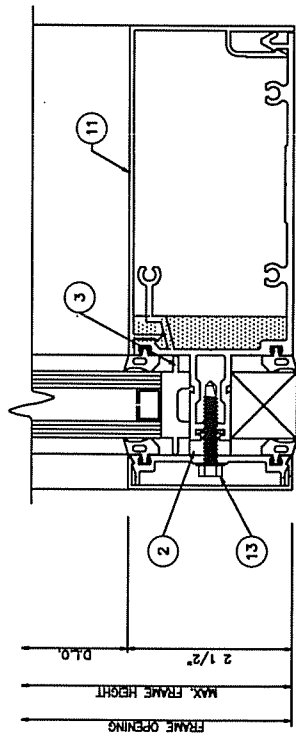
2 TYPICAL PRESSURE BAR ISOLATOR

5 TYPICAL INTERIOR SEALANT

12 TYPICAL AT ALL SPLINES

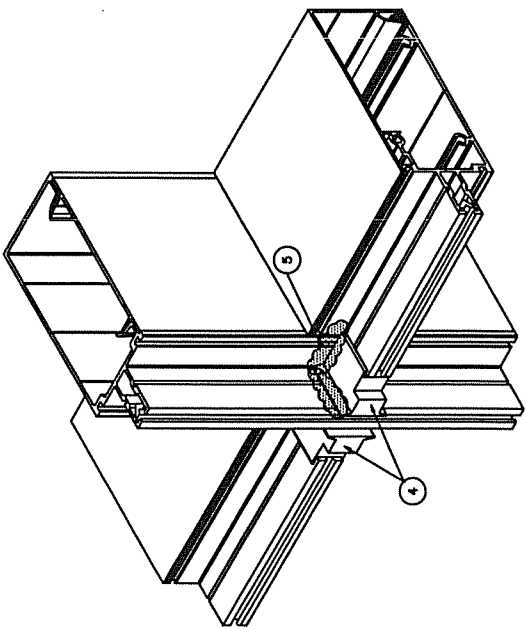
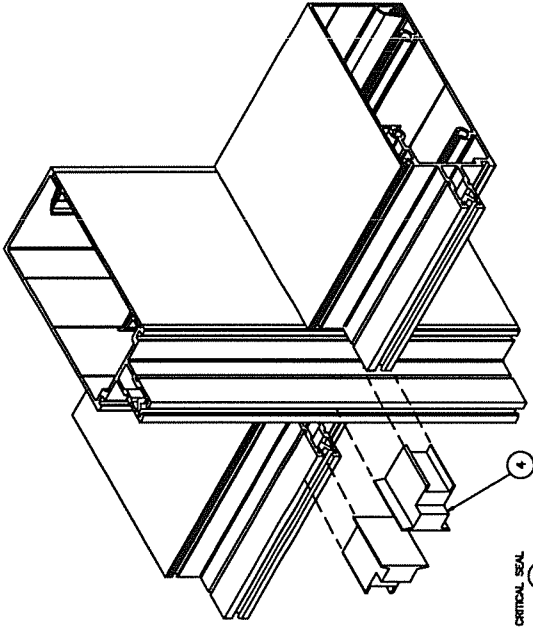
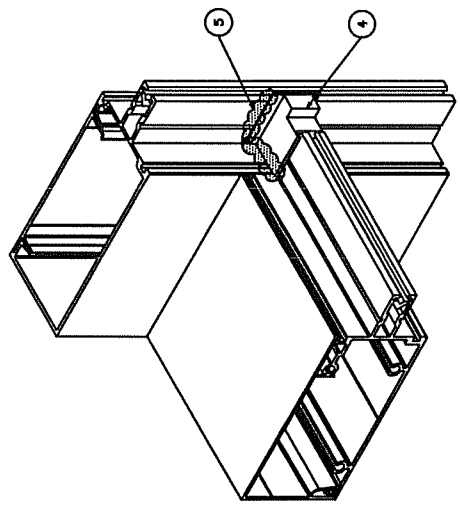
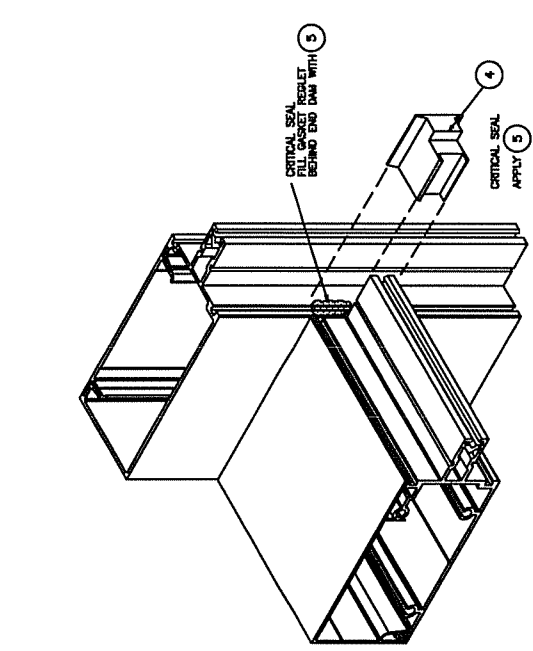


