



ASTM E1886 and ASTM E1996 TEST REPORT

Report No.: E6587.01-201-44

Rendered to:

3M COMPANY
St. Paul, Minnesota 55144

PRODUCT TYPE: Safety and Security Window Film
SERIES/MODEL: 3M™ Safety and Security Film Ultra Prestige
with 3M™ Impact Protection Adhesive

Test Date: 08/18/15
Report Date: 11/18/15
Test Record Retention End Date: 11/18/19

1.0 Report Issued To: 3M Company
Renewable Energy Division
St. Paul, Minnesota 55114

2.0 Test Laboratory: Architectural Testing, Inc., an Intertek company ("Intertek-ATI")
849 Western Avenue North
St. Paul, Minnesota 55117
651-636-3835

3.0 Project Summary:

3.1 Product Type: Safety and Security Window Film

3.2 Series/Model: 3M™ Safety and Security Film Ultra Prestige with 3M™ Impact Protection Adhesive

3.3 Compliance Statement: Results obtained are tested values and were secured by using the designated test methods. The specimens tested met the performance requirements set forth in the referenced test procedures for a ± 3360 Pa (± 70.0 psf) Design Pressure with missile impacts corresponding to Missile Level A and Wind Zone 4.

3.4 Test Dates: 11/18/15

3.5 Test Record Retention End Date: All test records for this report will be retained until August 18, 2019.

3.6 Test Location: Intertek-ATI test facility in St. Paul, Minnesota.

3.7 Test Specimen Source: The test specimens were provided by the client. Representative samples of the test specimens will be retained by Intertek-ATI for a minimum of four years from the test completion date.

3.8 Drawing Reference: The test specimen drawings have been reviewed by Intertek-ATI and are representative of the test specimens reported herein. Test specimen construction was verified by Intertek-ATI per the drawings located in Appendix A. Any deviations are documented herein or on the drawings.

3.0 Project Summary: (Continued)

3.9 List of Official Observers:

<u>Name</u>	<u>Company</u>
Paul Neumann	3M Company
Eric J. Schoenthaler	Intertek-ATI

4.0 Test Specifications:

ASTM E1886-05, *Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials*

ASTM E1996-12, *Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes*

5.0 Test Specimen Description:

5.1 Product Sizes:

Overall Area: 2.2 m ² (24.0 ft ²)	Width		Height	
	millimeters	inches	millimeters	inches
Overall size	1219	48	1829	72

5.2 Frame Construction:

Frame Member	Material	Description
All	Aluminum	Hollow extruded aluminum tube.

	Joinery Type	Detail
All corners	Butt	Secured with a corner key and screws.

5.3 Reinforcement: No reinforcement was utilized.

5.4 Weatherstripping: No weatherstripping was utilized.

5.0 Test Specimen Description: (Continued)

5.5 Glazing: *No conclusions of any kind regarding the adequacy or inadequacy of the glass in any glazed test specimen(s) can be made.*

Glass Type	Glazing	Glazing Method
Ultra Prestige	1/4" tempered glazing laminated with 3M™ Ultra Prestige	Sealed against a vinyl gasket and secured on the interior with a vinyl wedge gasket. The filmed glass was anchored to the interior part of the frame using 3M™ Impact Protection Adhesive overlapping the frame (reference Drawing ASSY_WINDOW_48x72).

Location	Quantity	Daylight Opening		Glass Bite
		millimeters	inches	
Frame	1	1127 x 1737	44-3/8 x 68-3/8	13 mm (1/2")

5.6 Drainage: No drainage was utilized.

5.7 Hardware: No hardware was utilized.

6.0 Installation:

The specimen was installed into a Spruce-Pine-Fir wood buck. The rough opening allowed for a 6 mm (1/4") shim space. The exterior perimeter of the window was sealed with sealant.

Location	Anchor Description	Anchor Location
Frame perimeter	#10 x 3" screws	Through the frame 152 mm (6") from each corner and spaced 610 mm (24") on center.

