

**ASTM F 1642-04/GSA TS01
TEST REPORT**

Rendered to:

CUSTOM DESIGNED SYSTEMS, INC.

SERIES/MODEL: 3100

PRODUCT TYPE: Aluminum Pyramidal Skylight

Title	Summary of Results		
	Test Specimen #1	Test Specimen #2	Test Specimen #3
ASTM Hazard Rating	No Break	No Break	No Break
GSA Performance Condition	1	1	1
Average Peak Blast Pressure	7.0 psi	6.7 psi	6.7 psi
Average Positive Phase Impulse	48 psi-msec	44 psi-msec	43 psi-msec
Average Positive Phase Duration	13 msec	11 msec	13 msec

This report contains in its entirety:

- Cover Page: 1 page
- Report Body: 8 pages
- Test Facility: 1 page
- Pressure-Time Plots: 6 pages
- Photographs: 6 pages
- Drawings: 4 pages

Reference should be made to Architectural Testing, Inc. Report No. 98371.01-122-12 for complete test specimen description and data.

ASTM F 1642-04/GSA TS01 TEST REPORT

Rendered to:

CUSTOM DESIGNED SYSTEMS, INC.
18315 Portland Avenue
Gladstone, Oregon 97027

Report No.: 98371.01-122-12
Test Date: 03/03/10
Report Date: 03/10/10
Expiration Date: 03/03/14

Project Summary: Architectural Testing, Inc. was contracted by Custom Designed Systems, Inc. to perform testing on three Series 3100, aluminum pyramidal skylights. Test specimen descriptions and results are reported herein. The samples were provided by the client.

Test Specification: The test specimens were evaluated in accordance with:

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.

Test Facility: Architectural Testing, Inc.'s shock tube is housed in a 10,000 square foot state-of-the-art test facility located in York, Pennsylvania. Blast loadings are produced on the specimen to simulate the effects of a high explosive charge at a specified standoff distance. Shock waves are generated by the sudden rupturing of a thin aluminum membrane. The shock wave expands as it travels down the tube, and impacts the target with a specific positive pressure and impulse. A photograph of the shock tube is provided in Figure #1 of Appendix A.

Data Acquisition: In accordance with ASTM F 1642-04 and GSA TS01, four reflective pressure transducers are utilized to record data at a 1MHz sample rate. Two reflective pressure transducers are located on the specimen holder at the top and right side (when viewed from the interior). A third pressure transducer is located on the shell to the exterior of the specimen, and a fourth is located in the witness chamber, directly to the interior of the specimen holder. A sketch of the specimen holder and corresponding reflective pressure sensor locations are provided in Figure #2 of Appendix A.

Drawing Reference: The attached drawings have been verified by Architectural Testing, Inc. and are representative of the samples tested. Drawings are provided in Appendix D.

Test Specimen Description:

The following descriptions apply to all specimens.

Test Series/Model: 3100

Product Type: Aluminum Pyramidal Skylight

Overall Size: 78" wide by 78" high

Fixed Daylight Opening (8 Total): 37" wide by 37" high (equal-leg triangle)

Overall Area: 42.3 ft²

Reinforcement: No reinforcement was utilized.

Finish: Painted aluminum

Glazing Details: The window was glazed with a 1-1/16" thick insulating glass unit constructed of an exterior sheet of 1/4" thick tempered glass and an interior sheet of 7/16" thick laminated glass with a 13/32" aluminum spacer system. The laminated glass consisted of two sheets of 3/16" thick heat strengthened glass with a 0.060" PVB interlayer. The glass was set from the exterior against a rubber gasket and secured with a pressure plate and rubber gasket. The pressure plate was secured with #10 x 1-3/4" long screws spaced at 11" on center. A snap cover was fit over the pressure plate and a bead of silicone was applied to the pressure plate cover and the glass. A brake formed skirt flashing was applied around the perimeter of the glass at the base and was secured to the glass with adhesive tape and silicone sealant. A brake formed flashing cap was applied at the peak of the unit and secured to the hip and rafter sections with #10 x 3/4" pan head self-drilling and tapping screws. Glazing bite measured 5/8".

Frame Construction: Frame members were constructed of extruded aluminum. The base frame corners were mitered and secured together with a 2" x 2" x 1/8" aluminum angle and eight #10 x 1/2" self-drilling and tapping pan head screws. Hip and rafter sections were attached to the base frame with shear block connections. Hip sections were attached to the shear blocks with four #10 x 3/4" pan head self-drilling and tapping screws. Shear blocks were attached to the frame with two 1/4" x 3" pan head screws. Rafter sections were attached to the shear blocks with four #10 x 3/4" pan head self-drilling and tapping screws. Shear blocks were attached to the frame with two #12 x 3/4" hex head self-drilling and tapping screws. At the peak, all hip and rafter sections utilized shear block connections to an eight sided 1/8" thick aluminum hub.

Test Specimen Description: (Continued)

Hardware: No hardware was utilized.

Installation: The base frame members were attached to a 6-11/16" long brake formed 1/8" thick aluminum plates. The aluminum plates were attached to the frame with three #12 x 3/4" hex head self-drilling and tapping screws. The aluminum plates were attached to the simulated wood roof curb with two 1/4" x 3" long pan head screws per plate. Two plates were located at each corner and one plate was located at each rafter section.

Test Results: The results are tabulated as follows:

Test Specimen #1:

<u>Description</u>	<u>Results</u>
Ambient Temperature	66°F
Glazing Temperature	66°F
Peak Positive Pressure	
Top Pressure	6.9 psi
Right Pressure	7.4 psi
Shell Pressure	6.6 psi
Average Pressure	7.0 psi
Positive Phase Duration	
Top Duration	13 msec
Right Duration	13 msec
Shell Duration	13 msec
Average Duration	13 msec
Positive Phase Impulse	
Top Impulse	48 psi-msec
Right Impulse	48 psi-msec
Shell Impulse	47 psi-msec
Average Impulse	48 psi-msec

- No pressure rise was measured on the protected side of the specimen.
- The exterior and interior lites remained unbroken. No visible frame damage was observed.
- No debris was observed.

