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Testing. Advising. Assuring.

**PERFORMANCE EVALUATION OF THE  
“EVOPLATE™ NON-COMBUSTIBLE RAINSCREEN SYSTEM”  
IN ACCORDANCE WITH AAMA 508-14 FOR  
VOLUNTARY TEST METHOD AND SPECIFICATION FOR  
PRESSURE EQUALIZED RAIN SCREEN WALL CLADDING SYSTEMS**

Report to:

**Carter Architectural Panels Inc.  
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New Report No.  
Proposal No.:

18-06-B0193-F1, Revision 3  
18-006-570736  
11 Pages, 1 Appendix

Report Date:

March 28, 2019

**1.0 INTRODUCTION**

Exova was retained to evaluate the "EVOPLATE™ Non-Combustible Rainscreen Systems" exterior wall panel system in accordance with AAMA 508-14 for voluntary test method and specification for pressure equalized rain screen wall cladding systems as outlined in Proposal number 18-006-570736.

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

**Client Specimen Description**

EVOPLATE™ Non-Combustible Rainscreen System  
 (T-Panel Scheme / 3 panels, not individually pressure isolated)

**Exova Specimen No.**

18-06-B0193-1

**2.0 PROCEDURE**

Test Description	Test Method
Voluntary Test Method and Specification for Pressure Equalized Rain Screen Wall Cladding Systems - Air Leakage Quantification	AAMA 508-14, Section 5.3 – Referencing ASTM E283-04 (2012)
Voluntary Test Method and Specification for Pressure Equalized Rain Screen Wall Cladding Systems - Pressure Equalization	AAMA 508-14, Section 5.5 – Referencing ASTM E1233-14
Voluntary Test Method and Specification for Pressure Equalized Rain Screen Wall Cladding Systems - Water Penetration via Static Pressure	AAMA 508-14, Section 5.6 – Referencing ASTM E331-00 (2016)
Voluntary Test Method and Specification for Pressure Equalized Rain Screen Wall Cladding Systems - Dynamic Water Penetration	AAMA 508-14, Section 5.7 – Referencing AAMA 501.1-17, Dynamic Water
Voluntary Test Method and Specification for Pressure Equalized Rain Screen Wall Cladding Systems - Structural Performance	AAMA 508-14, Section 5.8 – Referencing ASTM E330-14 (2014)

Note: SI units are the primary units of measure.

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 below in accordance with AAMA 508-14, Section 5.0.

