ASTM E 1886 and ASTM E 1996 TEST REPORT

Report No.: E2158.01-201-44

Rendered to:

3M COMPANY
St. Paul, Minnesota 55144

PRODUCT TYPE: Safety and Security Window Film
SERIES/MODEL: 3M™ Safety and Security Film Safety Neutral S35 with 3M™ Impact Protection Adhesive

Test Date: 10/23/14
Through: 10/24/14
Report Date: 12/23/14
Test Record Retention End Date: 10/24/18

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

2.0 Test Laboratory: Architectural Testing, Inc.
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 Safety Neutral S35 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 **±2880 Pa (±60.00 psf) Design Pressure** with missile impacts corresponding to **Missile Level C and Wind Zone 3**.

3.4 Test Dates: 10/23/14- 10/24/14

3.5 Test Record Retention End Date: All test records for this report will be retained until October 24, 2018.

3.6 Test Location: Architectural Testing, Inc. 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 Architectural Testing for a minimum of four years from the test completion date.

3.8 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 A. Any deviations are documented herein or on the drawings.

3.9 List of Official Observers:

Name	Company
Paul Neumann	3M Company
Karl A. Lips-Eakins	Architectural Testing, Inc.
Tony D. Gavin	Architectural Testing, Inc.

4.0 Test Specifications:

ASTM E 330-02, *Test Method for Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference*

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
Safety Neutral S35	1/4" tempered glazing laminated with 3M™ Safety Neutral S35	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 E330, *Static Air Pressure*

Title of Test	Results
Uniform Load Deflection, per ASTM E 330 taken at jamb between anchors	
+2880 Pa (+60.15 psf)	<0.3 mm (<0.01")
-2880 Pa (-60.15 psf)	<0.3 mm (<0.01")
Uniform Load Structural, per ASTM E 330 taken at jamb between anchors	
+4320 Pa (+90.23 psf)	<0.3 mm (<0.01")
-4320 Pa (-90.23 psf)	<0.3 mm (<0.01")

ASTM E1886, *Large Missile C 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 #1: Orientation within ±5° of horizontal

Impact #1: Missile Velocity: 12.3 m/s (40.5 fps)	
Impact Area:	Center of glazing.
Observations:	Missile hit target area; no rips, tears or penetrations.
Results:	Pass.

Test Unit #2: Orientation within ±5° of horizontal

Impact #1: Missile Velocity: 12.1 m/s (39.7 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, *Large Missile C 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 #3: Orientation within ±5° of horizontal

Impact #1: Missile Velocity: 12.2 m/s (39.9 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, *Air Pressure Cycling*

Test Unit #1
Design Pressure: ±2880 Pa (±60.00 psf)

POSITIVE PRESSURE

Pressure Range Pa (psf)	Number of Cycles	Average Cycle Time (seconds)	Observations
575 to 1440 (12.0 to 30.0)	3500	2.04	No rips, tears or penetrations.
0 to 1725 (0 to 36.0)	300	2.75	No rips, tears or penetrations.
30.0 to 48.0 (1440 to 2300)	600	1.83	No rips, tears or penetrations.
18.0 to 60.0 (865 to 2880)	100	2.57	No rips, tears or penetrations.

NEGATIVE PRESSURE

Pressure Range Pa (psf)	Number of Cycles	Average Cycle Time (seconds)	Observations
18.0 to 60.0 (865 to 2880)	50	2.35	No rips, tears or penetrations.
30.0 to 48.0 (1440 to 2300)	1050	1.91	No rips, tears or penetrations.
0 to 1725 (0 to 36.0)	50	2.81	No rips, tears or penetrations.
575 to 1440 (12.0 to 30.0)	3350	2.41	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: ±2880 Pa (±60.00 psf)

POSITIVE PRESSURE

Pressure Range Pa (psf)	Number of Cycles	Average Cycle Time (seconds)	Observations
575 to 1440 (12.0 to 30.0)	3500	2.04	No rips, tears or penetrations.
0 to 1725 (0 to 36.0)	300	2.75	No rips, tears or penetrations.
30.0 to 48.0 (1440 to 2300)	600	1.83	No rips, tears or penetrations.
18.0 to 60.0 (865 to 2880)	100	2.57	No rips, tears or penetrations.

