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CR LAURENCE CO., INC.

THERMAL PERFORMANCE TEST REPORT

SCOPE OF WORK
OST451 GLAZED WALL SYSTEM

REPORT NUMBER
K0573.01-301-46

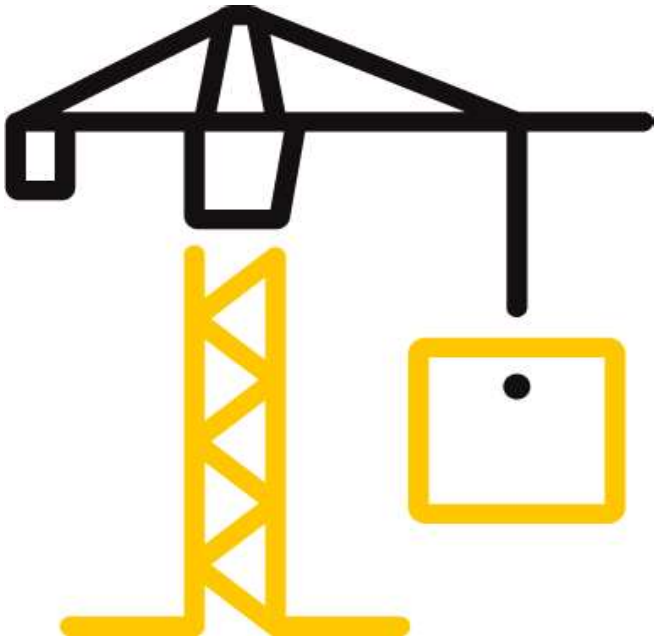
TEST DATE
09/25/19

ISSUE DATE
01/09/20

RECORD RETENTION END DATE
09/25/24

PAGES
28

DOCUMENT CONTROL NUMBER
RTTDS-R-AMER-Test-2822(a) (07/07/18)



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TEST REPORT FOR CR LAURENCE CO., INC.
Report No.: K0573.01-301-46
Date: 01/09/20

REPORT ISSUED TO

CR LAURENCE CO., INC.
2503 East Vernon Avenue
Los Angeles, California 90058

SECTION 1

SCOPE

SERIES/MODEL: OST451
TYPE: Glazed Wall System

Intertek Building & Construction (Intertek B&C) was contracted by CR Laurence Co., Inc. to evaluate the thermal performance per NFRC 102-2017. The purpose of this testing was to evaluate the U-Factor performance. Results obtained are tested values and were secured by using the designated test method. Testing was conducted at Intertek B&C test facility in Fresno, California. This report does not constitute certification of this product nor an opinion or endorsement by this laboratory.

SECTION 2

SUMMARY OF TEST RESULTS

Standardized U-factor (Ust): 0.39 Btu/hr·ft^2·F (CTS Method)

For INTERTEK B&C:

COMPLETED BY	William Simon Smeds	**REVIEWED BY**	Kenny C. White
TITLE	Technician	**TITLE**	Laboratory Manager, IIRC
SIGNATURE	Digitally Signed by: William Smeds	**SIGNATURE**	Digitally Signed by:Kenny C. White
DATE	01/09/20	**DATE**	01/09/20

WSS:ss

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SECTION 3
TEST SPECIMEN SUMMARY

SERIES/MODEL	OST451
TYPE	Glazed Wall System
OVERALL SIZE	78-3/4" x 78-3/4" (2000 mm x 2000 mm) (Model Size)
NFRC STANDARD SIZE	78.7" x 78.7" (2000 mm wide x 2000 mm high)
TEST SAMPLE SUBMITTED BY	C.R. Laurence Co., Inc. - Vernon, California
TEST SAMPLE SUBMITTED FOR	Validation for Initial Certification (Production Line Unit) & Plant Qualification

SECTION 4
TEST METHOD

The specimens were evaluated in accordance with the following:

NFRC 102-2017, Procedure for Measuring the Steady-State Thermal Transmittance of Fenestration Systems

SECTION 5
MATERIAL SOURCE/INSTALLATION

The test specimen was provided by C.R. Laurence Co., Inc. - Vernon, California. Representative samples of the test specimen will be retained by Intertek B&C for a minimum of two and half years from the submittal date to the Inspection Agency and no more than five years from the test date.