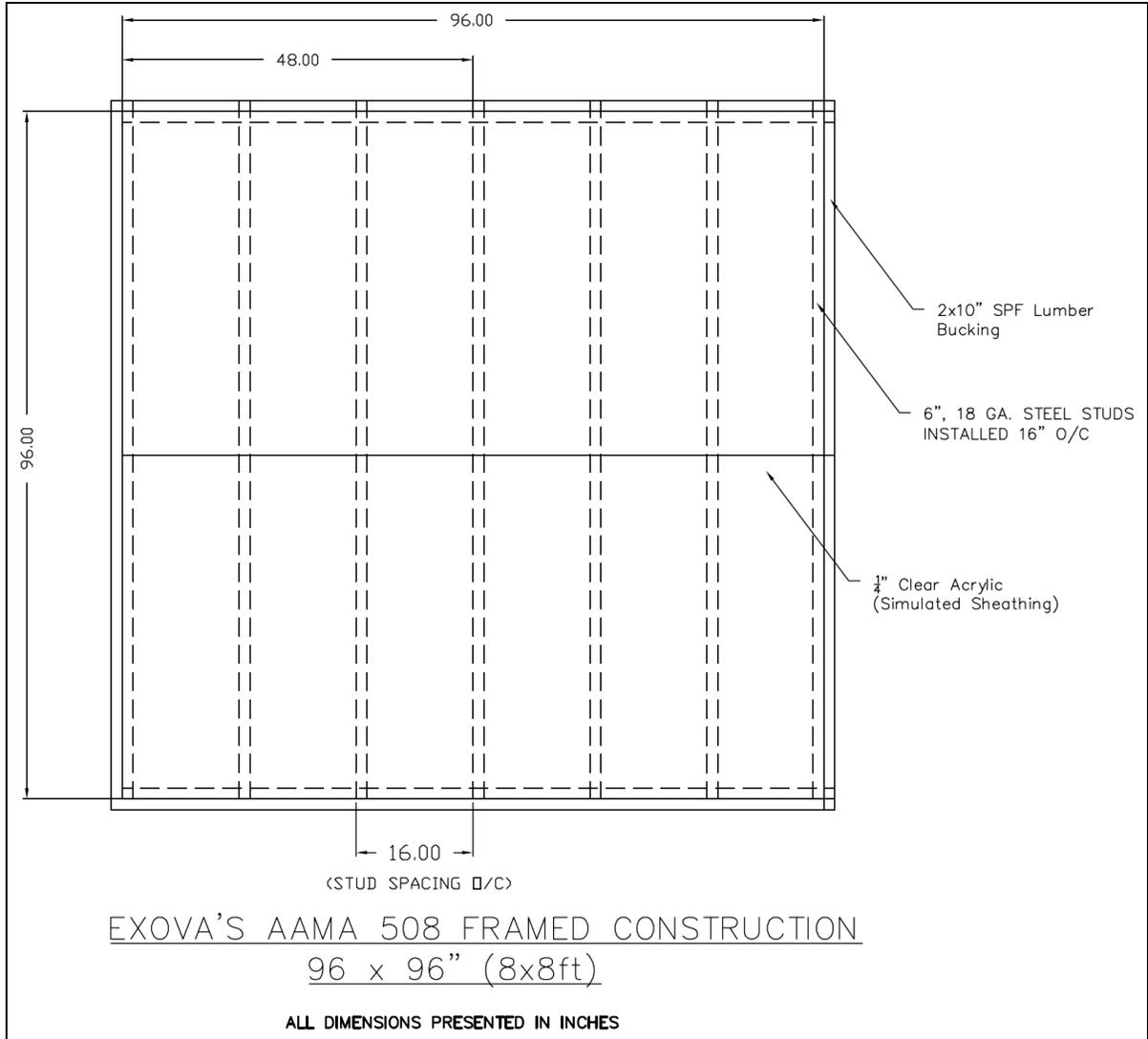


Figure 1 – Back-up Test Wall Framing Construction

**2.0 PROCEDURE (CONTINUED)**

Upon completion of the back-up wall, the Plexiglas joints and screw-heads were sealed to ensure the assembly was air-tight. After the air leakage validation for tightness was completed, as prescribed by AAMA 508-14, Section 5.2.2 & Figure 1A, three (3) mm (1/8") diameter holes were introduced equally spaced 150 mm (5.91") above horizontal seams and above the base of the mock-up in order for the air / water barrier to have an air leakage rate of 0.6 L/s·m<sup>2</sup> (+/- 10%).

The application of the cladding system on the test back-up wall was performed by Carter Fabricating Inc. authorized personnel on November 9, 2018. As permitted by AAMA 508-14, Note 5, the perimeter of the specimen was sealed to the fixture that the wall section was constructed into. No drainage/vent holes or critical areas of the specimen that would be affected by water infiltration / drainage or differential pressure were obstructed.

Using the procedure outlined in AAMA 508-14, Section 5.5, the pressure cycling tests were conducted as specified in ASTM E1233 to a positive pressure from 240 Pa (5.0 PSF) to 1200 Pa (25.06 PSF) to 240 Pa (5.0 PSF) based on a maximum average of three seconds for 100 cycles as per AAMA 508-14. Upon completion of the pressure equalization behavior test, the AAMA 508-14, Section 5.6, water penetration test at 300 Pa (6.24 PSF) for fifteen minutes was conducted.

Upon completion of the static water penetration test as outlined in AAMA 508-14, Section 5.6, testing was conducted in accordance with AAMA 508-14, Section 5.7 referencing AAMA 501.1-17 at 300 Pa (6.24 PSF).

**3.0 RESULTS**

<b>Table 1 – Custom Air Leakage Results per Client Request <sup>(1)</sup></b> <b>ASTM E283-04 (2012)</b> <b>Exova Specimen No.: 18-06-B0193-1 (Test Date: November 12, 2018)</b>		
Test Pressure Differential (Pa)	Infiltration	Exfiltration
75 Pa (1.57 PSF)	0.01 L/s m <sup>2</sup> (0.003 CFM/ft <sup>2</sup> ) <sup>(1)</sup>	0.01 L/s m <sup>2</sup> (0.003 CFM/ft <sup>2</sup> ) <sup>(1)</sup>
300 Pa (6.24 PSF)	0.02 L/s m <sup>2</sup> (0.003 CFM/ft <sup>2</sup> ) <sup>(1)</sup>	0.02 L/s m <sup>2</sup> (0.003 CFM/ft <sup>2</sup> ) <sup>(1)</sup>

<sup>(1)</sup> As per client request, the assembly was initially 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.

