



ASTM E1886 and ASTM E1996 TEST REPORT

Report No.: G2099.01-201-44

Rendered to:

3M COMPANY
St. Paul, Minnesota 55144

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

Test Date: 09/25/16
Report Date: 12/23/16
Test Record Retention End Date: 12/23/20

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 Night Vision 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: 09/26/16

3.5 Test Record Retention End Date: All test records for this report will be retained until December 23, 2020.

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>
Tony D. Gavin	Intertek-ATI
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 Night Vision	1/4" tempered glazing laminated with 3M™ Ultra Night Vision	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: 40.1 m/s (131.5 fps)	
Impact Area:	Upper left glazing corner
Observations:	Missile hit target area; no rips, tears or penetrations
Results:	Pass

Impact #2: Missile Velocity: 40.1 m/s (131.6 fps)	
Impact Area:	On the glazing located at the midspan of the right jamb, 152 mm (6") from the right jamb.
Observations:	Missile hit target area; no rips, tears or penetrations
Results:	Pass

Impact #3: Missile Velocity: 40.0 m/s (131.2 fps)	
Impact Area:	Lower left 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: 39.5 m/s (129.5 fps)	
Impact Area:	Upper right glazing corner
Observations:	Missile hit target area; no rips, tears or penetrations
Results:	Pass

Impact #2: Missile Velocity: 40.4 m/s (132.6 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 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: 40.2 m/s (131.9 fps)	
Impact Area:	On the glazing located at the midspan of the right jamb, 152 mm (6") 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: 40.3 m/s (132.3 fps)	
Impact Area:	Horizontal centerline of glazing, 152 mm (6") from the top rail
Observations:	Missile hit target area; no rips, tears or penetrations
Results:	Pass

Impact #2: Missile Velocity: 40.1 m/s (131.6 fps)	
Impact Area:	Horizontal and vertical centerline of the glazing
Observations:	Missile hit target area; no rips, tears or penetrations
Results:	Pass

Impact #3: Missile Velocity: 40.1 m/s (131.6 fps)	
Impact Area:	Horizontal centerline of glazing, 152 mm (6") from the bottom rail
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	2.49	No rips, tears or penetrations.
0 to 2105 (0 to 42.0)	300	2.53	No rips, tears or penetrations.
1680 to 2685 (35.0 to 56.0)	600	2.37	No rips, tears or penetrations.
1010 to 3360 (21.0 to 70.0)	100	2.90	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	2.75	No rips, tears or penetrations.
1680 to 2685 (35.0 to 56.0)	1050	2.28	No rips, tears or penetrations.
0 to 2105 (0 to 42.0)	50	2.91	No rips, tears or penetrations.
675 to 1680 (14.0 to 35.0)	3350	2.54	No rips, tears or penetrations.

Result: Pass**Note:** Test Specimens #1, #2 and #3 were cycled in a common chamber.

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	2.49	No rips, tears or penetrations.
0 to 2105 (0 to 42.0)	300	2.53	No rips, tears or penetrations.
1680 to 2685 (35.0 to 56.0)	600	2.37	No rips, tears or penetrations.
1010 to 3360 (21.0 to 70.0)	100	2.90	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	2.75	No rips, tears or penetrations.
1680 to 2685 (35.0 to 56.0)	1050	2.28	No rips, tears or penetrations.
0 to 2105 (0 to 42.0)	50	2.91	No rips, tears or penetrations.
675 to 1680 (14.0 to 35.0)	3350	2.54	No rips, tears or penetrations.

Result: Pass**Note:** Test Specimens #1, #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	2.49	No rips, tears or penetrations.
0 to 2105 (0 to 42.0)	300	2.53	No rips, tears or penetrations.
1680 to 2685 (35.0 to 56.0)	600	2.37	No rips, tears or penetrations.
1010 to 3360 (21.0 to 70.0)	100	2.90	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	2.75	No rips, tears or penetrations.
1680 to 2685 (35.0 to 56.0)	1050	2.28	No rips, tears or penetrations.
0 to 2105 (0 to 42.0)	50	2.91	No rips, tears or penetrations.
675 to 1680 (14.0 to 35.0)	3350	2.54	No rips, tears or penetrations.