Test Chamber Installation

The test sample was installed in a vertical orientation, the exterior of the specimen was exposed to the cold side.

SECTION 6
LIST OF OFFICIAL OBSERVERS

NAME	COMPANY
William Simon Smeds	Intertek B&C

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SECTION 7
TEST SAMPLE DESCRIPTION

Frame

MATERIAL	AT (0.25"): Aluminum with Thermal Breaks - All Members		
SIZE	78-3/4" x 78-3/4" (Model Size)		
DAYLIGHT OPENING	36" x 74-3/4" (x2)	**GLAZING METHOD**	Exterior
EXTERIOR COLOR	Grey	**EXTERIOR FINISH**	Anodized
INTERIOR COLOR	Grey	**INTERIOR FINISH**	Anodized
CORNER JOINERY	Square Cut / Screws / Sealed		

Glazing Information

LAYER 1	1/4"	Solarban 72VT (e=0.018*, #2)	
GAP	0.55"	SS-D: Stainless Steel Spacer	100% Air*
LAYER 2	1/4"	Clear	
GAS FILL METHOD		N/A*	

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

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SECTION 7 (CONTINUED)

TEST SAMPLE DESCRIPTION (CONTINUED)

Weatherstripping

DESCRIPTION	QUANTITY	LOCATION
No weatherstripping.		

Hardware

DESCRIPTION	QUANTITY	LOCATION
No hardware.		

Drainage

DRAINAGE METHOD	SIZE	QUANTITY	LOCATION
No visible weeps.			

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SECTION 8
THERMAL TRANSMITTANCE (U-FACTOR): MEASURED TEST DATA

Heat Flows

1.	Total Measured Input into Metering Box (Qtotal)	1354.72	Btu/hr
2.	Surround Panel Heat Flow (Qsp)	64.43	Btu/hr
3.	Surround Panel Thickness	5.00	inches
4.	Surround Panel Conductance	0.0358	$Btu/hr \cdot ft^2 \cdot F$
5.	Metering Box Wall Heat Flow (Qmb)	30.48	Btu/hr
6.	EMF vs Heat Flow Equation (equivalent information)	0.0205*EMF + 0.000	
7.	Flanking Loss Heat Flow (Qfl)	33.27	Btu/hr
8.	Net Specimen Heat Loss (Qs)	1226.54	Btu/hr

Areas

1.	Test Specimen Projected Area (As)	43.07	ft^2
2.	Test Specimen Interior Total (3-D) Surface Area (Ah)	50.96	ft^2
3.	Test Specimen Exterior Total (3-D) Surface Area (Ac)	44.99	ft^2
4.	Metering Box Opening Area (Amb)	69.44	ft^2
5.	Metering Box Baffle Area (Ab1)	60.56	ft^2
6.	Surround Panel Interior Exposed Area (Asp)	26.37	ft^2

Test Conditions

1.	Average Metering Room Air Temperature (th)	69.81	F
2.	Average Cold Side Air Temperature (tc)	-0.42	F
3.	Average Guard/Environmental Air Temperature	74.01	F
4.	Metering Room Average Relative Humidity	11.92	%
5.	Metering Room Maximum Relative Humidity	12.46	%
6.	Metering Room Minimum Relative Humidity	11.40	%
7.	Measured Cold Side Wind Velocity (Perpendicular Flow)	12.66	mph
8.	Measured Warm Side Wind Velocity (Parallel Flow)	0.04	mph
9.	Measured Static Pressure Difference Across Test Specimen	0.00" ± 0.04"	H_2O

Average Surface Temperatures

1.	Metering Room Surround Panel	67.69	F
2.	Cold Side Surround Panel	-0.59	F

Results

1.	Thermal Transmittance of Test Specimen (Us)	0.41	$Btu/hr \cdot ft^2 \cdot F$
2.	Standardized Thermal Transmittance of Test Specimen (Ust)	0.39	$Btu/hr \cdot ft^2 \cdot F$