DETAIL #1 HEAD



DETAIL #2 SILL

TEST SPECIMEN COMPLIES
 WITH THESE DETAILS.
 ANY DEVIATION IS NOTED.
 REPORT NO. NCTL-110-17179-1
 TEST DATE 7/30/14

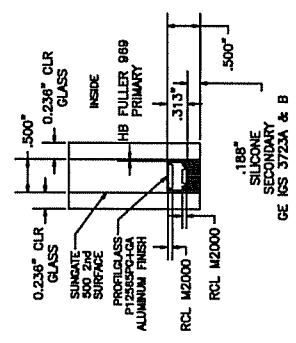


STANDARD END DAM INSTALLATION

BILL OF MATERIAL

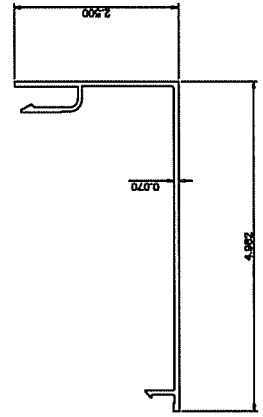
ITEM	P/N	DESCRIPTION	UOM (INCHES)	MATERIAL	MANUFACTURER	NOTES
1	CSK-10	GLAZING GASKET (INT/EXT)	0.280 X 0.581	EPDM ASTM-C-884	VARIES	
2	CSK-9	PREASSURE BAR ISOLATOR	0.377 X 0.420	EPDM ASTM-C-884	VARIES	
3	SB-9	SETTING BLOCK	1.488 X 0.438	EPDM ASTM-C-884	VARIES	4" LONG @ 1/4 POINTS
4	ED-1	END DAM 1" GL	1.500 X 1.125 X 0.745 X 0.050	ABS PLASTIC SWIC	VARIES	
5	995	SILICONE-INTERNAL SEALANT	FILL SPACE	SILICONE	DOW CORNING	INTERIOR JOINT SEALANT
6	CCW100-1	FACE CAP	2.500 X 0.531 X 0.082	6063-T8 AL	CARDINAL COMM. PRODUCTS	
7	CCW200-1	PRESSURE BAR	2.385 X 0.453 X 0.125	6063-T8 AL	CARDINAL COMM. PRODUCTS	
8	CCW725-1	CAPTURED VERTICAL MULLION	8.281 X 2.500 X 0.094	6063-T8 AL	CARDINAL COMM. PRODUCTS	
9	CCW725-2	FLAT FILLER	4.860 X 0.721 X 0.094	6063-T8 AL	CARDINAL COMM. PRODUCTS	
10	CCW725-4	INTERMEDIATE HORIZONTAL	6.188 X 2.405 X 0.094	6063-T8-AL	CARDINAL COMM. PRODUCTS	
11	CCW725-5	INTERIOR SNAP ON TRIM	4.982 X 2.500 X 0.078	6063-T8 AL	CARDINAL COMM. PRODUCTS	
12	AF12-4	FASTENER	#12-14 X 1" SQ. DRIVE	ZP STEEL	VARIES	SPLINE SCREWS (VERT/HORI CONNECTIONS)
13	AF12-10	FASTENER	#12-14 X 1 1/4" RHW SD	ZP STEEL	VARIES	PRESSURE BAR SCREWS