Result: Pass**Note:** Test Specimens #1, #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

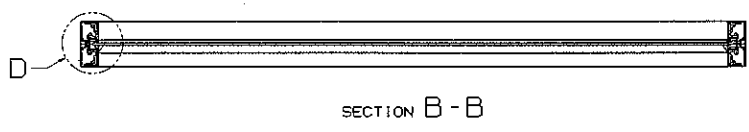
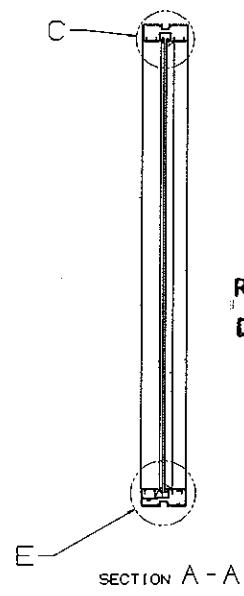
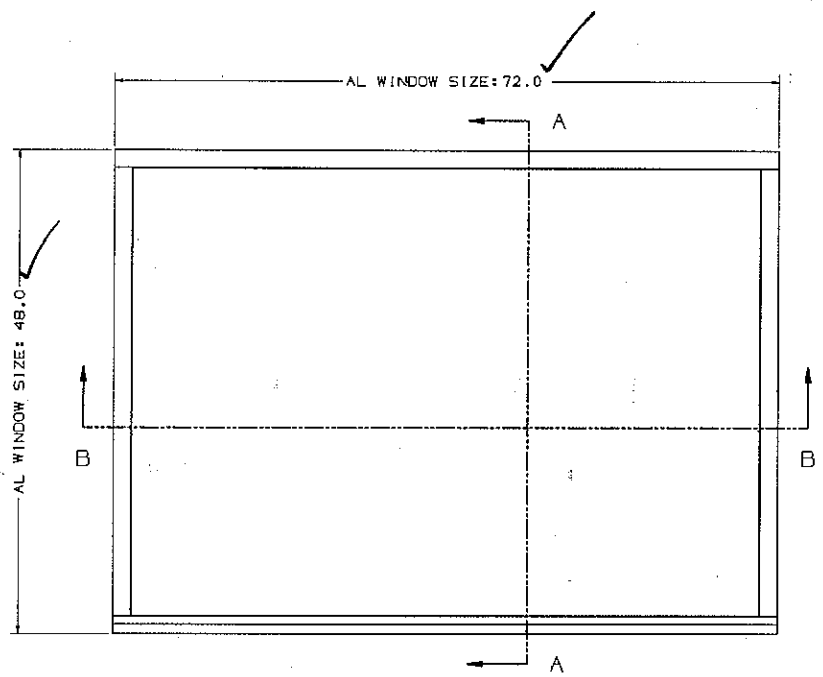
Attachments (pages): This report is complete only when all attachments listed are included.

Appendix A: Drawings (6)

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

Appendix A

Drawings



Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report# G2099
Date 1-3-17 Tech [Signature]

DESIGN REFERENCE	NEXT ASSEMBLY	REV	ED	ISSUE DATE AND DESCRIPTION	DWPT	CHKD
		1		SEP 09, 2014		
		2		SEP 08, 2014		

<p>DO NOT SCALE DRAWINGS</p> <p>SCALE: 1/8" = 1"</p> <p>THIRD ANGLE PROJECTION</p> <p>INTERPRET PER ASME Y14.5 - 2009</p> <p>MAX SURFACE ROUGHNESS: 125</p> <p>UNRAISED SURFACES ONLY</p>	<p>TOLERANCES EXCEPT AS NOTED</p> <p>INCHES: .0000 ± .0002</p> <p>MILLIMETERS: .0000 ± .0002</p> <p>ALL DIMENSIONS UNLESS OTHERWISE SPECIFIED</p>	<p>3M logo</p> <p>SINGLE PANE WINDOW TEST FIXTURE WITH 3M TINTED SAFETY FILM AND IPA</p> <p>CASE NUMBER: D ASSY_WINDOW_48X72</p> <p>MODEL: [Blank]</p>	<p>SEP 09, 2014</p> <p>SEP 08, 2014</p> <p>SEP 09, 2014</p> <p>SEP 08, 2014</p>
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8 7 6 5 4 3 2 1

