Intertek | Architectural Testing

ASTM F1642-12/GSA TS01 TEST REPORT

Report No.: D0345.02-119-12

Rendered to:
3M Company
St. Paul, Minnesota

PRODUCT TYPE:
Fragment Retention Film on Single Pane Annealed Glass with 3M™ Impact Protection Adhesive

SERIES/MODEL: 3M™ Safety S80, Safety and Security Window Film

SPECIFICATION: ASTM F 1642-12 *Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings*

AND

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

This report contains in its entirety:

Cover Page:	1 page
Summary of Results:	1 page
Report Body:	8 pages
Test Facility:	1 page
Pressure-Time Plots:	6 pages
Photographs:	5 pages
Drawings:	5 pages

Joseph A. Reed
Digitally Signed by: Joseph A. Reed
2014.09.15 15:17:36 -04'00'

Test Completion Date:	10/16/13
Report Date:	12/04/13
Test Record Retention Date:	12/04/17
Revision 1:	09/15/14

Summary of Results

ASTM F2912-11 System Rating: Minimal Hazard (H2)

Title	Summary of Results		
Test Specimen	**#1**	**#2**	**#3**
ASTM Hazard Rating	Minimal Hazard	No Hazard	Minimal Hazard
GSA Performance Condition	3b	2	2
Average Peak Reflected Pressure	6.40 psi	6.62 psi	6.41 psi
Average Positive Phase Impulse	41 psi-msec	40 psi-msec	41 psi-msec
Average Positive Phase Duration	13.46 msec	13.69 msec	13.32 msec

Reference must be made to Report No. D0345.02-119-12-R1, dated 09/15/14 for complete test specimen description and detailed test results.

Report Issued To: 3M Renewable Energy Division
3M Center, Building 235, E-330-3D-02
St. Paul, Minnesota 55144

Test Laboratory: Architectural Testing, Inc.
130 Derry Court
York, Pennsylvania 17406
717-764-7700

1.0 Project Summary:

1.1 Product Type: Fragment Retention Film on Single Pane Annealed Glass with 3M™ Impact Protection Adhesive

1.2 Series/Model: 3M™ Safety S80, Safety and Security Window Film

1.3 Compliance Statement: 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.

1.4 Test Dates: 10/15/2013 and 10/16/2013

1.5 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.

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

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

1.8 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.

1.9 List of Official Observers:

Name	Company
Paul Neumann	3M Renewable Energy Division
Josh I. Scott	Architectural Testing, Inc.
Emily C. Riley	Architectural Testing, Inc.
Travis A. Hoover	Architectural Testing, Inc.
Joseph A. Reed, P.E.	Architectural Testing, Inc.
Steven Neff	Architectural Testing, Inc.

2.0 Test Specifications:

ASTM F1642-12, *Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings*

ASTM F2912-11, *Standard Specification for Glazing and Glazing Systems Subject to Airblast Loadings*

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

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

3.1 Product Sizes:

Measured Dimensions	Width (inches)	Height (inches)
Overall Size	57	45
Fixed Day Lite Opening	53-1/2	41-1/2

3.0 Test Specimen Description: (Continued)

3.2 Frame Construction:

Frame Member	Material	Description
Head, sill and jambs	Aluminum	Extruded
Glass Stop	Aluminum	Extruded, snaps into place on sill frame member to secure the glazing.

	Joinery Type	Detail
All corners	Square Cut	Butted and secured using extruded aluminum shear blocks (Reference Drawing 3M window test fixture with IPA drawing detail D, P/N 45-101).
Jambs	N/A	The jambs were secured to each sill shear block using one #10 x 5/8" long Phillips flat head screw
Head	N/A	The head was secured to the each jamb shear block using one #10 x 5/8" long Phillips flat head screw

3.3 Glazing Method: All specimens utilized 1/4" thick clear annealed glass with an 8 mil Polyester (PET) safety and security film adhered to the interior surface of the glass. The glass was channel glazed and secured at the exterior sill using extruded aluminum glazing stops. The glass was set against a kerf-mounted rubber gasket with a 1/2" glazing bite. The glass was secured in place from the interior using a continuous bead of 3M™ Impact Protection Adhesive (IPA) structural sealant (Reference Drawing 3M Window Test Fixture W/IPA, Detail E).

3.4 Hardware: No hardware was utilized.

3.5 Reinforcement: No reinforcement was utilized.

4.0 Installation: The specimens were placed directly into the shock tube test frame.

5.0 Test Results: The results are tabulated as follows.

Test Specimen #1:

Description	Results
Ambient Temperature	68 °F
Glazing Temperature	68 °F
ASTM Hazard Rating	**Minimal Hazard**
GSA Performance Condition	**3b**
Peak Positive Pressure	
Top Pressure	6.58 psi
Right Pressure	6.58 psi
Shell Pressure	6.04 psi
Average Pressure	6.40 psi
Witness Chamber Pressure	0.44 psi
Peak Positive Phase Duration	
Top Duration	13.54 msec
Right Duration	13.61 msec
Shell Duration	13.22 msec
Average Duration	13.46 msec
Peak Positive Phase Impulse	
Top Impulse	42 psi*msec
Right Impulse	41 psi*msec
Shell Impulse	41 psi*msec
Average Impulse	41 psi*msec
Glazing Response	
Lite	Fractured
Glazing Pullout Length and Location	None
Glazing Tearing	1" at sill corner

Witness Chamber Results
The glazing fractured but was fully retained in the frame. Two slivers were located 35-1/4" and 50-1/2" from the specimen on the witness chamber floor. Two sliver indents were located at a height of 9-1/2" and 32-3/8" on the witness panel

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

5.0 Test Results: (Continued)

Test Specimen #2:

Description	Results
Ambient Temperature	68 °F
Glazing Temperature	68 °F
ASTM Hazard Rating	**No Hazard**
GSA Performance Condition	**2**
Peak Positive Pressure	
Top Pressure	6.67 psi
Right Pressure	7.06 psi
Shell Pressure	6.13 psi
Average Pressure	6.62 psi
Witness Chamber Pressure	0.41 psi
Peak Positive Phase Duration	
Top Duration	13.52 msec
Right Duration	13.91 msec
Shell Duration	13.63 msec
Average Duration	13.69 msec
Peak Positive Phase Impulse	
Top Impulse	40 psi*msec
Right Impulse	40 psi*msec
Shell Impulse	40 psi*msec
Average Impulse	40 psi*msec
Glazing Response	
Lite	Fractured
Glazing Pullout Length and Location	None
Glazing Tearing	None

Witness Chamber Results
The glazing fractured but was fully retained in the frame. A dusting of glass was deposited on the witness chamber floor with no markings on the witness panel.

