

**ASTM F1642-04/GSA TS01/UFC 4-010-01
TEST REPORT**

Report No.: C4837.02-801-12

Rendered to:

UNITED STATES ALUMINUM
A Division of CR Laurence Co., Inc.
Vernon, CA

PRODUCT TYPE: Single Hung Window
SERIES/MODEL: 8000

SPECIFICATION: ASTM F 1642-04, *Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loading.*

AND

GSA-TS01-2003, *US General Services Administration Standard Test Method for Glazing and Window Systems Subject to Dynamic Overpressure Loadings.*

AND

UFC 04-010-01, DoD Minimum Antiterrorism Standards for Buildings

Title	Summary of Results
ASTM Hazard Rating	Low
GSA Performance Condition	4
UFC Level of Protection	Very Low

Test Completion Date: 8/15/2013

Reference must be made to Report No. C4837.02-801-12, dated 8/20/13 for complete test specimen description and detailed test results.



1.0 Report Issued To: United States Aluminum
A Division of C.R. Laurence Co., Inc.
2100 E. 38th Street
Vernon, CA 90058

2.0 Test Laboratory: Architectural Testing, Inc.
1098 US Highway 380
Tahoka, TX 79373
806-797-2208

3.0 Project Summary:

3.1 Product Type: Single Hung Window

3.2 Series/Model: 8000

3.3 Compliance Statement: Results obtained are tested values and were secured by using the designated test method(s). 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 specimens tested. This report may not be reproduced, except in full, without the written approval of Architectural Testing, Inc.

3.4 Test Date: 5/14/2013 and 8/15/2013

3.5 Test Facility: Architectural Testing, Inc.'s shock tube construction consists of a 90 foot long steel tube reinforced with wide flange steel beams, steel tubes, and steel skin. ATI also placed a 48 inches long, 30 inch diameter steel pipe at the standoff calibrated to achieve the desired pressures. The specimen opening dimensions of the shock tube are 92 inches wide and 102 inches. An exterior platform houses the occupied space and witness panels. The sealed surfaces of the reaction buck and shock tube prevent air blast pressure from wrapping around the test specimen, so the blast pressure loads only one side of the test specimen.

3.6 Test Sample Source: The test specimens were provided by the client. Representative samples of the test specimen(s) will be retained by Architectural Testing for a minimum of four years from the test completion date.

3.7 Drawing Reference: The test specimen drawings have been reviewed by Architectural Testing and are representative of the test specimen(s) reported herein. Test specimen construction was verified by Architectural Testing per the drawings located in Appendix C. Any deviations are documented herein or on the drawings.

3.8 Data Acquisition: In accordance with ASTM F 1642-04 and GSA TS01, four reflective pressure transducers are utilized to record data at a 100 kHz sample rate. Three reflective pressure transducers are located on the reaction chamber at the horizontal and vertical midpoints. A fourth pressure transducer is located in the witness area, to the interior of the reaction chamber face. A sketch of the reaction chamber and corresponding reflective pressure sensor locations are provided in Figure #1 of Appendix A.

3.9 Explosive Charge:

Standoff	Charge Weight	Explosive
72 ft	600 grams.	C-4 (Composition 4)

3.10 List of Official Observers:

<u>Name</u>	<u>Company</u>
Bart Masters	Architectural Testing, Inc.
Daniel Simmons, E.I.T.	Architectural Testing, Inc.

4.0 Test Specification(s):

ASTM F 1642-04, *Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loading.*

GSA-TS01-2003, *US General Services Administration Standard Test Method for Glazing and Window Systems Subject to Dynamic Overpressure Loadings.*

UFC 4-010-1, *DoD Minimum Antiterrorism Standards for Buildings*

5.0 Test Specimen Description: The following descriptions apply to all specimens.

5.1 Product Sizes:

Measured Dimensions	Width (inches)	Height (inches)
Overall size	54-7/8	90
Fixed Day Light Opening	50-7/8	40
Vent Day Light Opening	47-7/8	40

**5.2 Frame Construction:**

Frame Member	Material	Description
SH862	6063-T6 Aluminum	4-1/2" Frame Head
SH863	6063-T6 Aluminum	4-1/2" Frame Sill
SH864	6063-T6 Aluminum	4-1/2" Frame Jamb
SH866	6063-T6 Aluminum	Mullion
SH865	6063-T6 Aluminum	Glazing Bead (Blast)

	Joinery Type	Detail
Glazing Bead	Snap-Fit	The glazing bead was square cut and snap fit into the mullion, head and jambs.
Head/Sill corners	Notched and Butted	The head/sill was notched and butted then mechanically fastened to the jamb using two (2) #8 x 1" Phil Hex Washer HD SMS Type AB SS screws.
Mullion	Square Cut and Butted	The mullion was mechanically fastened to the jambs using two (2) #8 x 1" Phil Hex Washer HD SMS Type AB SS screws per jamb.

5.3 Sash Construction:

Sash Member	Material	Description
SH854	6063-T6 Aluminum	Interlock
SH852	6063-T6 Aluminum	Bottom Rail
SH855	6063-T6 Aluminum	Stile
SH865	6063-T6 Aluminum	Glazing Bead (Blast)

	Joinery Type	Detail
Head	Notched and Butted	The vertical ran through while the horizontal was notched and butted and mechanically fastened using three (3) #8 x 1" Phil Hex Washer HD SMS Type AB SS screws.
Sill	Notched and Butted	The vertical ran through while the horizontal was notched and butted and mechanically fastened using four (4) #8 x 1" Phil Hex Washer HD SMS Type AB SS screws.

5.4 Glazing:

Glass Type	Interior Lite (Nominal)	Interlayer Material	Interlayer Thickness	Exterior Lite (Nominal)	Glazing Bite
1" IG	1/4" Lam. (2) 1/8 " AN	PVB	0.030"	1/4" HS	1"

Spacer: Aluminum; desiccant filled; 1/2" air space.

Glazing Method: The lite was exterior glazed. Tremco glazing gasket (Part# NP881) was applied to the interior of the glazing. Tremco glazing gasket (Part# NP825) was applied to the exterior of the glazing.

5.5 Hardware:

Description	Quantity	Location
Latch Housing	2	Mullion
Sash Release Lever	2	Vent Head
SS Latch Spring	2	Vent Jamb

5.6 Reinforcement: No reinforcement was utilized.

6.0 Installation:

The specimen was installed into a steel C-channel buck. The specimen was anchored to the surrounding steel buck using 1/4-20 x 1-1/8" TEK screws. See Drawing MU2012-019-00 in Appendix C for anchor spacing and location.

7.0 Test Results: The results are tabulated as follows

Test Specimen #1:

Description	Results
Ambient Temperature	83°F
Glazing Temperature	79°F
ASTM Hazard Rating	Low Hazard
GSA Performance Condition	4
UFC Level of Protection	Very Low

Peak Positive Pressure	
Top Pressure	7.519 psi
Right Pressure	8.953 psi
Shell Pressure	10.429 psi
Average Pressure	8.967 psi
Witness Chamber Pressure	0.255 psi

Peak Positive Phase Duration	
Top Duration	12.15 msec
Right Duration	11.62 msec
Shell Duration	14.1 msec

Peak Positive Phase Impulse	
Top Impulse	43.01 psi*msec
Right Impulse	40.34 psi*msec
Shell Impulse	42.87 psi*msec
Average Impulse	42.07 psi*msec

Glazing Response		
Lite	Operable	Fixed
Exterior Lite	Fractured	Fractured
Interior Lite	Fractured	Fractured
Glazing Pullout Length	> 20% of DLO Perimeter	> 20% of DLO Perimeter
Glazing Tearing	None	None

Witness Chamber Results
The sash came out of the surrounding framing at the head and jambs then rotated to the floor with the head 45° from its original location. No glazing indents were located above 20" in the vertical witness panel.

Pressure time plots are presented in Appendix B. Pre-test and post-test photographs are provided in Appendix C.

