

Exova
2395 Speakman Dr.
Mississauga
Ontario
Canada
L5K 1B3

T: +1 (905) 822-4111
F: +1 (905) 823-1446
E: sales@exova.com
W: www.exova.com



Testing. Advising. Assuring.

**PERFORMANCE EVALUATION OF THE
“FUSION™ NON-COMBUSTIBLE RAINSCREEN SYSTEM”
WALL ASSEMBLY
FOR AIR INFILTRATION, WATER PENETRATION AND STRUCTURAL PERFORMANCE**

Report to:	Carter Architectural Panels Inc. (Carter Fabricating Inc.) 326 Deerhurst Drive Brampton, Ontario, Canada L6T 5H9
Attention:	Mr. Joel McKinley
Telephone:	905-487-1684
Cell:	480-828-9648
E-mail:	JMcKinley@Carterpanels.com
CC:	BBourne@Carterpanels.com
New Report No.	18-06-B0193-F4
Proposal No.:	18-006-570736 9 Pages, 1 Appendix
Report Date:	March 25, 2019

1.0 INTRODUCTION

Exova was retained to evaluate the "FUSION™ Non-Combustible Rainscreen Systems" exterior wall panel system in accordance with ASTM E283, E331 and E330 as outlined in Proposal number 18-006-570736.

Upon receipt, the specimen was assigned the following Exova Specimen Number:

<u>Client Specimen Description</u> FUSION™ Non-Combustible Rainscreen System (T-Panel Scheme / 3 panels, not individually pressure isolated)	<u>Exova Specimen No.</u> 18-06-B0193-2
---	---

Test Backup Wall Description:

8 ft. x 8 ft Opaque wall comprising of one vertical sheathing joint (with joint sealed)
 Frame Construction: 6" Steel Z-Bar (vertical), 16 ga / 16" O/C
 2" Steel Z Bar (horizontal), 16 ga / 16" O/C
 Sheathing: 1/4" thick Plexiglas (simulating exterior gypsum sheathing with installed air-tight air barrier / water resistive barrier). Note: Clear Plexiglas (simulated sheathing panels) were required for the observation of water penetration (ASTM E331).

2.0 PROCEDURE

Test Method	Test Description
ASTM E283-04 (2012)	Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
ASTM E331-00 (2016)	Water Penetration of Exterior Windows, Skylights, Doors and Curtain Walls by Uniform Static Air Pressure Difference
ASTM E330-14	Standard Test Method for Structural Performance of Exterior Windows, Skylights, Doors and Curtain Walls by Uniform Static Air Pressure Difference (Modified)

Note: SI units are the primary units of measure.

Configuration No. 1:

The assembly was tested with an uncompromised simulated air-tight air / water resistive barrier on sheathing (Plexiglas sheathing intact / as delivered to Exova). The air-tight Plexiglas substrate was employed to simulate an air / water resistive barrier sheathing membrane in conjunction with the rainscreen system attached through the Plexiglas to the interior supporting studs.

Configuration No. 2:

The assembly was tested with a compromised air / water resistive barrier (simulation of a poorly installed air / water resistive barrier by drilling 1/8" diameter holes through the Plexiglas) in accordance with AAMA 508-14 to induce an air leakage of 0.6 L/s.m² @ 75 Pa through the Plexiglas sheathing.

2.0 PROCEDURE (CONTINUED)

Test Wall Section Description & Details:

The back-up test wall section (air / water barrier) was constructed in an Exova test frame as per the detail drawing.