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

5.0 Test Results: (Continued)

Test Specimen #3:

Description	Results
Ambient Temperature	71 °F
Glazing Temperature	70 °F
ASTM Hazard Rating	**Minimal Hazard**
GSA Performance Condition	**2**
Peak Positive Pressure	
Top Pressure	6.42 psi
Right Pressure	6.75 psi
Shell Pressure	6.07 psi
Average Pressure	6.41 psi
Witness Chamber Pressure	0.40 psi
Peak Positive Phase Duration	
Top Duration	13.49 msec
Right Duration	13.26 msec
Shell Duration	13.20 msec
Average Duration	13.32 msec
Peak Positive Phase Impulse	
Top Impulse	41 psi*msec
Right Impulse	41 psi*msec
Shell Impulse	41 psi*msec
Average Impulse	41 psi*msec
Glazing Response	
Lite	Fractured
Glazing Pullout Length and Location	4-1/2" along the head
Glazing Tearing	None

Witness Chamber Results
The glazing fractured but was fully retained in the frame. A dusting of glass was deposited on the witness chamber floor with no markings on the 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 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 specimens 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: Steve Neff

Steven A. Neff - Technician II
Structural Systems Testing

Digitally Signed by: Joseph A. Reed

Joseph A. Reed, P.E. - Director
Engineering

SAN:ecr/tah/jas

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 (5)
- Appendix D: Drawings (5)

Revision Log

Rev. #	Date	Page(s)	Revision(s)
0	12/04/13	N/A	Original report issue
1	09/15/14	30	Replaced assembly drawing

Appendix A

Test Facility

Figure #1
Shock Tube and Test Facility

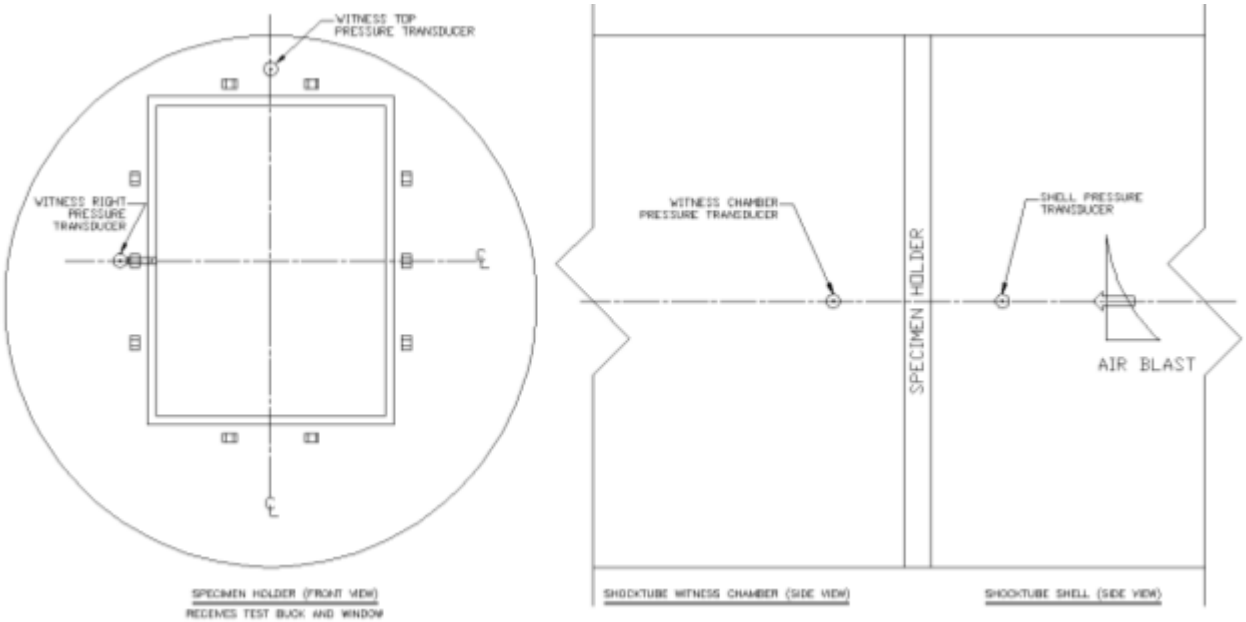
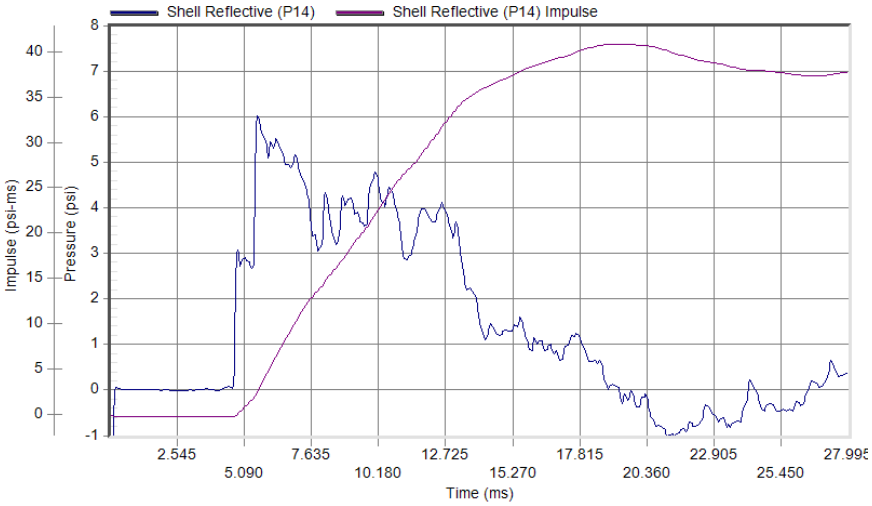