7.0 Test Results: The results are tabulated as follows:

ASTM E1886, Small Missile Impact

Conditioning Temperature: 24°C (76°F)

Missile Weight: 2.0 g

Muzzle Distance from Test Specimen: 1.8 m (6' 0")

Test Unit #1: Orientation within $\pm 5^\circ$ of horizontal

Impact #1: Missile Velocity: 41.8 m/s (137.1 fps)	
Impact Area:	Upper right glazing corner
Observations:	Missile hit target area; no rips, tears or penetrations
Results:	Pass

Impact #2: Missile Velocity: 43.6 m/s (143.0 fps)	
Impact Area:	On the glazing located at the midspan of the left jamb, 275 mm (11") from the left jamb.
Observations:	Missile hit target area; no rips, tears or penetrations
Results:	Pass

Impact #3: Missile Velocity: 41.8 m/s (137.1 fps)	
Impact Area:	Lower right glazing corner
Observations:	Missile hit target area; no rips, tears or penetrations
Results:	Pass

Test Unit #2: Orientation within $\pm 5^\circ$ of horizontal

Impact #1: Missile Velocity: 41.5 m/s (136.2 fps)	
Impact Area:	Lower left glazing corner
Observations:	Missile hit target area; no rips, tears or penetrations
Results:	Pass

Impact #2: Missile Velocity: 42.4 m/s (139.0 fps)	
Impact Area:	Upper left glazing corner
Observations:	Missile hit target area; no rips, tears or penetrations
Results:	Pass

7.0 Test Results: (Continued)**ASTM E1886, Small Missile Impact****Conditioning Temperature:** 24°C (76°F)**Missile Weight:** 2.0 g**Muzzle Distance from Test Specimen:** 1.8 m (6' 0")**Test Unit #2:** (Continued)

Impact #3: Missile Velocity: 396 m/s (130.0 fps)	
Impact Area:	On the glazing located at the midspan of the right jamb, 275 mm (11") from the right jamb.
Observations:	Missile hit target area; no rips, tears or penetrations
Results:	Pass

Test Unit #3: Orientation within $\pm 5^\circ$ of horizontal

Impact #1: Missile Velocity: 39.9 m/s (130.9 fps)	
Impact Area:	On the glazing located at the midspan of top rail, 275 mm (11") from the top rail
Observations:	Missile hit target area; no rips, tears or penetrations
Results:	Pass

Impact #2: Missile Velocity: 40.1 m/s (131.7 fps)	
Impact Area:	Center of glazing
Observations:	Missile hit target area; no rips, tears or penetrations
Results:	Pass

Impact #3: Missile Velocity: 43.0 m/s (141.0 fps)	
Impact Area:	On the glazing located at the midspan of the sill, 275 mm (11") from the sill.
Observations:	Missile hit target area; no rips, tears or penetrations
Results:	Pass

7.0 Test Results: (Continued)**ASTM E1886, Air Pressure Cycling****Test Unit #1****Design Pressure:** ± 3360 Pa (± 70.0 psf)**POSITIVE PRESSURE**

Pressure Range Pa (psf)	Number of Cycles	Average Cycle Time (seconds)	Observations
675 to 1680 (14.0 to 35.0)	3500	1.97	No rips, tears or penetrations.
0 to 2105 (0 to 42.0)	300	2.50	No rips, tears or penetrations.
1680 to 2685 (35.0 to 56.0)	600	2.01	No rips, tears or penetrations.
1010 to 3360 (21.0 to 70.0)	100	2.37	No rips, tears or penetrations.

NEGATIVE PRESSURE

Pressure Range Pa (psf)	Number of Cycles	Average Cycle Time (seconds)	Observations
1010 to 3360 (21.0 to 70.0)	50	2.38	No rips, tears or penetrations.
1680 to 2685 (35.0 to 56.0)	1050	1.75	No rips, tears or penetrations.
0 to 2105 (0 to 42.0)	50	2.66	No rips, tears or penetrations.
675 to 1680 (14.0 to 35.0)	3350	1.77	No rips, tears or penetrations.

Result: Pass

7.0 Test Results: (Continued)**ASTM E1886, Air Pressure Cycling****Test Unit #2****Design Pressure:** ± 3360 Pa (± 70.0 psf)**POSITIVE PRESSURE**

Pressure Range Pa (psf)	Number of Cycles	Average Cycle Time (seconds)	Observations
675 to 1680 (14.0 to 35.0)	3500	2.72	No rips, tears or penetrations.
0 to 2105 (0 to 42.0)	300	3.25	No rips, tears or penetrations.
1680 to 2685 (35.0 to 56.0)	600	2.00	No rips, tears or penetrations.
1010 to 3360 (21.0 to 70.0)	100	2.66	No rips, tears or penetrations.