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SECTION 9
THERMAL TRANSMITTANCE (U-FACTOR): CALCULATED TEST DATA

CTS Method Results

1.	Warm Side Emittance of Glass (e1)	0.84	
2.	Cold Side Emittance of Glass	0.84	
3.	Warm Side Frame Emittance*	0.80	
4.	Cold Side Frame Emittance*	0.80	
5.	Warm Side Sash/Panel/Vent Emittance*	N/A	
6.	Cold Side Sash/Panel/Vent Emittance*	N/A	
7.	Warm Side Baffle Emittance (eb1)	0.92	
8.	Cold Side Baffle Emittance (eb2)	N/A	
9.	Equivalent Warm Side Surface Temperature (t1)	49.85	F
10.	Equivalent Cold Side Surface Temperature (t2)	5.31	F
11.	Warm Side Baffle Surface Temperature	69.75	F
12.	Cold Side Baffle Surface Temperature	N/A	F
13.	Measured Warm Side Surface Conductance (hh)	1.43	$Btu/hr \cdot ft^2 \cdot F$
14.	Measured Cold Side Surface Conductance (hc)	4.98	$Btu/hr \cdot ft^2 \cdot F$
15.	Test Specimen Thermal Conductance (Cs)	0.64	$Btu/hr \cdot ft^2 \cdot F$
16.	Convection Coefficient (Kc)	0.32	$Btu/(hr \cdot ft^2 \cdot F^{1.25})$
17.	Radiative Test Specimen Heat Flow (Qr1)	644.21	Btu/hr
18.	Conductive Test Specimen Heat Flow (Qc1)	582.34	Btu/hr
19.	Radiative Heat Flux of Test Specimen (qr1)	14.96	$Btu/hr \cdot ft^2 \cdot F$
20.	Convective Heat Flux of Test Specimen (qc1)	13.52	$Btu/hr \cdot ft^2 \cdot F$
21.	Standardized Warm Side Surface Conductance (hsth)	1.20	$Btu/hr \cdot ft^2 \cdot F$
22.	Standardized Cold Side Surface Conductance (hstc)	5.28	$Btu/hr \cdot ft^2 \cdot F$
23.	Standardized Thermal Transmittance (Ust)	0.39	$Btu/hr \cdot ft^2 \cdot F$

**Stated per NFRC 101*

SECTION 10
TEST DURATION

1. The environmental systems were started at 13:14 hours, 09/24/19.
2. The test parameters were considered stable for two consecutive four hour test periods from 23:06 hours, 09/24/19 to 07:06 hours, 09/25/19.
3. The thermal performance test results were derived from 03:06 hours, 09/25/19 to 07:06 hours, 09/25/19.

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SECTION 11
GLAZING DEFLECTION

	Left Glazing	Right Glazing
EDGE GAP WIDTH	0.55"	0.55"
ESTIMATED CENTER GAP WIDTH upon receipt of specimen in laboratory (after stabilization)	0.52"	0.50"
CENTER GAP WIDTH at laboratory ambient conditions on day of testing	0.52"	0.50"
CENTER GAP WIDTH at test conditions	0.42"	0.44"

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 are expected from field installations due to not accounting for solar radiation, air leakage effects, and the thermal bridge effects that have the potential to occur due to the specific design and construction of the fenestration system opening. The latter can only be determined by in-situ measurements. Therefore, it is important to recognize 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."

Required annual calibrations for the Intertek B&C, 'thermal test chamber' (ICN 004287) in Fresno, California were last conducted in October 2018 in accordance with Intertek B&C calibration procedure. A CTS Calibration verification was performed December 2018. A Metering Box Wall Transducer and Surround Panel Flanking Loss Characterization was performed March 2019.

The reported Standardized Thermal Transmittance (Ust) was determined using CTS Method, per Section 9.2(A) of NFRC 102.