ASTM Hazard Rating: No Break

GSA Performance Condition: 1

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

Test Results: (Continued)

Test Specimen #2:

<u>Description</u>	<u>Results</u>
Ambient Temperature	66°F
Glazing Temperature	66°F
Peak Positive Pressure	
Top Pressure	6.8 psi
Right Pressure	7.1 psi
Shell Pressure	6.3 psi
Average Pressure	6.7 psi
Positive Phase Duration	
Top Duration	11 msec
Right Duration	11 msec
Shell Duration	11 msec
Average Duration	11 msec
Positive Phase Impulse	
Top Impulse	44 psi-msec
Right Impulse	44 psi-msec
Shell Impulse	43 psi-msec
Average Impulse	44 psi-msec

- No pressure rise was measured on the protected side of the specimen.
- The exterior and interior lites remained unbroken. No visible frame damage was observed.
- No debris was observed.

ASTM Hazard Rating: No Break

GSA Performance Condition: 1

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

Test Results: (Continued)

Test Specimen #3:

<u>Description</u>	<u>Results</u>
Ambient Temperature	66°F
Glazing Temperature	65°F
Peak Positive Pressure	
Top Pressure	6.8 psi
Right Pressure	7.0 psi
Shell Pressure	6.3 psi
Average Pressure	6.7 psi
Positive Phase Duration	
Top Duration	13 msec
Right Duration	13 msec
Shell Duration	13 msec
Average Duration	13 msec
Positive Phase Impulse	
Top Impulse	44 psi-msec
Right Impulse	43 psi-msec
Shell Impulse	43 psi-msec
Average Impulse	43 psi-msec

- No pressure rise was measured on the protected side of the specimen.
- The exterior and interior lites remained unbroken. No visible frame damage was observed.
- No debris was observed.

ASTM Hazard Rating: No Break

GSA Performance Condition: 1

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

List of Official Observers:

<u>Name</u>	<u>Company</u>
Wes Sanburn	Custom Designed Systems Inc.
Jeff Lander	Architectural Testing, Inc.
Brady McNaughton	Architectural Testing, Inc.

Detailed drawings, data sheets, representative samples of test specimens, a copy of this report, and 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 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 specimens tested. This report may not be reproduced, except in full, without the written approval of Architectural Testing, Inc.

For ARCHITECTURAL TESTING, INC:

Brady W. McNaughton
Project Engineer

John S. Stacey, P.E.
Senior Project Engineer

BWM:ddr

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

- Appendix-A: Test Facility (1)
- Appendix-B: Pressure-Time Plots (6)
- Appendix-C: Photographs (6)
- Appendix-D: Drawings (4)

Revision Log

<u>Rev. #</u>	<u>Date</u>	<u>Page(s)</u>	<u>Revision(s)</u>
0	03/10/10	N/A	Original report issue

Appendix A

Test Facility



Figure #1
Shock Tube and Test Facility

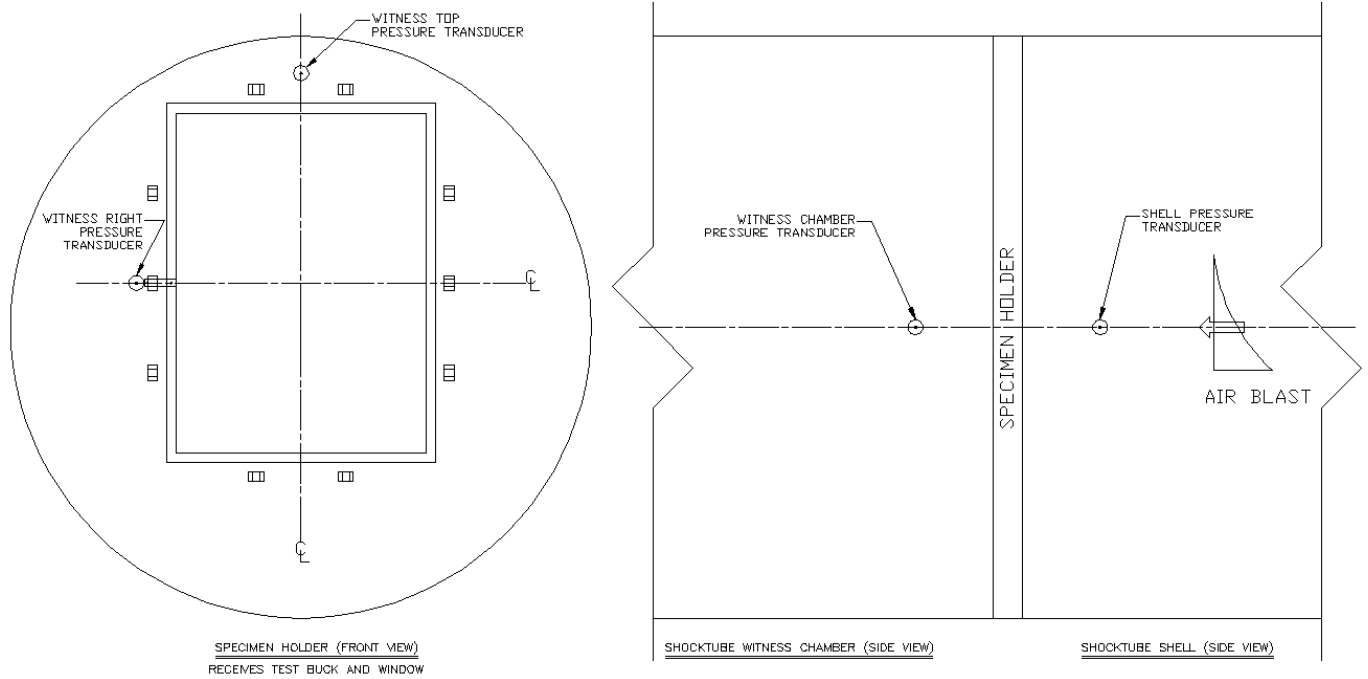
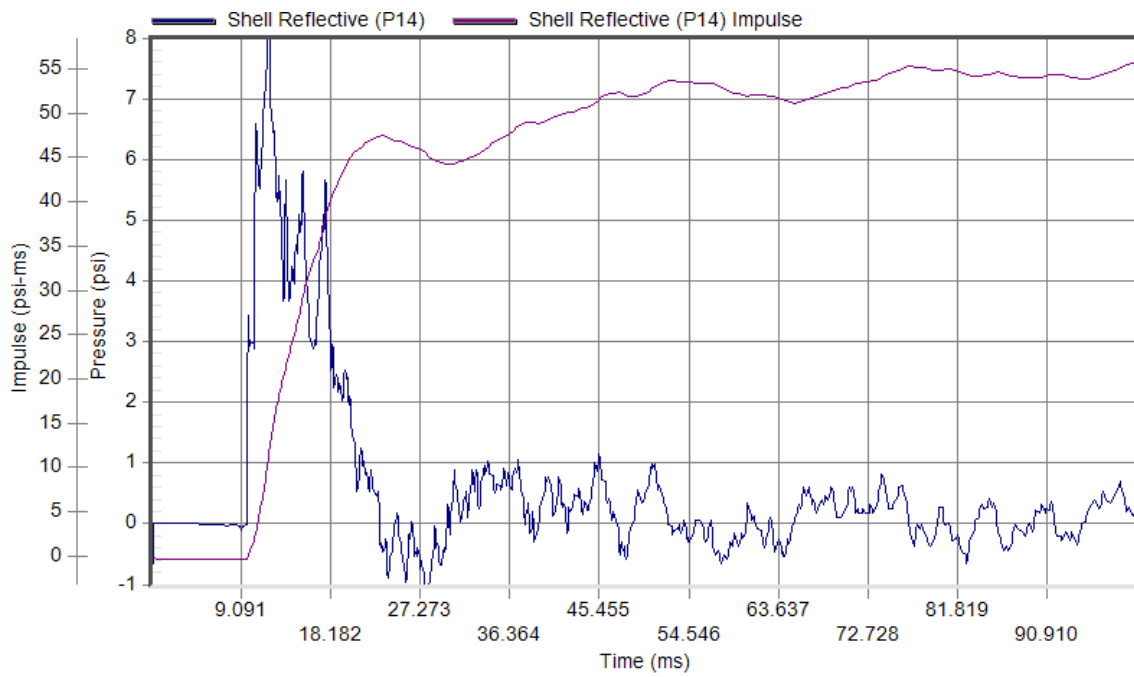