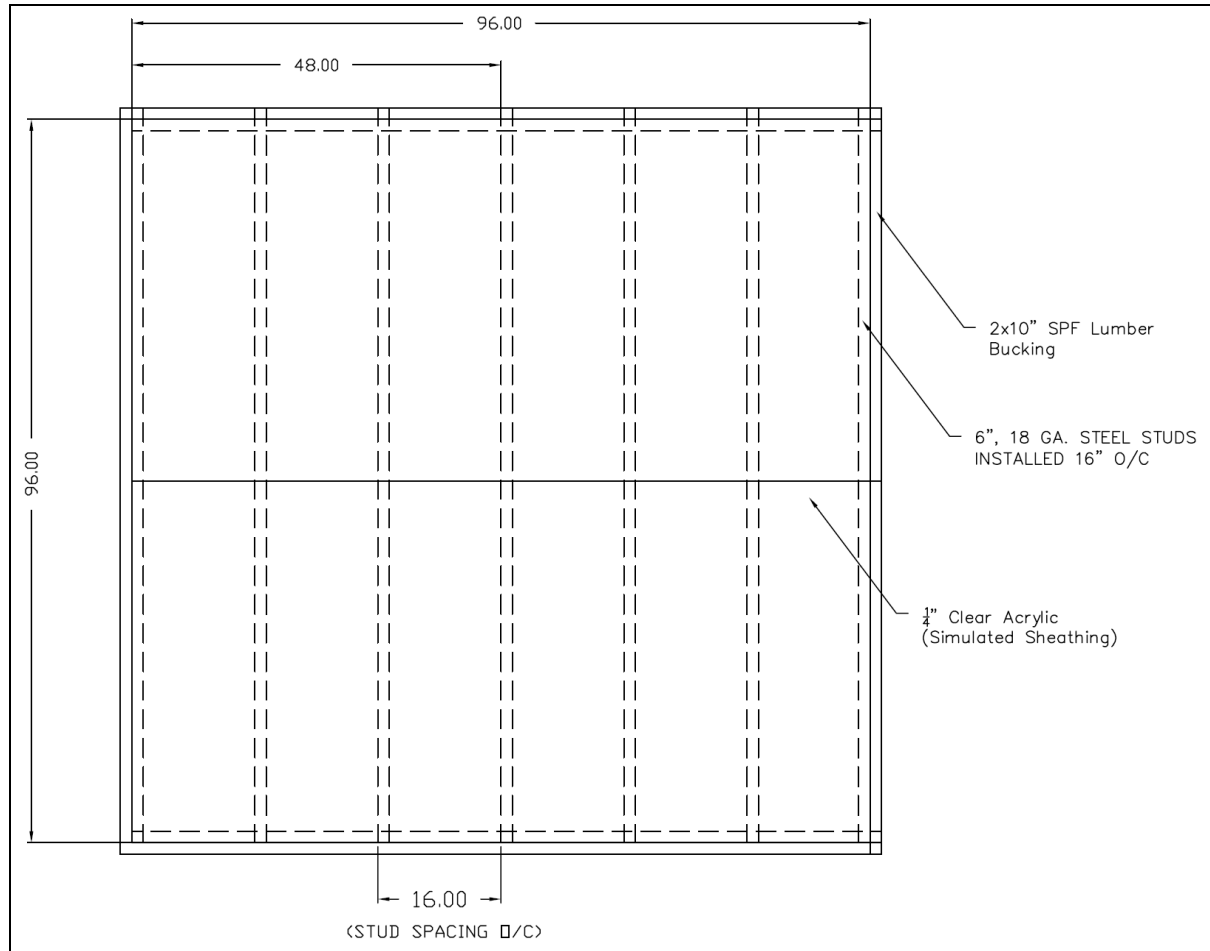


Figure 1 – Back-up Test Wall Framing Construction

3.0 RESULTS

Table No. 1 - Summarized Air Leakage Results Configuration 1 – ASTM E283-04 (2012) Exova Specimen No.: 18-06-B0193-2 (Test Date: November 13, 2018)		
Test Pressure Differential (Pa)	Infiltration	Exfiltration
75 Pa (1.57 lbs./ft ²)	0.01 L/s m ² (0.003 CFM/ft ²)	0.02 L/s m ² (0.003 CFM/ft ²)
300 Pa (6.24 lbs./ft ²)	0.03 L/s m ² (0.006 CFM/ft ²)	0.03 L/s m ² (0.006 CFM/ft ²)

Table No. 2 - Summarized Water Penetration Resistance Results Configuration 1 – ASTM E331-00 (2016) Exova Specimen No.: 18-06-B0193-2 (Test Date: November 14, 2018)		
Test Pressure Differential (Pa)	Test Period (Minutes)	Observations
720 (15.04 lbs./ft ²)	15	No water penetration was observed or droplets present on simulated exterior sheathing

Table No. 3 - Summarized Air Leakage Results Configuration 2 – ASTM E283-04 (2012) Exova Specimen No.: 18-06-B0193-2 (Test Date: November 14, 2018)	
Test Pressure Differential (Pa)	Infiltration ⁽¹⁾
75 Pa (1.57 lbs./ft ²)	0.56 L/s m ² (0.11 CFM/ft ²)

⁽¹⁾ Forty-eight (48) 3 mm diameter holes were drilled through the Plexiglas substrate, equally spaced, 6" above the drainage tracks. These penetrations were employed to simulate an air / water resistive barrier sheathing membrane imperfections in general accordance with AAMA 508-14, Section 5.2.2.

3.0 RESULTS (CONTIUNED)

Table No. 4 - Summarized Water Penetration Resistance Results Configuration 2 – AAMA 508-14, Section 5.7, Referencing ASTM E331-00 (2016) Exova Specimen Number: 18-06-B0193-2 (Test Date: November 14, 2018)			
Test Pressure Differential (Pa)	Test Period (Minutes)	Observations	Comments
300 <i>(6.24 lbs./ft²)</i>	15	3.2 % of air/water barrier surface area had water misting and / or water droplets. All water that penetrated the exterior rain screen cladding was controlled and drained to the exterior with no continuous streaming observed	Meets Requirement⁽²⁾
720 <i>(15.04 lbs./ft²)</i>	15	4.9 % of air/water barrier surface area had water misting and / or water droplets. All water that penetrated the exterior rain screen cladding was controlled and drained to the exterior with no continuous streaming observed	Meets Requirement⁽²⁾

⁽²⁾ AAMA 508-14, Section 5.7 Water Penetration Requirements:

All water that penetrates the exterior rain screen cladding shall be controlled and drained to the exterior.

All water that contacts the air / water barrier shall be visually observed and recorded:

- a) Water mist or droplets on the air/water barrier surface; and/or
- b) Water in continuous stream on the air/water barrier surface.

Failure shall be defined as water mist or water droplets appearing in excess of 5% of the air/water barrier surface, or continuous streaming at any location on the air/water barrier.