<b>Table 2 – AAMA 508-14, Section 5.3,</b> <b>Referencing ASTM E283-04 (2012) Summarized Air Leakage Results <sup>(2)</sup></b> <b>Exova Specimen No.: 18-06-B0193-1 (Test Date: November 12, 2018)</b>	
Test Pressure Differential (Pa)	Infiltration
75 Pa (1.57 PSF)	0.55 L/s m <sup>2</sup> (0.110 CFM/ft <sup>2</sup> ) <sup>(2)</sup>

<sup>(2)</sup> 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 3 – AAMA 508-14, Section 5.5, Referencing ASTM E1233-14 Pressure Equalization Behavior Analysis Exova Specimen No.: 18-06-B0193-1 (Test Date: November 12, 2018)					
Compartment Tested	Maximum External Gust Pressure of Pulse	Maximum Cavity Pressure of Pulse	Requirements		Comments
			Pressure Differential	Maximum Time Shift of Pulse	
Primary Compartment	1178 Pa (24.60 PSF)	972 Pa (20.30 PSF)	Pressure differential on rain screen cladding shall not exceed 50% of maximum wind gust pressure	< 0.08 seconds	Meets Requirement

- Air Leakage of Back-Up Wall (air / water barrier): **0.55 L/s m<sup>2</sup>** (0.11 CFM/ft<sup>2</sup>)
- Ratio of cavity volume to vent area (Upper Panels): **636 m<sup>3</sup> / m<sup>2</sup>**
- Ratio of cavity volume to vent area (Lower Panel): **763 m<sup>3</sup> / m<sup>2</sup>**

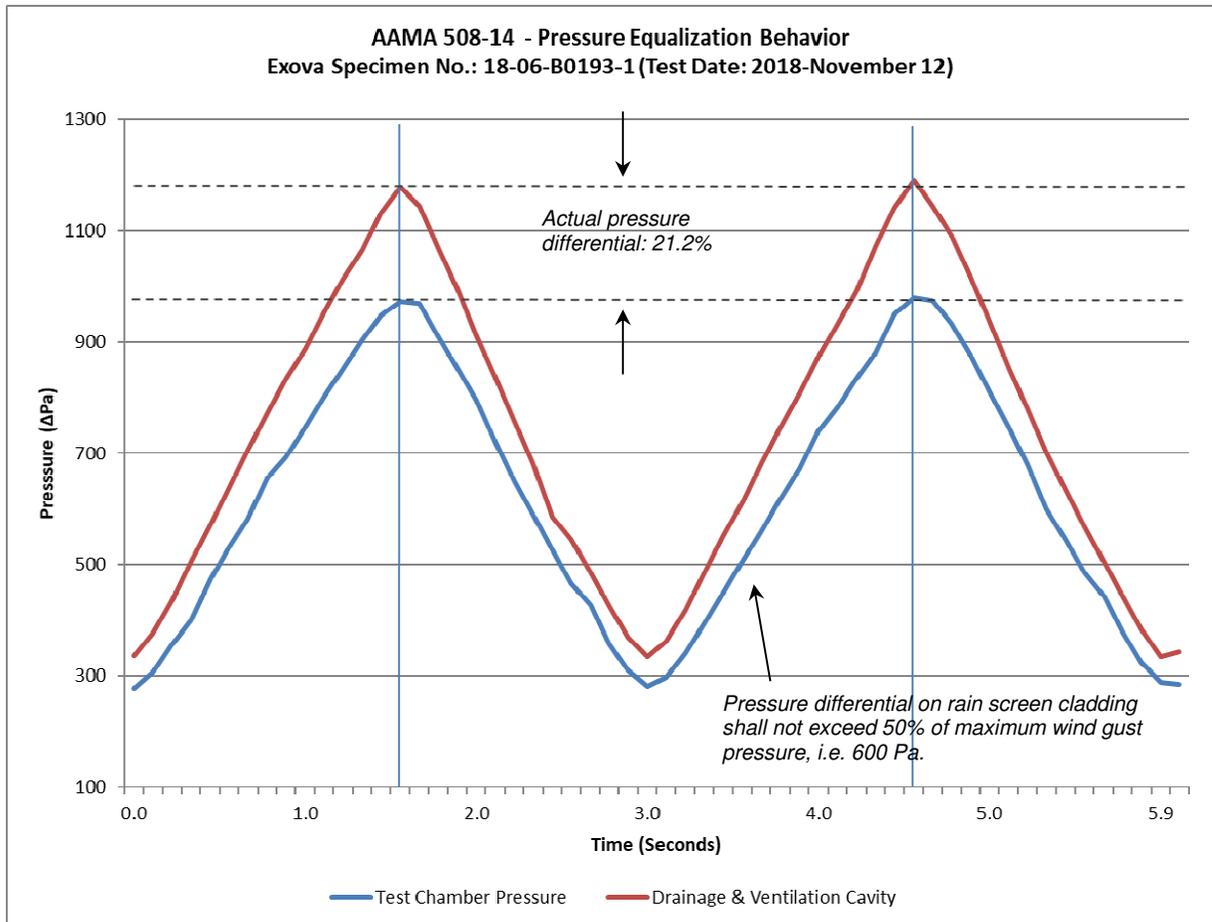


Figure 2 – Pressure Equalization Behavior

**3.0 RESULTS (CONTIUNED)**

<b>Table 4 – AAMA 508-14, Section 5.6, Referencing ASTM E331-14                      Water Penetration Resistance                      Exova Specimen Number: 18-06-B0193-1 (Test Date: November 13, 2018)</b>			
<b>Test Pressure (Pa)</b>	<b>Requirements</b>	<b>Results</b>	<b>Comments</b>
300 Pa <sup>(2)</sup> (6.24 PSF)  (15-Minutes)	<p>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:</p> <p>a) Water mist or droplets on the air/water barrier surface; and/or</p> <p>b) Water in continuous stream on the air/water barrier surface.</p> <p>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.</p>	<p>Water mist and/or droplets were observed. No continuous streaming was observed.</p> <p>3.7 % of air/water barrier surface area had water misting and / or water droplets.</p>	<p><b>Meets Requirement</b></p>