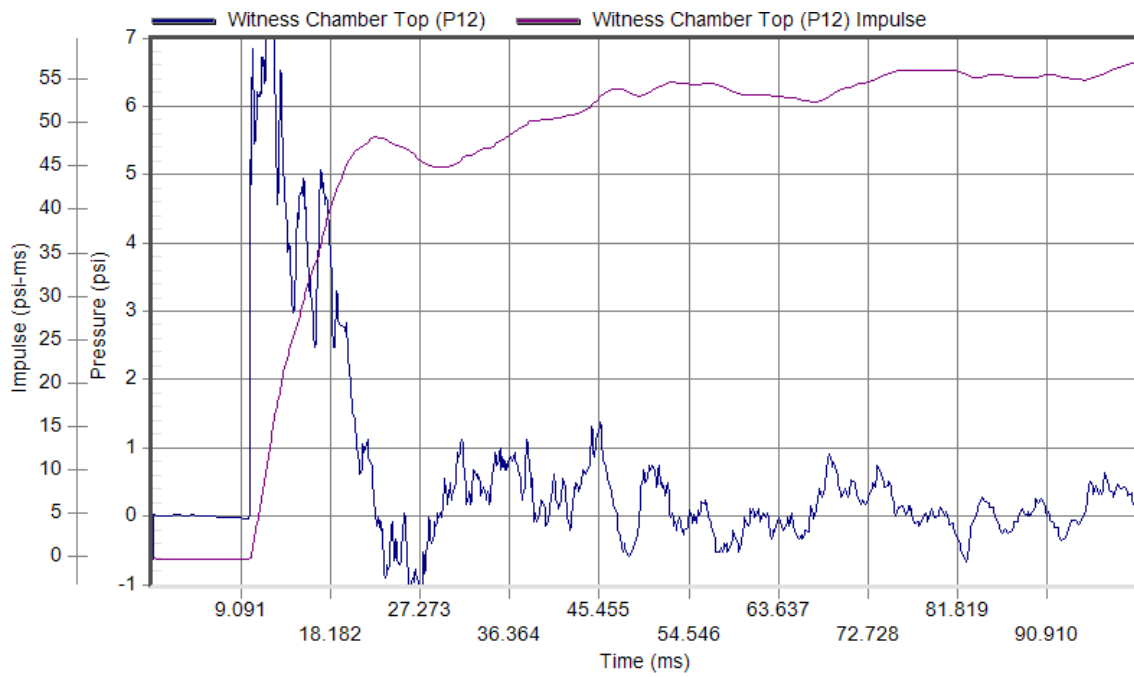
Figure #2
Pressure Sensor Locations

Appendix B
Pressure-Time Plots

Specimen #1

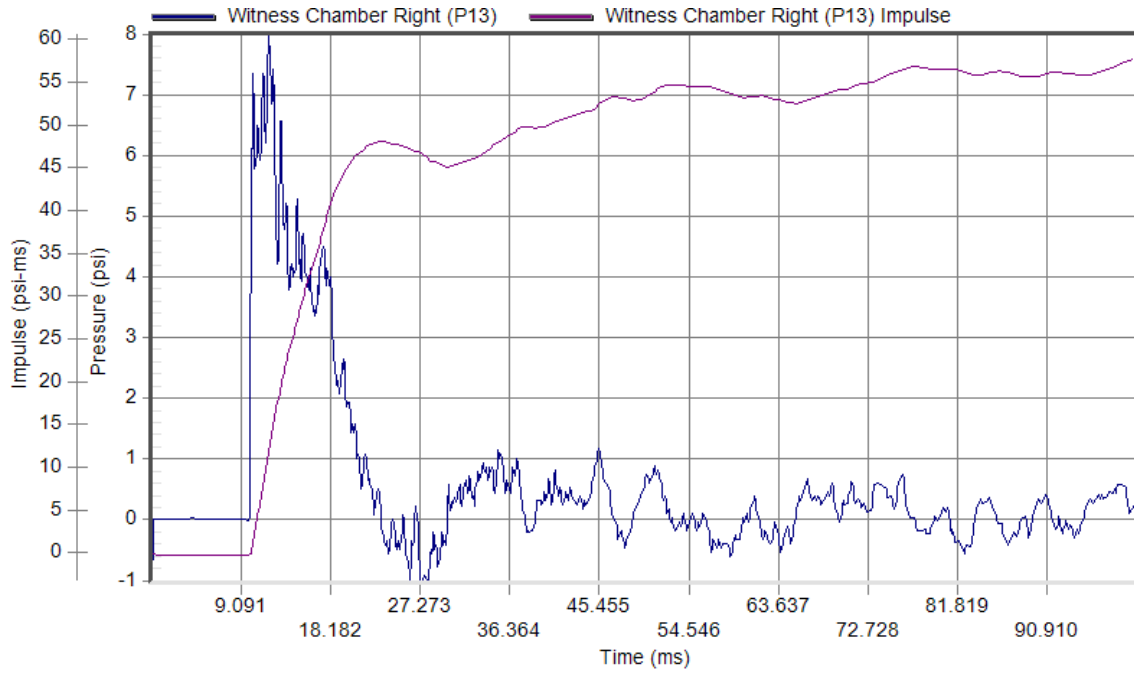