NEGATIVE PRESSURE

Pressure Range Pa (psf)	Number of Cycles	Average Cycle Time (seconds)	Observations
1010 to 3360 (21.0 to 70.0)	50	3.03	No rips, tears or penetrations.
1680 to 2685 (35.0 to 56.0)	1050	2.17	No rips, tears or penetrations.
0 to 2105 (0 to 42.0)	50	2.65	No rips, tears or penetrations.
675 to 1680 (14.0 to 35.0)	3350	2.26	No rips, tears or penetrations.

Result: Pass**Note:** Test Specimens #2 and #3 were cycled in a common chamber.

7.0 Test Results: (Continued)**ASTM E1886, Air Pressure Cycling****Test Unit #3****Design Pressure:** ± 3360 Pa (± 70.0 psf)**POSITIVE PRESSURE**

Pressure Range Pa (psf)	Number of Cycles	Average Cycle Time (seconds)	Observations
675 to 1680 (14.0 to 35.0)	3500	2.72	No rips, tears or penetrations.
0 to 2105 (0 to 42.0)	300	3.25	No rips, tears or penetrations.
1680 to 2685 (35.0 to 56.0)	600	2.00	No rips, tears or penetrations.
1010 to 3360 (21.0 to 70.0)	100	2.66	No rips, tears or penetrations.

NEGATIVE PRESSURE

Pressure Range Pa (psf)	Number of Cycles	Average Cycle Time (seconds)	Observations
1010 to 3360 (21.0 to 70.0)	50	3.03	No rips, tears or penetrations.
1680 to 2685 (35.0 to 56.0)	1050	2.17	No rips, tears or penetrations.
0 to 2105 (0 to 42.0)	50	2.65	No rips, tears or penetrations.
675 to 1680 (14.0 to 35.0)	3350	2.26	No rips, tears or penetrations.

Result: Pass**Note:** Test Specimens #2 and #3 were cycled in a common chamber.

General Note: Upon completion of testing, the specimens met the requirements of Section 7 of ASTM E1996.

8.0 Test Equipment:

Cannon: Constructed from steel piping utilizing compressed air to propel the missile

Missile: 8 mm (5/16") diameter ball bearings

Timing Device: Electronic Beam Type

Cycling Mechanism: Computer controlled centrifugal blower with electronic pressure measuring device

Tape and film were not used to seal against air leakage during structural testing.

Intertek-ATI will service this report for the entire test record retention period. Test records such as detailed drawings, datasheets, representative samples of test specimens, or other pertinent project documentation, will be retained by Intertek-ATI for the entire test record retention period.

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 Intertek-ATI.

For INTERTEK-ATI:

Eric J. Schoenthaler
Project Manager

Daniel A. Johnson
Director – Regional Operations

EJS/jb

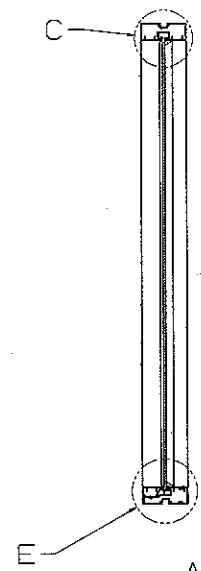
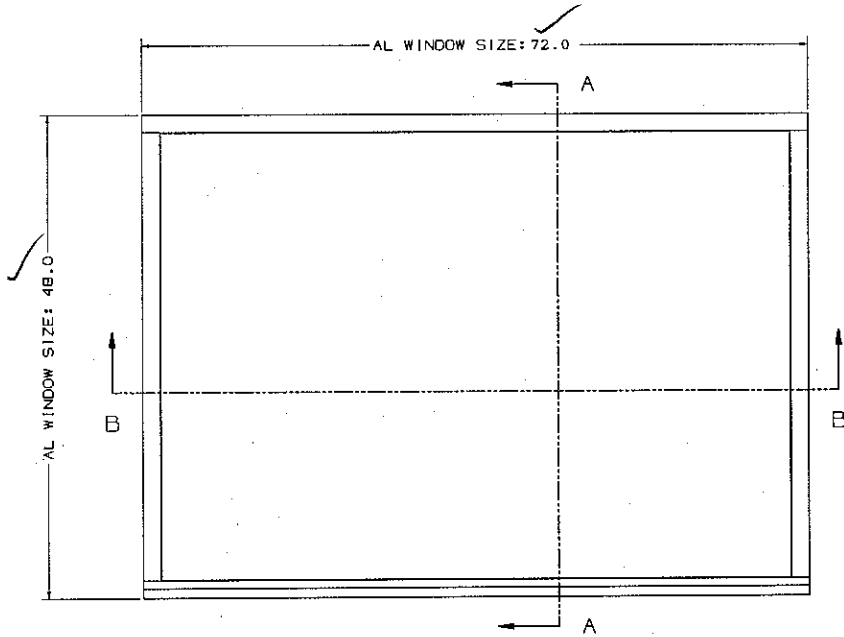
Attachments (pages): This report is complete only when all attachments listed are included.