<sup>(2)</sup> 300 Pa = 22.1 m/s (or 50 mph / 80.5 km/h). Calculation based on the Enswiler formula, where  $P = 0.613 \cdot V^2$ , V is m/s & P is N/m<sup>2</sup>

**3.0 RESULTS (CONTIUNED)**

<b>Table 5 – AAMA 508-14, Section 5.7, Referencing AAMA 501.1-17                      Dynamic Water Penetration test                      Exova Specimen Number: 18-06-B0193-1 (Test Date: November 14, 2018)</b>			
Test Pressure (Pa)	Requirements	Test Results	Comment
300 Pa <sup>(2)</sup> (15-Minutes)	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.	Water mist and/or droplets were observed.  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.	<b>Meets Requirements</b>

<sup>(2)</sup> 300 Pa = 22.1 m/s (or 50 mph / 80.5 km/h). Calculation based on the Enswiler formula, where  $P = 0.613 \cdot V^2$ , V is m/s & P is N/m<sup>2</sup>

**Outdoor Conditions during Test:**

Temperature: 3.2 °C  
 Relative Humidity: 42 %RH  
 Barometric Pressure: 29.8 inHg



Figure 3 – AAMA 501.1, Dynamic Water Penetration Test

**3.0 RESULTS (CONTIUNED)**

<b>Table 6 – AAMA 508-14, Section 5.8, Referencing ASTM E330-14 (2014)                      Static Structural Performance (Preload and Design Pressure)<sup>(2)</sup>                      Exova Specimen Number: 18-06-B0193-1 (January 16, 2019)</b>			
Test	Requirements	Test Results	Comment
<b>Static Structural Performance</b> (Section 5.8)	<b>ASTM E330-14</b> Preload (0.5 x Design Pressure)  +/- 1,795 Pa (37.5 PSF)  <b>Requirements:</b> - No permanent damage-	No Permanent Damage Observed	No visual damage or buckling observed
	<b>ASTM E330-14</b> Design Pressure  +/- 3,591 Pa (75.0 PSF) <sup>(1)</sup>  <b>Requirements:</b> - Report Support Wall Deflection	Stud Length (L) = 2,438 mm (96.0 inches) Allowable (L/180) = 13.54 mm (0.533 inches)  <b>Vertical Net Deflection at Design Pressure:</b>  + 3,591 Pa (75.0 PSF) = -2.04 mm (0.08 inches)  - 3,591 Pa (75.0 PSF) = 0.60 mm (0.02 inches)  <b>Horizontal Net Deflection at Design Pressure:</b>  + 3,591 Pa (75.0 PSF) = -1.87 mm (0.07 inches)  - 3,591 Pa (75.0 PSF) = 3.53 mm (0.14 inches)  - No Permanent Damage Observed	<b>Meets Requirements</b>  L/180

<sup>(1)</sup> 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/m<sup>2</sup>

<sup>(2)</sup> 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 7 – AAMA 508-14, Section 5.8, Referencing ASTM E330-14 (2014) Static Structural Performance (Structural Pressure) <sup>(4)</sup> Exova Specimen Number: 18-06-B0193-1 (January 16, 2019)			
Test	Requirements	Test Results	Comment
<b>Static Structural Performance</b> (Section 5.8)	<p style="text-align: center;"><b>ASTM E330-14</b></p> Structural Test Pressure (1.5 x Design Pressure) +/- 5,386 Pa (112.5 PSF) <sup>(3)</sup> <p style="text-align: center;"><b>Requirements:</b></p> - No permanent damage - Report Support Wall Deflection	<p style="text-align: center;"><b>Vertical Net Deflection at Design Pressure:</b></p> + 5,386 Pa (112.5 PSF) = -0.44 mm (0.02 inches)  <i>Residual Deflection</i> -0.64 mm (0.03 inches)  - 5,386 Pa (112.5 PSF) = 1.36 mm (0.05 inches)  <i>Residual Deflection</i> 0.25 mm (0.01 inches)  <p style="text-align: center;"><b>Horizontal Net Deflection at Design Pressure:</b></p> + 5,386 Pa (112.5 PSF) = -1.24 mm (0.05 inches)  <i>Residual Deflection</i> -0.64 mm (0.03 inches)  - 5,386 Pa (112.5 PSF) = 1.44 mm (0.06 inches)  <i>Residual Deflection</i> 1.42 mm (0.06 inches)  - No Permanent Damage Observed	<p style="text-align: center;"><b>No Permanent Damage Observed</b></p>

