



ASTM E 1886 and ASTM E 1996 TEST REPORT

Report No.: E2894.02-201-44

Rendered to:

3M COMPANY
St. Paul, Minnesota 55144

PRODUCT TYPE: Safety and Security Window Film
SERIES/MODEL: 3M™ Safety and Security Film Ultra S800
with 3M™ Impact Protection Adhesive

Test Date: 01/19/15
Through: 01/20/15
Report Date: 03/03/15
Test Record Retention End Date: 03/03/19

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

2.0 Test Laboratory: 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 S800 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 **±3600 Pa (±75.00 psf) Design Pressure** with missile impacts corresponding to **Missile Level A and Wind Zone 4**.

3.4 Test Dates: 01/19/15 – 01/20/15

3.5 Test Record Retention End Date: All test records for this report will be retained until March 3, 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.

3.9 List of Official Observers:

<u>Name</u>	<u>Company</u>
Paul Neumann	3M Company
Karl A. Lips-Eakins	Intertek-ATI
Tony D. Gavin	Intertek-ATI

4.0 Test Specifications:

ASTM E 1886-05, *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 E 1996-12, *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 Weatherstripping: No weatherstripping was utilized.

5.0 Test Specimen Description: (Continued)

5.4 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 S800	1/4" tempered glazing laminated with 3M™ Ultra S800	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_48x96).

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

5.5 Drainage: No drainage was utilized.

5.6 Reinforcement: No reinforcement 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 A Impact*

Conditioning Temperature: 21°C (70°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: 39.1 m/s (128.2 fps)	
Impact Area:	Upper right glazing corner.
Observations:	Missile hit target area; no rips, tears or penetrations.
Results:	Pass.

Impact #2: Missile Velocity: 39.3 m/s (128.8 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: 40.6 m/s (133.1 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: 39.2 m/s (128.6 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 (131.4 fps)	
Impact Area:	Center of glazing.
Observations:	Missile hit target area; no rips, tears or penetrations.
Results:	Pass.

7.0 Test Results: (Continued)**ASTM E 1886, Small Missile A Impact****Conditioning Temperature:** 21°C (70°F)**Missile Weight:** 2041 g (4.50 lbs)**Missile Length:** 1219 mm (48")**Muzzle Distance from Test Specimen:** 2.4 m (8'0")**Test Unit #2:** (Continued)

Impact #3: Missile Velocity: 39.8 m/s (130.7 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.

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

Impact #1: Missile Velocity: 39.9 m/s (130.8 fps)	
Impact Area:	Upper left glazing corner.
Observations:	Missile hit target area; no rips, tears or penetrations.
Results:	Pass.

Impact #2: Missile Velocity: 39.7 m/s (130.1 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.

Impact #3: Missile Velocity: 39.9 m/s (131.0 fps)	
Impact Area:	Lower left glazing corner.
Observations:	Missile hit target area; no rips, tears or penetrations.
Results:	Pass.

7.0 Test Results: (Continued)**ASTM E 1886, Air Pressure Cycling****Test Unit #1****Design Pressure:** ± 3600 Pa (± 75.00 psf)**POSITIVE PRESSURE**

Pressure Range Pa (psf)	Number of Cycles	Average Cycle Time (seconds)	Observations
720 to 1680 (15.0 to 35.0)	3500	2.11	No rips, tears or penetrations.
0 to 2160 (0 to 45.0)	300	2.59	No rips, tears or penetrations.
1680 to 2880 (35.0 to 60.0)	600	2.09	No rips, tears or penetrations.
575 to 3600 (22.5 to 75.0)	100	2.79	No rips, tears or penetrations.

NEGATIVE PRESSURE

Pressure Range Pa (psf)	Number of Cycles	Average Cycle Time (seconds)	Observations
575 to 3600 (22.5 to 75.0)	50	2.33	No rips, tears or penetrations.
1680 to 2880 (35.0 to 60.0)	1050	1.69	No rips, tears or penetrations.
0 to 2160 (0 to 45.0)	50	2.56	No rips, tears or penetrations.
720 to 1680 (15.0 to 35.0)	3350	2.04	No rips, tears or penetrations.

Result: Pass**Note:** Test Specimens #1 and #2 were cycled in a common chamber.

7.0 Test Results: (Continued)**ASTM E 1886, Air Pressure Cycling****Test Unit #2****Design Pressure:** ± 3600 Pa (± 75.00 psf)**POSITIVE PRESSURE**

Pressure Range Pa (psf)	Number of Cycles	Average Cycle Time (seconds)	Observations
720 to 1680 (15.0 to 35.0)	3500	2.11	No rips, tears or penetrations.
0 to 2160 (0 to 45.0)	300	2.59	No rips, tears or penetrations.
1680 to 2880 (35.0 to 60.0)	600	2.09	No rips, tears or penetrations.
575 to 3600 (22.5 to 75.0)	100	2.79	No rips, tears or penetrations.

NEGATIVE PRESSURE

Pressure Range Pa (psf)	Number of Cycles	Average Cycle Time (seconds)	Observations
575 to 3600 (22.5 to 75.0)	50	2.33	No rips, tears or penetrations.
1680 to 2880 (35.0 to 60.0)	1050	1.69	No rips, tears or penetrations.
0 to 2160 (0 to 45.0)	50	2.56	No rips, tears or penetrations.
720 to 1680 (15.0 to 35.0)	3350	2.04	No rips, tears or penetrations.

Result: Pass**Note:** Test Specimens #1 and #2 were cycled in a common chamber.