3.0 RESULTS (CONTIUNED)

Table 5 – AAMA 508-14, Section 5.8, Referencing ASTM E330-14 Static Structural Performance (Preload and Design Pressure) ⁽⁴⁾ Exova Specimen Number: 18-06-B0193-2 (March 11, 2019)			
Test	Requirements	Test Results	Comment
Static Structural Performance (Section 5.8)	ASTM E330-14 Preload (0.5 x Design Pressure) +/- 1,795 Pa (37.5 PSF) Requirements: - No permanent damage-	No Permanent Damage Observed	No visual damage or buckling observed
	ASTM E330-14 Design Pressure +/- 3,591 Pa (75.0 PSF) ⁽³⁾ Requirements: - Report Support Wall Deflection	Stud Length (L) = 2,438 mm (96.0 inches) Allowable (L/180) = 13.54 mm (0.533 inches) Vertical Net Deflection at Design Pressure: + 3,591 Pa (75.0 PSF) = -1.37 mm (0.05 inches) - 3,591 Pa (75.0 PSF) = 5.33 mm (0.21 inches) Horizontal Net Deflection at Design Pressure: + 3,591 Pa (75.0 PSF) = -1.30 mm (0.05 inches) - 3,591 Pa (75.0 PSF) = 2.59 mm (0.10 inches) - No Permanent Damage Observed	Meets Requirements L/180

⁽³⁾ 3,591 Pa = 76.6 m/s (or 171 mph / 275 km/h). Calculation based on the Enswiler formula, where $P = 0.613 \cdot V^2$, V is m/s & P is N/m²

⁽⁴⁾ AAMA 508-14, Section 5.8 states: "When testing the actual air/water barrier for a project specific system, perform static structural performance test ASTM E330 at 0.5, 1.0 and 1.5 times the specified positive and negative design pressures." As the testing outlined in this report was not for a project specific system, a design pressure was not outlined. However, Exova performed structural testing of the AAMA 508-14 system in accordance with ASTM E330-14 with an assumption Design Pressure of ±3,591 Pa (171 mph / 275 km/h) for informational purposes.

3.0 RESULTS (CONTIUNED)

Table 6 – AAMA 508-14, Section 5.8, Referencing ASTM E330-14 Static Structural Performance (Structural Pressure) ⁽⁶⁾ Exova Specimen Number: 18-06-B0193-2 (March 11, 2019)			
Test	Requirements	Test Results	Comment
<p>Static Structural Performance (Section 5.8)</p>	<p>ASTM E330-14</p> <p>Structural Test Pressure (1.5 x Design Pressure)</p> <p>+/- 5,386 Pa (112.5 PSF)⁽⁵⁾</p> <p>Requirements:</p> <ul style="list-style-type: none"> - No permanent damage - Report Support Wall Deflection 	<p>Vertical Net Deflection at Design Pressure:</p> <p>+ 5,386 Pa (112.5 PSF) = -2.10 mm (0.082 inches)</p> <p><i>Residual Deflection</i> -1.33 mm (0.05 inches)</p> <p>- 5,386 Pa (112.5 PSF) = 2.74 mm (0.11 inches)</p> <p><i>Residual Deflection</i> 0.24 mm (0.01 inches)</p> <p>Horizontal Net Deflection at Design Pressure:</p> <p>+ 5,386 Pa (112.5 PSF) = -2.12 mm (0.08 inches)</p> <p><i>Residual Deflection</i> -0.64 mm (0.03 inches)</p> <p>- 5,386 Pa (112.5 PSF) = 4.48 mm (0.18 inches)</p> <p><i>Residual Deflection</i> 1.84 mm (0.07 inches)</p> <p>- No Permanent Damage Observed</p>	<p>No Permanent Damage Observed</p>

⁽⁵⁾ 5,386 Pa = 93.7 m/s (or 209 mph / 337 km/h). Calculation based on the Enswiler formula, where $P = 0.613 \cdot V^2$, V is m/s & P is N/m²

⁽⁶⁾ AAMA 508-14, Section 5.8 states: "When testing the actual air/water barrier for a project specific system, perform static structural performance test ASTM E330 at 0.5, 1.0 and 1.5 times the specified positive and negative design pressures." As the testing outlined in this report was not for a project specific system, a design pressure was not outlined. However, Exova performed structural testing of the AAMA 508-14 system in accordance with ASTM E330-14 with an assumption Design Pressure of ±5,386 Pa (209 mph / 337 km/h) for informational purposes.

3.0 RESULTS (CONTIUNED)

Table 7 – Client Specific (Requested) Testing Test to Failure in the Negative Wind Load Direction ASTM E330-14 – SI & IP Units Static Structural Performance Exova Specimen Number: 18-06-B0193-2 (March 11, 2019)	
Maximum Pressure Achieved	Comments
8,524 Pa ⁽⁷⁾	Cladding System did not disengage from wall assembly. However, vertical supporting steel studs buckled in the center
178 lbs. /ft ²	

⁽⁷⁾ 8,524 Pa = 117.9 m/s (or 263 mph / 424 km/h). Load
 Calculation based on the Enswiler formula, where $P = 0.613 \cdot V^2$, V is m/s & P is N/m²