<sup>(3)</sup> 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/m<sup>2</sup>

<sup>(4)</sup> 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 8 – 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-B0193-1 (January 16, 2019)	
Maximum Pressure Achieved	Comments
8,349 Pa <sup>(3)</sup>	Cladding System did not disengage from wall assembly. However, vertical supporting steel studs buckled in the center
174 lbs. /ft <sup>2</sup>	

<sup>(3)</sup> 8,349 Pa = 116.7 m/s (or 261 mph / 420 km/h). Load  
 Calculation based on the Enswiler formula, where  $P = 0.613 \cdot V^2$ ,  $V$  is m/s &  $P$  is N/m<sup>2</sup>

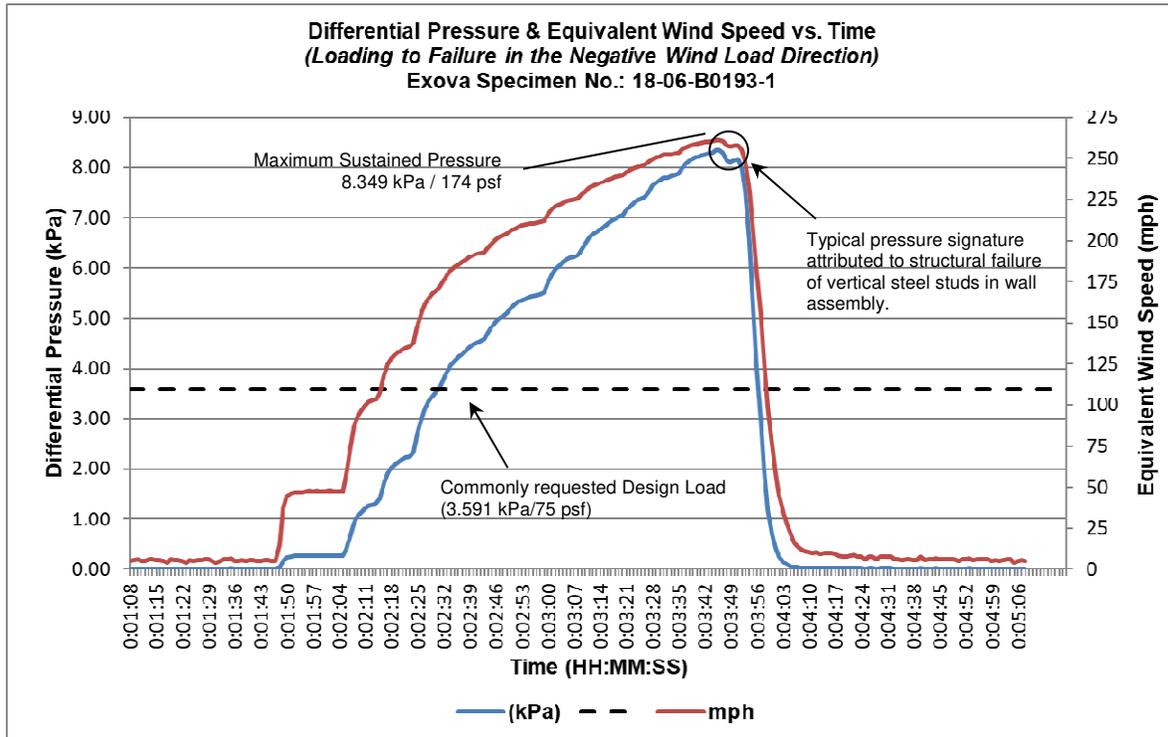


Figure 4 – Differential Pressure & Equivalent Wind Speed vs. Time (during testing to failure)

\*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., "EVOPLATE™ Non-Combustible Rainscreen" (*Exova Specimen No.: 18-06-B0193-1*) identified in this report met the requirements of AAMA 508-14 for cavity pressure differential, time shift of pulse and water penetration.

The system has a cavity volume to vent area ratio of **636 m<sup>3</sup> / m<sup>2</sup>** (2,087 ft<sup>3</sup>/ft<sup>2</sup>) on the upper panels and **763 m<sup>3</sup> / m<sup>2</sup>** (2,503 ft<sup>3</sup>/ft<sup>2</sup>) on the lower panels with a total of eight (8) 0.375" diameter vent holes.

This report is not indented as a comprehensive evaluation of the system regarding performance and application to specific buildings.