Test Specimen #2:

Description	Results
Ambient Temperature	93°F
Glazing Temperature	95°F
ASTM Hazard Rating	Low
GSA Performance Condition	3b
UFC Level of Protection	Very Low

Peak Positive Pressure	
Top Pressure	6.726 psi
Right Pressure	7.467 psi
Shell Pressure	8.927 psi
Average Pressure	7.707 psi
Witness Chamber Pressure	0.268 psi

Peak Positive Phase Duration	
Top Duration	13.53 msec
Right Duration	14.30 msec
Shell Duration	13.65 msec

Peak Positive Phase Impulse	
Top Impulse	40.75 psi*msec
Right Impulse	41.27 psi*msec
Shell Impulse	40.63 psi*msec
Average Impulse	40.88 psi*msec

Glazing Response		
Lite	Operable	Fixed
Exterior Lite	Fractured	Fractured
Interior Lite	Fractured	Fractured
Glazing Pullout Length	> 20% of DLO Perimeter	> 20% of DLO Perimeter
Glazing Tearing	None	None

Witness Chamber Results
The sash came out of the surrounding framing at the head and jambs then rotated to about a 45° angle from its original location. Two (2) fragments were located greater than 40" from the interior face of the specimen and no glazing indents were located anywhere in the vertical witness panel.

Pressure time plots are presented in Appendix B. Pre-test and post-test photographs are provided in Appendix C.

Test Specimen #3:

Description	Results
Ambient Temperature	87°F
Glazing Temperature	91°F
ASTM Hazard Rating	Very Low
GSA Performance Condition	3b
UFC Level of Protection	Low

Peak Positive Pressure	
Top Pressure	6.703 psi
Right Pressure	8.049 psi
Shell Pressure	6.230 psi
Average Pressure	6.994 psi
Witness Chamber Pressure	0.402 psi

Peak Positive Phase Duration	
Top Duration	12.08 msec
Right Duration	13.93 msec
Shell Duration	12.50 msec

Peak Positive Phase Impulse	
Top Impulse	37.07 psi*msec
Right Impulse	42.31 psi*msec
Shell Impulse	42.23 psi*msec
Average Impulse	40.53 psi*msec

Glazing Response		
Lite	Operable	Fixed
Exterior Lite	Fractured	Fractured
Interior Lite	Fractured	Fractured
Glazing Pullout Length	> 20% of DLO Perimeter	> 20% of DLO Perimeter
Glazing Tearing	None	None

Witness Chamber Results
The sash came out of the surrounding framing at the head and jambs then rotated to about a 20° angle from its original location. One (1) fragment was located greater than 40" from the interior face of the specimen and no glazing indents were located anywhere in the vertical witness panel.

Pressure time plots are presented in Appendix B. Pre-test and post-test photographs are provided in Appendix C.



The service life of this report will expire on the stated Test Record Retention End Date, at which time such materials as drawings, data sheets, samples of test specimens, copies of this report, and any other pertinent project documentation, shall be discarded without notice.

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.

Daniel Simmons, E.I.T.
Project Manager

John Waskow, P.E.
Director – Regional Operations

DS:hd

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

- Appendix-A: Test Facility (1)
- Appendix-B: Pressure Time Plots (3)
- Appendix-C: Photographs (6)
- Appendix-D: Drawings (8)



Revision Log

<u>Rev. #</u>	<u>Date</u>	<u>Page(s)</u>	<u>Revision(s)</u>
0	8/20/13	N/A	Original report issue

This report produced from controlled document template ATI 00368, issued 06/08/12.

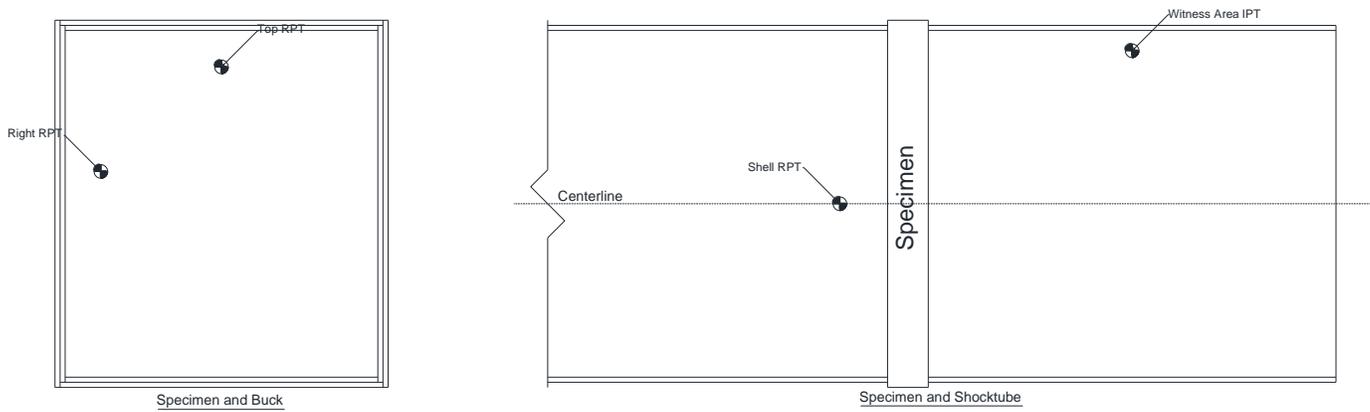


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Test Record Retention End Date: 8/20/17

Appendix A

Test Facility

Figure #1
Pressure Sensor Locations



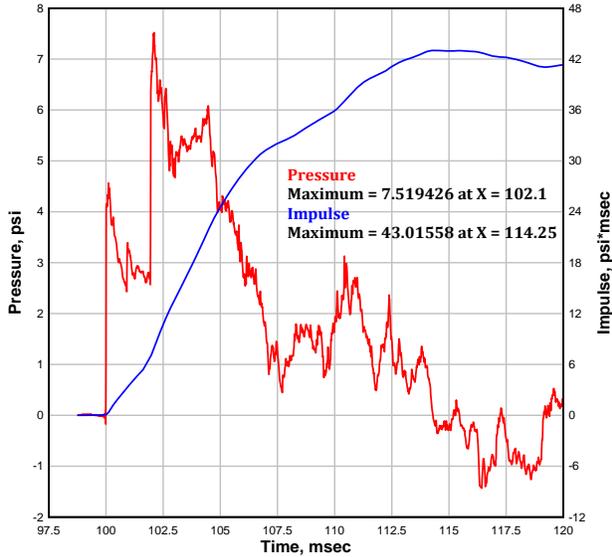


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Appendix B
Pressure Time Plots