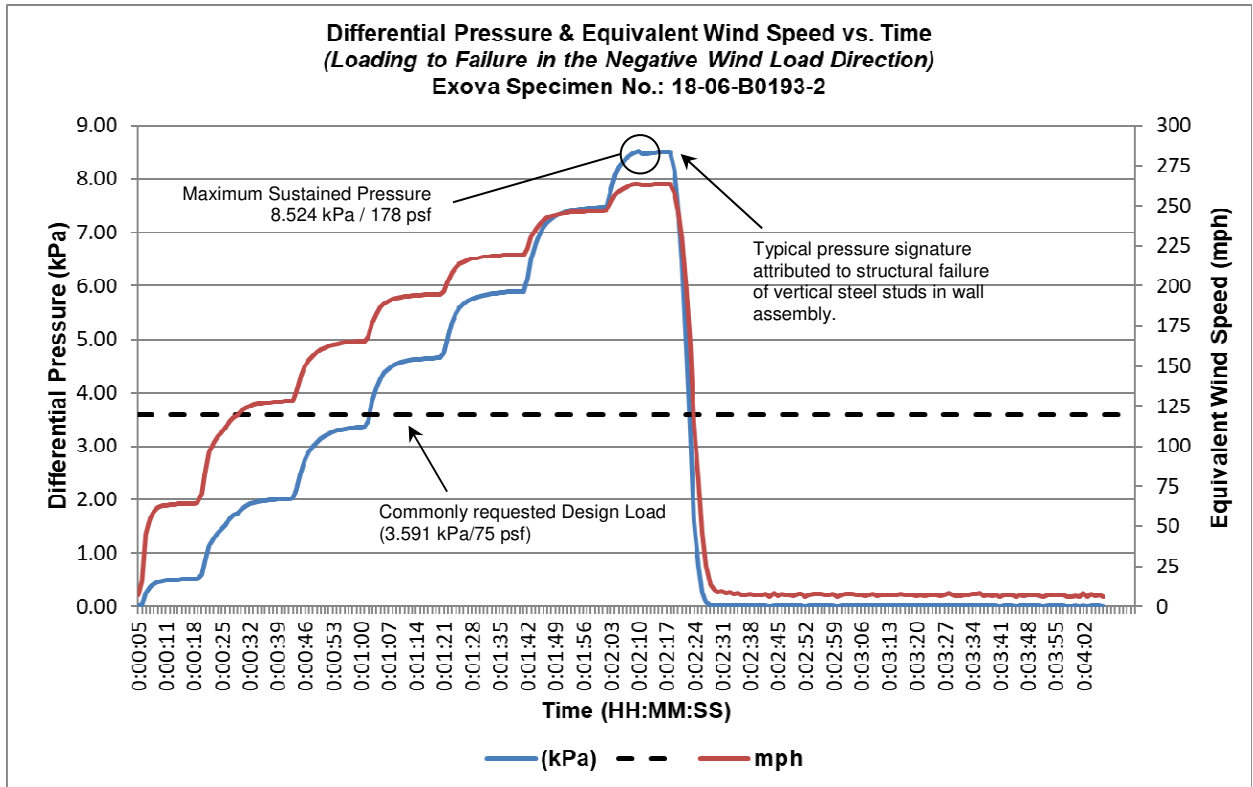


Figure 2 – Differential Pressure & Equivalent Wind Speed vs. Time (during testing to failure)

*Note: Design loads are building and location specific. Please refer to architect or design engineer for specific building load requirements.

4.0 SYSTEM MODIFICATIONS

No modifications were made to the system as shown respectively in Appendix A.

5.0 DISCUSSION

The Carter Architectural Panels Inc., "FUSION™ Non-Combustible Rainscreen" (*Exova Specimen No.: 18-06-B0193-2*) identified in this report met the requirements of AAMA 508-14 for cavity pressure differential, time shift of pulse and water penetration.

The Carter Architectural Panels Inc., exterior panel system identified as the "FUSION™ Non-Combustible Rainscreen" (*Exova Specimen No.: 18-06-B0193-2*) as detailed in this report was tested in accordance ASTM E283-04(2012), ASTM E331-00(2016) and ASTM E330-14 and achieved the following:

- Air Leakage: 0.01 L/s m² (0.003 CFM/ft²) @ 75 Pa (1.57 lbs/ft²) – Infiltration
0.02 L/s m² (0.003 CFM/ft²) @ 75 Pa (1.57 lbs/ft²) – Exfiltration
0.03 L/s m² (0.006 CFM/ft²) @ 300 Pa (6.24 lbs/ft²) – Infiltration
0.03 L/s m² (0.006 CFM/ft²) @ 300 Pa (6.24 lbs/ft²) – Exfiltration
- Water Penetration Configuration No. 1: 720 Pa (15.04 lbs. /ft²)
Configuration No. 2: 720 Pa (15.04 lbs. /ft²)
- Structural-Performance: 3,591 Pa (75.0 lbs. /ft²) – Specified Design Load
5,386 Pa (112.5 lbs. /ft²) – Structural Test Pressure
8,524 Pa⁽⁸⁾ (178.0 lbs. /ft²) – Maximum Pressure Achieved
(Equivalent to 263 mph / 424 km/h based on Ensewiler formula)

⁽⁸⁾ Cladding system did not disengage from the wall assembly. The "FUSION™ Non-Combustible Rainscreen" did not fail at 8,524 Pa, whereas, the vertical steel studs behind the wall assembly buckled in the center, thereby, concluding the test procedure.