Figure #2
Pressure Sensor Locations

Appendix B

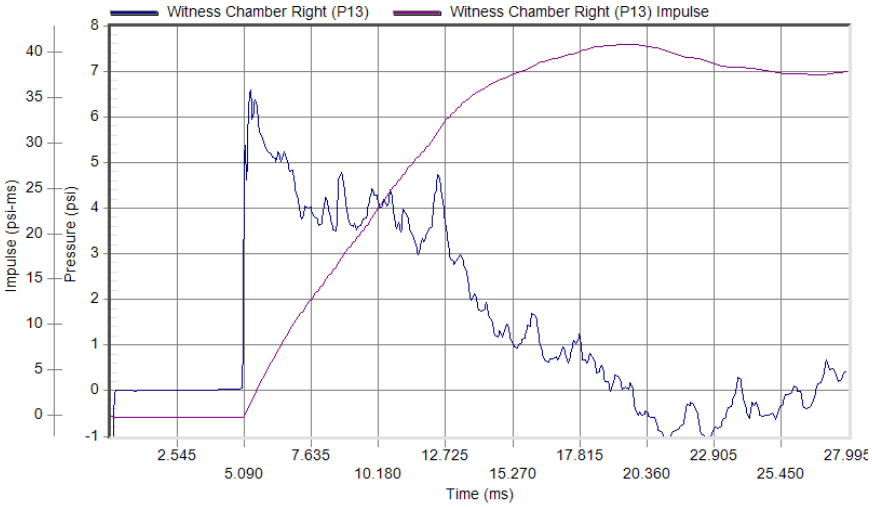
Pressure-Time Plots

Specimen #1



Peak Pressure: 6.04 psi at 5.63 ms
Duration: 13.22 ms

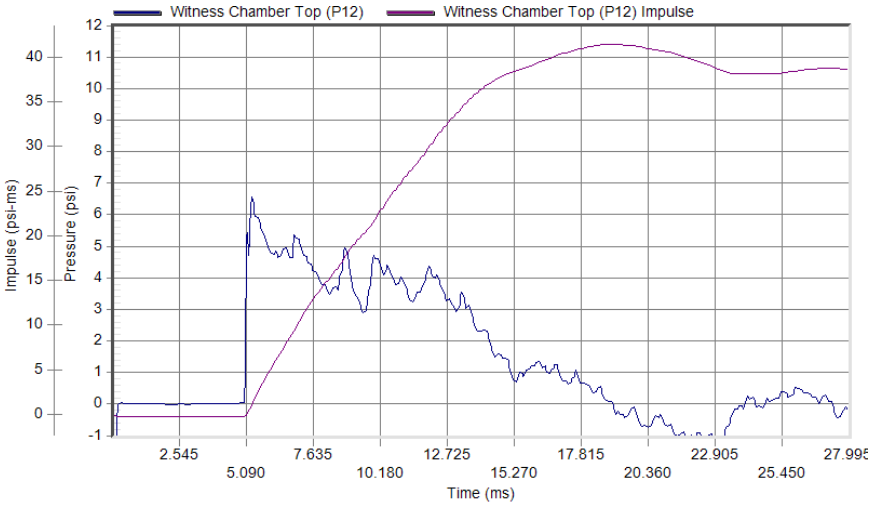
Test Date: 10/15/2013
Test Time: 11:11 am



Peak Pressure: 6.58 psi at 5.33 ms
Duration: 13.61 ms

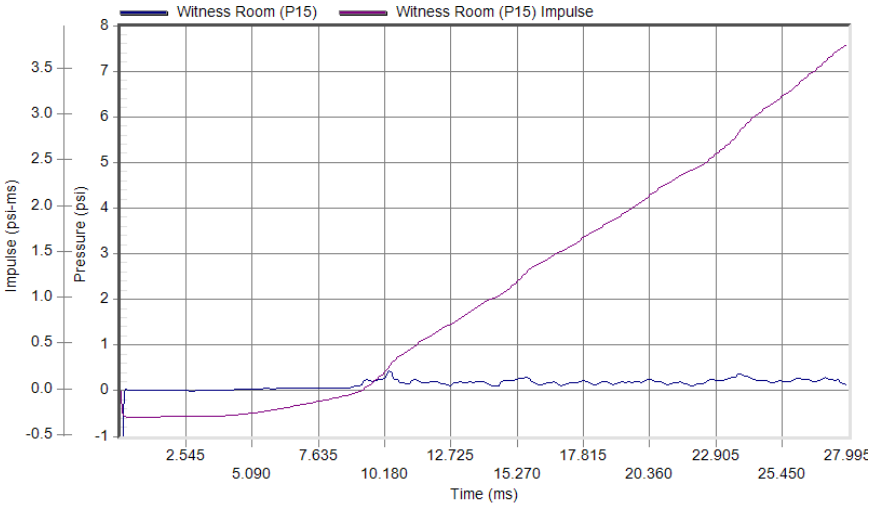
Test Date: 10/15/2013
Test Time: 11:11 am

Specimen #1: (Continued)



Peak Pressure: 6.58 psi at 5.30 ms
Duration: 13.54 ms

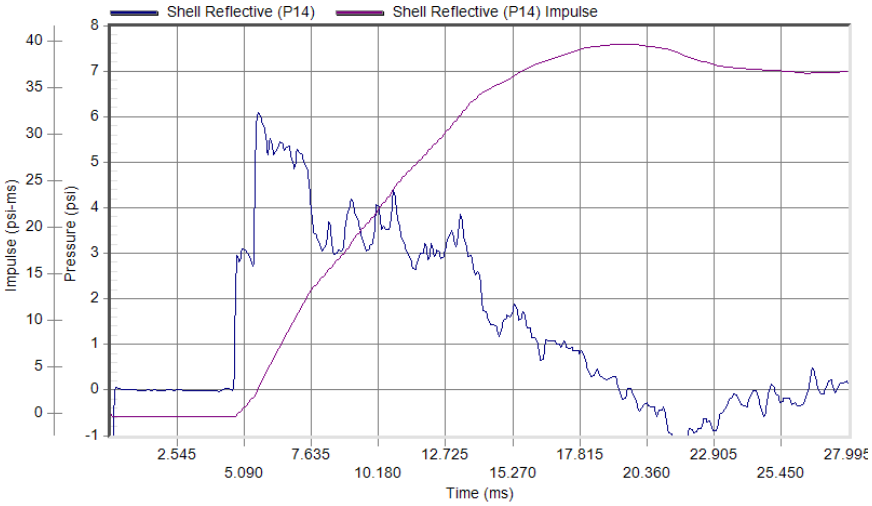
Test Date: 10/15/2013
Test Time: 11:11 am



Peak Pressure: 0.44 psi at 10.38 ms
Duration: 0.00 ms

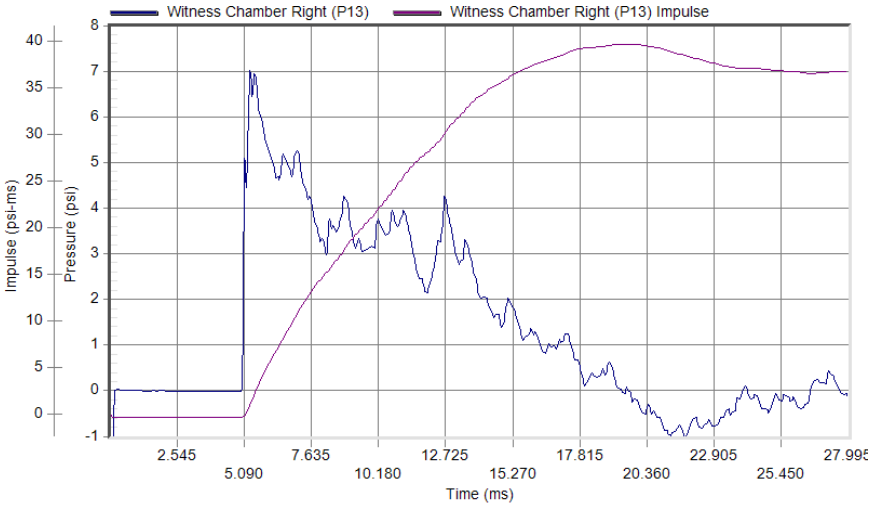
Test Date: 10/15/2013
Test Time: 11:11 am

Specimen #2



Peak Pressure: 6.13 psi at 5.65 ms
Duration: 13.63 ms

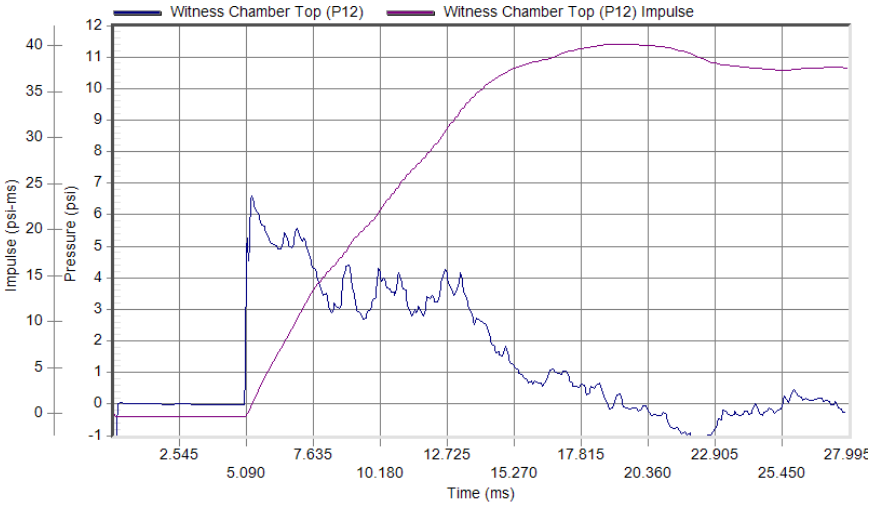
Test Date: 10/16/2013
Test Time: 11:05 am