NEGATIVE PRESSURE

Pressure Range Pa (psf)	Number of Cycles	Average Cycle Time (seconds)	Observations
18.0 to 60.0 (865 to 2880)	50	2.35	No rips, tears or penetrations.
30.0 to 48.0 (1440 to 2300)	1050	1.91	No rips, tears or penetrations.
0 to 1725 (0 to 36.0)	50	2.81	No rips, tears or penetrations.
575 to 1440 (12.0 to 30.0)	3350	2.41	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: ±2880 Pa (±60.00 psf)

POSITIVE PRESSURE

Pressure Range Pa (psf)	Number of Cycles	Average Cycle Time (seconds)	Observations
575 to 1440 (12.0 to 30.0)	3500	1.96	No rips, tears or penetrations.
0 to 1725 (0 to 36.0)	300	2.05	No rips, tears or penetrations.
30.0 to 48.0 (1440 to 2300)	600	1.71	No rips, tears or penetrations.
18.0 to 60.0 (865 to 2880)	100	1.96	No rips, tears or penetrations.

NEGATIVE PRESSURE

Pressure Range Pa (psf)	Number of Cycles	Average Cycle Time (seconds)	Observations
18.0 to 60.0 (865 to 2880)	50	1.93	No rips, tears or penetrations.
30.0 to 48.0 (1440 to 2300)	1050	1.90	No rips, tears or penetrations.
0 to 1725 (0 to 36.0)	50	2.15	No rips, tears or penetrations.
575 to 1440 (12.0 to 30.0)	3350	1.80	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:

Cannon: 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.

Architectural Testing 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 Architectural Testing, Inc. 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 Architectural Testing, Inc.

For ARCHITECTURAL TESTING, Inc.

Digitally Signed by: Eric Schoenthaler

Eric J. Schoenthaler
Project Manager

Digitally Signed by: Daniel A. Johnson

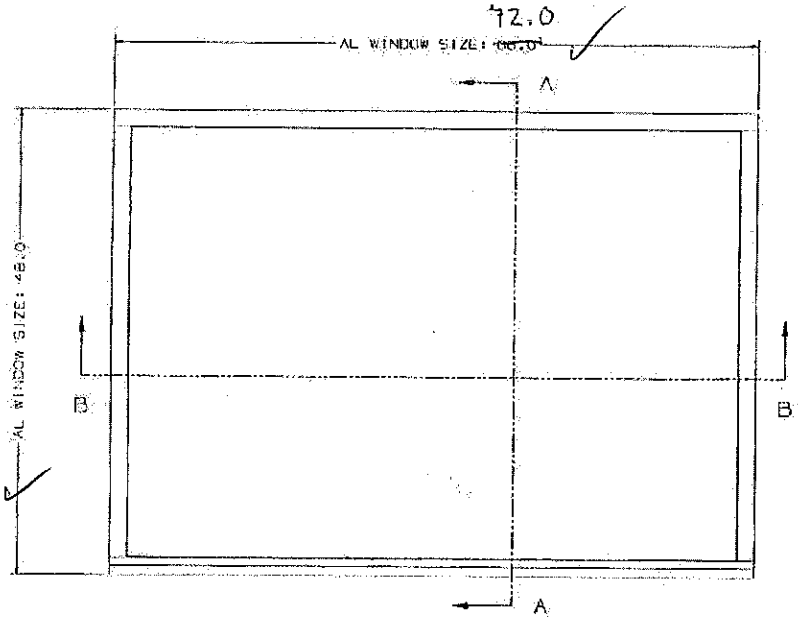
Daniel A. Johnson
Director – Regional Operations

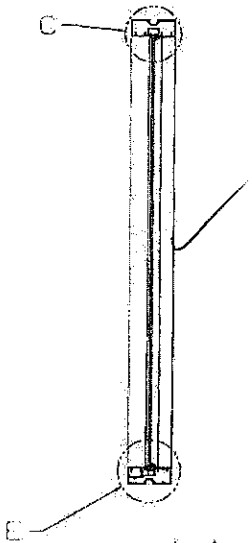
EJS/jb

Attachments (pages): This report is complete only when all attachments listed are included.
Appendix-A: Drawings (6)