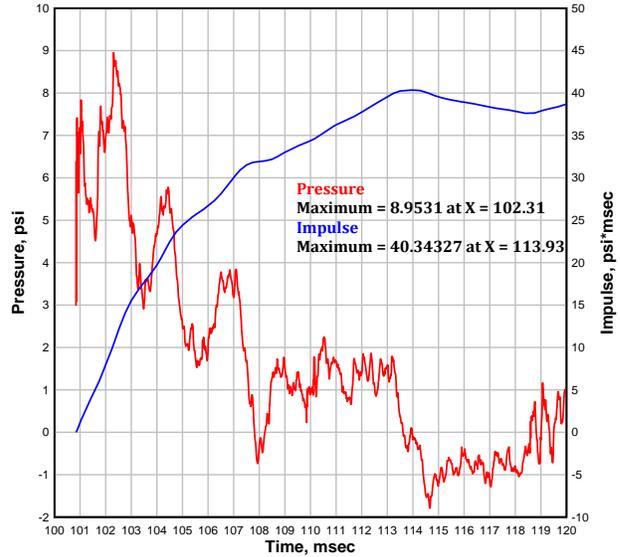
Specimen #1

Reflected Air Blast Pressure
RPT #1



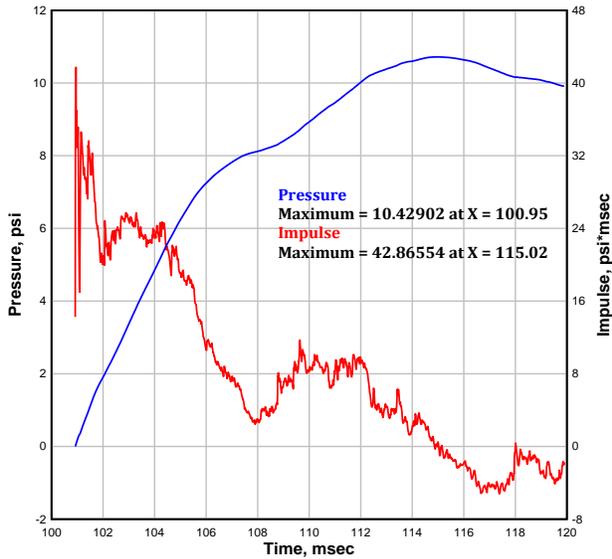
Top RPT

Reflected Air Blast Pressure
RPT #2



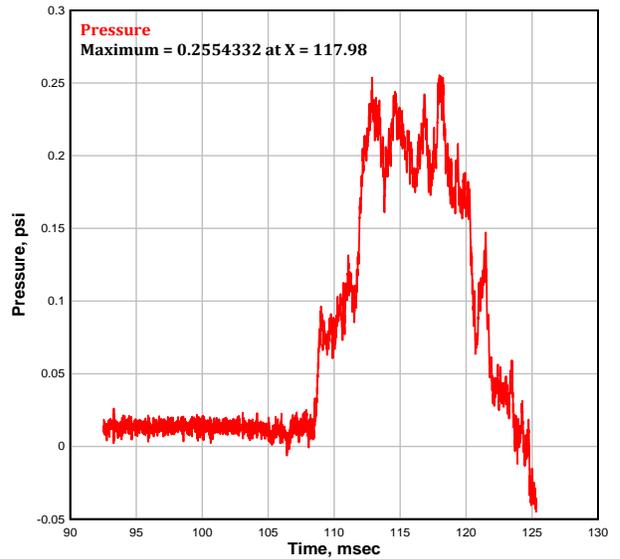
Right RPT

Reflected Air Blast Pressure
RPT #3



Shell RPT

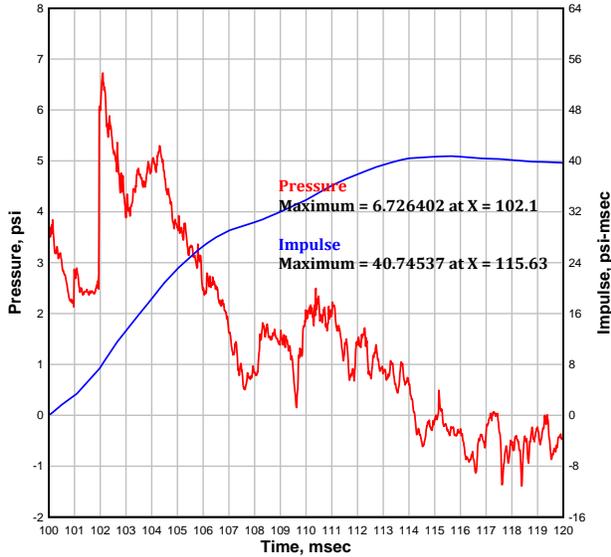
Internal Air Blast Pressure
IPT #1



Witness Chamber IPT

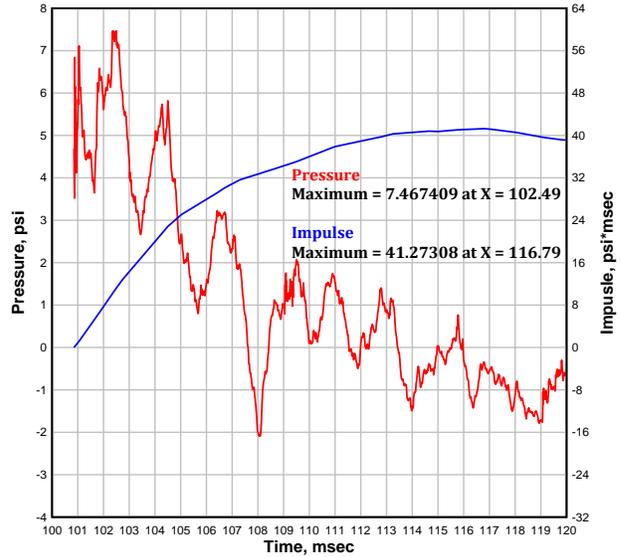
Specimen #2

Reflected Air Blast Pressure
RPT #1



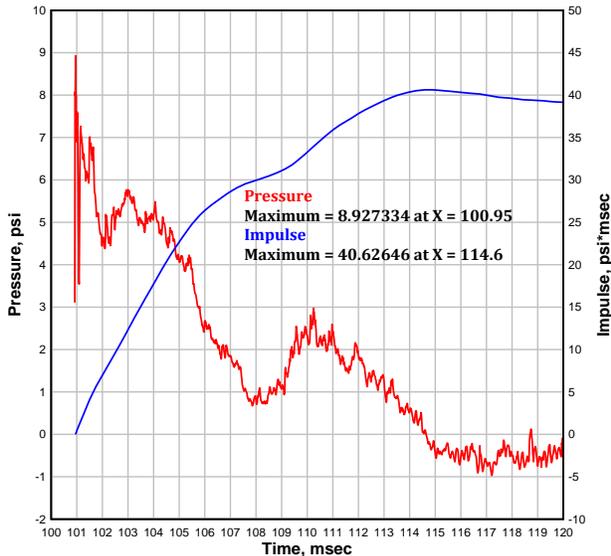
Top RPT

Reflected Air Blast Pressure
RPT #2



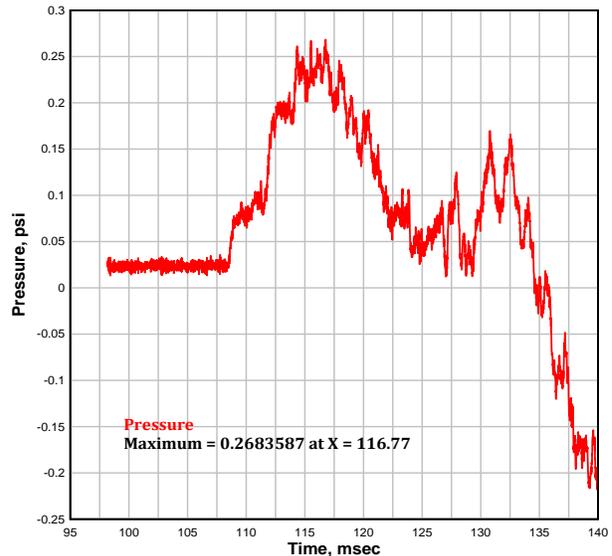
Right RPT

Reflected Air Blast Pressure
RPT #3



Shell RPT

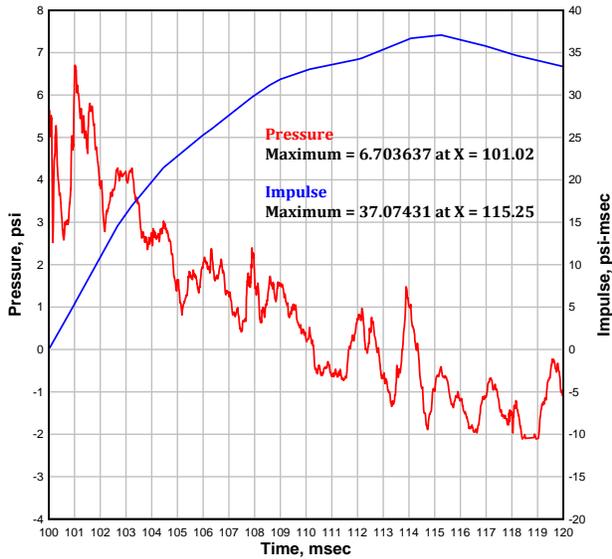
Internal Air Blast Pressure
IPT #1



Witness Chamber IPT

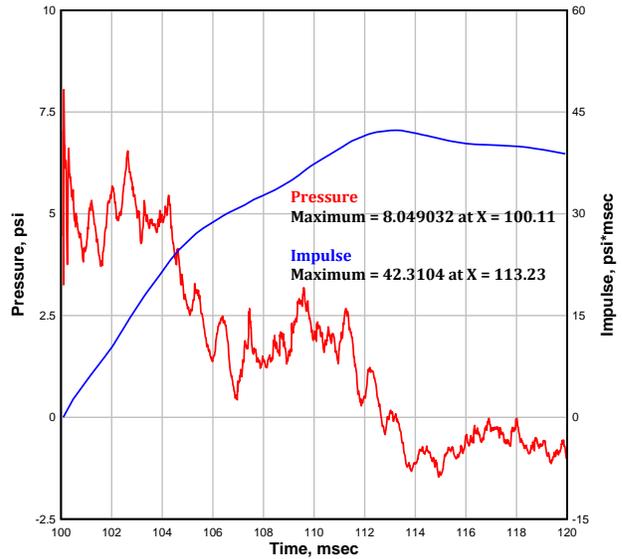
Specimen #3

Reflected Air Blast Pressure
RPT #1



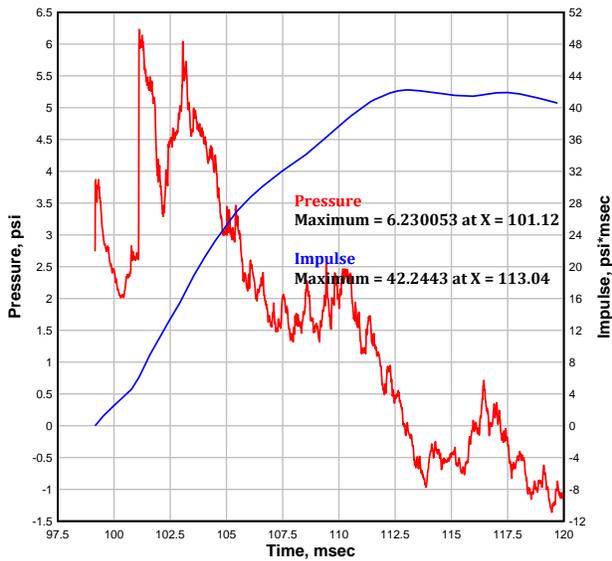
Top RPT

Reflected Air Blast Pressure
RPT #2



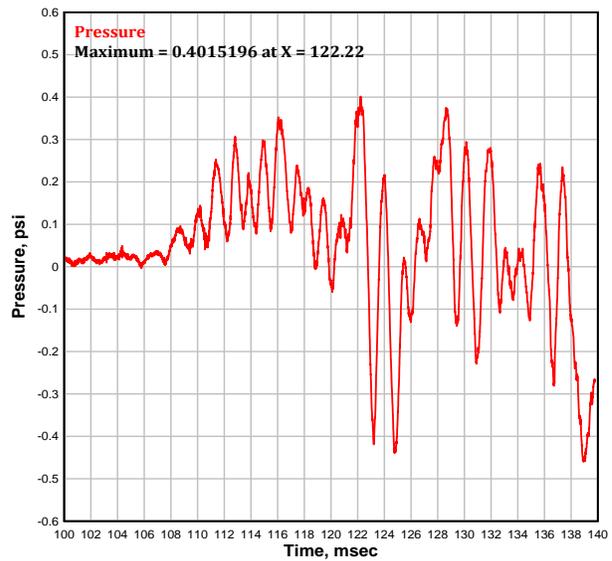
Right RPT

Reflected Air Blast Pressure
RPT #3



Shell RPT

Internal Air Blast Pressure
IPT #1



Witness Chamber IPT



Architectural Testing

Test Report No.: C4837.02-801-12
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Appendix C

Photographs