#### 6.0 REVISION HISTORY

<b><u>Report No:</u></b>	<b><u>Date:</u></b>	<b><u>Description of Revisions:</u></b>
18-06-B0193-F1	2019-01-16	Original Document
18-06-B0193-F1, Revision 1	2019-01-31	Editorial changes to test graph and pressure vs. wind speed commentary.
18-06-B0193-F1, Revision 2	2019-03-05	Correction was made to Specimen identification And client updated detail drawings and B.O.M.
18-06-B0193-F1, Revision 3	2019-03-28	Correction was made to cavity volume to vent area ratio

***Reviewed by:***



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

***Reported & Authorized by:***



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 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 EVO Panel assembly

2 pcs Patented EVO 2mm perimeter extrusion square cut @ 43.75" 6061-T6

2 pcs Patented EVO 2mm perimeter extrusion square cut @ 91.375" 6061-T6

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

14 pcs EVO Aluminum Corner reinforcement bracket 3003 Alloy

2mm EVOPlate coil coated 5052-H32 solid aluminum skin

30 EVO Torxalig zinc coated screws

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 EVO Panel assembly (2 assemblies used in test)

4 pcs Patented EVO 2mm perimeter extrusion square cut @ 43.75" 6061-T6

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

8 pcs EVO Aluminum Corner reinforcement bracket 3003 Alloy

2mm EVOPlate coil coated 5052-H32 solid aluminum skin

16 EVO Torxalig zinc coated screws

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 EVO Starter Strip 6061-T6 profile square cut to 94"

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

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

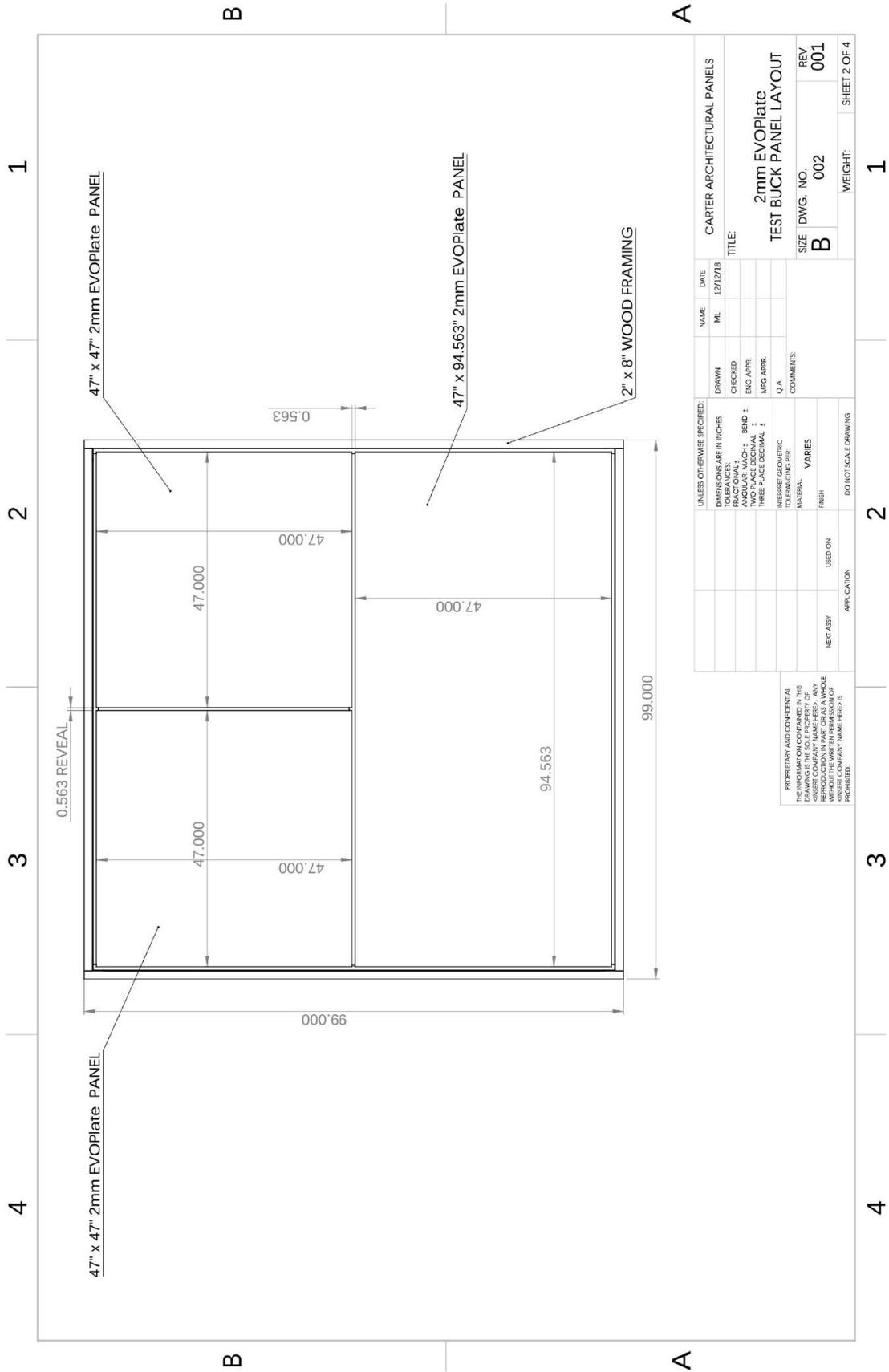
1 pc 2mm EVOPlate solid aluminum plate cut to 2" wide x 95" long (Horizontal Centre)