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SECTION 12
CTS CALIBRATION DATA

1.	CTS Test Date	11/03/17	
2.	CTS Size	43.06	ft^2
3.	CTS Glass/Core Conductance	0.40	$Btu/hr \cdot ft^2 \cdot F$
4.	Warm Side Air Temperature	69.81	F
5.	Cold Side Air Temperature	-0.33	F
6.	Warm Side Average Surface Temperature	55.03	F
7.	Cold Side Average Surface Temperature	3.79	F
8.	Convection Coefficient (Kc)	0.32	$Btu/(hr \cdot ft^2 \cdot F^{1.25})$
9.	Measured Cold Side Surface Conductance (hc)	4.98	$Btu/hr \cdot ft^2 \cdot F$
10.	Measured Thermal Transmittance	0.31	$Btu/hr \cdot ft^2 \cdot F$

ANSI/NCSL Z540-2-1997 type B uncertainty for this test was 1.66%.

"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 options identified on a valid Certificate of Authorization (CA) are to be used for labeling purposes."

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. The data acquisition frequency is 5 minutes.

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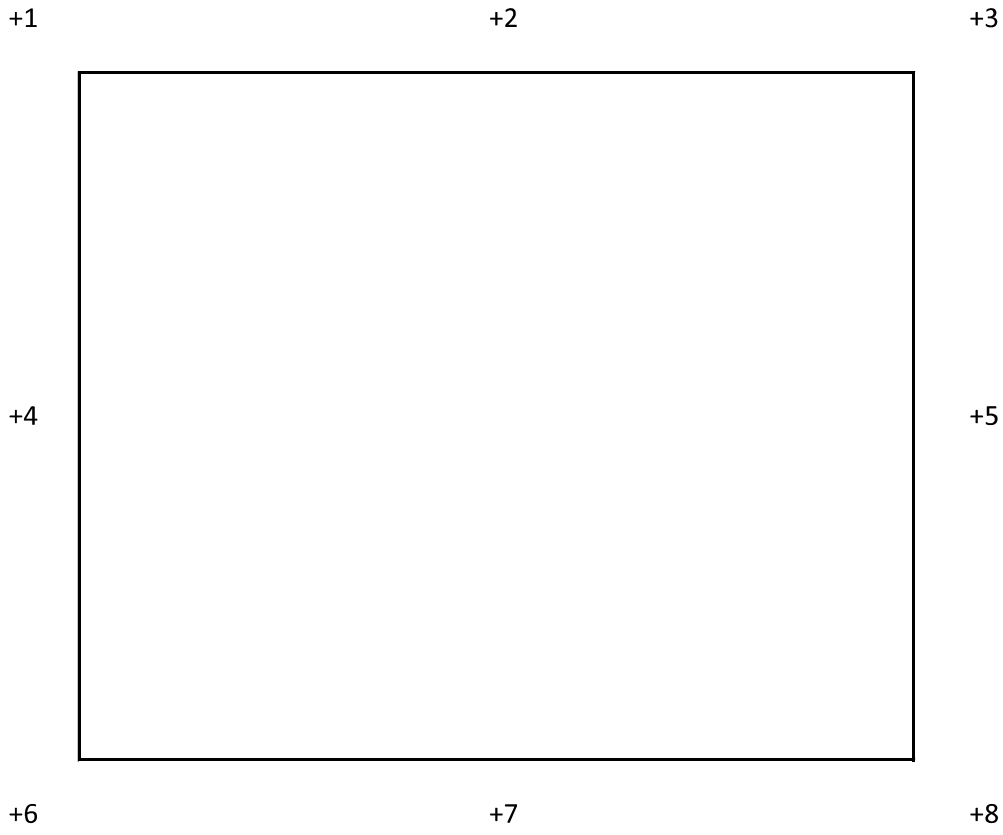
SECTION 13
SURROUND PANEL WIRING DIAGRAM



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SECTION 14
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

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SECTION 15
SUBMITTAL FORM AND DRAWINGS

The test specimen drawings which follow have been reviewed by Intertek B&C and are representative of the test specimen(s) reported herein. Test specimen construction was verified by Intertek B&C per the drawings included in this report. Any deviations are documented herein or on the drawings.