7.0 Test Results: (Continued)**ASTM E 1886, Air Pressure Cycling****Test Unit #3****Design Pressure:** ± 3600 Pa (± 75.00 psf)**POSITIVE PRESSURE**

Pressure Range Pa (psf)	Number of Cycles	Average Cycle Time (seconds)	Observations
720 to 1680 (15.0 to 35.0)	3500	1.90	No rips, tears or penetrations.
0 to 2160 (0 to 45.0)	300	2.16	No rips, tears or penetrations.
1680 to 2880 (35.0 to 60.0)	600	1.74	No rips, tears or penetrations.
575 to 3600 (22.5 to 75.0)	100	2.44	No rips, tears or penetrations.

NEGATIVE PRESSURE

Pressure Range Pa (psf)	Number of Cycles	Average Cycle Time (seconds)	Observations
575 to 3600 (22.5 to 75.0)	50	2.35	No rips, tears or penetrations.
1680 to 2880 (35.0 to 60.0)	1050	1.78	No rips, tears or penetrations.
0 to 2160 (0 to 45.0)	50	2.20	No rips, tears or penetrations.
720 to 1680 (15.0 to 35.0)	3350	1.71	No rips, tears or penetrations.

Result: Pass

General Note: Upon completion of testing, the specimens met the requirements of Section 7 of ASTM E 1996.

8.0 Test Equipment:

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

Missile: 2x4 Southern Pine

Timing Device: Electronic Beam Type

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

Deflection Measuring Device: Linear transducers

Tape and film were used to seal against air leakage during structural testing. In our opinion, the tape and film did not influence the results of the test.

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

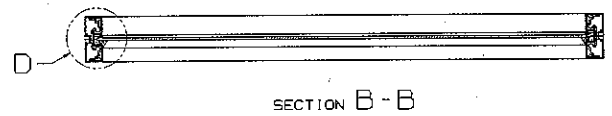
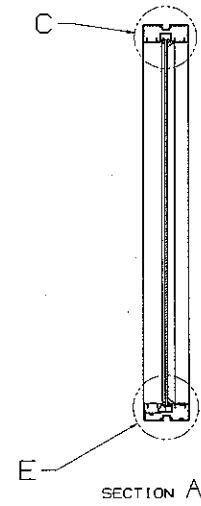
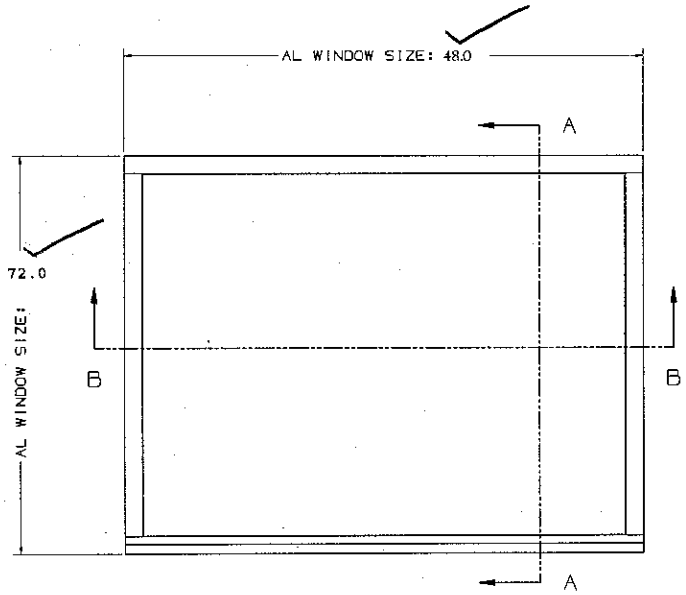
EJS/jb

Attachments (pages): This report is complete only when all attachments listed are included.
Appendix-A: Drawings (10)

This report produced from controlled document template ATI 00498, revised 06/26/14.

Appendix A

Drawings



Architectural Testing

Test sample complies with these details.
Deviations are noted.