TEST SPECIMEN COMPLIES
WITH THESE DETAILS.
ANY DEVIATION IS NOTED.
REPORT NO. NCTL-110-17179-1
TEST DATE 7/30/14

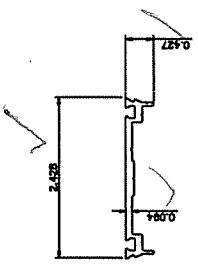


GLASS MARK SYMBOL	GLASS TYPE	GLASS SCHEDULE	MANUFACTURER	DLD SIZE	QUANTITY FEET
(A)	1/2\"/>				

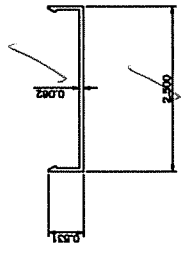
TEST SPECIMEN COMPLIES WITH THESE DETAILS. ANY DEVIATION IS NOTED. REPORT NO. NCTL-110-17199-1 TEST DATE 7/30/14



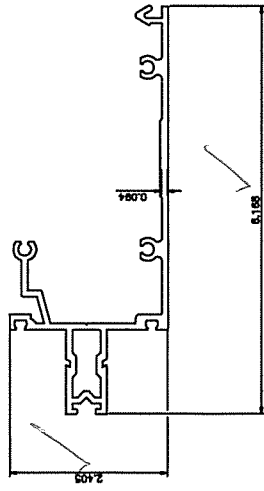
ITEM #11
CCW725-5
INTERIOR SNAP ON TRIM



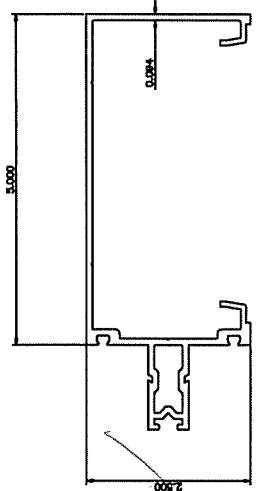
ITEM #7
CCW200-1
PRESSURE PLATE



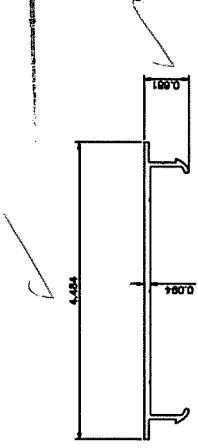
ITEM #6
CCW100-1
FACE CAP



ITEM #10
CCW725-4
INTERMEDIATE HORIZONTAL



ITEM #8
CCW725-1
CAPTURE MULLION



ITEM #9
CCW725-2
FLAT FILLER



ITEM #1
GLAZING GASKET



ITEM #2
PRESSURE BAR ISOLATOR



ITEM #3
SETTING BLOCK

CARDINAL COMMERCIAL PRODUCTS PRODUCT DEVELOPMENT

NCTL THERMAL TEST REPORT DRAWING FOR CCW725 CAPTURED CURTAIN WALL PROFILES

DATE	05-27-14
DRAWN	WJD
CHECKED	JDW
APPROVED	
PROJECT NO.	CCW725_02
DRAWING NO.	CCW725_02
SHEET	6 OF 6