Appendix A: Drawings (6)

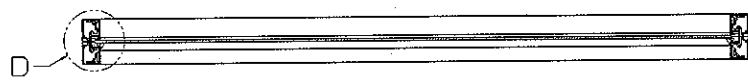
This report produced from controlled document template ATI 00498, revised 06/19/15.

Appendix A

Drawings



SECTION A - A



SECTION B - B



Test sample complies with these details.
Deviations are noted.

Report# EG587
Date 11/19/15 Tech GO

DESIGN REFERENCE	NEXT ASSEMBLY	REV	ISSUE DATE AND DESCRIPTION	DATE	CHKD
		1	SEP 09, 2014		
		2	SEP 09, 2014		
DO NOT SCALE DRAWINGS SCALE 1/8" = 1'-0" TELEPRINTS EXCEPT AS NOTED INCHES 0 1/8 1/4 3/8 1/2 5/8 3/4 7/8 1 .000 1.000 2.000 3.000 4.000 5.000 6.000 7.000 8.000 9.000 10.000 THIRD ANGLE PROJECTION ASME Y14.5 - 2009 INTERPRET FOR ALL SURFACES UNLESS OTHERWISE NOTED MAX SURFACE ROUGHNESS 125 UNLESS OTHERWISE NOTED		TITLE 3M SINGLE PANE WINDOW TEST FIXTURE WITH 3M TINTED SAFETY FILM AND IPA MODEL D ASSY_WINDOW_48X72		© 3M COPYRIGHT 2014 This drawing and the information it contains are the property of 3M and are not to be reproduced or used in any manner without the prior written consent of 3M.	
		NO. OF SHEETS	TOTAL SHEETS	DATE	REV.
		1	1	SEP 09, 2014	1

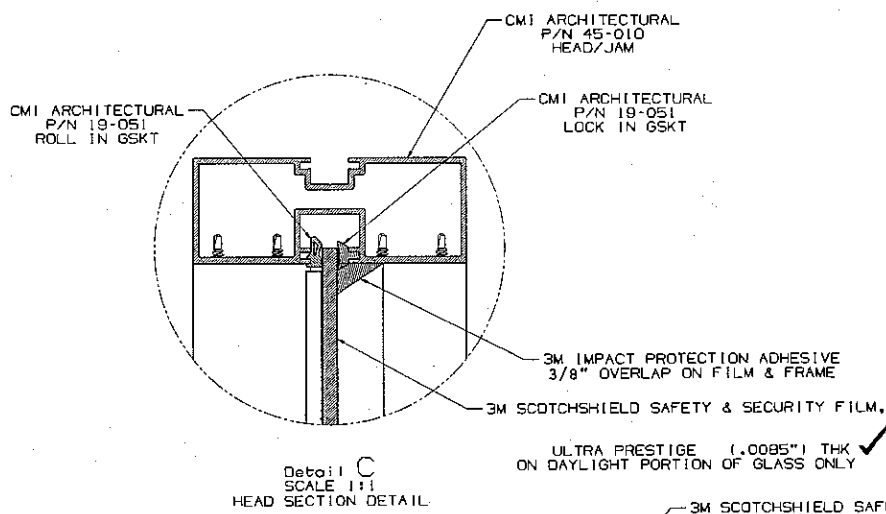
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D