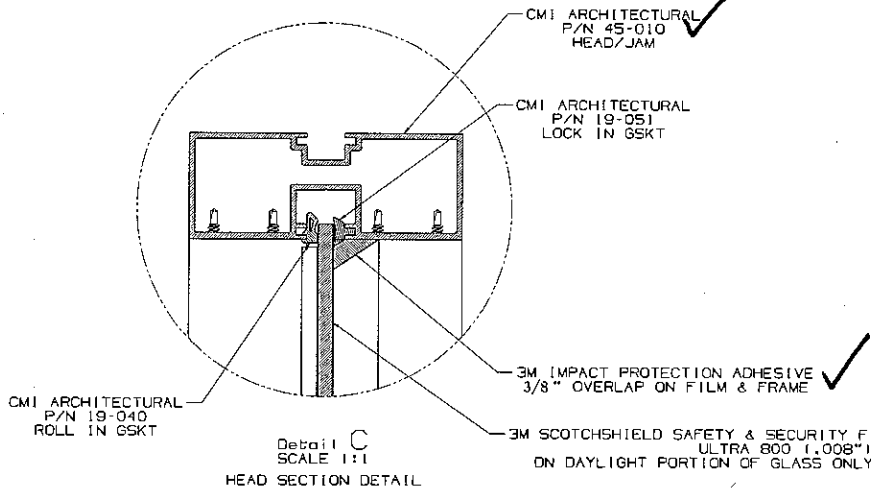
Report# E 2844
Date 3/4/15 Tech GR

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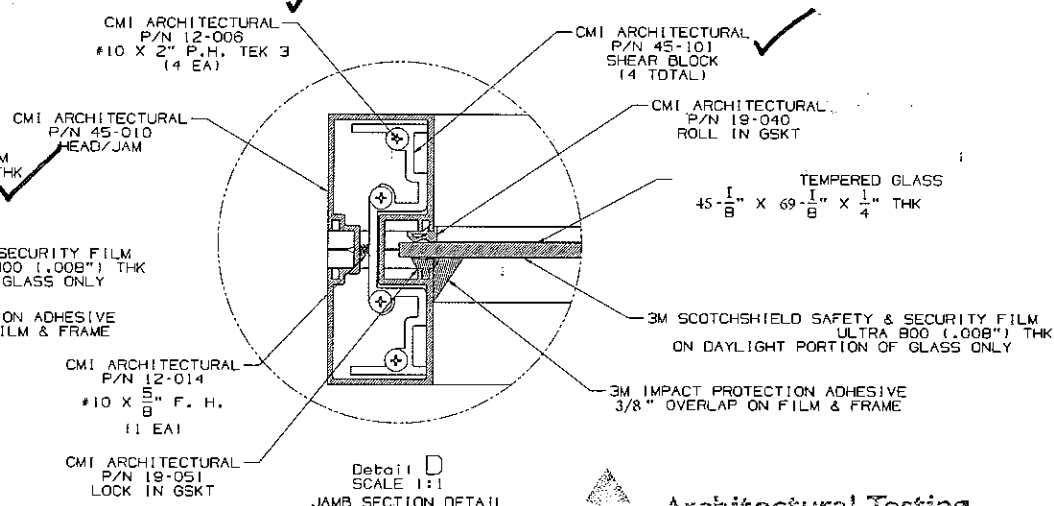
3M © 3M COPYRIGHT 2014
SINGLE PANE WINDOW
TEST FIXTURE WITH 3M
CLEAR ULTRA SAFETY FILM
AND IPA

EDGE VIEW DRAWING NO. **D**
MODEL ASSY_WINDOW_C

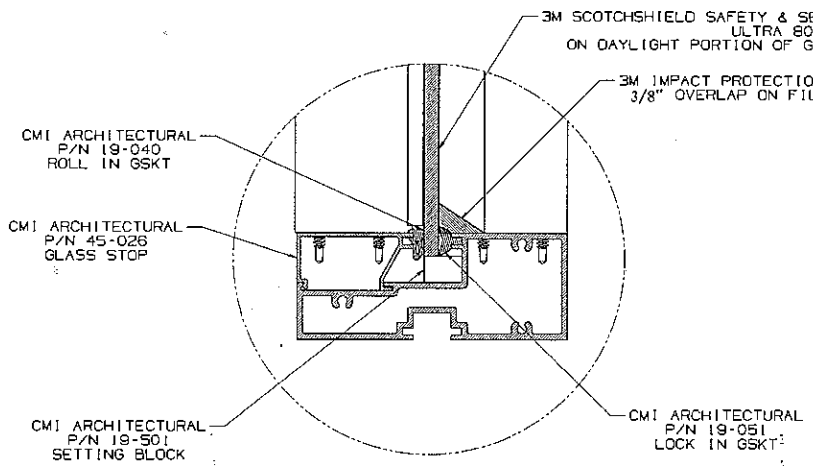
DATE 09/09/14 SHEET 1 OF 2



Detail C
SCALE 1:1
HEAD SECTION DETAIL



Detail D
SCALE 1:1
JAMB SECTION DETAIL



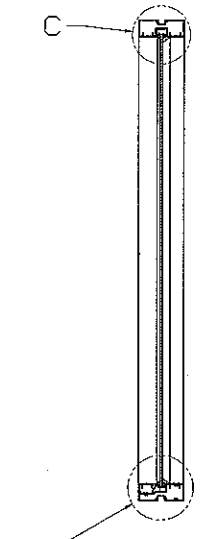
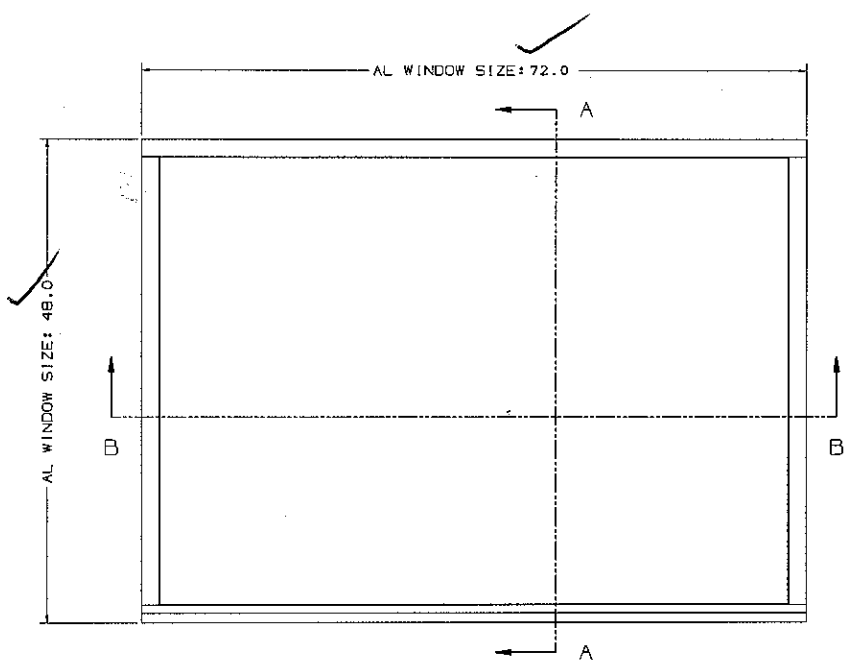
Detail E
SCALE 1:1
SILL SECTION DETAIL

Architectural Testing

Test window complies with these details.
Deviations are noted.