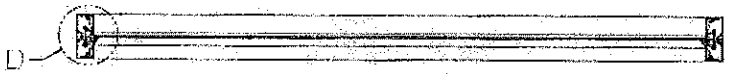
Appendix A

Drawings





SECTION A - A



SECTION B - B

Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report# E2158

Date 1-8-15 Tech SK

DO NOT SCALE DRAWING	SCALE 1/8	TOLERANCES EXCEPT AS NOTED	FRACTIONS ± 1/64
THIRD ANGLE PROJECTION			.X ± .1 .XX ± .05 .XXX ± .005 .XXXX ± .0050
INTERPRET PER ASME Y14.5 - 2009			ANGLES ± 1°
MAX SURFACE ROUGHNESS 125 ALL SURFACES UNLESS OTHERWISE SPECIFIED			

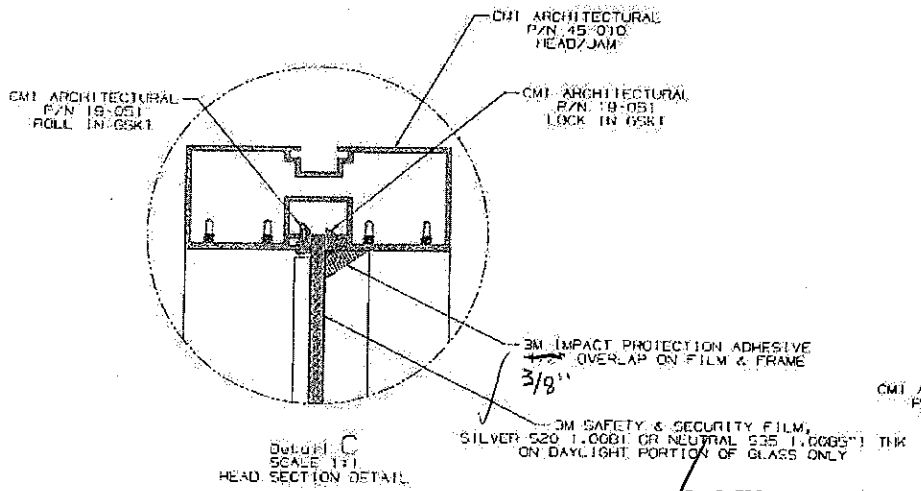
SEP 09,2014

3M

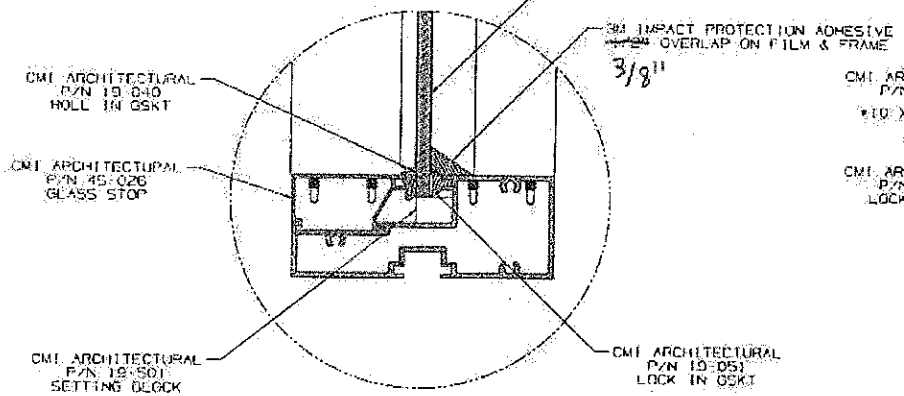
SINGLE PANE WINDOW TEST FIXTURE WITH 3M TINTED SAFETY FILM AND IPA

SIZE D DRAWING NO. ASSY_WINDOW_40x66 REV 1

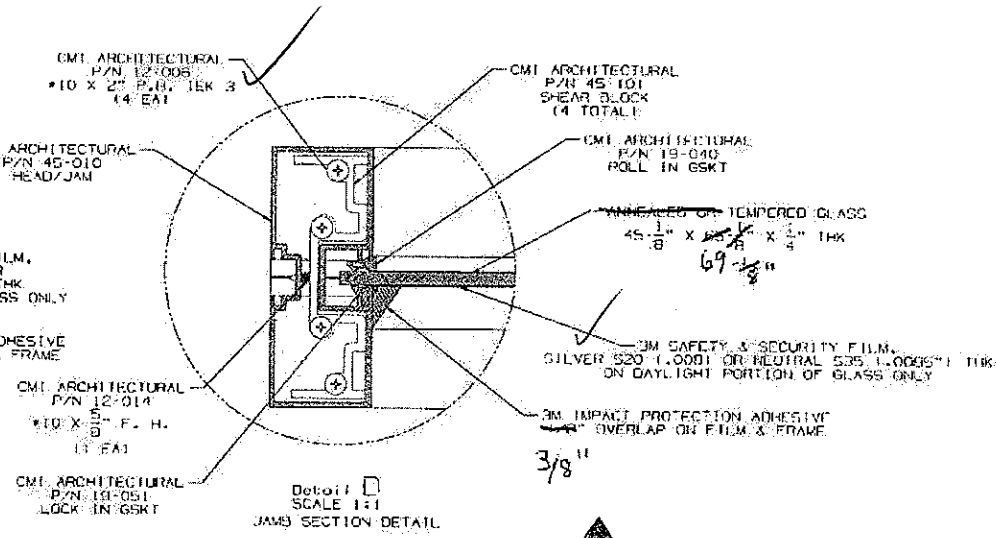
SCALE: 1/8 WEIGHT: LBS SHEET 1 OF 2



Detail C
SCALE 1:1
HEAD SECTION DETAIL



Detail E
SCALE 1:1
SILL SECTION DETAIL



Detail D
SCALE 1:1
JAMB SECTION DETAIL

Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report# E2158

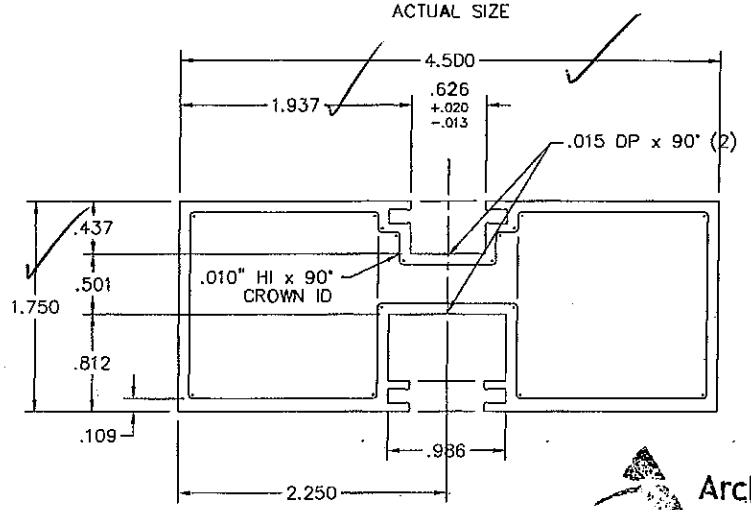
Date 1-8-15 Tech SR