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Test Time: 8:47 am



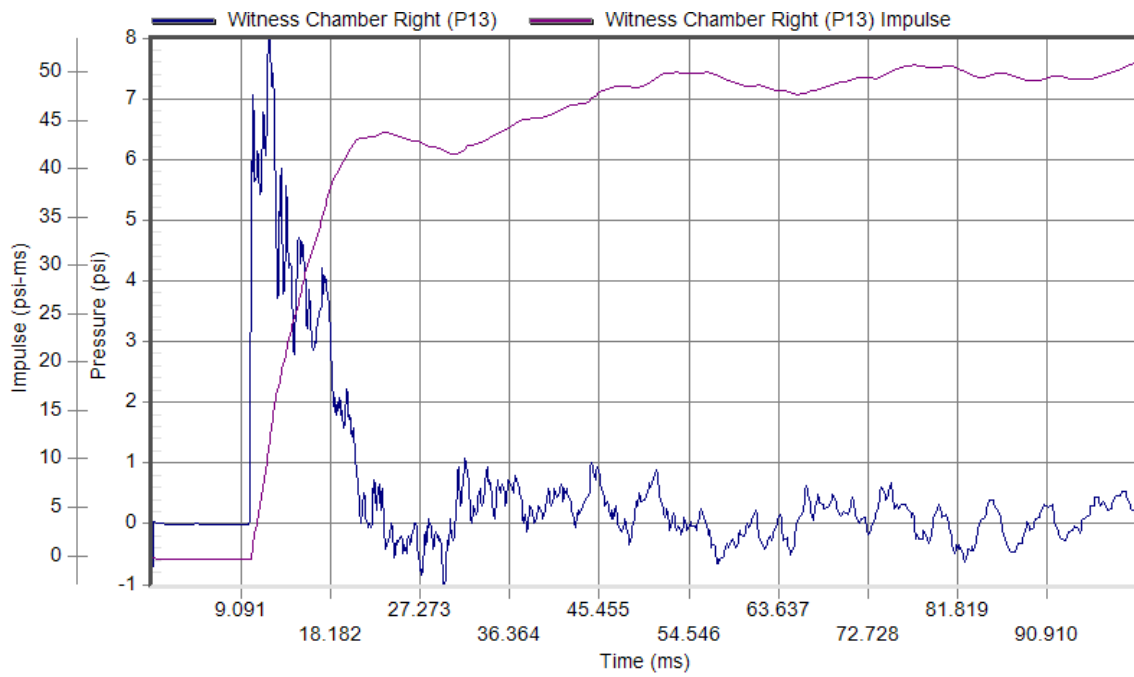
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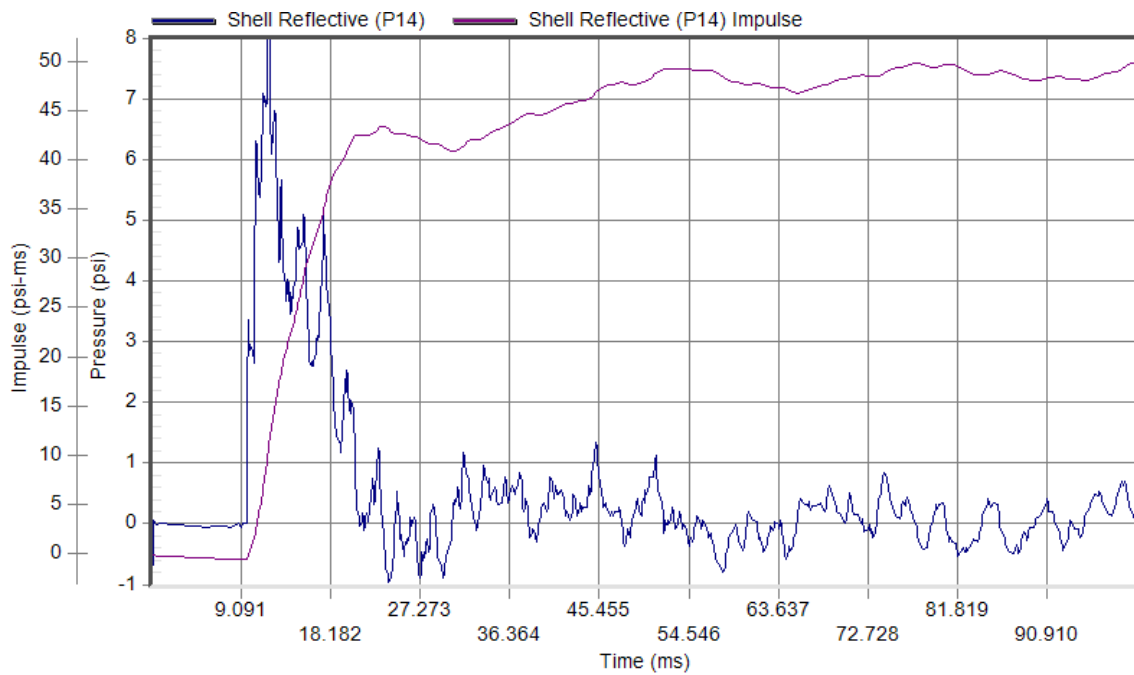