C

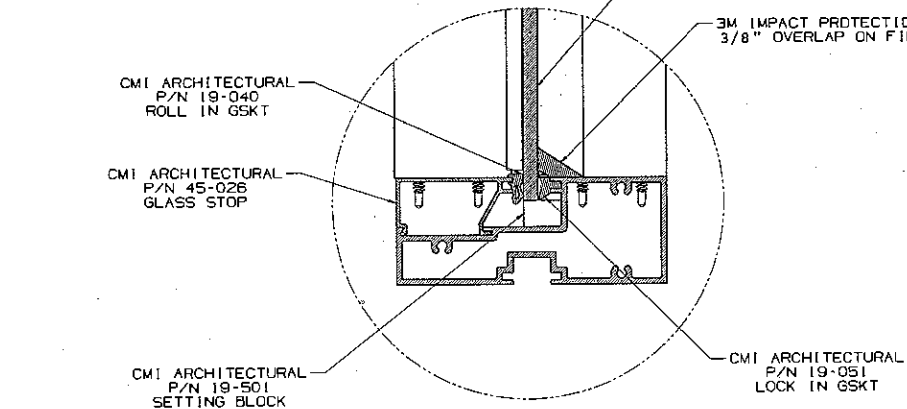
B

A



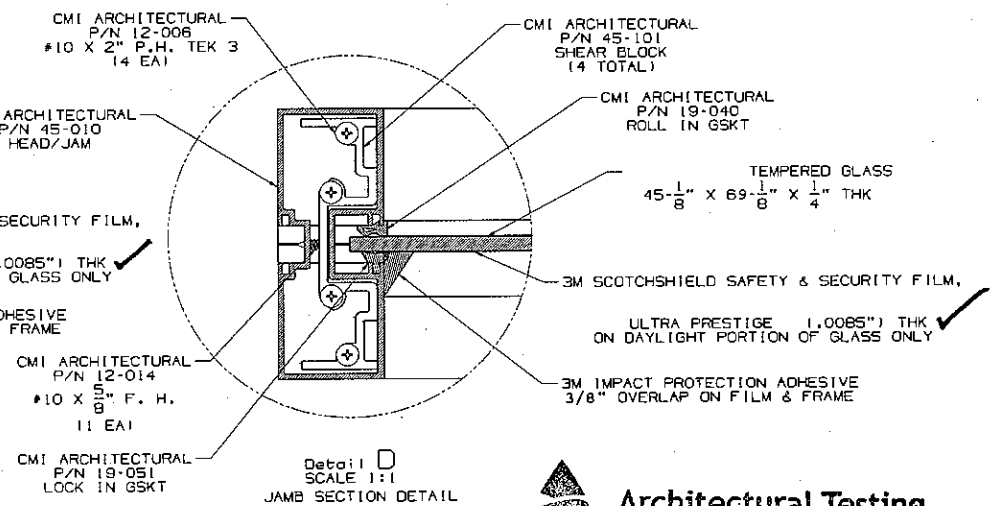
Detail C
SCALE 1:1
HEAD SECTION DETAIL

ULTRA PRESTIGE (1.0085") THK
ON DAYLIGHT PORTION OF GLASS ONLY



Detail E
SCALE 1:1
SILL SECTION DETAIL

ULTRA PRESTIGE (1.0085") THK
ON DAYLIGHT PORTION OF GLASS ONLY



Detail D
SCALE 1:1
JAMB SECTION DETAIL

TEMPERED GLASS
45-1/8" X 69-1/8" X 1/4" THK

ULTRA PRESTIGE (1.0085") THK
ON DAYLIGHT PORTION OF GLASS ONLY



Architectural Testing

Test sample complies with these details.
Deviations are noted.

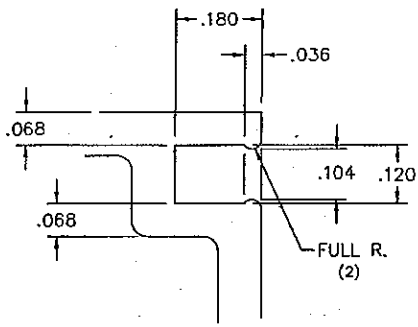
Report# EG587
Date 11/11/15 Tech 62

DESIGN REFERENCE	NEXT ASSEMBLY	REV	ECO	ISSUE DATE AND DESCRIPTION	DRFT	CHGD
				SEP 09, 2014		
				SEP 06, 2014		
DO NOT SCALE DRAWING SCALE 1:1 TOLERANCES UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES THIRD ANGLE PROJECTION INTERPRET PER ASME Y14.5 - 2009 MAX SURFACE ROUGHNESS 125 <input checked="" type="checkbox"/> ALL SURFACES <input type="checkbox"/> SPARKED ONLY		DIVISION WORK TITLE SINGLE PANE WINDOW TEST FIXTURE WITH 3M TINTED ULTRA SAFETY FILM AND IPA SCALE NUMBER D MODEL ASSY_WINDOW_48x72_UNV		3M © 3M COPYRIGHT 2014 THIS DOCUMENT AND THE INFORMATION IT CONTAINS ARE THE PROPERTY OF 3M AND ARE NOT TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT THE WRITTEN PERMISSION OF 3M.		
UNLESS NOTED OTHERWISE, ALL DIMENSIONS ARE IN INCHES. DIMENSIONS IN PARENTHESES ARE IN MILLIMETERS.		SCALE NUMBER D MODEL ASSY_WINDOW_48x72_UNV		REV. 1 11/11/15		