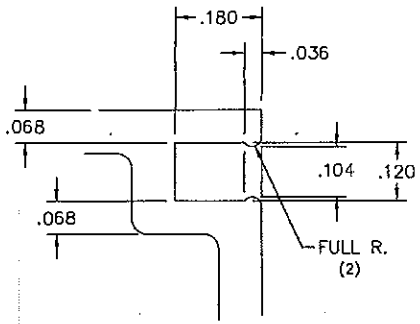
DESIGN REFERENCE	NEXT ASSEMBLY	REV	ISSUE DATE AND DESCRIPTION
		05	02-2014
DO NOT SCALE DRAWING	SCALE 1/8	3M	© 3M COMPANY 2014
THIRD ANGLE PROJECTION	INCHES .0 ±.1 .00 ±.01 .000 ±.005 .0000 ±.0002	SINGLE PANE WINDOW TEST FIXTURE WITH 3M TINTED SAFETY FILM AND IPA	
INTERPRET PER ASME Y14.5 - 2009	MATERIAL	SIZE D	DWG NO ASSY_WINDOW_48X65
MFR SURFACE FINISH 125 ALL SURFACES UNLESS NOTED	FINISH	SCALE 1:1	WEIGHT
		MODEL	SHT 2 OF 2

PRINT REVISIONS	DATE

12580
Die Number
45–010
Customer Number

ACTUAL SIZE





DETAIL "A"
4 x SIZE

ENTIRE OUTSIDE
SURFACE EXPOSED

Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report# E2158

Date 1-8-15 Tech SK

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	

PRESS SIZE

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

DIE REVISIONS	DATE

STANDARD TOLERANCES APPLY UNLESS OTHERWISE NOTED

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
605-854-3326 Fax: 605-854-3620