6.0 REVISION HISTORY

Report No:
18-06-B0193-F4

Date:
2019-03-25

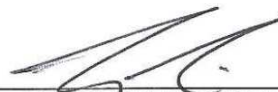
Description of Revisions:
Original Document

Reviewed by:

Reported & Authorized by:



Allan Lawrence, Ext. 11212
Supervisor, Building Systems
Products Division



Sunny Ling, C.E.T, Ext. 11412
Assistant Operations Manager, Building Science
Technical Manager, Building Systems
Products Division

APPENDIX A

Specimen Bill of Materials and Drawings

(5 Pages)

2mm EVOPlate FUSION Testing Bill of Materials

Framework:

6 pcs 1.5" x 1.5" x 2" x 1.5" x 1.5" Pre-punched Top Hat 18 Gauge G-90 Galvanized profile

4 pcs 2" x 1.5" x 2" Pre-punched U-channel 18 Gauge G-90 Galvanized profile

100 pcs #12 x 1.5" self-drilling screws

Panel Assemblies

1 pc 47" X 94.5625" 2MM EVOPlate FUSION Panel assembly

2 pcs Patented FUSION DRILL FREE perimeter extrusion square cut @ 43.75" 6061-T6

2 pcs Patented FUSION DRILL FREE perimeter extrusion square cut @ 91.375" 6061-T6

4 pcs FUSION 2mm 60 Durometer High Temp Silicon Corner blocks

10 pcs EVO Aluminum Corner reinforcement bracket 3003 Alloy

4 pcs FUSION corner bracket 303 Alloy

2mm EVOPlate coil coated 5052-H32 solid aluminum skin

30 EVO Torxalig zinc coated screws

30 domed head FUSION DRILL FREE RIVETS

5 pcs Patented EVO Integrated stiffener square cut to 43.5" 6061-T6

2 tubes of Dymonic FC adhesive

5 pcs 1" x .5" bug screen to cover weep holes

1 pc 47" X 47" 2MM EVOPlate FUSION Panel assembly (2 assemblies used in test)

4 pcs Patented FUSION DRILL FREE perimeter extrusion square cut @ 43.75" 6061-T6

4 pcs EVO 2mm 60 Durometer High Temp Silicon Corner block

4 pcs EVO Aluminum Corner reinforcement bracket 3003 Alloy

4 pcs FUSION corner bracket 303 Alloy

2mm EVOPlate coil coated 5052-H32 solid aluminum skin

16 EVO Torxalig zinc coated screws

20 domed head FUSION DRILL FREE RIVETS

2 pcs Patented EVO Integrated stiffener square cut to 43.5" 6061-T6

.5 tube of Dymonic FC adhesive

3 pcs 1" x .5" bug screen to cover weep holes

Wall assembly

1 pc Patented FUSION DRILL FREE Starter Strip 6061-T6 profile square cut to 94"

15 pc Patented FUSION DRILL FREE Mid-Clip 6061-T6 profile square cut to 3" with pre-punched slot (Mounted on 16" maximum centre distance)

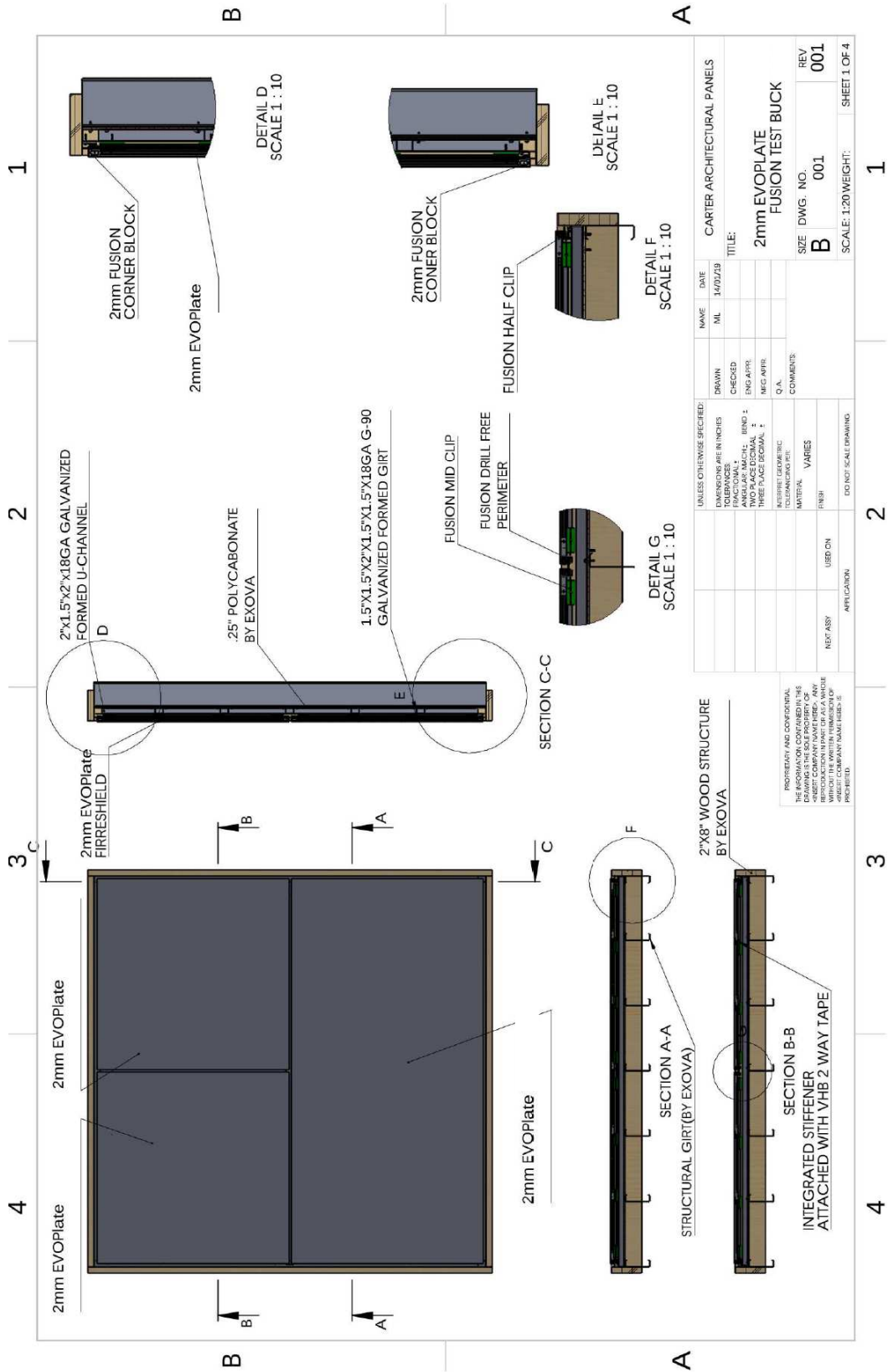
20 pc Patented FUSION DRILL FREE Half-Clip 6061-T6 profile square cut to 3" with pre-punched slot (Mounted on 16" maximum centre distance)