Peak Pressure: 7.06 psi at 5.33 ms
Duration: 13.91 ms

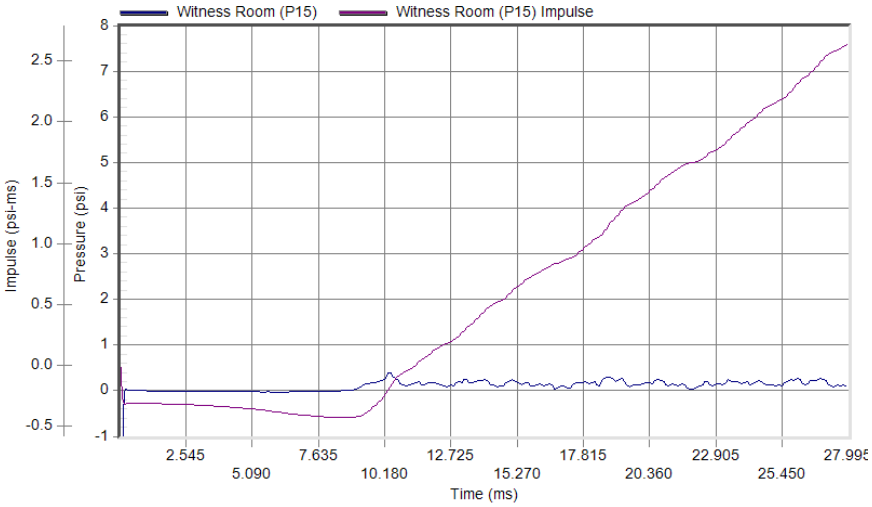
Test Date: 10/16/2013
Test Time: 11:05 am

Specimen #2: (Continued)



Peak Pressure: 6.67 psi at 5.30 ms
Duration: 13.52 ms

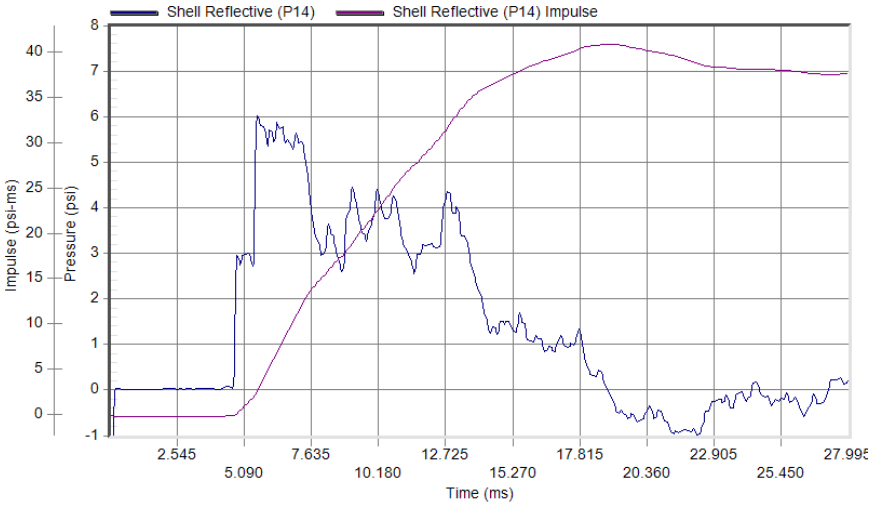
Test Date: 10/16/2013
Test Time: 11:05 am



Peak Pressure: 0.41 psi at 10.37 ms
Duration: 6.35 ms

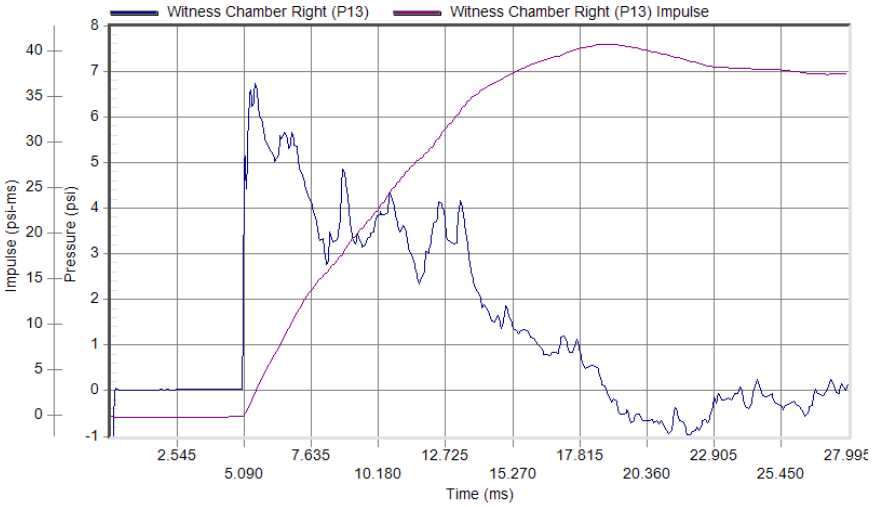
Test Date: 10/16/2013
Test Time: 11:05 am

Specimen #3



Peak Pressure: 6.07 psi at 5.63 ms
Duration: 13.20 ms

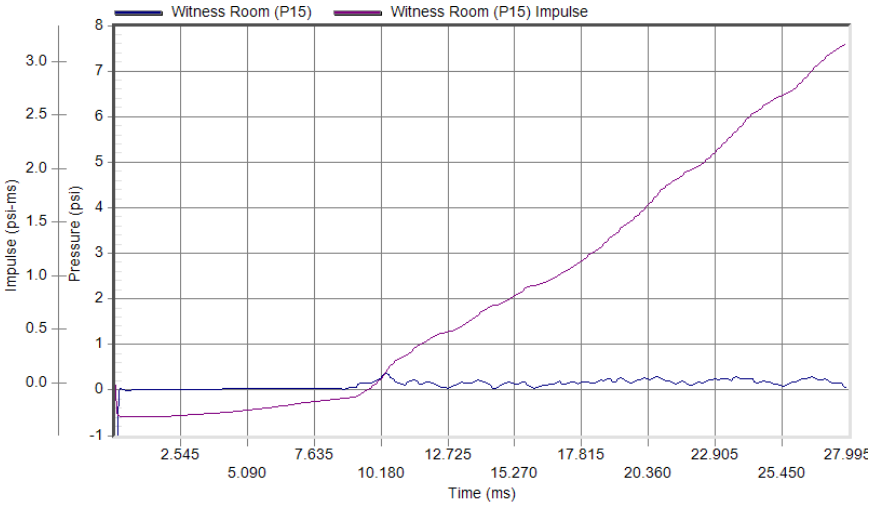
Test Date: 10/16/2013
Test Time: 2:16 pm