PART NAME: MULLION

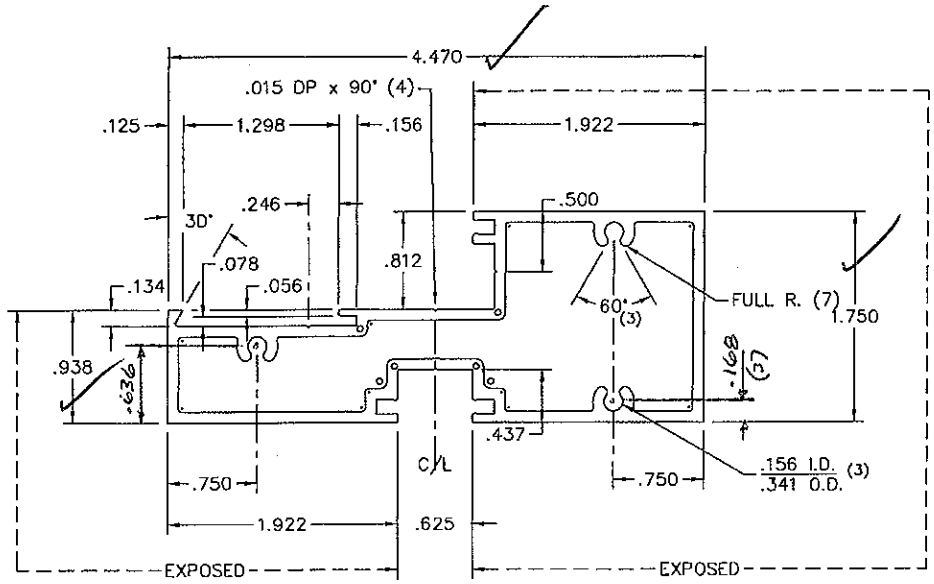
DIE #	12580
SCALE	FULL & NOTED
DATE	12–11–08
LAST REVISION	03–24–11
DRAWN	TCG
CUSTOMER NUMBER	45–010

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

CRM-44

REV.

DELHI	TIFTON	BOTH
☒	☐	☐

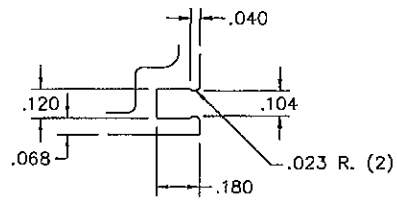


Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report# E2158

Date 1-8-15 Tech SK



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	

DIE REVISIONS	DATE

PRESS SIZE

LEGEND
- • = .031 R.
- o = .062 R.
- x = .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"

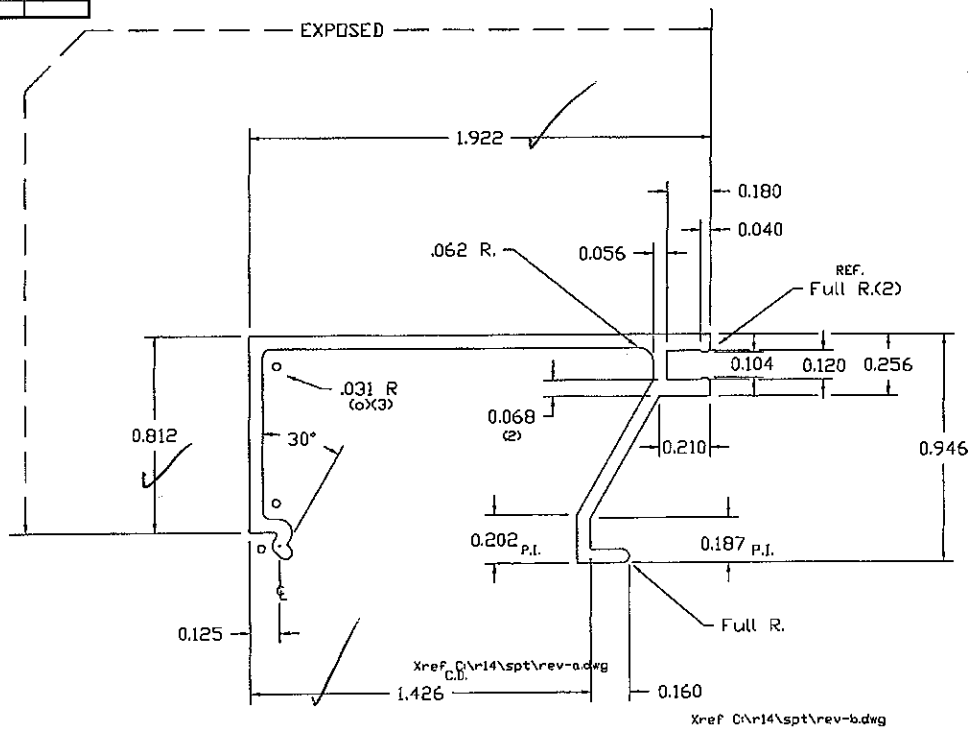
CADD #	CRM-44 350
SCALE	FULL & NOTED
DATE	7-29-98
LAST REVISION	
DRAWN	Michael Bryan
JOB	
CUSTOMER NUMBER	45-018