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Specimen #2

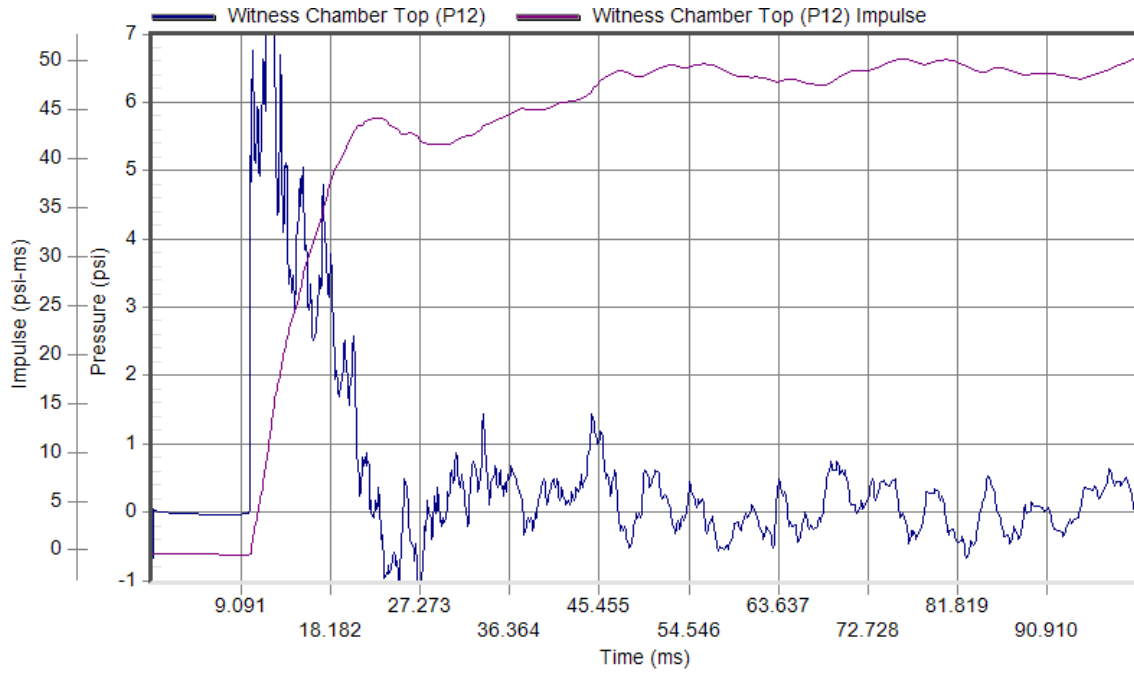


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Test Time: 10:17 am



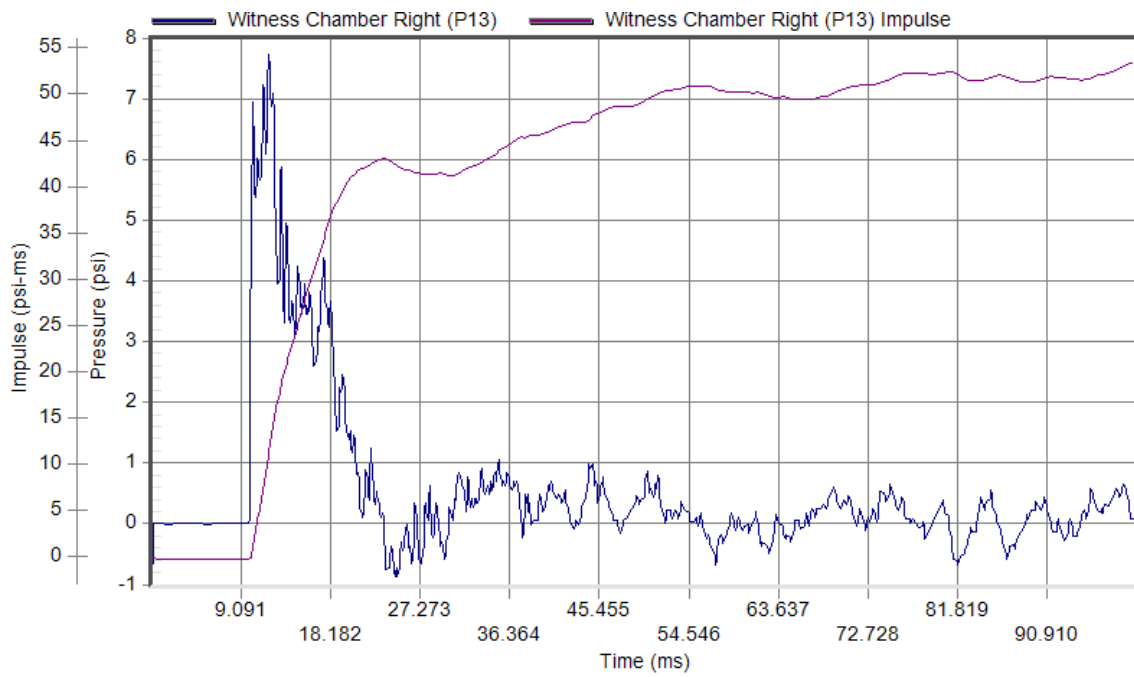
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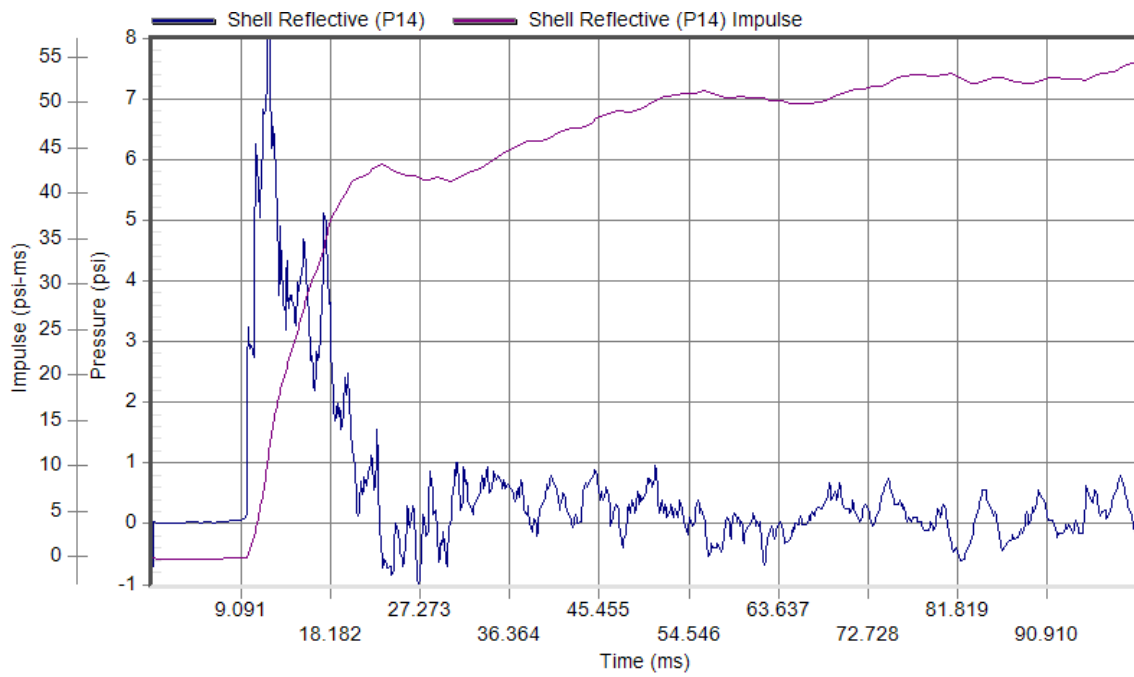