8 7 6 5 4 3 2 1

D
C
B
A

D
C
B
A

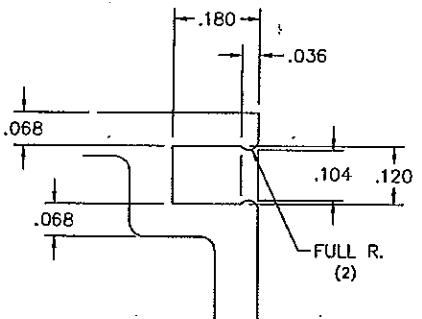
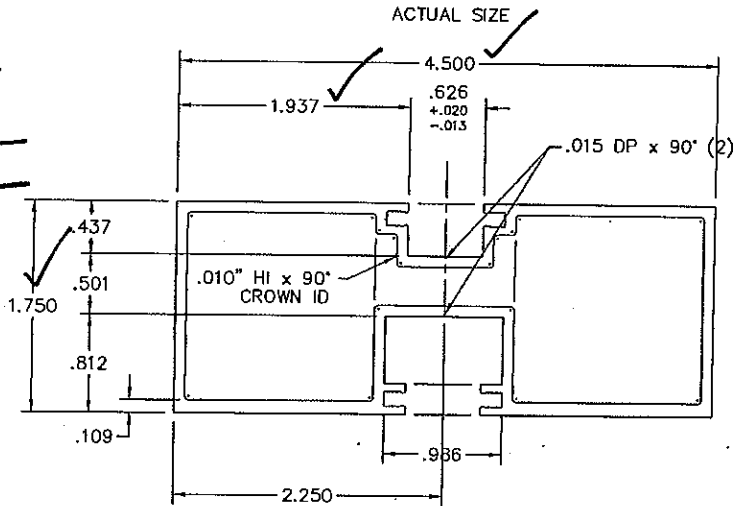
PRINT REVISIONS	DATE

12580
Die Number
45-010
Customer Number



Test sample complies with these details.
Deviations are noted.

Report# S 2099
Date 1-3-17 Tech DS



DETAIL "A"
4 x SIZE

ENTIRE OUTSIDE
SURFACE EXPOSED

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.
20621 SD Highway 25
DeSmet, SD 57231-5827
605-854-3326 Fax: 605-854-3620

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

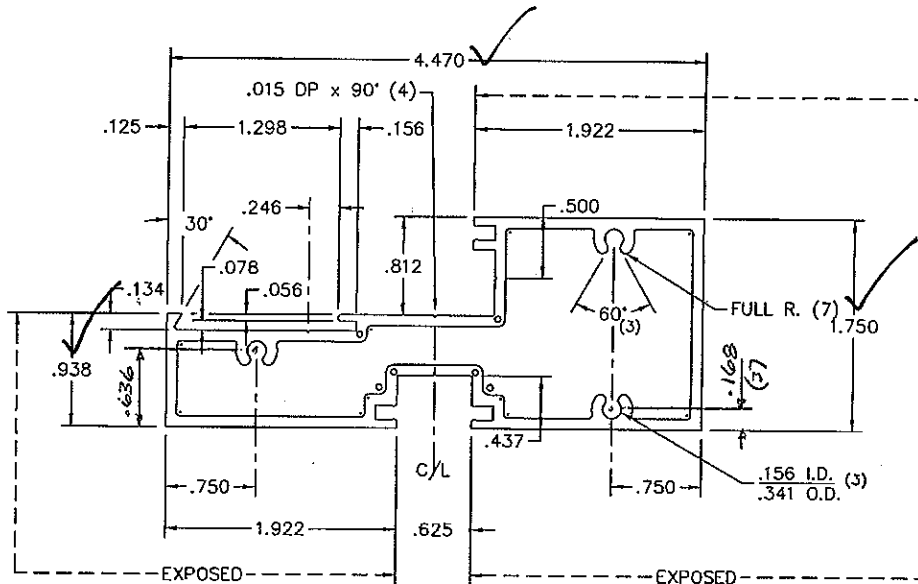
LEGEND	DIE REVISIONS	DATE
• = .031 R.		
◊ = .062 R.		
x = .125 R.		
⊗ = .250 R.		
* =		