Report# E2894
Date 3/4/15 Tech GR

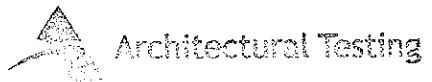
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DIVISION DO NOT SCALE DRAWING THIRD ANGLE PROJECTION INTERPRET PER ASME Y14.5 2009 MAX SURFACE ROUGHNESS 125 / DALL SURFACES / SHANKED ONLY UNLESS NOTED OTHERWISE		DIVISION CODE SCALE UNLESS NOTED OTHERWISE INCHES MILLIMETERS UNLESS NOTED OTHERWISE UNLESS NOTED OTHERWISE		© 2014 COPYRIGHT 2014 This drawing and the information it contains are the property of CMI Architectural. All rights reserved. No part of this drawing may 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 prior written permission of CMI Architectural.		
SINGLE PANE WINDOW TEST FIXTURE WITH 3M CLEAR ULTRA SAFETY FILM AND IPA				DRAWING NUMBER D ASSY_WINDOW_C		
				SHEET 2 OF 2		



SECTION A - A



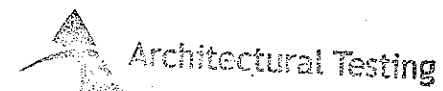
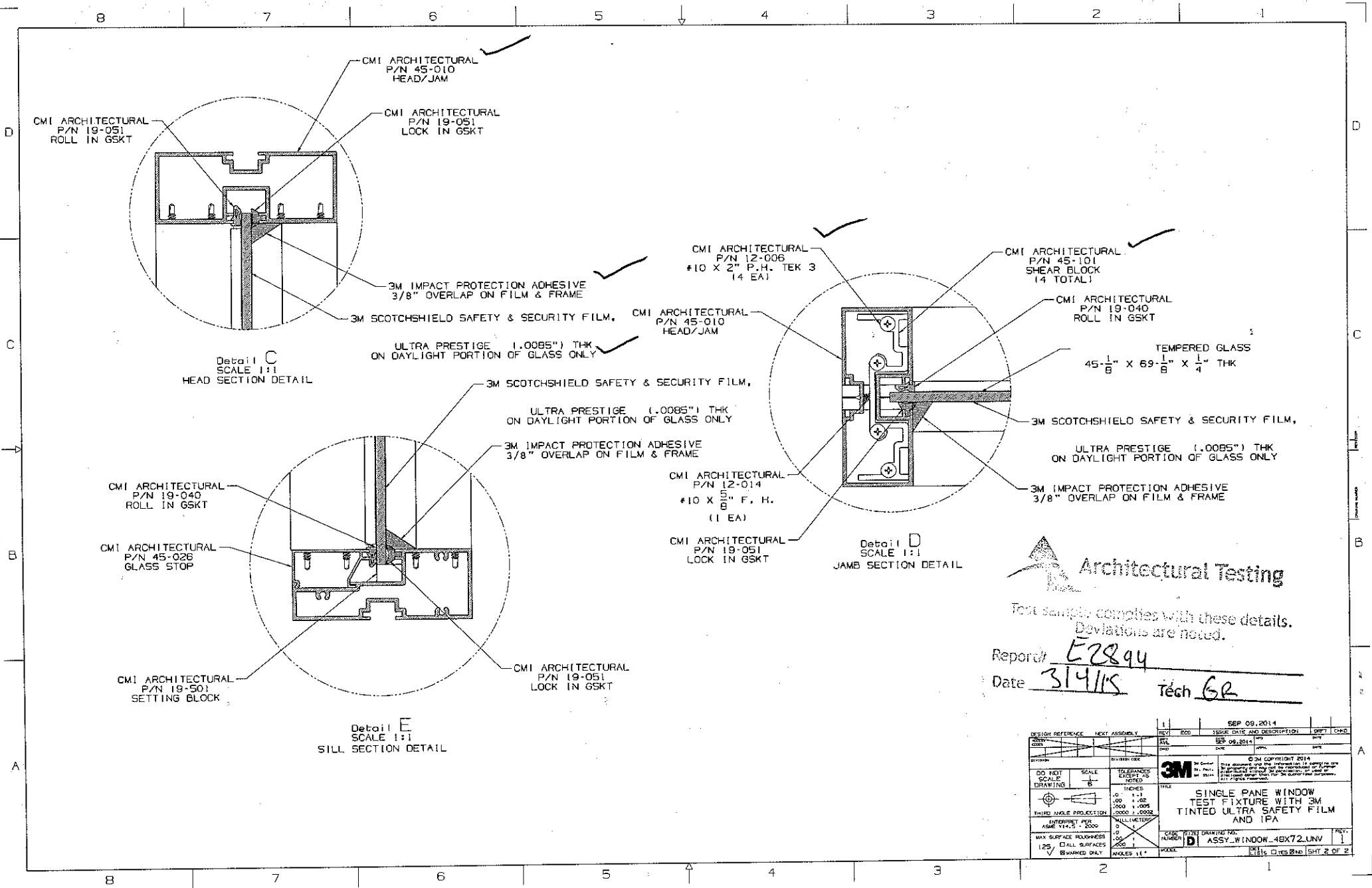
SECTION B - B



Test sample complies with these details.
Deviations are noted.