Peak Pressure: 6.75 psi at 5.53 ms
Duration: 13.26 ms

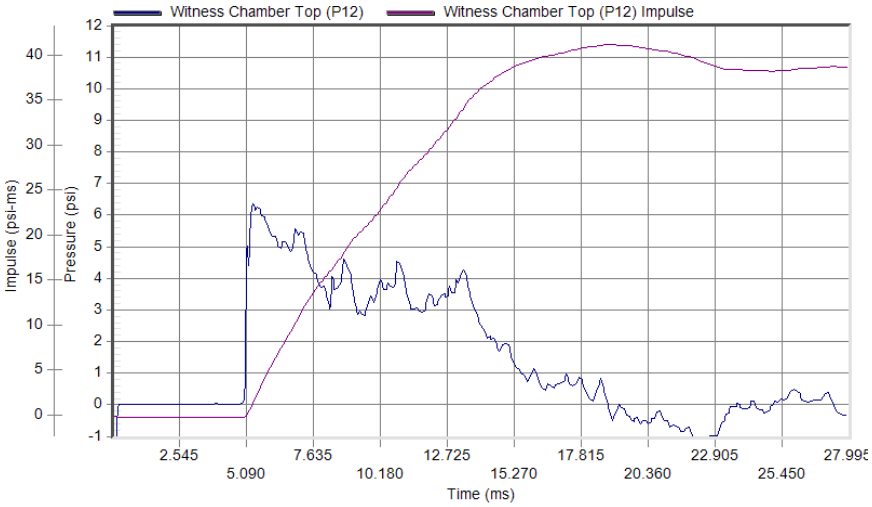
Test Date: 10/16/2013
Test Time: 2:16 pm

Specimen #3: (Continued)