NFRC PRODUCT CERTIFICATION PROGRAM

Submittal Form for Test Samples

National Fenestration Rating Council®

For use by Manufacturers, Lineal Suppliers and Fabricators

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

Manufacturer: C.R. Laurence Co., Inc. Date of sample manufacture: 7/13/2019

Plant Address where manufactured: 2100 E. 38h Street

City: Vernon State: CA Zip Code: 90058

Name of IA: Associated Laboratories Inc. Phone: (214) 565-1094 Fax:

2. Product Information (complete **APPLICABLE** fields):

Existing Product Line ID (CPD) No.: Product/Operator Type (Table 4-3 of NFRC 100): Storefront

Series/Model: OST451

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

a. ☐ Validation for Initial Certification (prototype only) no plant qualification

b. ☑ Validation for Initial Certification or Recertification (production line unit) & plant qualification

c. ☐ Plant Qualification Only (production line unit)

d. ☐ Test Only Alternative (production line unit) & plant qualification

I, Chien Huang, as the designated agent for C.R. Laurence Co., Inc. 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: 9/25/2019

For Laboratory Use Only

1. Laboratory: INTERTEK
2. Date Sample Received: 8/9/19 Test Report #: KOS73.01-301-46
3. Date Sample Tested: 9/25/19 By: SIMON SMEDS
4. Modifications made: NONE

ITEM		PT. NO.	PART DESCRIPTION	MATERIAL
C1	FRAME & SASH COMPONENTS	0T652	WALL JAMB	ANODIZED
C2		0T655	VERTICAL MULLION	ANODIZED
C3		0T551	SSG VERTICAL MULLION	ANODIZED
C4		SS551	OPTIONAL STEEL STIFFENER	ANODIZED
C5		FF561	MALE EXPANSION MULLION	ANODIZED
C6		FF569	FEMALE EXPANSION MULLION	ANODIZED
C7		PV100	PVC JAMB FILLER	PVC
C8		0G539	SILL FACE PLATE	ANODIZED
C9		0G534	INTERMEDIATE HORIZONTAL (EXT. GLAZE) FACE PLATE	ANODIZED
C10		0T668	HEAD CHANNEL (EXT. GLAZE)	ANODIZED
C11		0T666	HEAD INSERT (EXT. GLAZE)	ANODIZED
C12		0T663	INTERMEDIATE HORIZONTAL (EXT. GLAZE)	ANODIZED
C13		0T676	SILL INSERT (EXT. GLAZE)	ANODIZED
C14		0T662	SILL CHANNEL (EXT. GLAZE)	ANODIZED
C15		0G532	INSERT INTERMEDIATE HORIZONTAL (EXT. GLAZE)	ANODIZED
	WEATHERSTRIP			
W1		NP225	GASKET	EPDM
W2		SP450	VERTICAL SSG GASKET	EPDM
W4		VS200	TWO FINGERED GASKET	EPDM
G1	GLAZING		1/4 TEMPERED GLASS – 1/2" AIR FILLED ALUM SPACER – 1/4" TEMPERED GLASS	G1
G2		SB451	SETTING BLOCK INTERMEDIATE (EXT. GLAZE)	G2
G3		SB230	SETTING BLOCK SILL	G3