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)

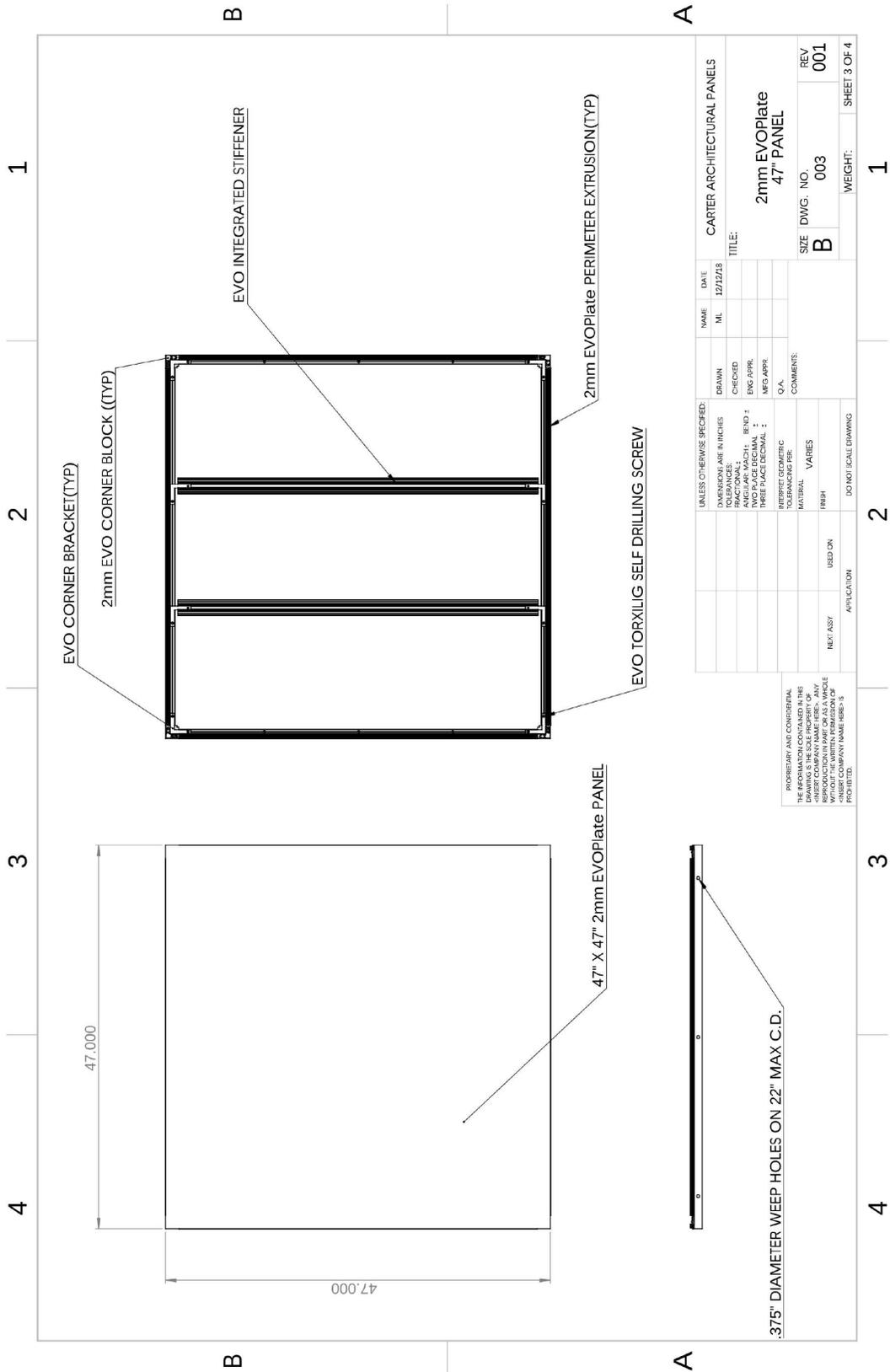
1 pc 2mm EVOPlate solid aluminum plate cut to 47" (Vertical centre)