Specimen 1



Photo No. 1
Pre-test, Interior

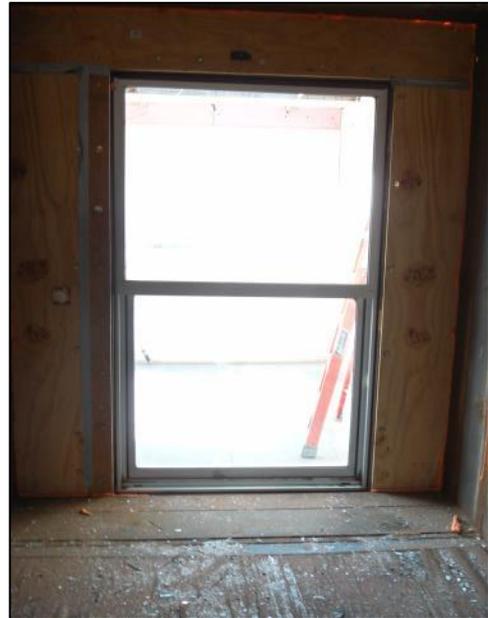


Photo No. 2
Pre-test, Exterior



Photo No. 3
Post-test, Interior



Photo No. 4
Post-test, Exterior



Photo No. 5
Post-test, Fragment



Photo No. 6
Post-test, Glazing Pull-out



Photo No. 7
Post-test, Witness Panel Impact



Photo No. 8
Post-test, Witness Panel Impact

Specimen #2



Photo No. 1
Pre-test, Interior



Photo No. 2
Pre-test, Exterior



Photo No. 3
Post-test, Interior



Photo No. 4
Post-test, Exterior



Photo No. 5
Post-test, Witness Area



Photo No. 6
Post-test, Fragment



Photo No. 7
Post-test, Fragment



Photo No. 8
Post-test, Glazing Tear

Specimen #3



Photo No. 1
Pre-test, Interior



Photo No. 2
Pre-test, Exterior



Photo No. 3
Post-test, Interior



Photo No. 4
Post-test, Exterior



Photo No. 5
Post-test, Fragment



Photo No. 6
Post-test, Witness Panel Impact



Photo No. 7
Post-test, Witness Panel Impact



Photo No. 8
Post-test, Witness Panel Impact

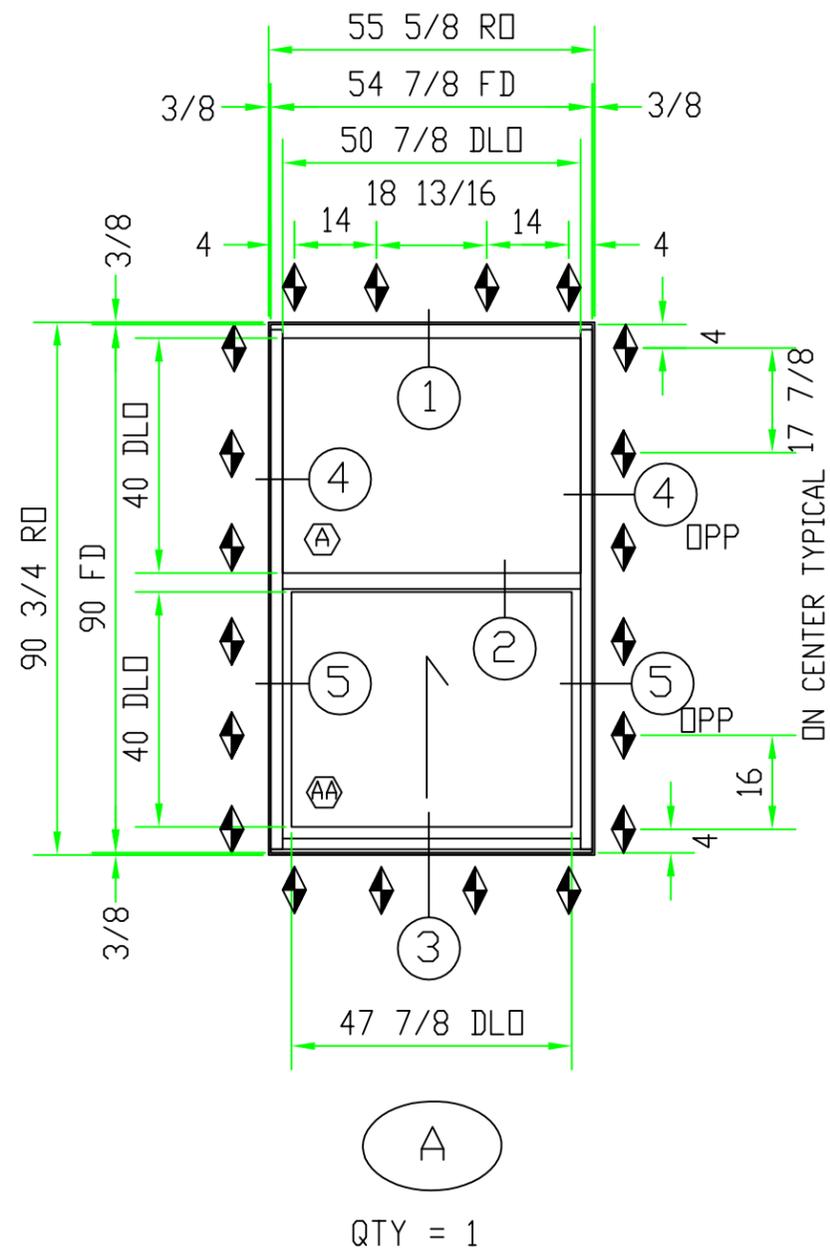


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Appendix D

Drawings



Architectural Testing, Inc
 Test sample complies with details shown herein. Any deviations are noted in the test report or drawings.