Report#: E2894
Date: 3/4/15 Tech: GR

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DIVISION DO NOT SCALE DRAWING THIRD ANGLE PROJECTION INTERSECT PER ASME Y14.5 - 2009 MAX SURFACE ROUGHNESS 1.25 CALL SURFACES DAMAGED ONLY	GRAPHIC CODE SCALE INCHES MILLIMETERS ANGLES 1:1 1:100 1:500 1:1000 1:2000 1:5000 1:10000	IN CONFORMANCE WITH THE 3M COMPANY'S 3M SPECIFICATIONS AND THE 3M COMPANY'S 3M WINDOW FILM AND IPA	© 2014 ARCHITECTURAL TESTING SINGLE PANE WINDOW TEST FIXTURE WITH 3M TINTED SAFETY FILM AND IPA	TITLE	TAGS NUMBER 1
3M					
D ASSY_WINDOW_48X72					
SHT 1 OF 2					



Test sample complies with these details.
Deviations are noted.

Report # E2894
Date 3/9/15 Tech GR

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TITLE
SINGLE PANE WINDOW TEST FIXTURE WITH 3M TINTED ULTRA SAFETY FILM AND IPA

CAD NUMBER
D ASSY_WINDOW_4BX72_UNV

DATE
09/09/2014

SCALE
1:1

UNIT
INCHES

TOLERANCES UNLESS NOTED
FRACTIONS DECIMALS ANGLES
1/16 0.0625 15

THIRD ANGLE PROJECTION
ALL UNLESS NOTED

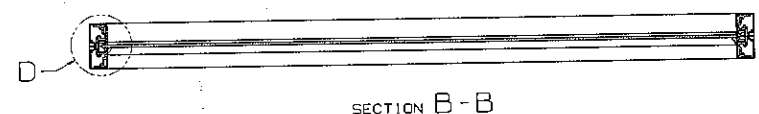
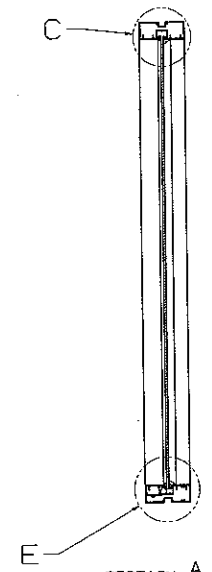
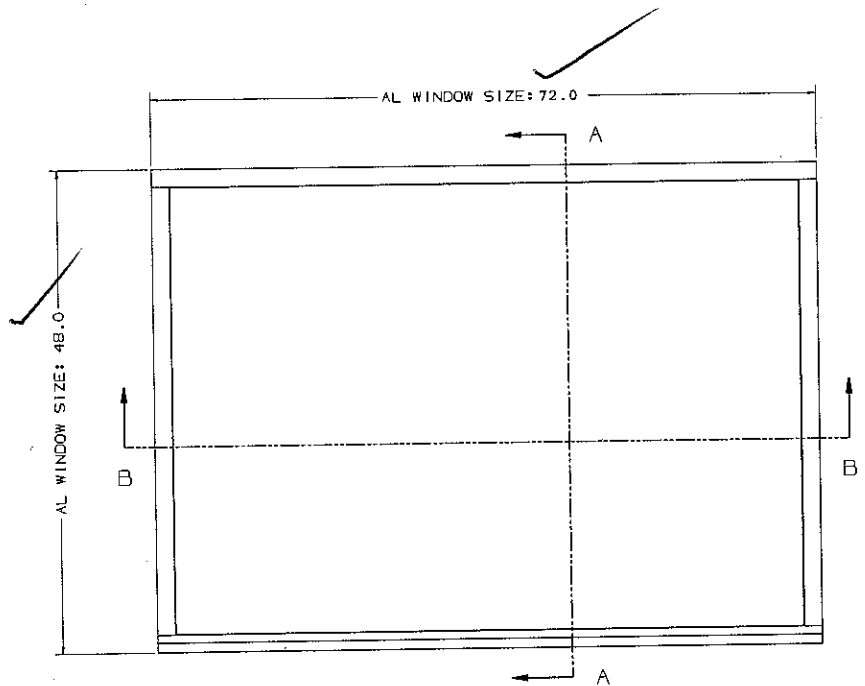
INTERPRET PER
ASME Y14.5 - 2009

MAX SURFACE ROUGHNESS
125

ALL SURFACES
UNLESS NOTED

SHARPED ONLY
UNLESS NOTED

ANGLES
UNLESS NOTED



Architectural Testing

Test sample complies with these details.
 Deviations are noted.

Report# E2894
 Date 31/11/15 Tech GR

DESIGN REFERENCE	NEXT ASSEMBLY	REV	ISSUE DATE AND DESCRIPTION	DRFT	CHG
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		80	SEP 09, 2014		
		81	SEP 09, 2014		
		82	SEP 09, 2014		
		83	SEP 09, 2014		
		84	SEP 09, 2014		
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		90	SEP 09, 2014		
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		93	SEP 09, 2014		
		94	SEP 09, 2014		
		95	SEP 09, 2014		
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		99	SEP 09, 2014		
		100	SEP 09, 2014		