Peak Pressure: 0.40 psi at 10.38 ms
Duration: 4.08 ms

Test Date: 10/16/2013
Test Time: 2:16 pm



Peak Pressure: 6.42 psi at 5.34 ms
Duration: 13.49 ms

Test Date: 10/16/2013
Test Time: 2:16 pm

Appendix C

Photographs

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

Photo No. 2
Post-test Specimen #1, Interior

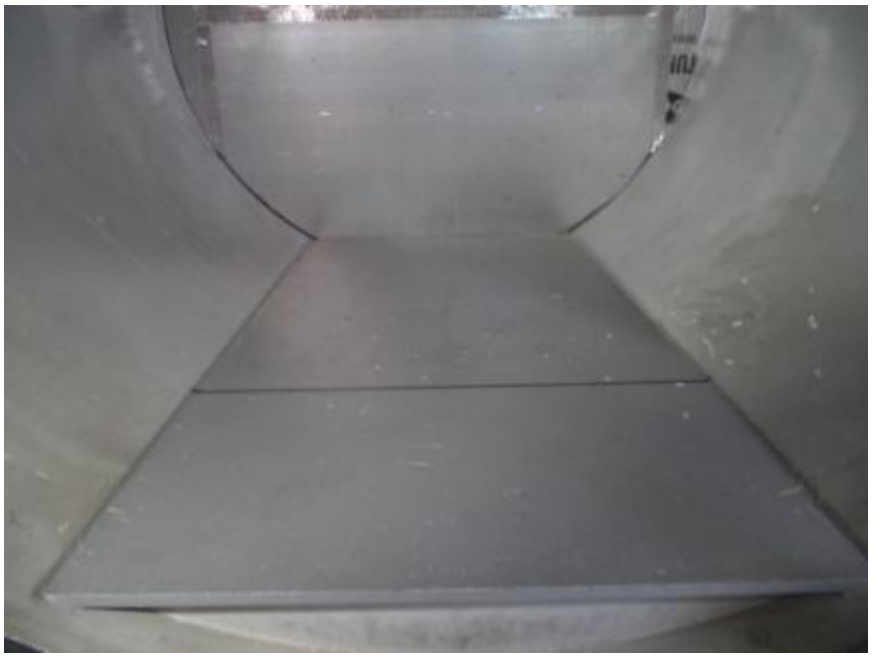


Photo No. 3
Post-test Specimen #1, Witness Chamber

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

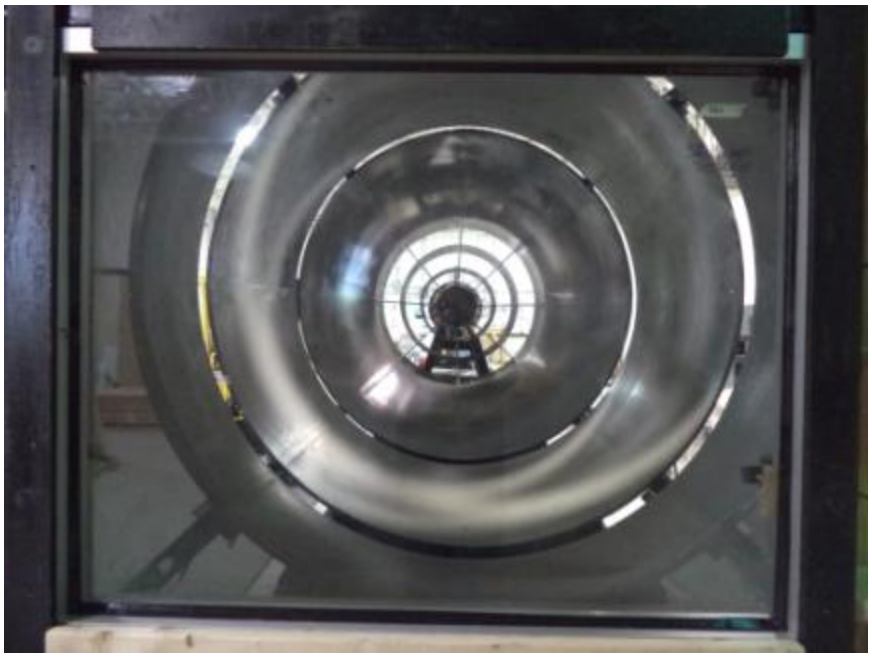


Photo No. 7
Pre-test Specimen #3, Interior

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

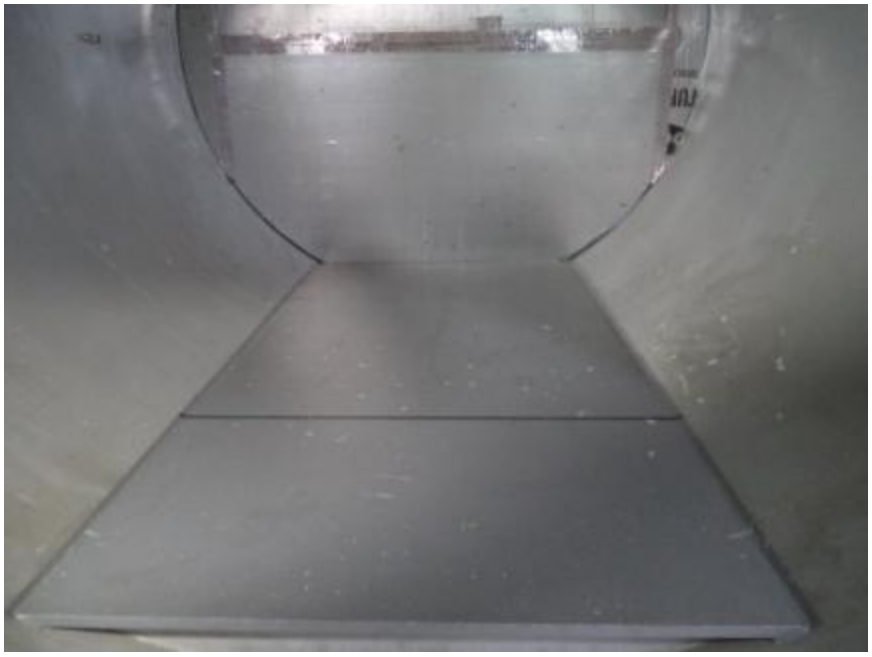


Photo No. 9
Post-test Specimen #3, Witness Chamber

Appendix D

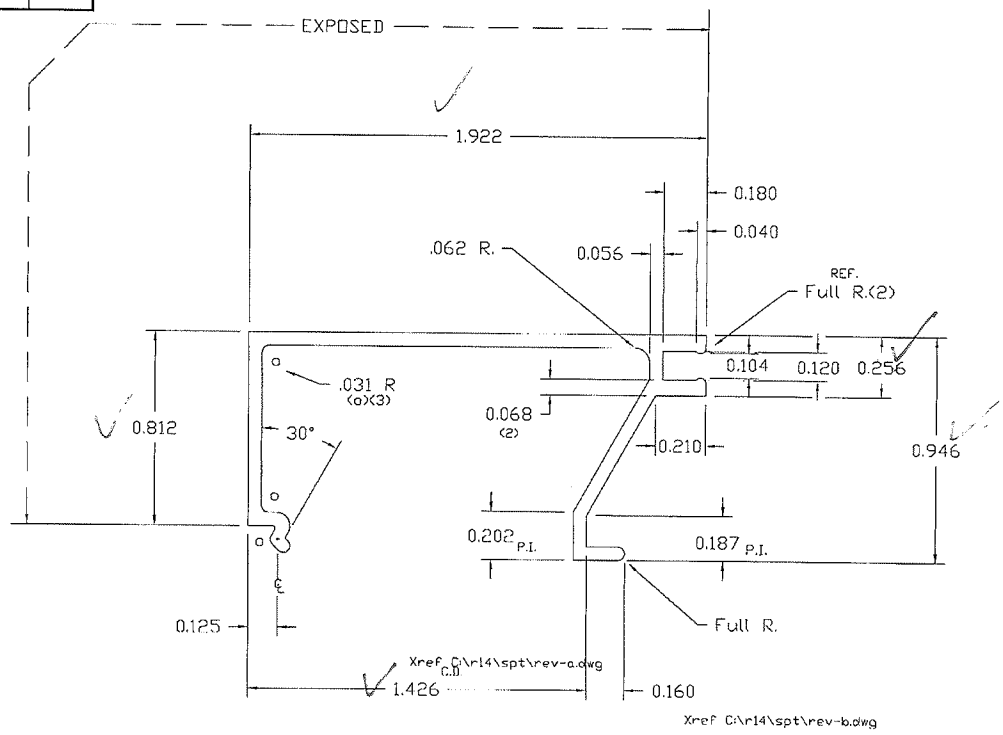
Drawings

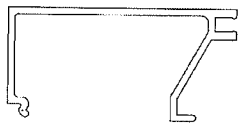
PRINT REVISIONS	DATE

CRM-49 B

REV.

DELHI ☐ TIFTON ☐ BOTH ☐





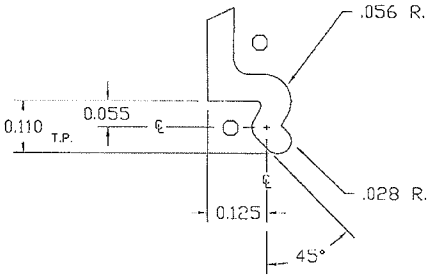
ACTUAL SIZE

Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # D0345

Date 12/4/13 Tech SER



DETAIL

4 × Size

BREAK UNSPECIFIED CORNERS .010 R. .056 TYPICAL WALL UNLESS SPECIFIED OTHERWISE.

ESTIMATED DIE DATA			
INTERNAL USE		6063-T5	
AREA	.243	WT/FT	.291
PERIMETER	8.478	CIRCLE SIZE	2-3
OUTSIDE PERIMETER		FACTOR	29
EXPOSED PERIMETER	2.734		

PRESS SIZE

LEGEND
• = .031 R.
○ = .062 R.
× = .125 R.
⊗ = .250 R.
* =

DIE REVISIONS		DATE
A	RE-DESIGNED	1-5-88
B	SHORTENED LEG	2-13-89

sapa: Sapa Extrusions, Inc.
DELHI, LA 71232

CUSTOMER
CRONSTROMS
MINNEAPOLIS, MN

APPLICATION
SILL STOP 1/4" TO 1"

CADD #

SCALE 2 × & Noted

DATE 10-31-88

LAST REVISION

DRAWN J. ALBEREZ

JOB

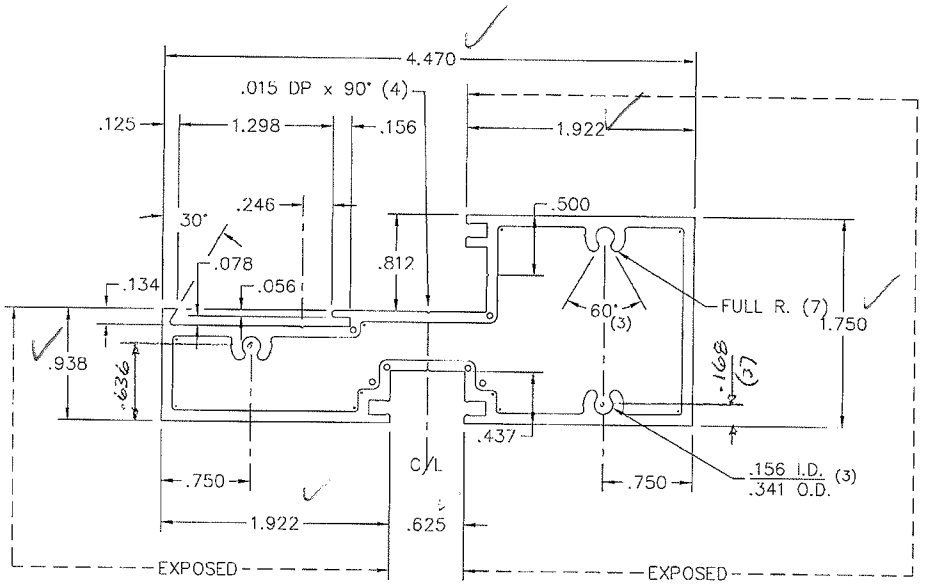
CUSTOMER NUMBER 45-026

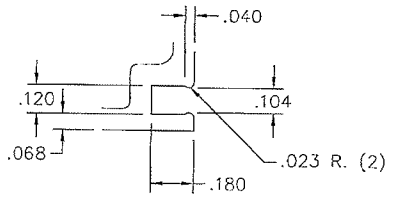
PRINT REVISIONS		DATE
1	REDRAWN ON CAD MB	7-30-98

CRM-44

REV.