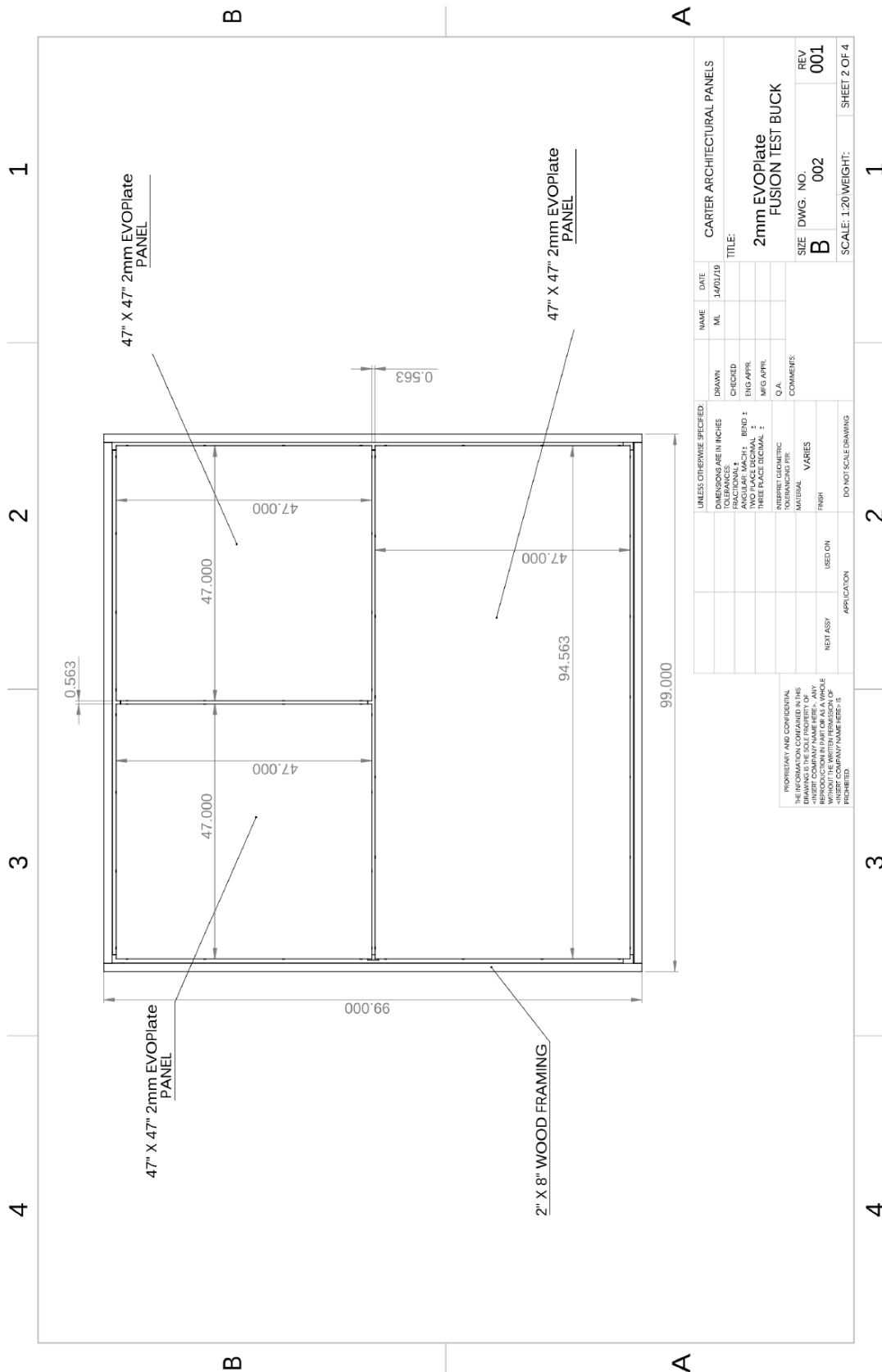
1 pc 2mm EVOPlate solid aluminum plate cut to 2" wide x 95" long (Horizontal Centre)

2 pc 2mm EVOPlate solid aluminum plate cut to 1.25" wide x 95" long (Top and bottom)