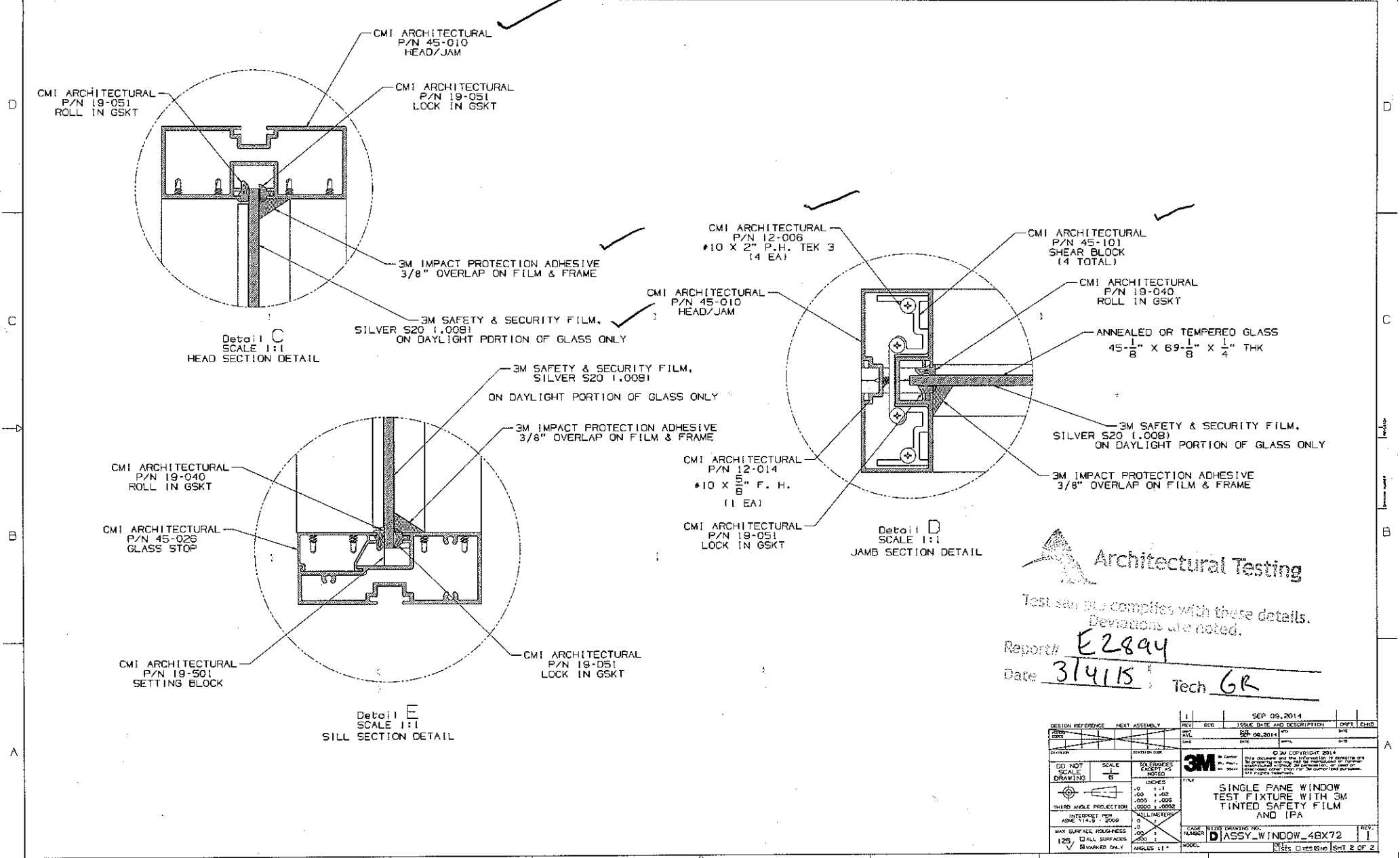
3M
 SINGLE PANE WINDOW
 TEST FIXTURE WITH 3M
 TINTED SAFETY FILM
 AND IPA

ASSY_WINDOW_48X72

REV. 1

SHT. 1 OF 2

8 7 6 5 4 3 2 1



Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report# E2894
Date 3/4/15 Tech GR

DESIGN REFERENCE		NEXT ASSEMBLY		REV	ISSUE DATE AND DESCRIPTION	DRPT. CHGD
DATE	BY	DATE	BY	NO.	DATE	NO.
				01	SEP 09, 2014	
				02	SEP 09, 2014	
				03	SEP 09, 2014	
<p>© 2014 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 prior written permission of 3M.</p>						
DRAWING SCALE G INCHES 1" = 1'-0"	THERM. SHIELD PROTECTION INTERPRET PER ASME Y14.5 - 2009 MAX SURFACE ROUGHNESS 125 □ ALL SURFACES V SHAWED ONLY	TELESCOPE FACTORY 25 .0001 .0002 .0003 .0004 .0005 .0006 .0007 .0008 .0009 .0010	FILE 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 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100	CODE NUMBER D JASSY_WINDOW_48X72 MODEL 1	SINGLE PANE WINDOW TEST FIXTURE WITH 3M TINTED SAFETY FILM AND IPA	SHEET 2 OF 2