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Specimen #3

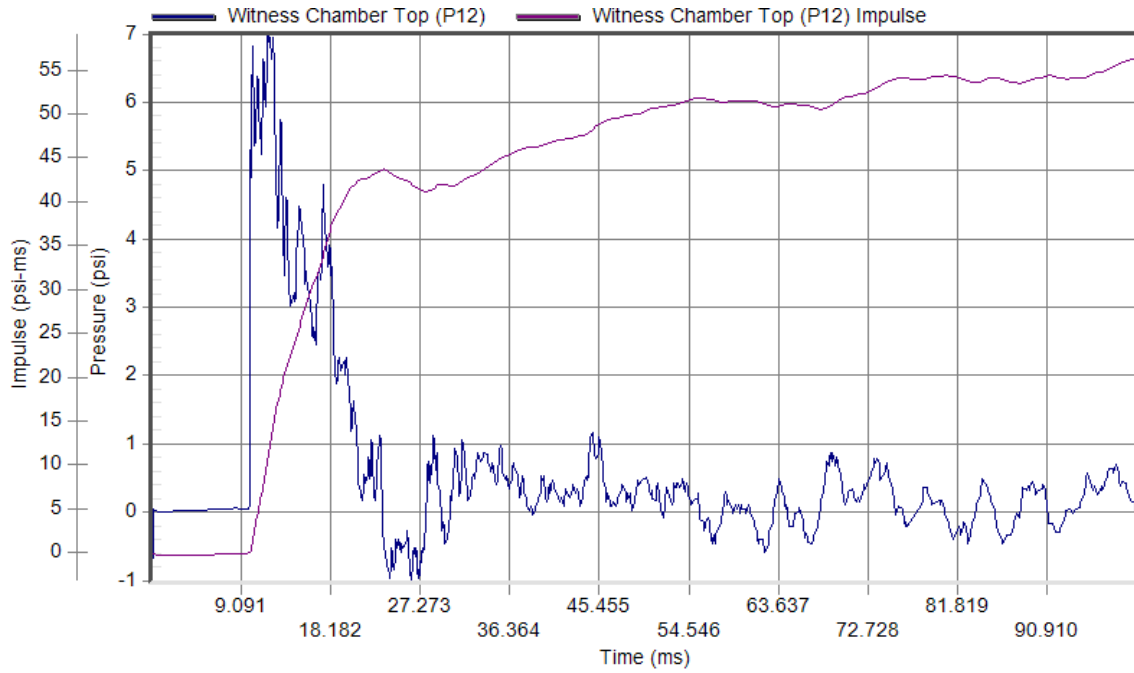


Test Date: 3/3/2010
Test Time: 11:31 am



Test Date: 3/3/2010
Test Time: 11:31 am

Specimen #3: (Continued)



Test Date: 3/3/2010
Test Time: 11:31 am

Appendix C

Photographs



Photo No. 1
Pre-test Specimen #1, Interior



Photo No. 2
Pre-test Specimen #1, Side



Photo No. 3
Post-test Specimen #1, Witness Chamber



Photo No. 4
Pre-test Specimen #2, Interior



Photo No. 5
Post-test Specimen #2, Interior



Photo No. 6
Post-test Specimen #2, Witness Chamber



Photo No. 7
Pre-test Specimen #3, Interior



Photo No. 8
Post-test Specimen #3, Interior



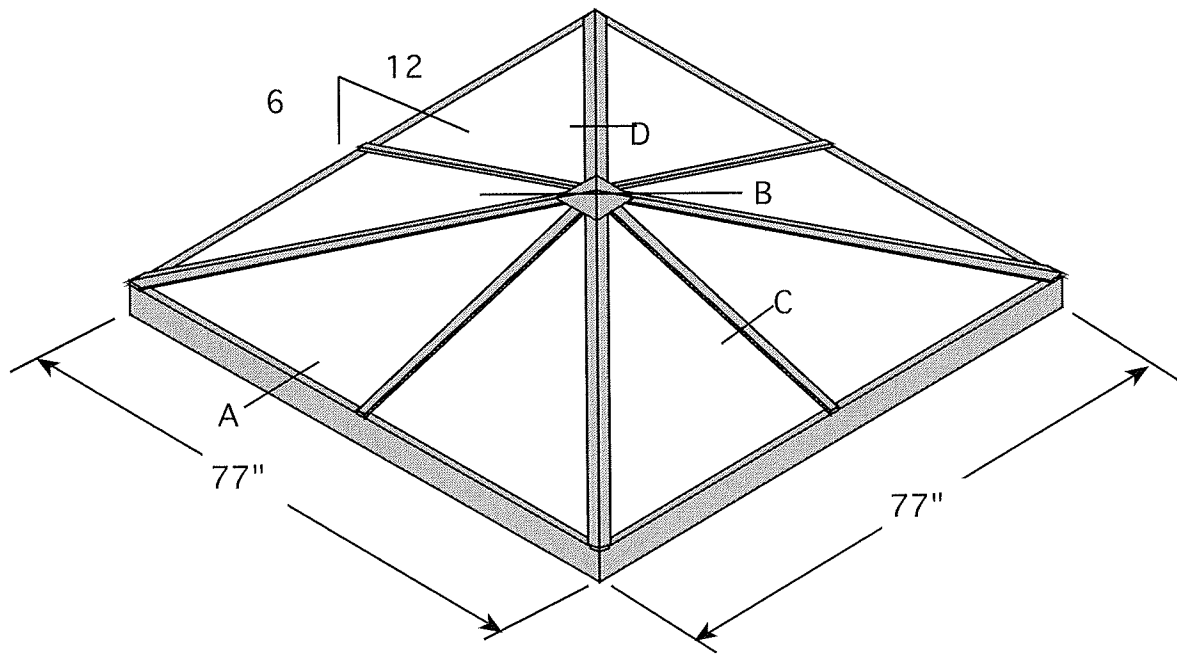
Photo No. 9
Post-test Specimen #3, Witness Chamber