8 7 6 5 4 3 2 1

PRINT REVISIONS	DATE

12580
Die Number
45-010
Customer Number



DETAIL "A"
4 x SIZE

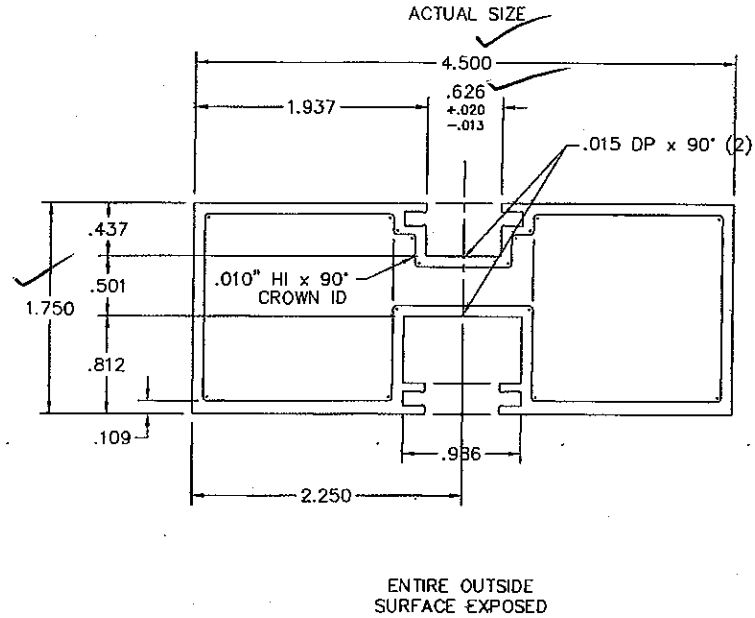


Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report# E6587
Date 11/19/15 Tech Ge

STANDARD TOLERANCES APPLY UNLESS OTHERWISE NOTED



ENTIRE OUTSIDE SURFACE EXPOSED

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

Crown Extrusions, Inc.
122 Columbia Court N.
Chaska, MN 55318
952-448-5533 Fax: 952-448-5928

CMI Architectural
CMI Architectural Products, Inc.
20821 SD Highway 25
DeSmet, SD 57231-5827
605-854-3326 Fax: 605-854-3620

PART NAME: MULLION

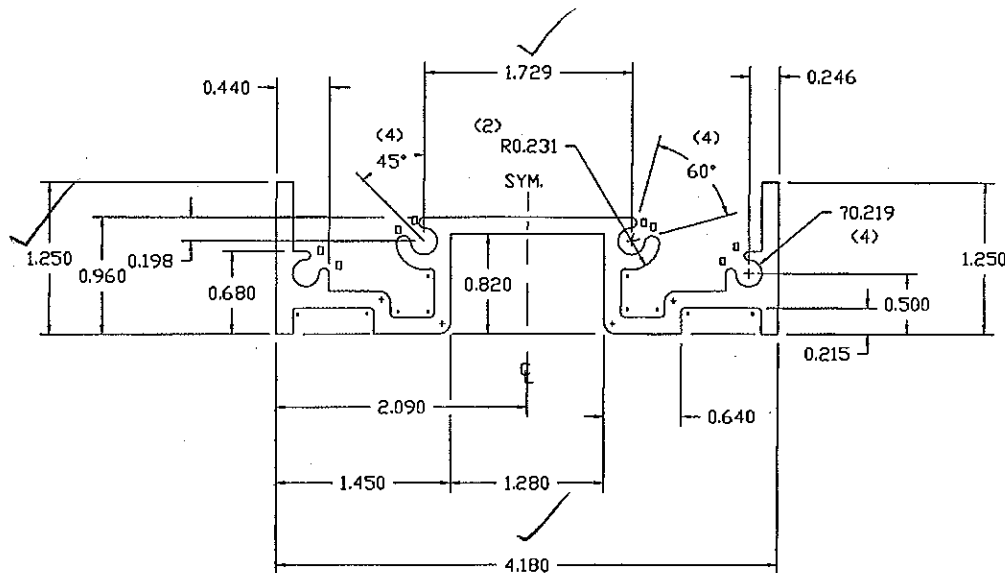
DIE #	12580
SCALE	FULL & NOTED
DATE	12-11-08
LAST REVISION	03-24-11
DRAWN	TCG
CUSTOMER NUMBER	45-010