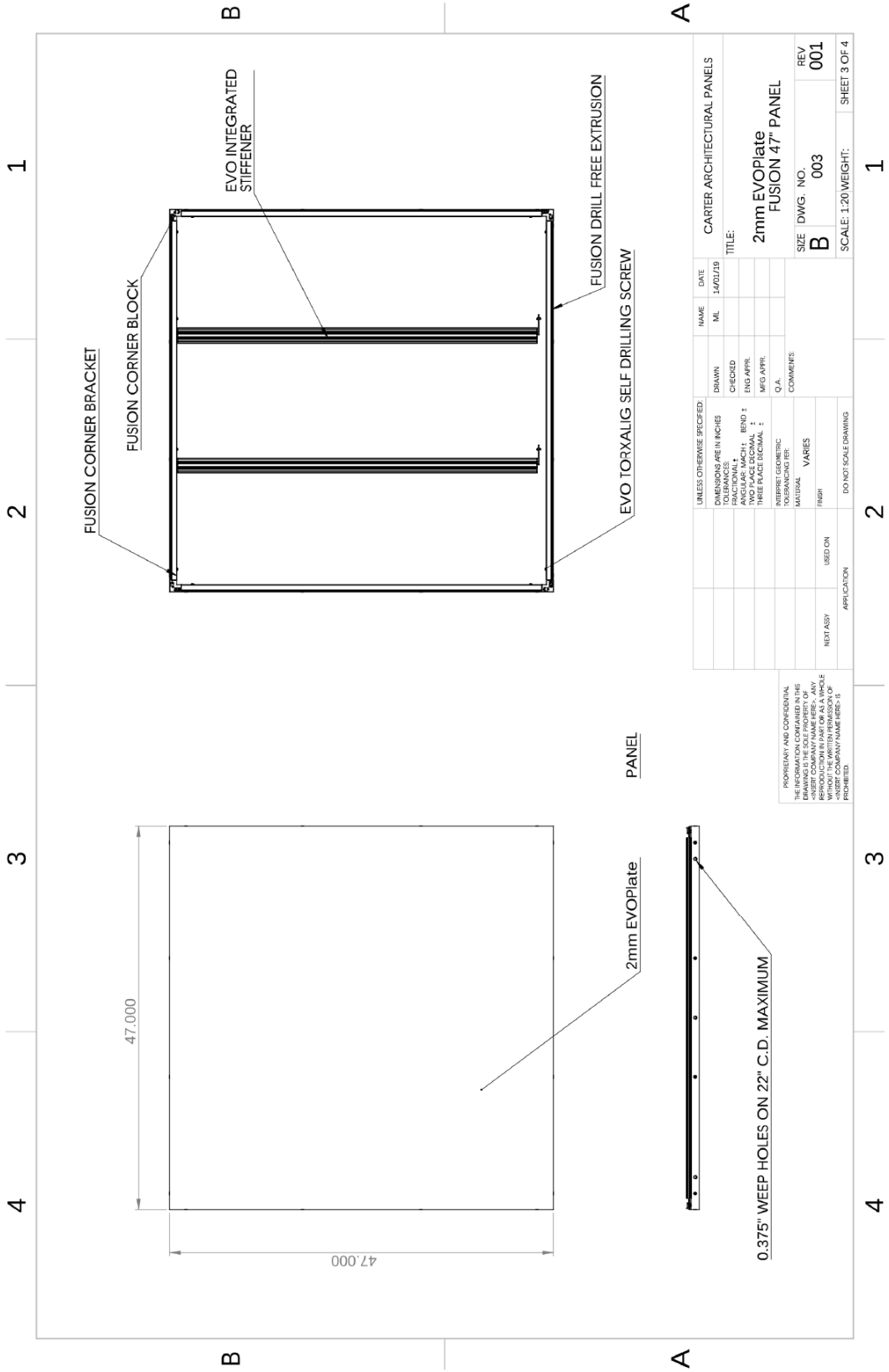
2 pc 2mm EVOPlate solid aluminum plate cut to 1.25" wide x 94" long (Sides)

1 pc 2mm EVOPlate solid aluminum plate cut to 47" (Vertical centre)