Photo No. 10
All Specimens, Corner Detail

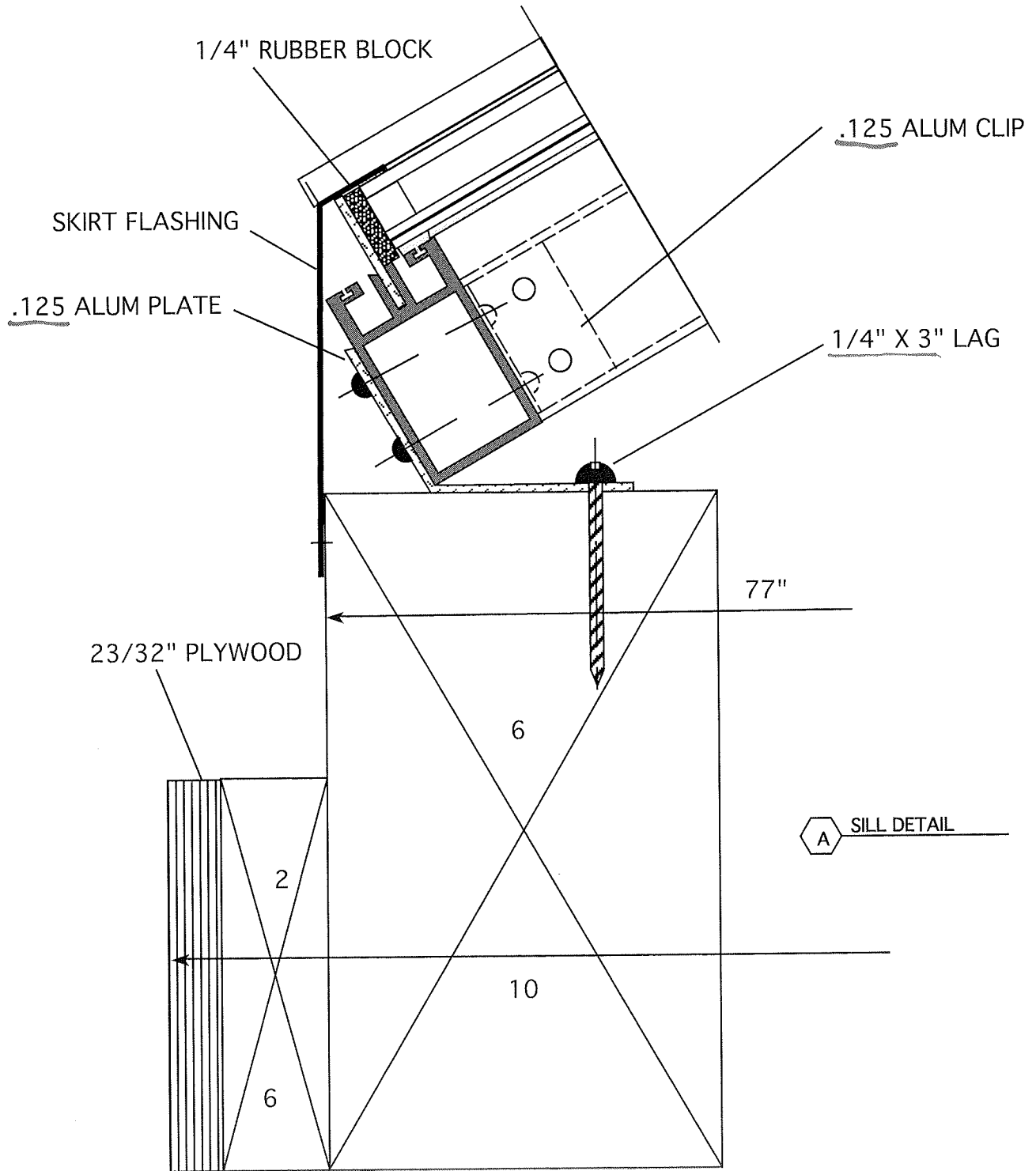
Appendix D

Drawings



1 ISOMETRIC VIEW PYRAMID


Architectural Testing
 Test sample complies with these details.
 Deviations are noted.
 Report # 98371.01-122-12
 Date 3/8/2010 Tech ds