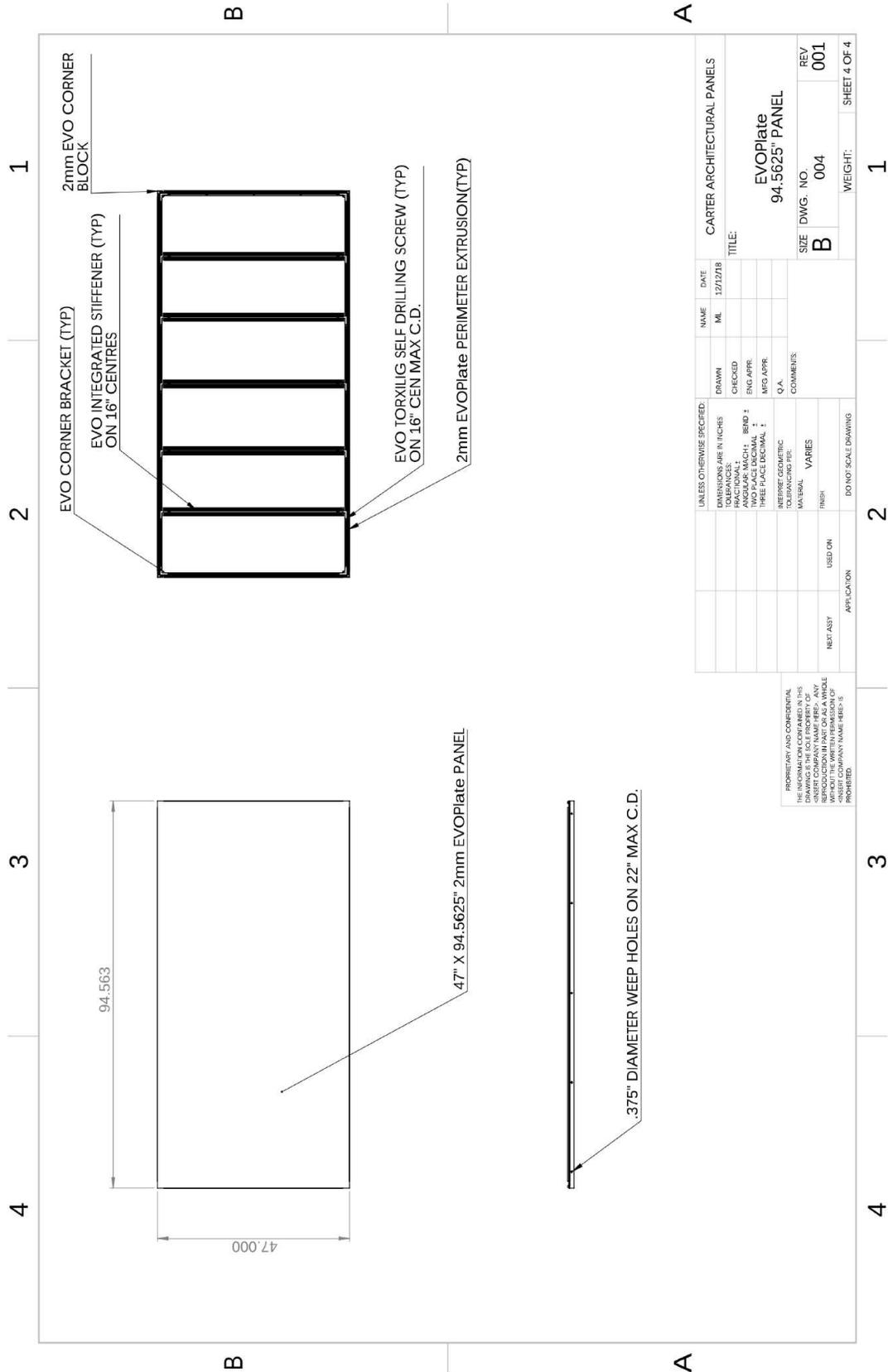
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ANGULAR MATCH - BEHD 1	ENG APPR			TEST BUCK PANEL LAYOUT	
THREE PLACE DECIMAL	MFG APPR			SIZE	DWG. NO.
WELDING DIMENSIONS TO BRACKETS PER	Q.A.			B	002
MATERIAL	COMMENTS			REV	001
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ALL DIMENSIONS TO BE SHOWN TO TWO PLACE DECIMALS				47" PANEL	
ALL DIMENSIONS TO BE SHOWN TO THREE PLACE DECIMALS				SIZE	DWG. NO.
INTERPRET GEOMETRIC TOLERANCING PER: VARIATION				B	003
MATERIAL VARIES				REV	001
FRISH				WEIGHT: SHEET 3 OF 4	
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ANGULAR MATCH	BEND :			EVOPlate	
THREE PLACE DECIMAL				94.5625" PANEL	
RESPECT GEOMETRIC TOLERANCING PER				SIZE DWG. NO.	REV
MATERIAL VARIES				B	004
FINISH				WEIGHT:	SHEET 4 OF 4
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