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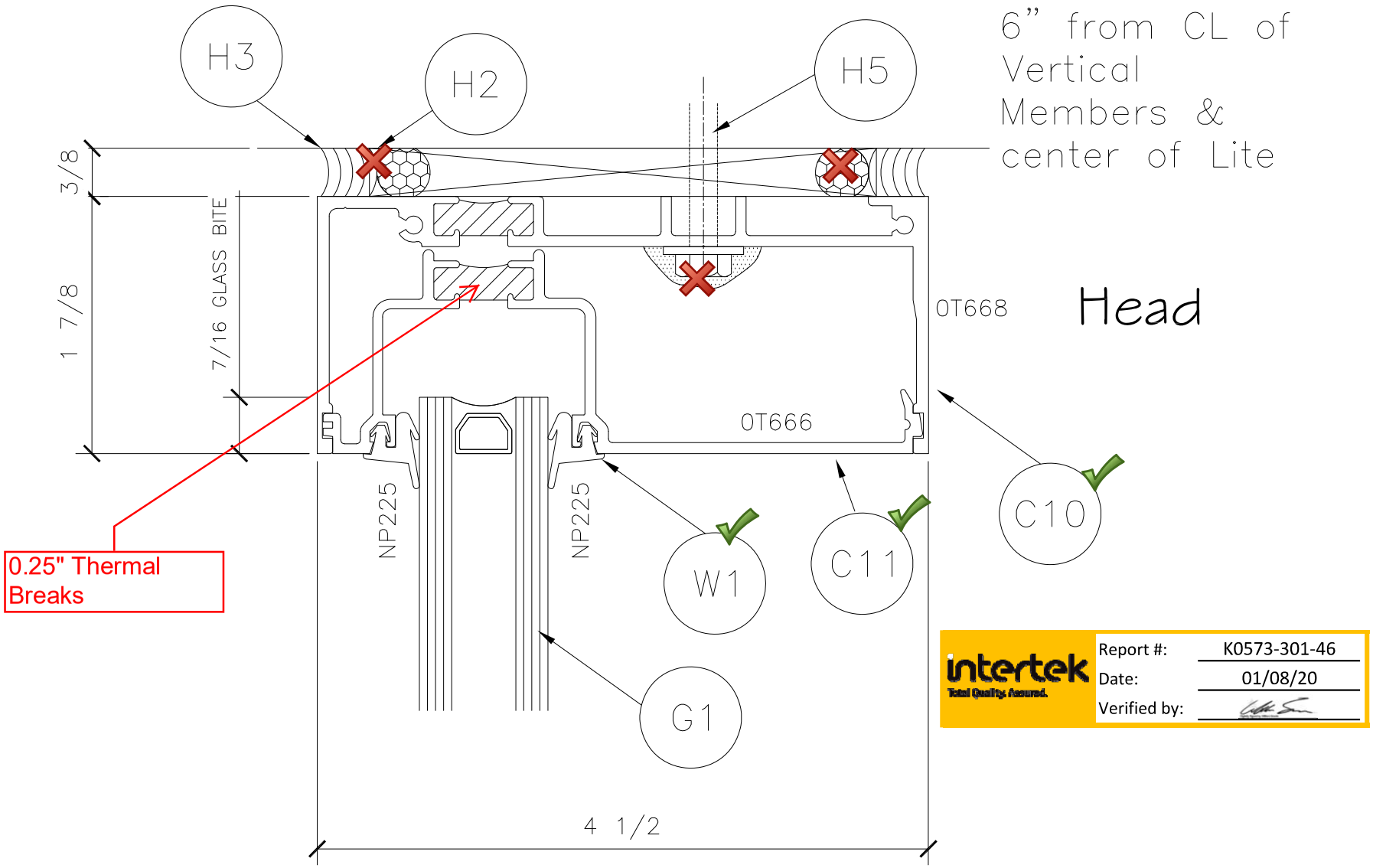
H2 - Backer Rod