8 7 6 5 4 3 2 1

PRINT REVISIONS

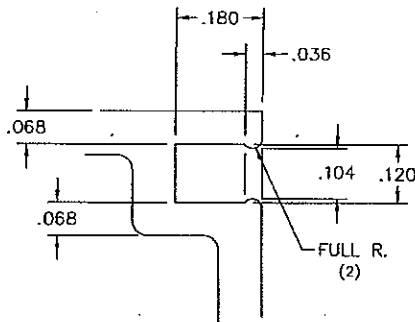
DATE

12580

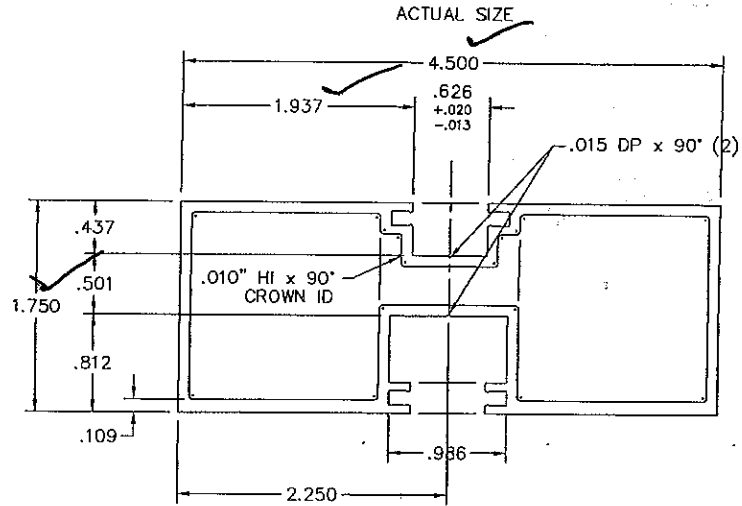
Die Number

45-010

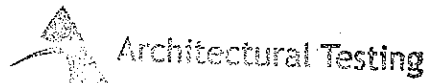
Customer Number



DETAIL "A"
4 x SIZE



ENTIRE OUTSIDE
SURFACE EXPOSED



Test sample complies with these details.
Deviations are noted.

Report# E2894
Date 3/4/15 Tech GC

STANDARD TOLERANCES APPLY UNLESS OTHERWISE NOTED

03-24-11 added .625 tolerance

TYPICAL WALL UNLESS OTHERWISE NOTED: .090

BREAK UNSPECIFIED CORNER: .010 R.

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
952-448-3533 Fax: 952-448-5328

CUSTOMER

CMI Architectural
CMI Architectural Products, Inc.
20821 SD Highway 25
DeSmet, SD 57231-5827
805-854-3326 Fax: 805-854-3620

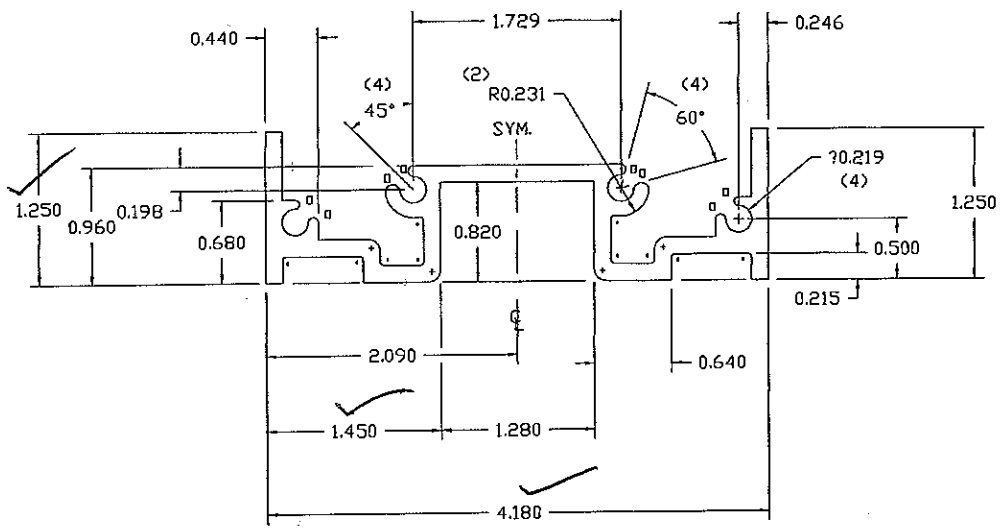
PRESS SIZE	LEGEND	DIE REVISIONS	DATE
⊖	-.031 R.		
○	-.062 R.		
×	-.125 R.		
⊗	-.250 R.		
*			

PART NAME: MULLION

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

PRINT REVISIONS	DATE

REV.	CRM-62	
DELHI	TIFTON	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# E2894
 Date 3/4/15 Tech GR

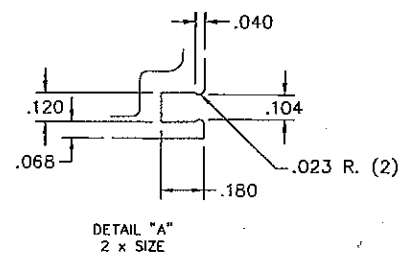
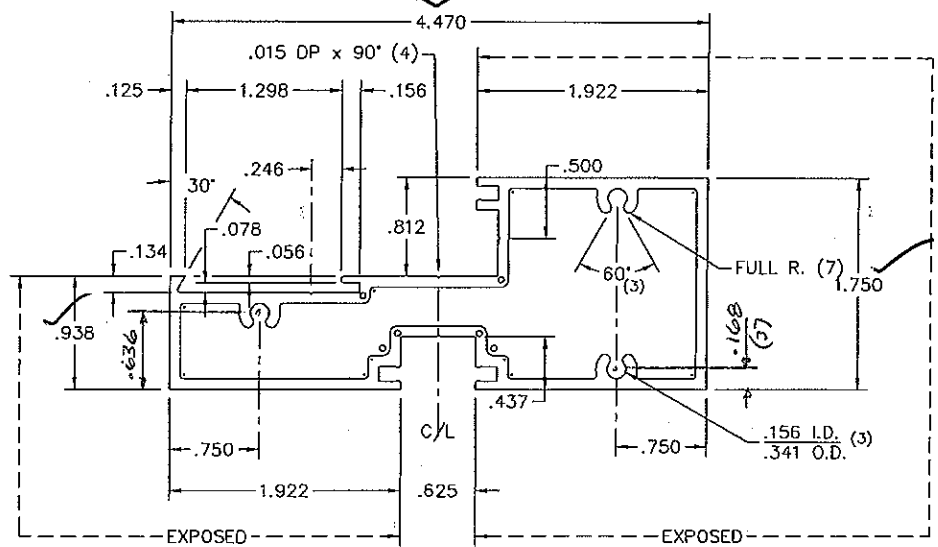
LEGEND:
 * = 0.031 R. (10)
 + = 0.100 R. (4)
 o = FULL R. (8)