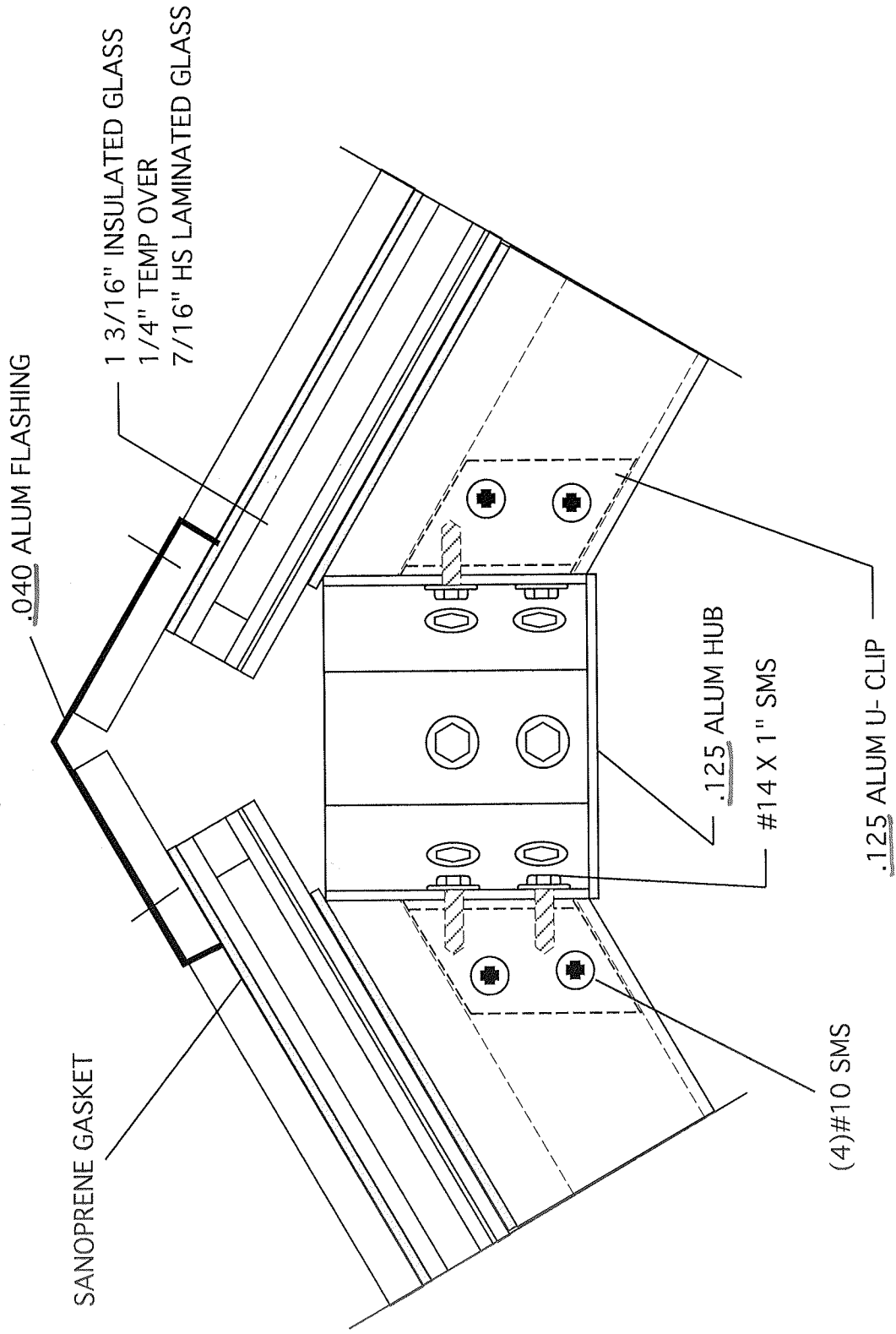


Architectural Testing

Test sample complies with these details.
 Deviations are noted.

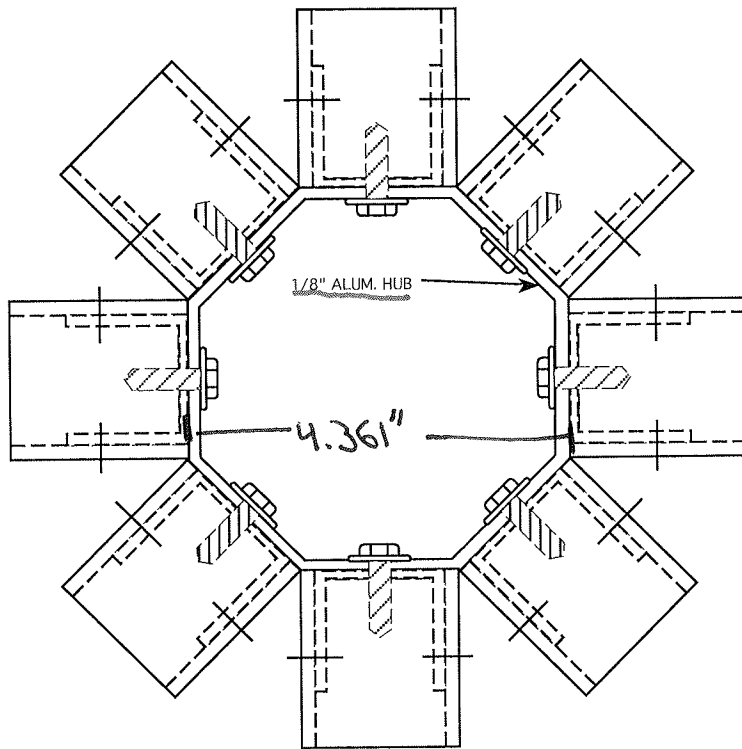
Report # 98371.01-122-12

Date 3/8/2010 Tech JS



HUB SECTION
B

Architectural Testing
 Test sample complies with these details.
 Deviations are noted.
 Report # 98371.01-122-12
 Date 3/8/2010 Tech *JS*



B2 HUB PLAN VIEW



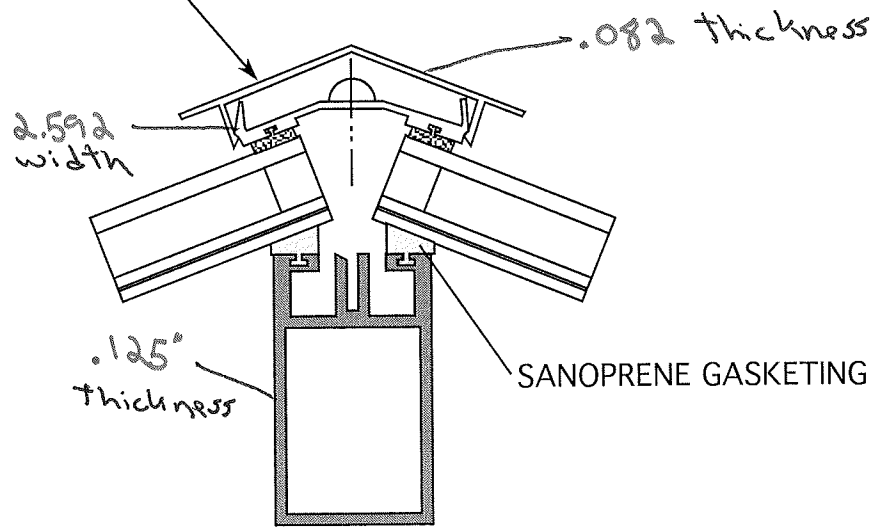
Architectural Testing

Test sample complies with these details.
 Deviations are noted.

Report # 98371.01-122-12

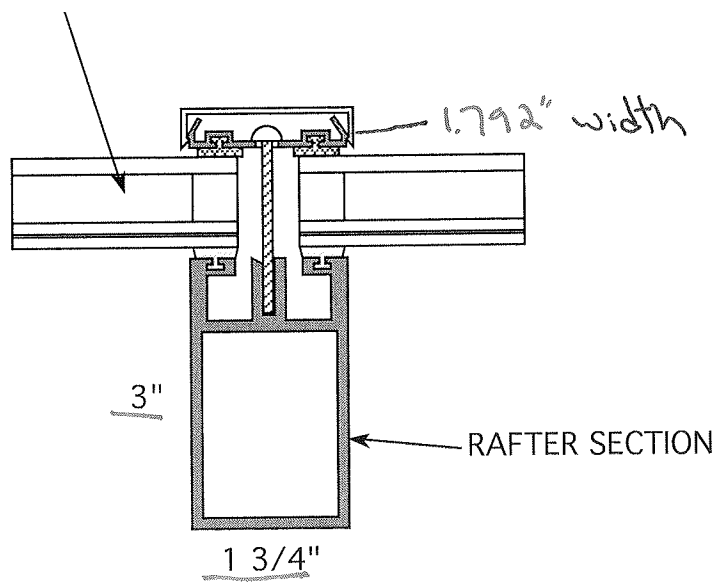
Date 03/8/2010 Tech JS

ALUM. HIP PRESSURE SYSTEM



D HIP DETAIL

1 3/16" INSULATED GLASS



C RAFTER DETAIL



Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # 98371.01-122-12

Date 3/8/2010 Tech *lg*