Report #: C4837.02-801-12

Date: 08/20/13 By: DS

SYMBOL KEY			
SYMBOL	DESCRIPTION	QTY	COMMENTS
⬡	52.875 X 42.000	1	1' INS = 1/4' CLR, 1/2' AIR, LAMI 1/8"HS,030,1/8"HS BUT/PVB
⬢	49.875 X 42.000	1	1' INS = 1/4' CLR, 1/2' AIR, LAMI 1/8"HS,030,1/8"HS BUT/PVB
◆	ANCHOR POINT		

REV	REV_DESCRIPTION	DATE	XXX
SYM	REVISION	DATE	BY



2100 E. 38TH STREET
 PHONE: (323) 588-1281
 VERNON, CA 90058
 FAX: (323) 232-2523

DIVISION UNITED STATES ALUMINUM

DRWN BY: DCW

DATE: 11.12.12

SCALE: 3/8"=1"

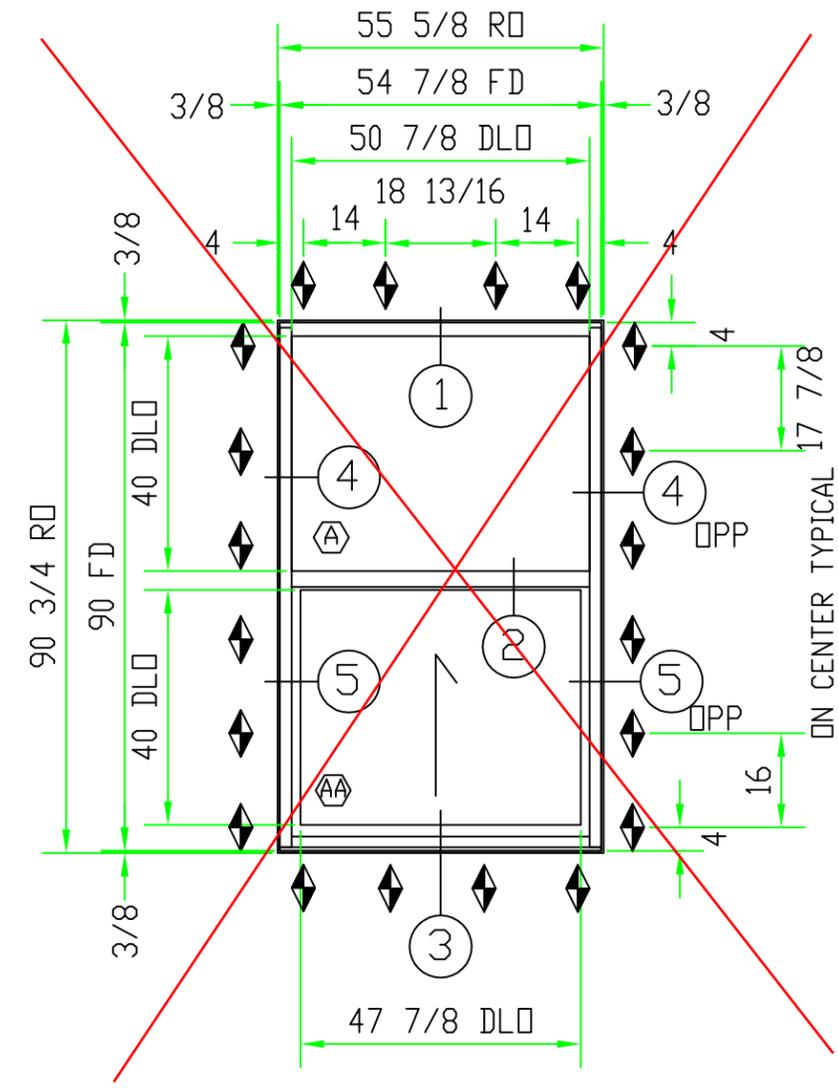
SHOCK_TUBE_TESTING

1 PSI - 4 PSI - 6 PSI

SERIES_8000_SINGLE_HUNG

DWG NO.

MU2012-019-00



B

QTY = 1
NOT USED

SYMBOL KEY			
SYMBOL	DESCRIPTION	QTY	COMMENTS
Ⓟ	52.875 X 42.000	1	1.034" INS = 1/4" CLR, 1/2" AIR, LAMI 1/8"HS,060,1/8"HS BUT/PVB
Ⓞ	49.875 X 42.000	1	1.034" INS = 1/4" CLR, 1/2" AIR, LAMI 1/8"HS,060,1/8"HS BUT/PVB
⚡	ANCHOR POINT		

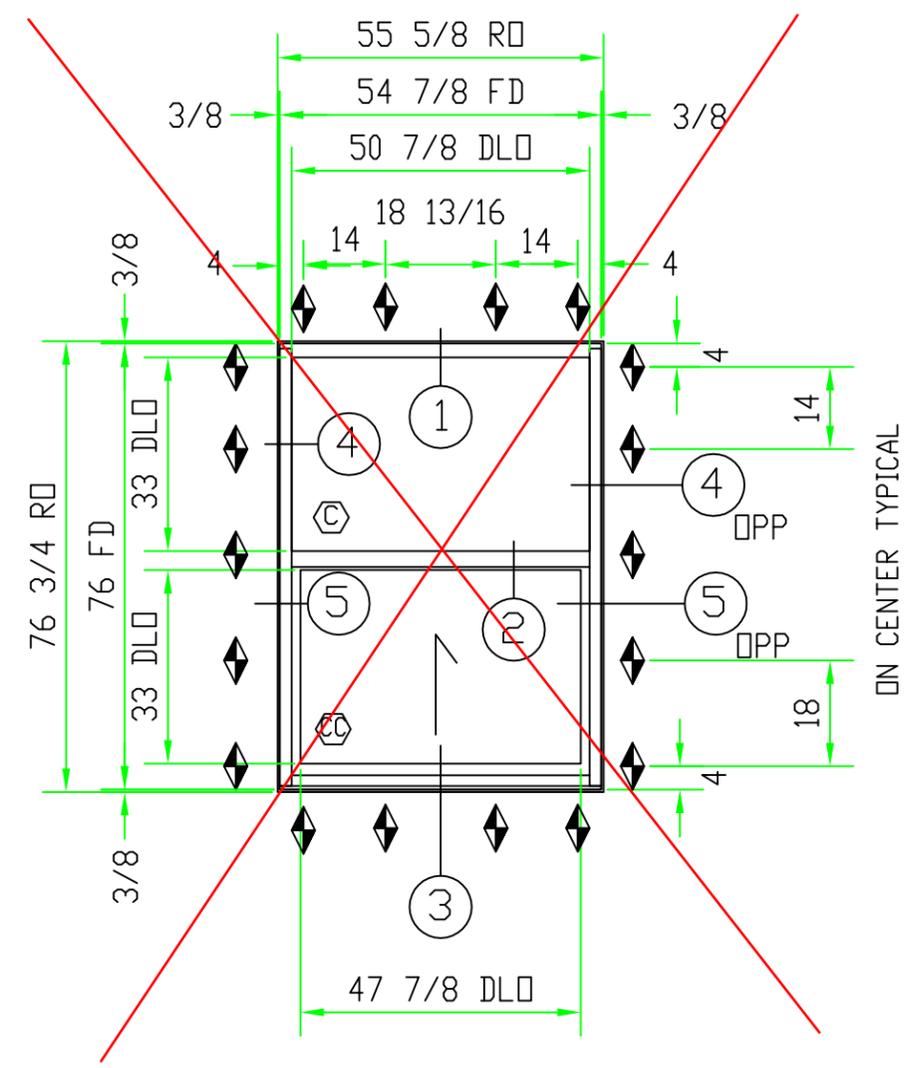
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SYM	REVISION	DATE	BY



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DRWN BY: DCW	SHOCK_TUBE_TESTING	DWG NO.
DATE: 11.12.12	1 PSI - 4 PSI - 6 PSI	MU2012-019-01
SCALE: 3/8"=1"	SERIES_8000_SINGLE_HUNG	



(C)
QTY = 1
NOT USED

SYMBOL KEY			
SYMBOL	DESCRIPTION	QTY	COMMENTS
(C)	52.875 X 35.000	1	1.054" INS = 1/4" CLR, 3/8" AIR, LAMI 3/16"HS,090,3/16"HS SGP
(CC)	49.875 X 35.000	1	1.054" INS = 1/4" CLR, 3/8" AIR, LAMI 3/16"HS,090,3/16"HS SGP
◆	ANCHOR POINT		