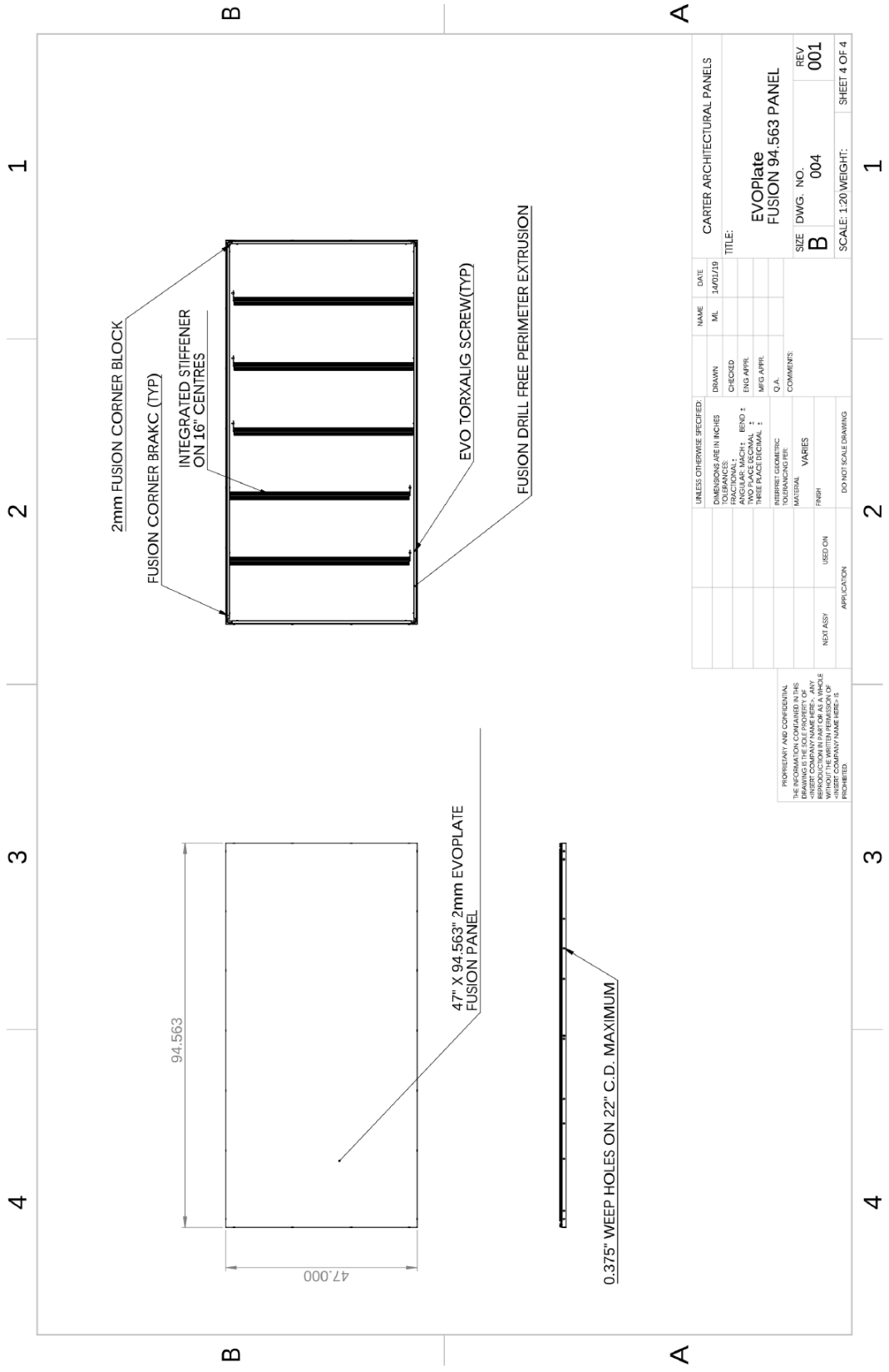


NAME		DATE		CARTER ARCHITECTURAL PANELS	
ML		ML		TITLE:	
			1/10/19	2mm EVOPlate FUSION TEST BUCK	
DRAWN	CHECKED	ENG APPR	MEG APPR	REV	
				B	002
UNLESS OTHERWISE SPECIFIED:				SCALE: 1:20 WEIGHT: SHEET 2 OF 4	
DIMENSIONS ARE IN INCHES					
TOLERANCES:					
ANGULAR: MACH: BEND: 1					
FINISH: DECIMAL: 1					
FINISH: DECIMAL: 1					
MATERIAL: VARIES					
FINISH: VARIES					
DO NOT SCALE DRAWING					
APPLICATION					
NEST ASSY					
USED ON					
PROPRIETARY AND CONFIDENTIAL					
THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF CARTER ARCHITECTURAL PANELS INC. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF CARTER ARCHITECTURAL PANELS INC. IS PROHIBITED.					



UNLESS OTHERWISE SPECIFIED:		NAME	DATE	CARTER ARCHITECTURAL PANELS	
DIMENSIONS ARE IN INCHES	FRAC TIONAL	ML	14/07/19	TITLE:	2mm EVOplate FUSION 47" PANEL
ANGULAR TIGHTENING	BEYD 2	CHECKED		SIZE	B
THREE PLACE DECIMAL		ENG APPR.		DWG. NO.	003
		MFG APPR.		REV	001
		O.A.		SCALE:	1:20 WEIGHT: SHEET 3 OF 4
		COMMENTS:			
NEAREST GEOMETRIC					
TOLERANCING REF.					
MATERIAL	VARIABLES				
FINISH					
DO NOT SCALE DRAWING					
NEXT ASY	USED ON				
APPLICATION					

PROPRIETARY AND CONFIDENTIAL
 THE INFORMATION CONTAINED IN THIS
 DRAWING IS THE PROPERTY OF CARTER ARCHITECTURAL PANELS INC.
 NO PART OF THIS DRAWING IS TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, WITHOUT THE WRITTEN PERMISSION OF CARTER ARCHITECTURAL PANELS INC.



UNLESS OTHERWISE SPECIFIED:		NAME	DATE	CARTER ARCHITECTURAL PANELS	
ALL DIMENSIONS ARE IN INCHES	FRAC TIONAL :	ML	14/02/19	TITLE:	
TOLERANCES:	DECIMAL :	DRAWN		EVOPlate	
FRACTIONAL :	FIFTHS :	CHECKED		FUSION 94.563 PANEL	
THREE PLACE DECIMAL :	TENTHS :	END APPR.		SIZE	REV
INTERPRET GEOMETRIC TOLERANCING PER:	Q.A.	MFG APPR.		B	004
MATERIAL VARIES	COMMENTS			SCALE: 1:20 WEIGHT:	SHEET 4 OF 4
FINISH					
DO NOT SCALE DRAWING					
PROPRIETARY AND CONFIDENTIAL INFORMATION. THE INFORMATION CONTAINED HEREIN IS THE SOLE PROPERTY OF CARTER ARCHITECTURAL PANELS. ANY REPRODUCTION OR TRANSMISSION OF THIS DRAWING WITHOUT THE WRITTEN PERMISSION OF CARTER ARCHITECTURAL PANELS IS PROHIBITED.	NEXT ASSY	USED ON	APPLICATION		