DELHI	TIFTON	BOTH
☒	☐	☐





DETAIL "A"
2 x SIZE

Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # D0345

Date 12/4/13 Tech SER

BREAK UNSPECIFIED CORNERS .010 R. .090 TYPICAL WALL UNLESS SPECIFIED OTHERWISE.

ESTIMATED DIE DATA			
INTERNAL USE		6063-T5	
AREA	1.354	WT/FT	1.624
PERIMETER	29.721	CIRCLE SIZE	4 - 5
OUTSIDE PERIMETER	15.421	FACTOR	18
EXPOSED PERIMETER		HOLLOW II	

DIE REVISIONS	DATE

PRESS SIZE

LEGEND
- • = .031 R.
- ○ = .062 R.
- × = .125 R.
- ⊗ = .250 R.
- ⁎ =

sapa: Sapa Extrusions, Inc.
DELHI, LA 71232

CUSTOMER

CMI ARCHITECTURAL PRODUCTS
2800 FREEWAY BOULEVARD
SUITE 205
MINNEAPOLIS, MN 55430

APPLICATION

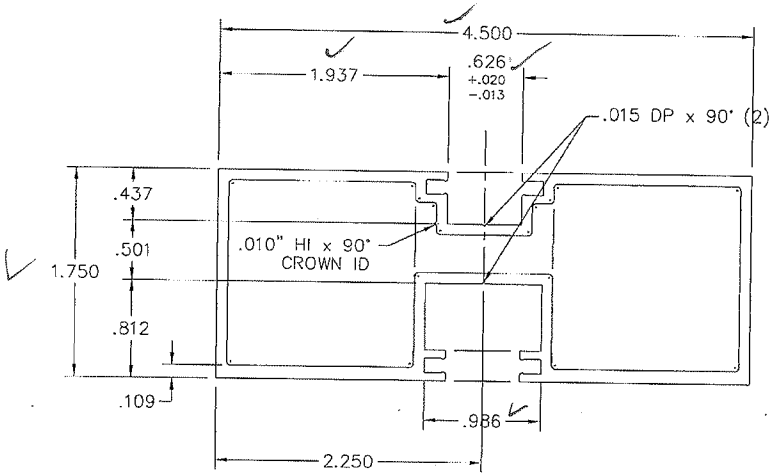
F.G. SILL 1/4"

CADD #	CRM-44 350
SCALE	FULL & NOTED
DATE	7-29-98
LAST REVISION	
DRAWN	Michael Bryan
JOB	
CUSTOMER NUMBER	45-018

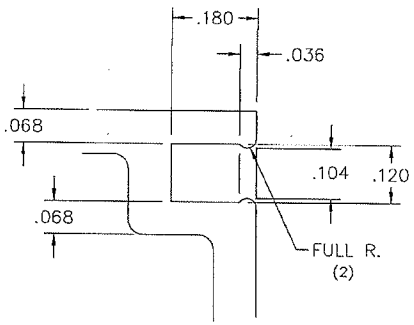
PRINT REVISIONS	DATE

12580
Die Number
45-010
Customer Number

ACTUAL SIZE



ENTIRE OUTSIDE
SURFACE EXPOSED



DETAIL "A"
4 x SIZE

Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # D8345

Date 12/4/13 Tech CJR

STANDARD TOLERANCES APPLY UNLESS OTHERWISE NOTED

03-24-11 added .625 tolerance

BREAK UNSPECIFIED CORNER: .010 R.

TYPICAL WALL UNLESS OTHERWISE NOTED: .090

ESTIMATED DIE DATA			
ALLOY/TEMPER:	6063-T5		
AREA	1.445	WT/FT	1.733
PERIMETER	31.168	CIRCLE SIZE	4 - 5
OUTSIDE PERIMETER	17.197	FACTOR	18
EXPOSED PERIMETER	17.197	HOLLOW	

DIE REVISIONS	DATE

PRESS SIZE

LEGEND
- • = .031 R.
- ○ = .062 R.
- × = .125 R.
- ⊗ = .250 R.
- ✳ =

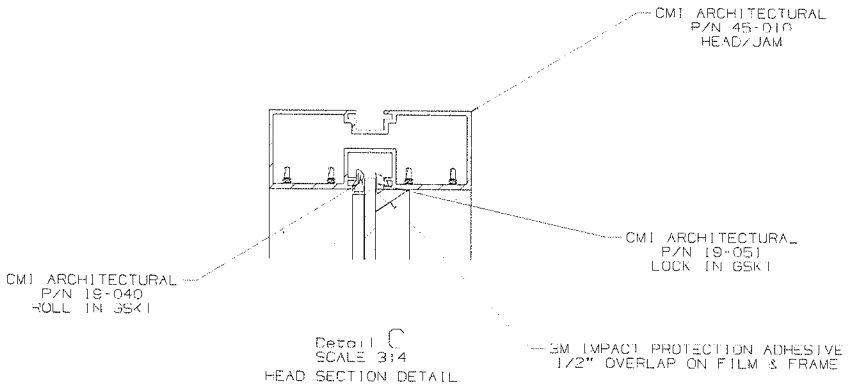
CROWN EXTRUSIONS

Crown Extrusions, Inc.
122 Columbia Court N.
Chaska, MN 55318
952-448-3533 Fax: 952-448-5328

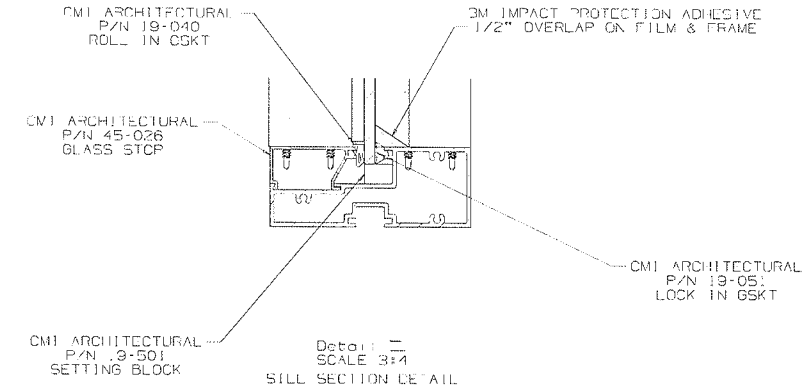
CUSTOMER [redacted] CMI Architectural
CMI Architectural Products,Inc.
20621 SD Highway 25
DeSmet, SD 57231-5827
605-854-3328 Fax: 605-854-3620