REV	REV_DESCRIPTION	DATE	XXX
SYM	REVISION	DATE	BY

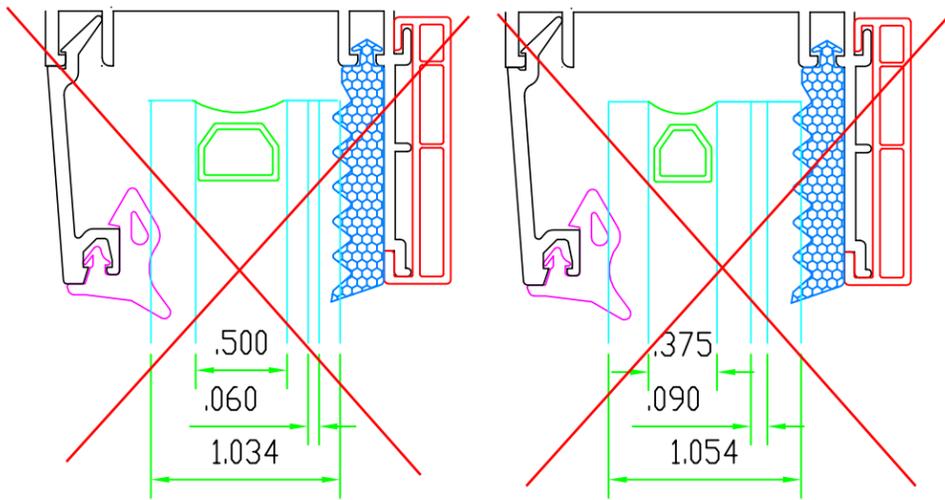
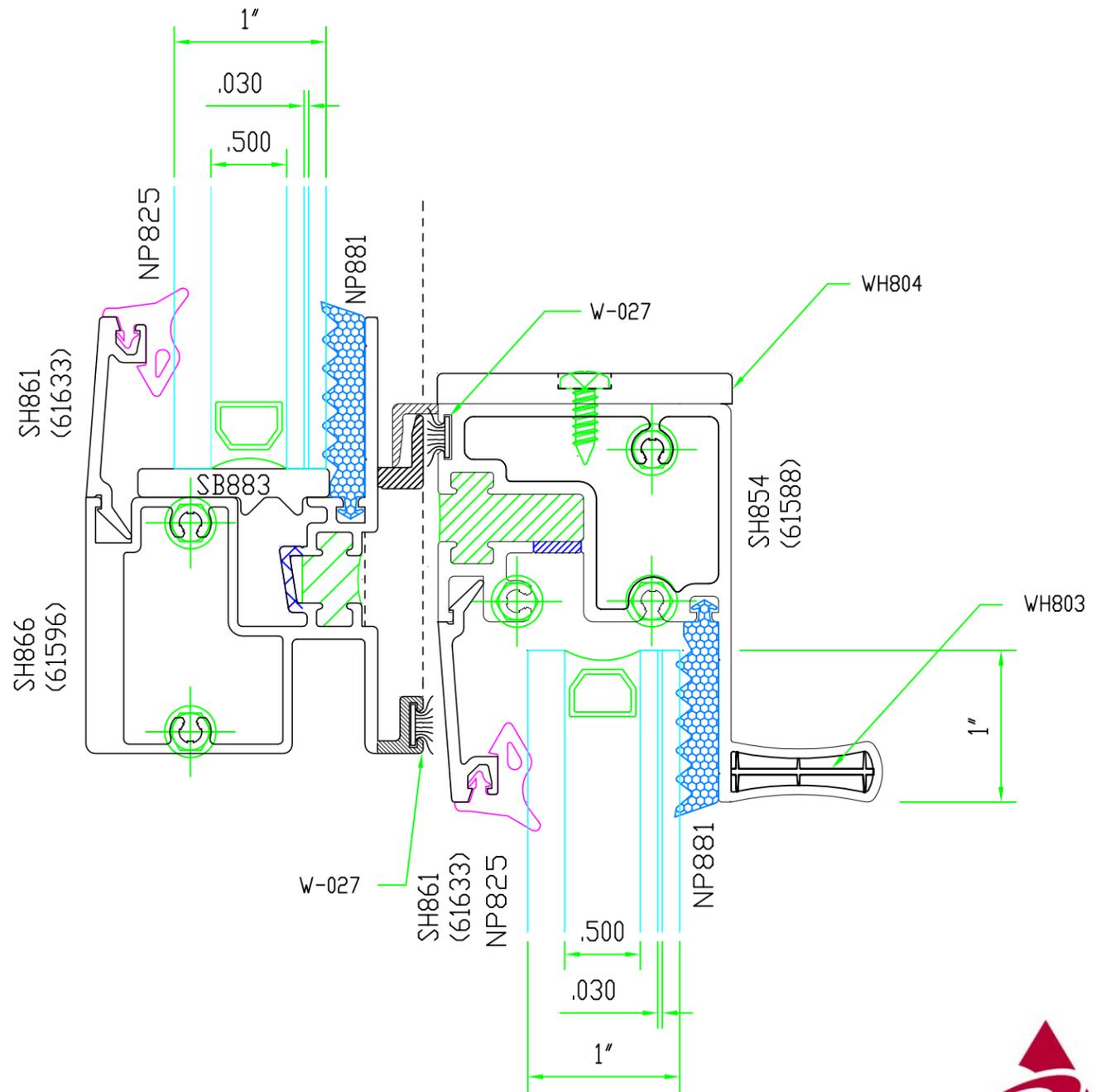
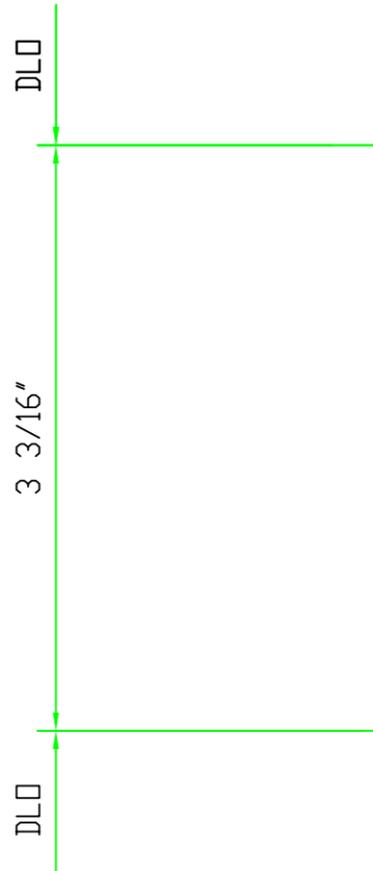


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DRWN BY: DCW	SHOCK_TUBE_TESTING	DWG NO.
DATE: 11.12.12	10 PSI	MU2012-019-10
SCALE: 3/8"=1"	SERIES_8000_SINGLE_HUNG	

2



Architectural Testing, Inc
 Test sample complies with details shown herein. Any deviations are noted in the test report or drawings.