PRESS SIZE	LEGEND
	• = .031 R.
	◦ = .062 R.
	× = .125 R.
	⊗ = .250 R.
	* =

DIE REVISIONS	DATE

PRINT REVISIONS	DATE

CRM-62		
REV.		
DELH	TIFYDN	BOTH
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



NOTE:
NO EXPOSED SURFACE



Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report# E6587

Date 11/19/85 Tech GR

LEGEND:

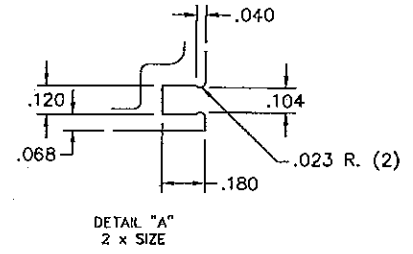
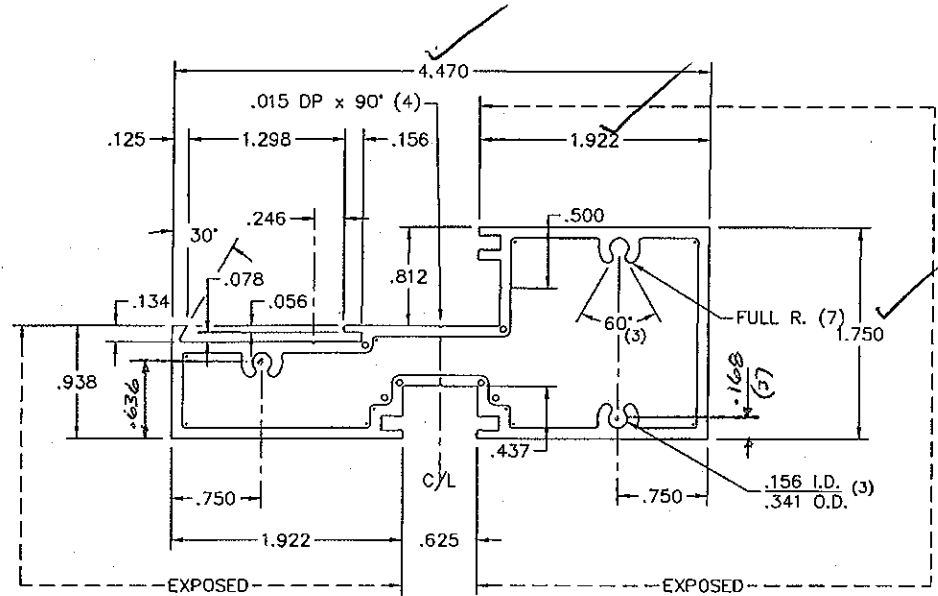
- = 0.031 R. (10)
- + = 0.100 R. (4)
- ⊖ = FULL R. (8)

BREAK UNSPECIFIED CORNERS 0.010 R. 0.140 TYPICAL WALL UNLESS SPECIFIED OTHERWISE.

ESTIMATED DIE DATA		sapa: Sapa Extrusions, Inc. DELHI, LA 71232	CADD # MRC---10 010
INTERNAL USE	6063-T5		
AREA	1.389	WT/FT	1.667
PERMETER	23.555	CIRCLE SIZE	4-5
OUTSIDE PERMETER		FACTOR	12
PRESS SIZE		MINNEAPOLIS, MINN.	DATE 12-3-88
LEGEND	DIE REVISIONS	DATE	LAST REVISION
• = .031 R.			DRAWN M. COPEL
⊖ = .062 R.			JOB
+ = .125 R.			CUSTOMER NUMBER
⊗ = .250 R.			32-003
* =			APPLICATION
			MULL. CLIP

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

CRM-44		
REV.		
DELHI	TIFTON	BOTH
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



Architectural Testing
 Test sample complies with these details.
 Deviations are noted.
 Report# EL587
 Date 11/14/15 Tech GR

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

ESTIMATED DIE DATA	
INTERNAL USE	6063-T5
AREA	1.354
PERIMETER	29.721
OUTSIDE PERIMETER	15.421
EXPOSED PERIMETER	HOLLOW II