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6 SECTION DETAIL AT HEAD

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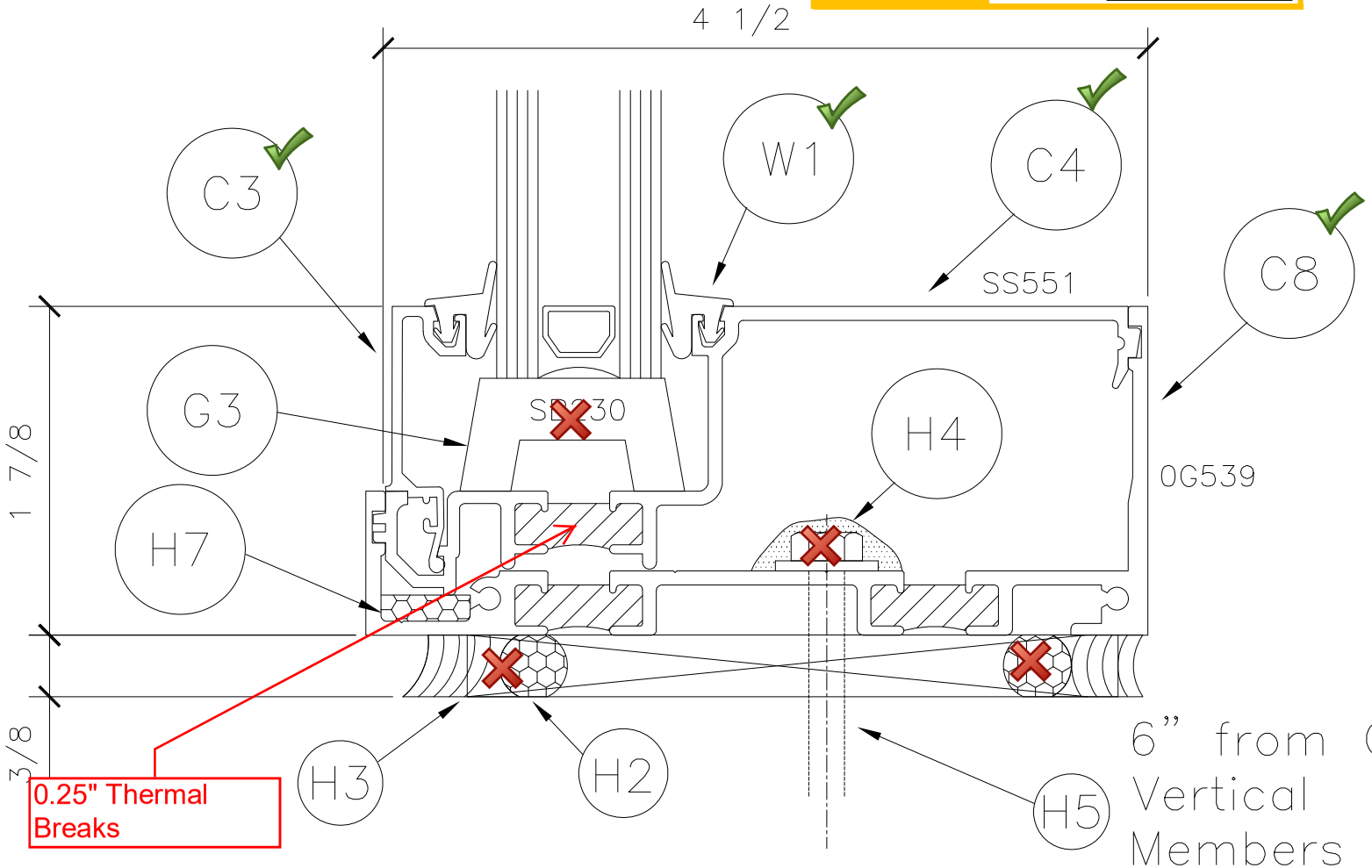