Report #: C4837.02-801-12

Date: 08/20/13 By: DS



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REV	REV_DESCRIPTION	DATE	XXX	DATE	DRWN BY:	SHOCK_TUBE_TESTING	DWG NO.
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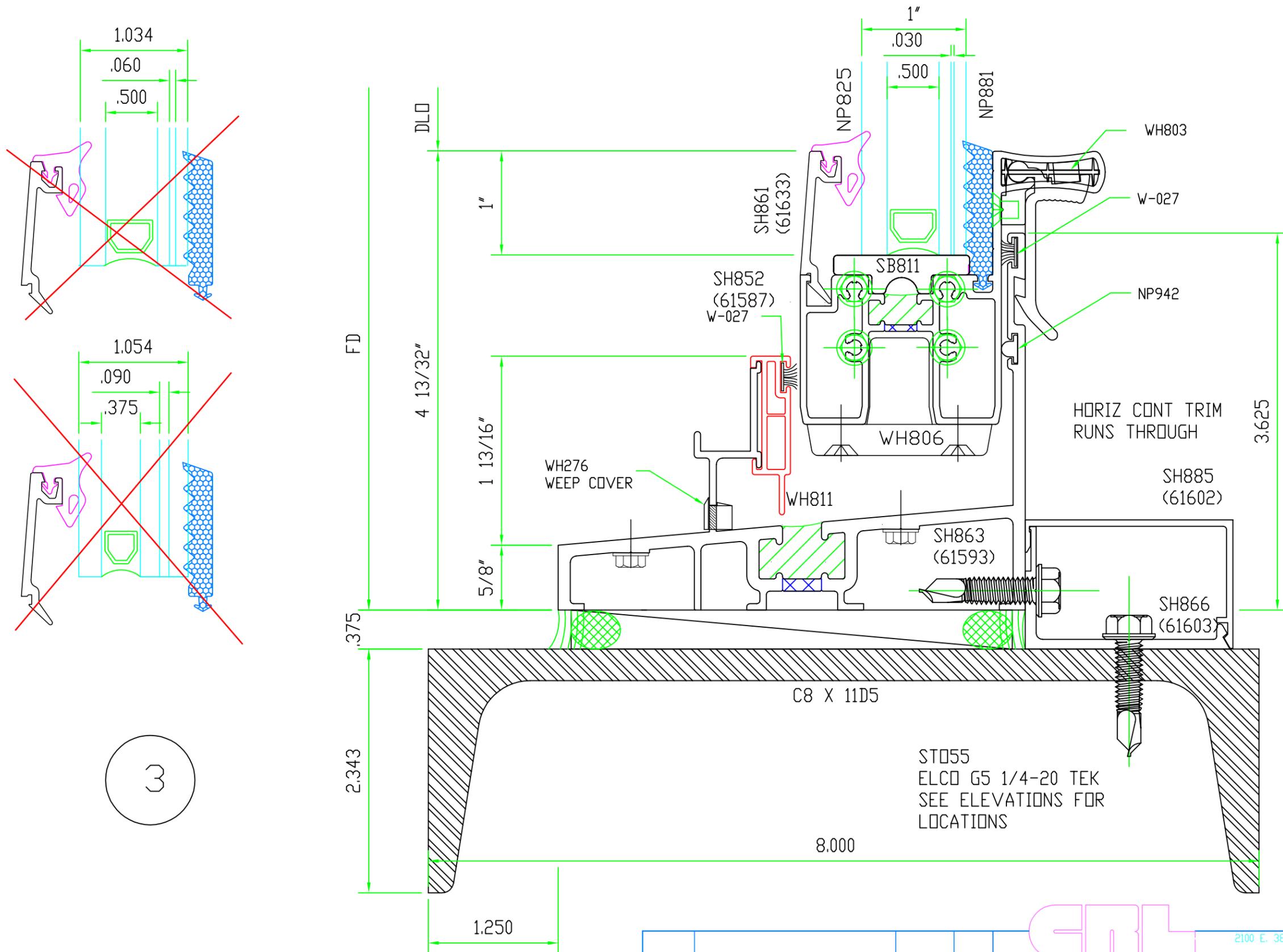
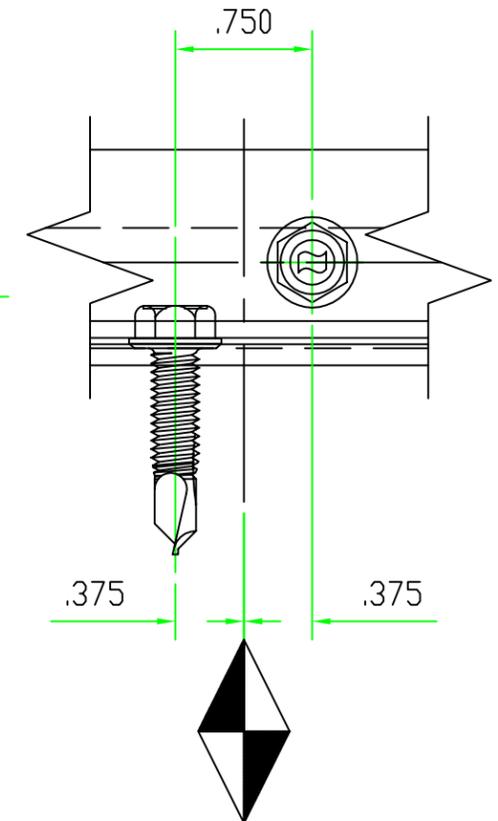


Architectural Testing, Inc
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TYPICAL FASTENER OFFSET FOR INSTALLATION



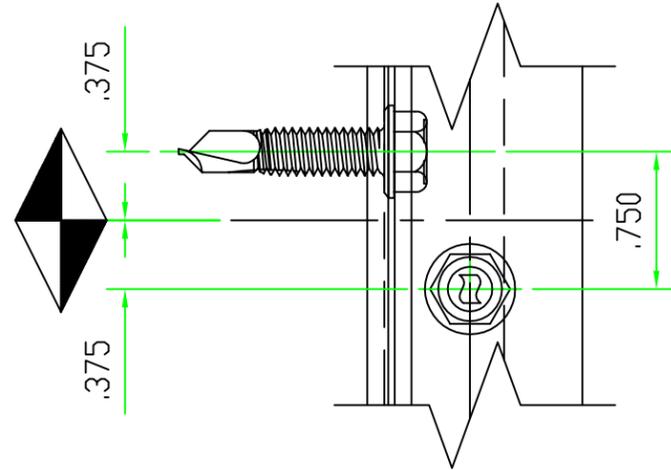
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 PHONE: (323) 588-1281 FAX: (323) 232-2523