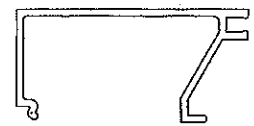
PRINT REVISIONS	DATE

CRM-49 B

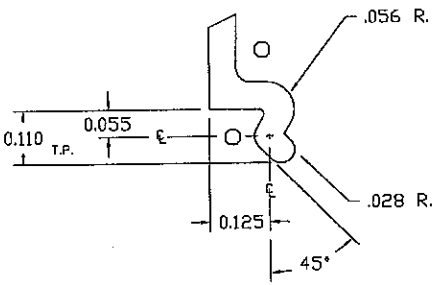
REV.

DELHI ☐ TIFTON ☐ BOTH ☐





ACTUAL SIZE



DETAIL

4 x Size

Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report# E2158

Date 1-8-15 Tech SK

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.
o = .062 R.
x = .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 x & Noted

DATE 10-31-88

LAST REVISION

DRAWN J. ALBEREZ

JOB

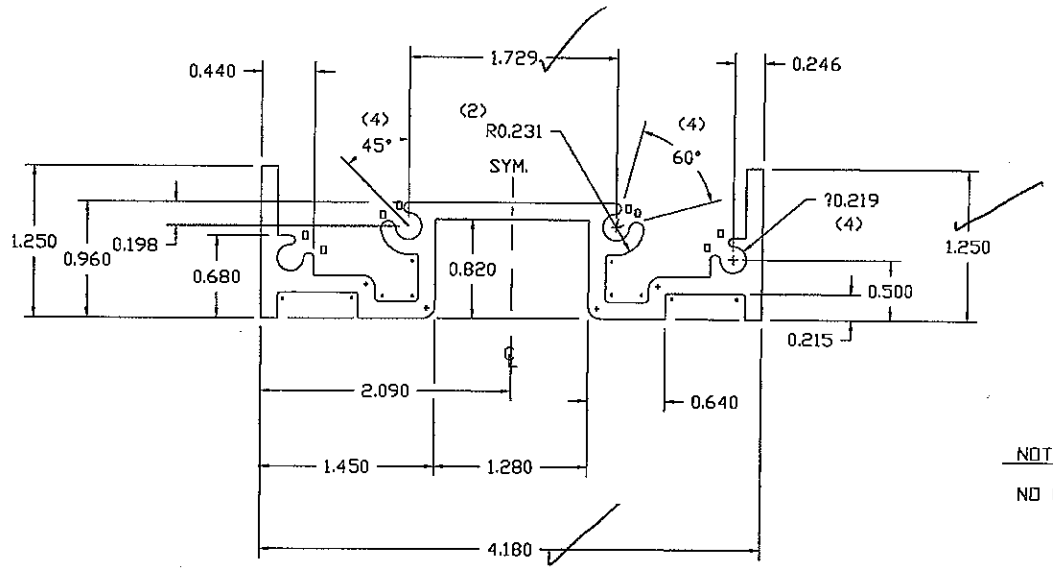
CUSTOMER NUMBER 45-026

PRINT REVISIONS	DATE

CRM-62

REV.

DELHI	TIFTON	BOTH
☐	☐	☐



NOTE:

NO EXPOSED SURFACE

Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report# E2158

Date 1-8-15 Tech SK

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			
INTERNAL USE		6063-T5	
AREA	1.389	WT/FT	1.667
PERIMETER	23.555	CIRCLE SIZE	4-5
OUTSIDE PERIMETER		FACTOR	12
EXPOSED PERIMETER			

PRESS SIZE	
LEGEND	
• = .031 R.	
o = .062 R.	
x = .125 R.	
⊗ = .250 R.	
* =	

DIE REVISIONS	DATE

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