8 SECTION DETAIL AT SILL

Sill

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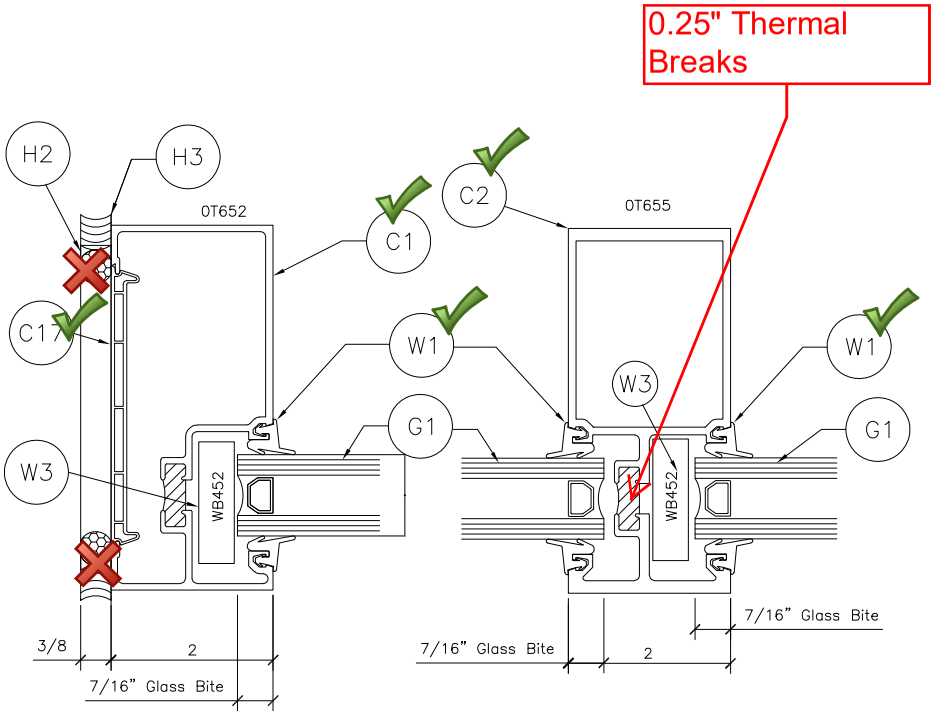
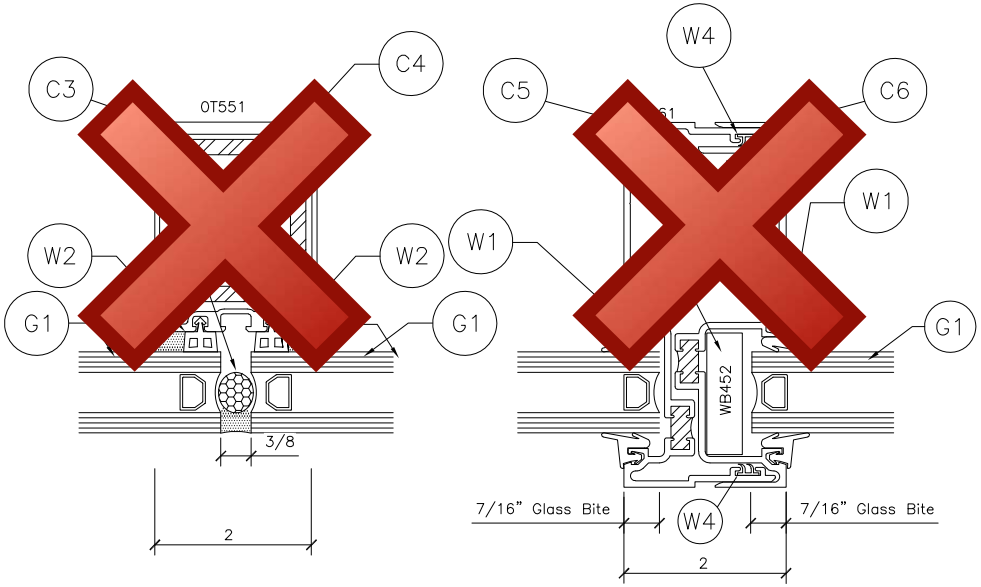


1 SECTION DETAIL AT JAMB

Left Jamb/Right Jamb

2 SETION DETAIL AT VERTICAL

Left Jamb/VM/Right Jamb



3 SECTION DETAIL AT STRUCTURAL SILICONE

Left Jamb/VM/Right Jamb

4 SECTION DETAIL AT EXPANSION MULLION

Left Jamb/VM/Right Jamb

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SECTION 16
REVISION LOG

REVISION #	DATE	PAGES	REVISION
.01 R0	01/09/20	N/A	Original Report Issue