STANDARD TOLERANCES APPLY UNLESS OTHERWISE NOTED

PART NAME: MULLION

PRINT REVISIONS		DATE
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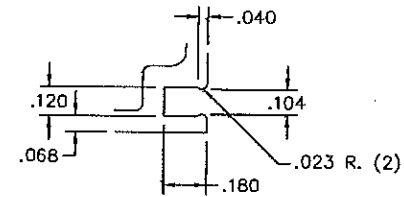
CRM-44		
REV.	1	
DELHI	TIFTON	BOTH
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Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report# G2099
Date 1-3-17 Tech AD



DETAIL "A"
2 x SIZE

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

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

sapa: Sapa Extrusions, Inc. DELR LA 71233	CADD # CRM-44 350
CUSTOMER CMi ARCHITECTURAL PRODUCTS 2800 FREEWAY BOULEVARD SUITE 205 MINNEAPOLIS, MN 55430	SCALE FULL & NOTED
APPLICATION F.G. SILL 1/4"	DATE 7-29-98
	LAST REVISION
	DRAWN Michael Bryan
	JOB
	CUSTOMER NUMBER 45-018

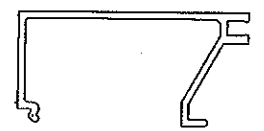
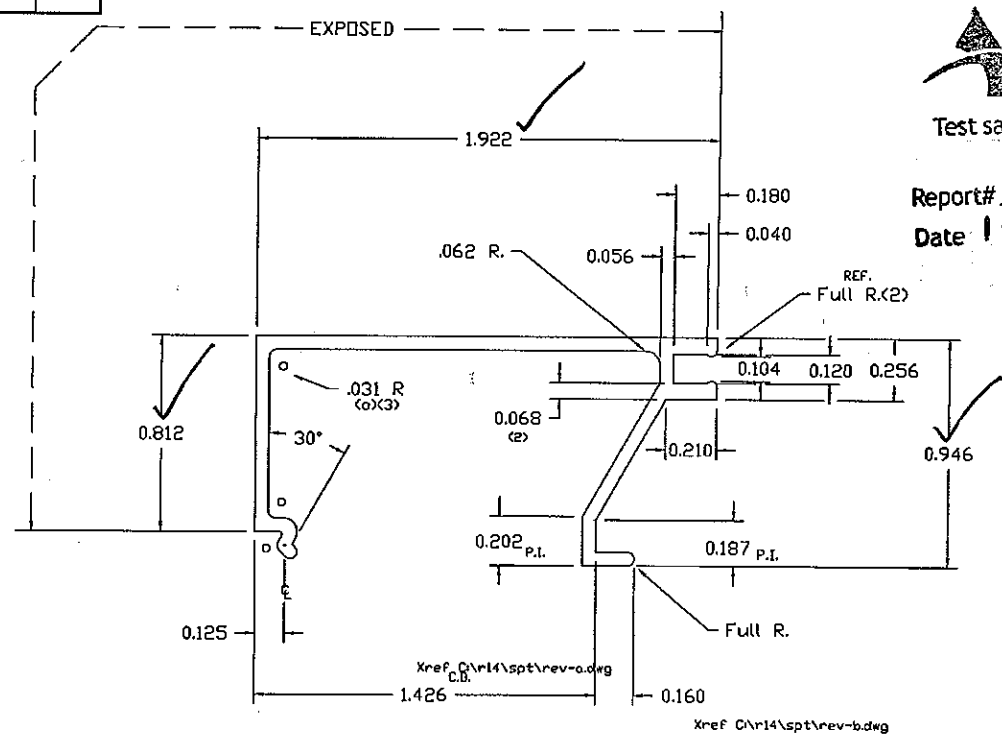
PRINT REVISIONS	DATE

CRM-49. B		
REV.		
DELHI	TIFTON	BOTH
0	0	0

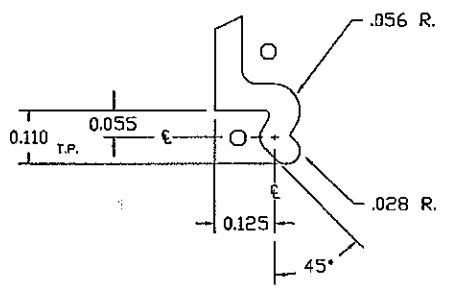


Test sample complies with these details.
Deviations are noted.