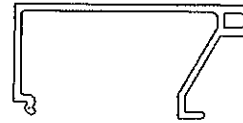
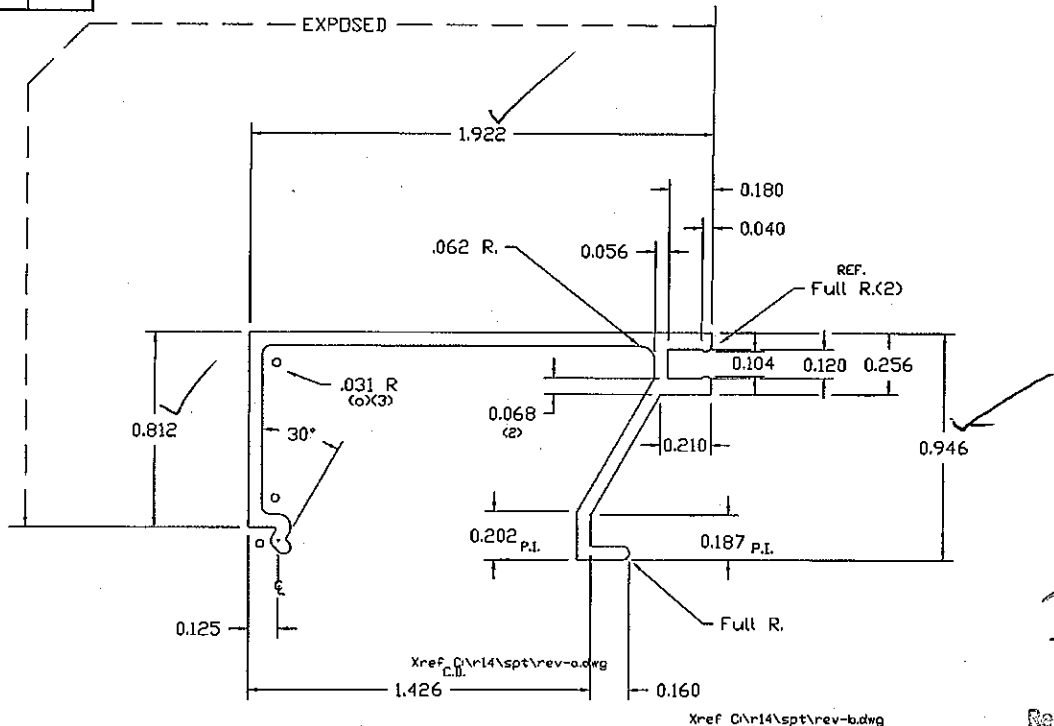
sapa: Sapa Extrusions, Inc.
 DELHI, IA 51232
 CUSTOMER
CMI ARCHITECTURAL PRODUCTS
 2800 FREEWAY BOULEVARD
 SUITE 205
 MINNEAPOLIS, MN 55430
 APPLICATION
 F.G. SILL 1/4"

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

LEGEND	DIE REVISIONS	DATE
• = .031 R.		
o = .062 R.		
x = .125 R.		
⊗ = .250 R.		
* =		

PRINT REVISIONS	DATE

CRM-49-B
 REV.
 DELHI TIFTON BOTH

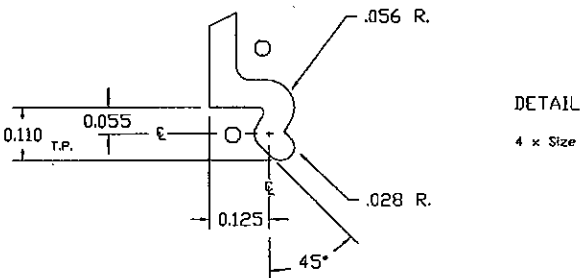


Architectural Testing

Test sample complies with these details.
 Deviations are noted.

Report# ELS87

Date 11/19/15 Tech GR



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	
PRESS SIZE	EXPOSED PERIMETER	2.734
LEGEND		
• = .031 R.	A RE-DESIGNED	1-5-88
o = .062 R.	B SHORTENED LEG	2-13-89
x = .125 R.		
⊗ = .250 R.		
* =		

sapa: Sapa Extrusions, Inc.
 DELHI, LA 71232

CUSTOMER
CRONSTROMS
 MINNEAPOLIS, MN

APPLICATION
 SILL STOP 1/4" TO 1"

CADD #	
SCALE	2 x & Noted
DATE	10-31-88
LAST REVISION	
DRAWN	J. ALBEREZ
JOB	
CUSTOMER NUMBER	45-026