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
PERIMETER	23.555	CIRCLE SIZE	4-5	CUSTOMER	CRONSTROMS
OUTSIDE PERIMETER		FACTOR	12		MINNEAPOLIS, MINN.
PRESS SIZE		EXPOSED PERIMETER		SCALE	ACTUAL
LEGEND	DIE REVISIONS	DATE		DATE	12-3-88
* = .031 R.				LAST REVISION	
o = .062 R.				DRAWN	M. COPES
+ = .125 R.				JOB	
x = .250 R.				APPLICATION	MULL. CLIP
o = .250 R.				CUSTOMER NUMBER	32-003
* =					

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# E2894

Date 3/4/15 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
WT/FT	1.624
CIRCLE SIZE	4 - 5
FACTOR	18

sapa: Sapa Extrusions, Inc.
DEHLI LA 71232

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

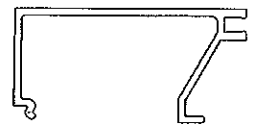
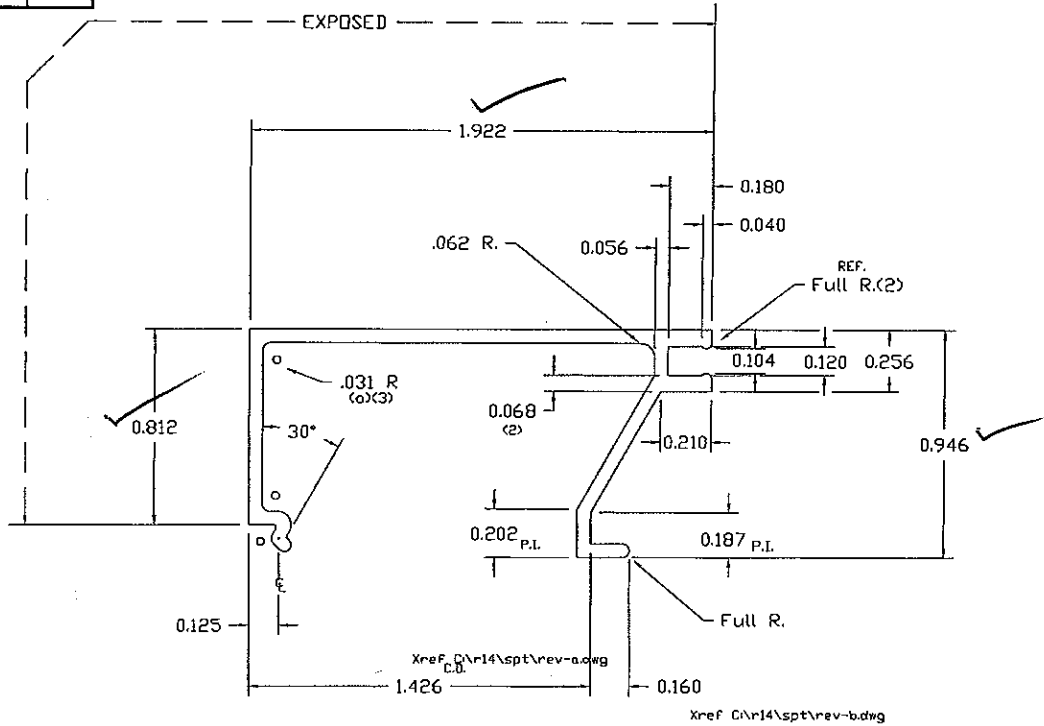
APPLICATION
F.G. SILL 1/4"

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

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

PRINT REVISIONS	DATE

CRM-49 B		
REV.		
DELHI	TIFTON	BOTH
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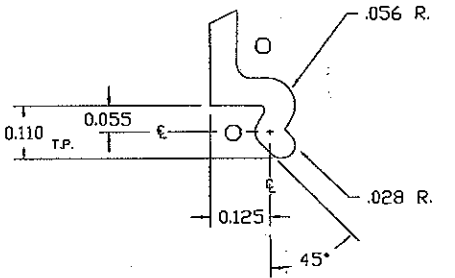
ACTUAL SIZE



Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report# F2894
Date 3/4/15 Tech GE



DETAIL
4 x Size

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

ESTIMATED DIE DATA	
INTERNAL USE	6063-T5
AREA	.243
PERIMETER	8.478
OUTSIDE PERIMETER	2.734
WT/LY	.291
CIRCLE SIZE	2-3
FACTOR	29
LEGEND	DIE REVISIONS
• = .031 R.	A RE-DESIGNED
o = .062 R.	B SHORTENED LEG
x = .125 R.	
⊗ = .250 R.	
* =	

sapa:	Sapa Extrusions, Inc. DELHI, LA 71232
CUSTOMER	CRONSTROMS MINNEAPOLIS, MN
APPLICATION	SILL STOP 1/4" TO 1"

CAOD #	
SCALE	2 x 8 Noted
DATE	10-31-88
LAST REVISION	
DRAWN	J. ALBEREZ
JOB	
CUSTOMER NUMBER	45-026