Report# G2099
Date 1-3-87 Tech AD



ACTUAL SIZE



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/FT	.291
CIRCLE SIZE	2-3
FACTOR	29

sapa: Sapa Extrusions, Inc.
DELHI, LA 71232

CUSTOMER
CRONSTROMS
MINNEAPOLIS, MN

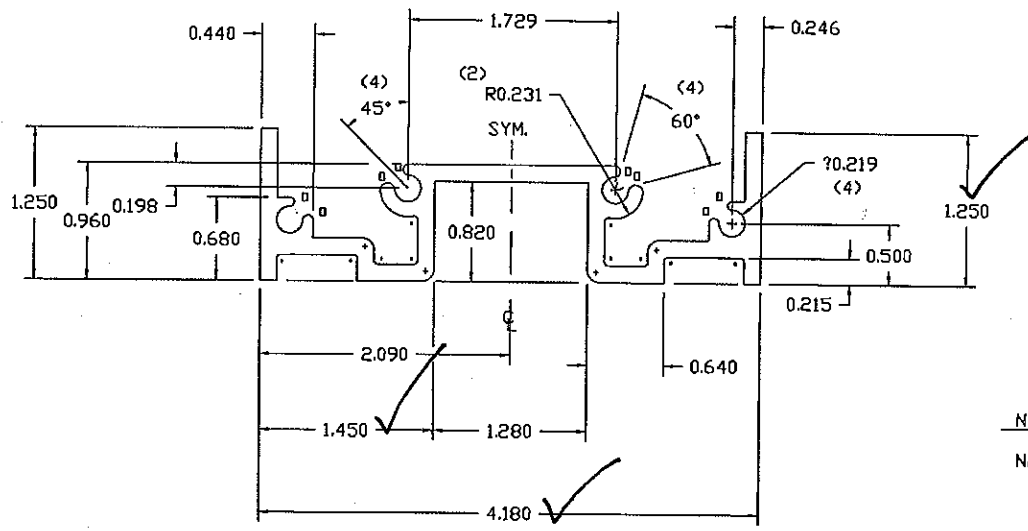
CADD #	
SCALE	2 x & Noted
DATE	10-31-88
LAST REVISION	
DRAWN	J. ALBEREZ
JOB	
CUSTOMER NUMBER	45-026

LEGEND	DIE REVISIONS	DATE
- = .031 R.	A RE-DESIGNED	1-5-88
o = .062 R.	B SHORTENED LEG	2-13-89
x = .125 R.		
⊗ = .250 R.		
* =		

APPLICATION
SILL STOP 1/4" TO 1"

PRINT REVISIONS	DATE

CRM-62		
REV.	1	
DELHI	TIFTON	BOTH
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



Test sample complies with these details.
Deviations are noted.

Report# G2099
Date 1-3-17 Tech: ES

NOTE:
NO EXPOSED SURFACE

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	
INTERNAL USE	6063-T5
AREA	1.389 WT/FT 1.667
PERIMETER	23.555 CIRCLE SIZE 4-5
OUTSIDE PERIMETER	FACTOR 12
PRESS SIZE	EXPOSED PERIMETER
LEGEND	DIE REVISIONS DATE
• = .031 R.	
◦ = .062 R.	
x = .125 R.	
⊗ = .250 R.	
* =	

sapa:	Sapa Extrusions, Inc. DELHI, LA 71232
CUSTOMER	CRONSTROMS MINNEAPOLIS, MINN.
APPLICATION	MULL. CLIP

CADD #	MRC---10 010
SCALE	ACTUAL
DATE	12-3-88
LAST REVISION	
DRAWN	M. COPES
JOB	
CUSTOMER NUMBER	32-003