PART NAME: MULLION

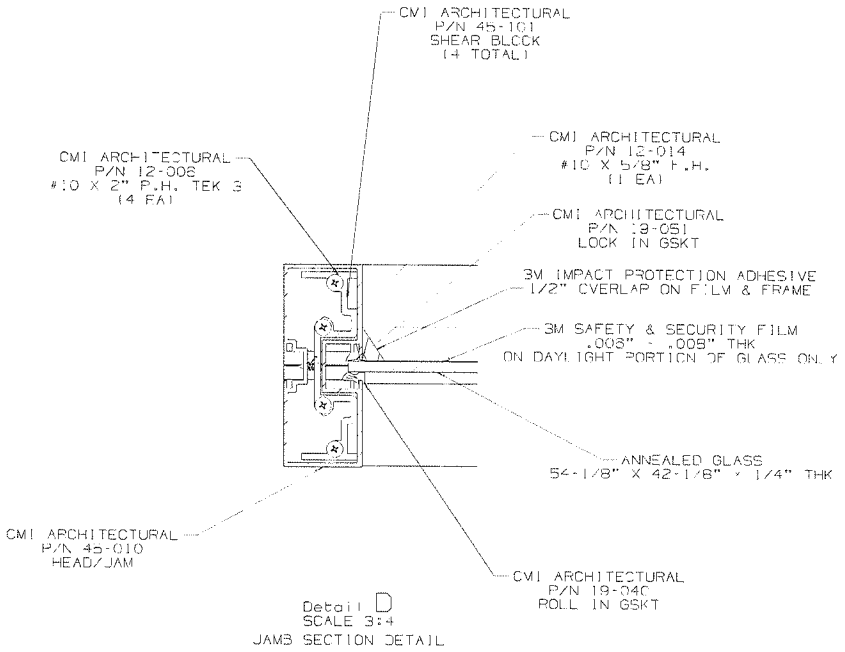
DIE #	12580
SCALE	FULL & NOTED
DATE	12-11-08
LAST REVISION	03-24-11
DRAWN	TCG
CUSTOMER NUMBER	45-010



Detail C
SCALE 3:4
HEAD SECTION DETAIL



Detail B
SCALE 3:4
SILL SECTION DETAIL



Detail D
SCALE 3:4
JAMB SECTION DETAIL

Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # D0345

Date 9/15/14 Tech EOR

REV	ECO	ISSUE DATE AND DESCRIPTION	CAPT	CHKD
A		OCT 29,2013		

DRAWN: M. PHILIPPI OCT 29,2013
CHKD: DATE: APPD: DATE:

DO NOT SCALE DRAWING | SCALE 1/8 | TOLERANCES EXCEPT AS NOTED: INCHES .X ±.06, .XX ±.030, .XXX ±.010 | THIRD ANGLE PROJECTION | INTERPRET PER ASME Y14.5 1994 | MILLIMETERS X ±1, .X ±.4, .XX ±.05, .XXX ±.020 | MAX SURFACE ROUGHNESS 125 √ ALL SURFACES MAXIMUM ONLY | ANGLES ±1°

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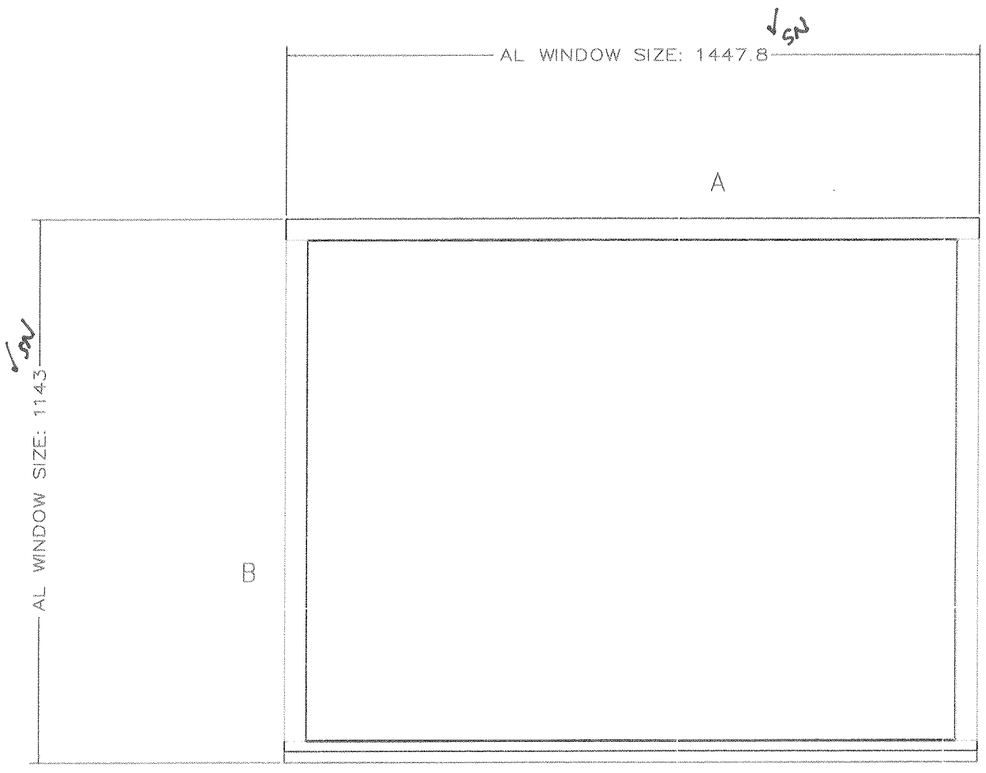
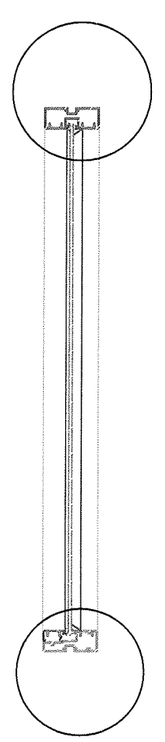
3M WINDOW TEST FIXTURE W/IPA

CAGE NUMBER | SIZE D | DRAWING NO | REV A

MODEL | SHT 2 OF 3





SECTION A—A

SECTION B—B

DLO: $53\frac{1}{2} \times 41\frac{1}{2}$

Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report # D0345

Date 12/4/13 Tech ECK

DESIGN REFERENCE	NEXT ASSEMBLY	A	OCT 29,2013		
		REV	ECO	ISSUE DATE AND DESCRIPTION	DRFT CHKD
		DRFT M. PHILIPPI	DATE OCT 29,2013	CHD	DATE
		CHD	DATE	APPR.	DATE
DIVISION	DIVISION CODE				

DO NOT SCALE DRAWING	SCALE 1/6	TOLERANCES EXCEPT AS NOTED	
THIRD ANGLE PROJECTION		INCHES .0 ± .00 ± .000 ± .0000 ±	TITLE: 3M WINDOW TEST FIXTURE W/IPA
INTERPRET PER ASME Y14.5 - 1994		MILLIMETERS .0 ± .00 ± .000 ±	
MAX SURFACE ROUGHNESS 125 ✓	☐ALL SURFACES ☒MARKED ONLY	ANGLES ±	CAGE NUMBER	SIZE D	DRAWING NO.	REV. A
			MODEL			
					DET. LISTS ☐ YES ☒ NO	SHT 1 OF 3