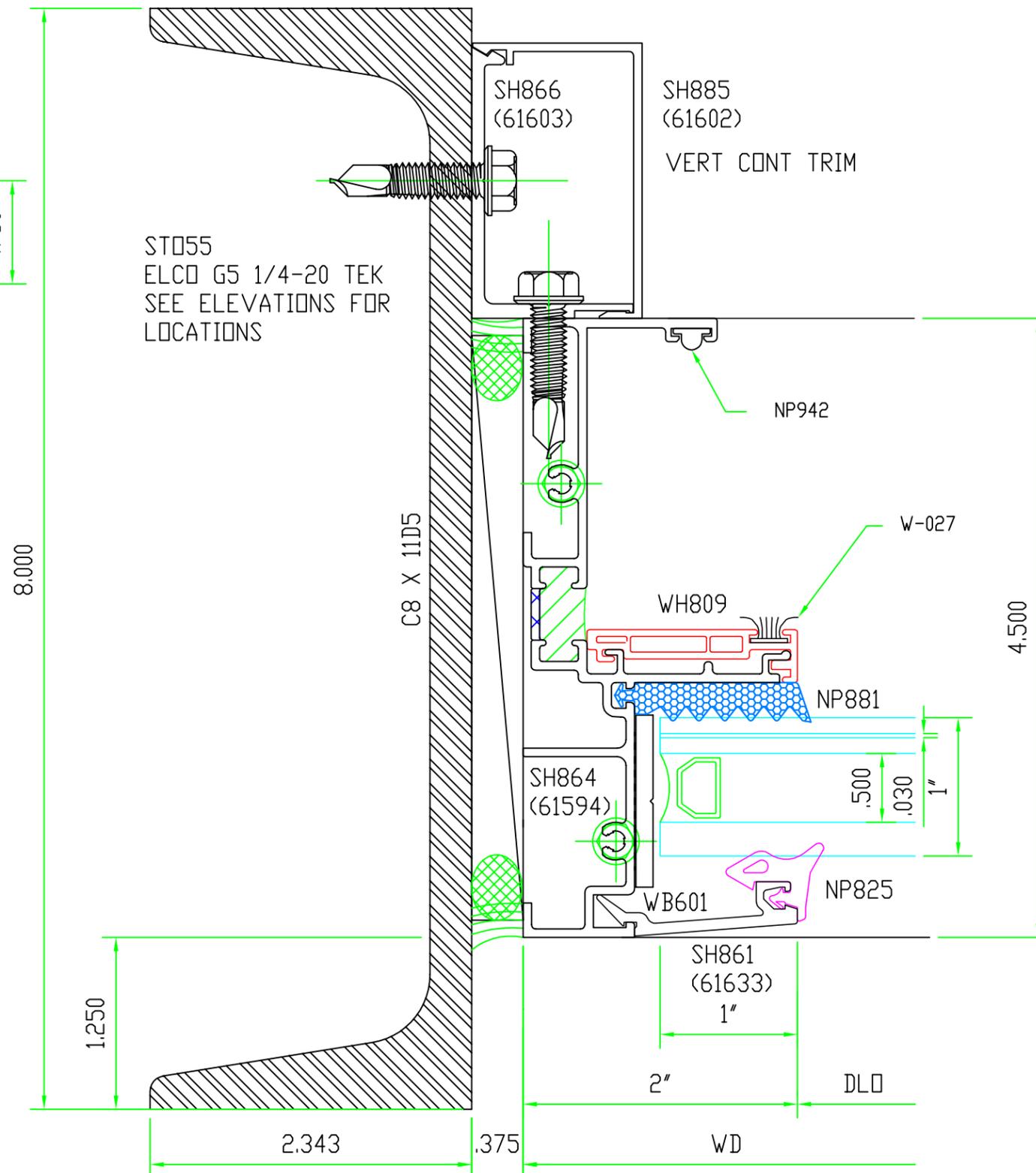
DIVISION UNITED STATES ALUMINUM

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TYPICAL FASTENER OFFSET FOR INSTALLATION

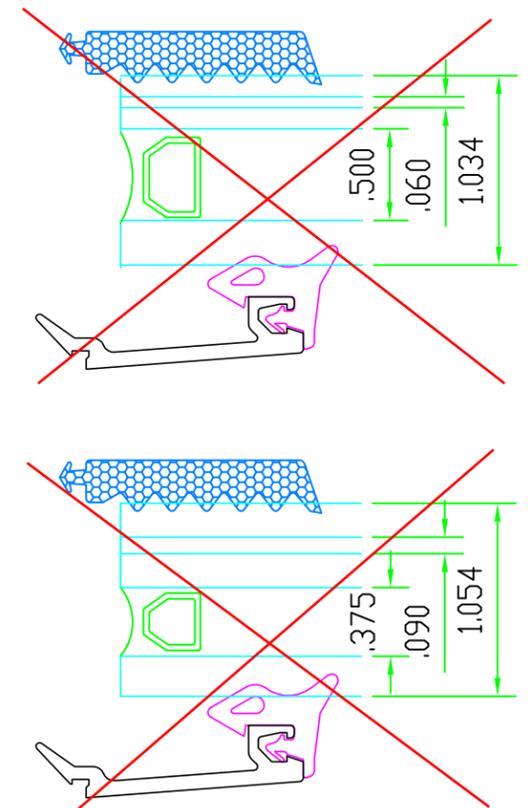
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Architectural Testing, Inc
 Test sample complies with details shown herein. Any deviations are noted in the test report or drawings.

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Date: 08/20/13 By: DS



2100 E. 38TH STREET VERNON, CA 90058
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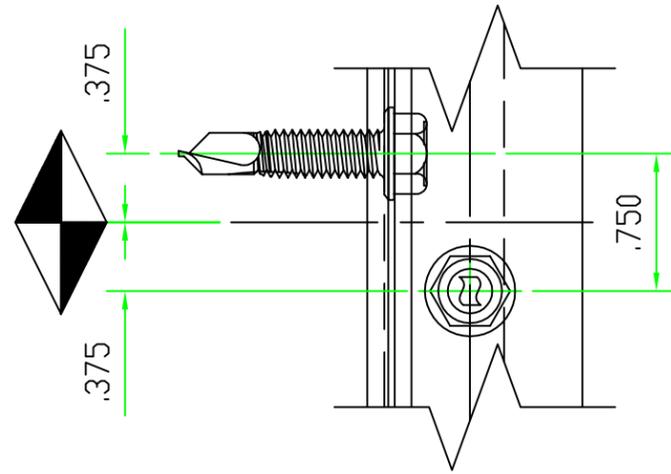
DIVISION UNITED STATES ALUMINUM

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SYM	REVISION	DATE	BY

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 DATE: 11.21.12
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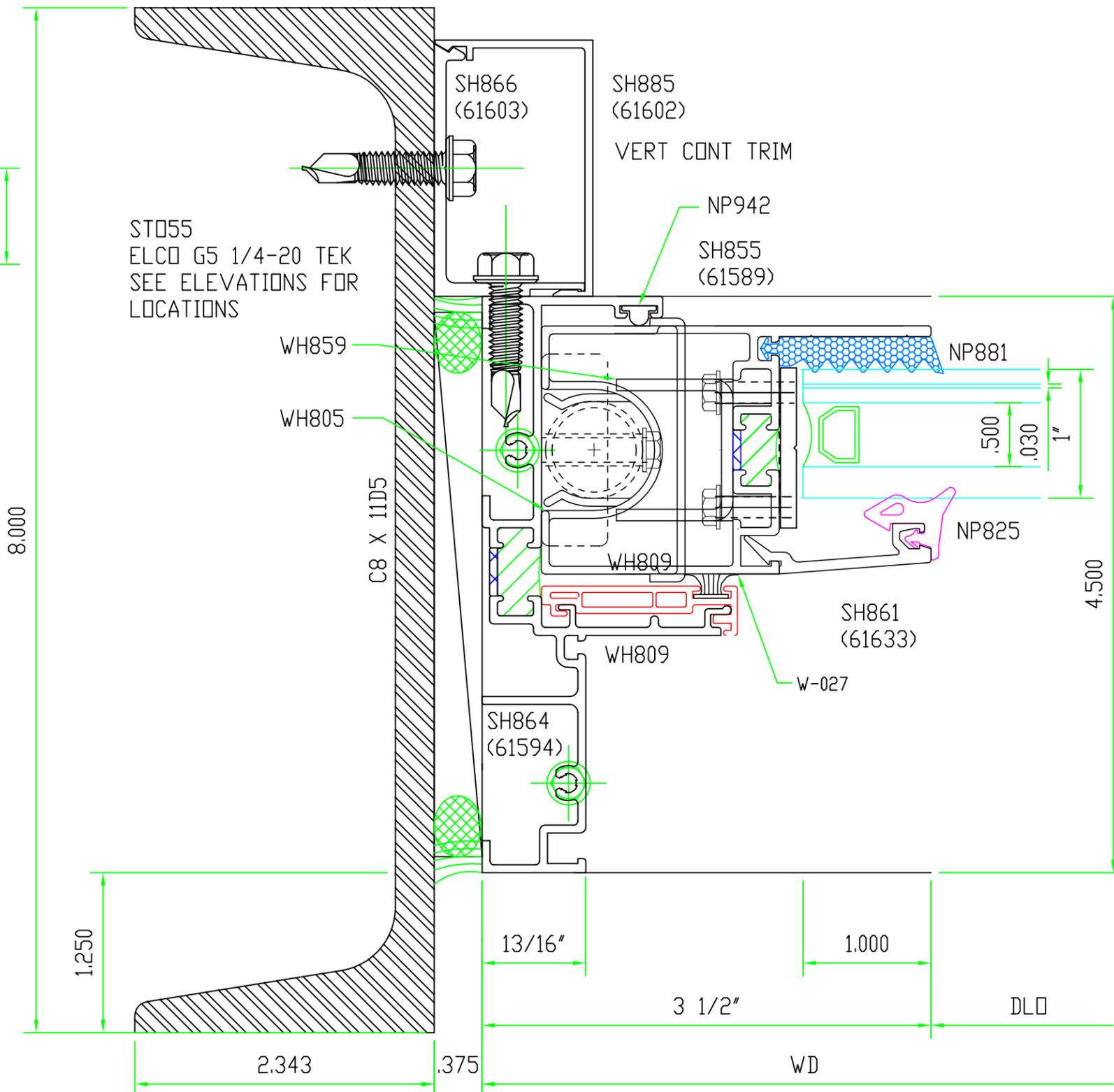
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 SERIES_8000_SINGLE_HUNG

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 MU2012-019-50

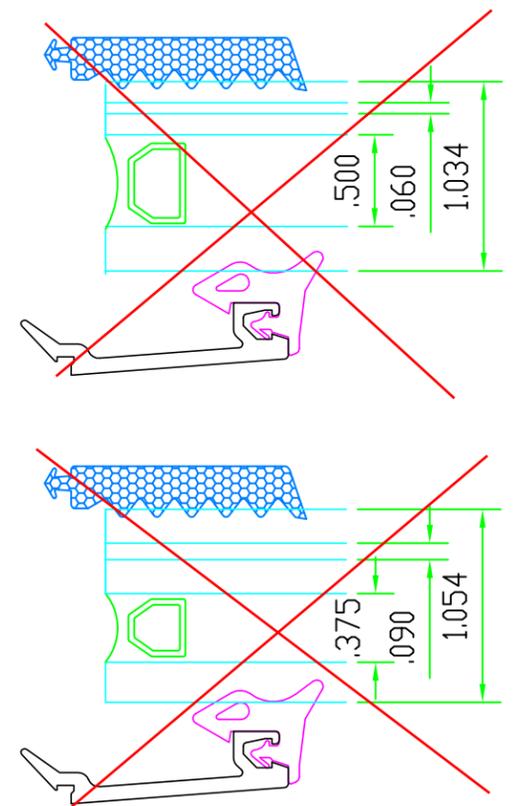


TYPICAL FASTENER OFFSET FOR INSTALLATION

5



Architectural Testing, Inc
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DIVISION UNITED STATES ALUMINUM

REV	REV_DESCRIPTION	DATE	XXX	DRWN BY:	DCW	SHOCK_TUBE_TESTING	DWG NO.
SYM	REVISION	DATE	BY	DATE:	11.21.12	SERIES_8000_SINGLE_HUNG	MU2012-019-60
				SCALE:	FULL		