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PERFORMANCE EVALUATION OF THE CARTER ARCHITECTURAL PANELS, INC. "FUSION™ DRILLFREE™ PANEL SYSTEM" IN ACCORDANCE WITH AAMA 508-14 FOR PRESSURE EQUALIZATION BEHAVIOUR & WATER PENETRATION RESISTANCE

Report to:

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Report No.:

Proposal No.:

20-006-162693 RV1

10 Pages, 2 Appendices

20-06-B0075-2

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1.0 INTRODUCTION

Element was retained to evaluate the "FUSION[™] DRILLFREE[™] Panel System" in accordance with AAMA 508-14 for pressure equalization behaviour and water penetration resistance as outlined in Proposal Number 20-006-162693 RV1.

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

Client Specimen Description

Element Specimen No. 20-06-B0075-1

FUSION[™] DRILLFREE[™] Panel System ("T" Panel Scheme / 3 panels, not individually pressure isolated)

Note: The ACM used in the "FUSION[™] DRILLFREE[™] Panel System" by Carter Architectural Panels, Inc., is "etalbond[®] by ELVAL COLOUR." A complete bill-of-materials and details for the specimen identified above is located in Appendix A.

2.0 PROCEDURE

| Test Method | Test Description |
|---|--|
| AAMA 508-14, Section 5.5 – Referencing ASTM E1233 (Modified) | Voluntary Test Method and Specification for Pressure Equalized Rain Screen Wall Cladding Systems – Pressure Equalization Behaviour |
| AAMA 508-14, Section 5.6 – Referencing ASTM E331 | Voluntary Test Method and Specification for Pressure Equalized Rain Screen Wall Cladding Systems – Water Penetration Resistance |
| AAMA 508-14, Section 5.7 – Referencing AAMA 501.1-05 | Voluntary Test Method and Specification for Pressure Equalized Rain Screen Wall Cladding Systems – Dynamic Water Test |

Note: SI units are the primary units of measure.

Test Wall Section Description & Details:

The back-up test wall section (air / water barrier) was constructed in an Element test frame as per the detail drawing below in accordance with AAMA 508-14, Section 5.0:



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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 1B, 3 mm (*1/8 in*) diameter holes were introduced equally spaced 150 mm 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 m² (0.12 cfm/ft²).

The application of the cladding system on the test back-up wall was performed by Carter Architectural Panels, Inc. authorized personnel on June 27, 2020. 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. However, ASTM E1233 was modified to incorporate a positive pressure from 240 Pa (*5.0 psf*) to 1200 Pa (*25.0 psf*) to 240 Pa (*5.0 psf*) based on a maximum average of three (3) seconds for 100 cycles as per AAMA 508-14.

Upon completion of the pressure equalization behaviour test, the AAMA 508-14, Section 5.6, water penetration test at 300 Pa (6.27 psf) for fifteen (15) 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 501.1-05.

3.0 RESULTS

| Table 1 – Pressure Equalization Behaviour Analysis ASTM E1233/1233M-14 Element Specimen Number: 20-06-B0075-1 <i>(Test Date: July 9, 2020)</i> | | | | | |
|--|--------------------------------|----------------------|---|--------------------------------|----------------------|
| Compartment | Maximum External Gust | Maximum Cavity | Requi | rements | Comments |
| rested | Pressure of Pulse | Pulse | Pressure Differential | Maximum Time Shift of Pulse | |
| Primary Compartment | 1283 Pa (<i>26.8 psf</i>) | 986 Pa (20.6 psf) | Pressure differential on rain screen cladding shall not exceed 50% of maximum wind gust pressure | < 0.08 seconds | Meets Requirement |

Pressure equalization graphs are located in Figures 2 (Page 4)

- Air Leakage of Back-Up Wall (air / water barrier): 0.61 L/s·m² (0.12 cfm/ft²)
 - Ratio of cavity volume to vent area (Upper Panels): 372 m³/m² (1220 ft³/ft²)
- Ratio of cavity volume to vent area (Lower Panel): 903 m³ / m² (2963 ft³/ft²)

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Figure 2 – Pressure Equalization Behaviour

| Ele | Table 2 – Static Water Penetra AAMA 508-14, Section 5.6, Referencin ement Specimen Number: 20-06-B0075- | tion Resistance g ASTM E331-00 (2009) 1 <i>(Test Date: July 10, 202</i> 0 | 0) |
|---|--|---|----------------------|
| Test Pressure | Requirements | Results | Comments |
| 300 Pa <i>(6.24 PSF)</i> (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. No continuous streaming was observed. 2.80 % of air/water barrier surface area had water misting and / or water droplets. | Meets Requirement |

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|------------|---------------|
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| | Table 3 – Water Penetration Resis AAMA 501.1-05, Section 5.7, I Element Specimen Number: 20-06- | stance Using Dynamic Pressure Referencing AAMA 501.1-05 B0075-1 <i>(Test Date: July 13, 2020</i> |)) |
|---|--|---|-----------------------|
| Test Pressure | Requirements | Test Results | Comment |
| 300 Pa ⁽²⁾ (6.24 PSF) (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. 2.7 % 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 Requirements |

⁽²⁾ 300 Pa = 22.1 m/s or 80 km/h (49 mph). Calculation based on the Ensewiler formula, where P = $0.613 \cdot V^2$, V is m/s & P is N/m²

Outdoor Conditions during Test (July 13, 2020):

| Temperature: | 24 °C <i>(75°F)</i> |
|----------------------|-------------------------------|
| Relative Humidity: | 65 % R.H. |
| Barometric Pressure: | 101.5 kPa <i>(29.97 inHg)</i> |



Figure 3 – AAMA 501.1, Dynamic Water Penetration Test

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| Table 4 – Structural Results, Positive Wind Load Direction ASTM E330/E330M-14 – SI & IP Units Element Specimen No.: 20-06-B0075-1 <i>(Test Date: July 14, 2020)</i> | | | | |
|---|----------------------------|-----------------------------|----------------------------|----------------------------|
| Test Dressure | | Gauge No. ar | nd Deflection | |
| Test Pressure | 1 | 2 | 3 | Net Deflection |
| 3,591 Pa ⁽¹⁾ (75.0 lbs. /ft²) | -2.9 mm (-0.114 inches) | -10.9 mm (-0.429 inches) | -3.5 mm (-0.138 inches) | -7.8 mm (-0.307 inches) |
| Residual Deflection | -0.4 mm (-0.016 inches) | -0.8 mm (-0.031 inches) | -0.8 mm (-0.031 inches) | -0.3 mm (-0.011 inches) |



Figure 4 - Net Deflection vs Time, Positive Wind Direction, SI Units



Figure 5 - Net Deflection vs Time, Positive Wind Direction, IP Units

Evaluation of the "FUSION™ DRILLFREE™ Panel System" For Carter Architectural Panels, Inc. Page 7 of 10 Report No. 20-06-B0075-2

| Table 5 – Structural Results, Negative Wind Load Direction ASTM E330/E330M-14 – SI & IP Units Element Specimen No.: 20-06-B0075-1 <i>(Test Date: July 14, 2020)</i> | | | | |
|---|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| Toot Drooouro | | Gauge No. ar | nd Deflection | |
| Test Pressure | 1 | 2 | 3 | Net Deflection |
| 3,591 Pa ⁽¹⁾ (75.0 lbs. /ft²) | 2.6 mm <i>(0.102 inches)</i> | 11.9 mm (0.469 inches) | 4.2 mm (0.165 inches) | 8.5 mm <i>(0.334 inches)</i> |
| Residual Deflection | 0.6 mm <i>(0.024 inches)</i> | 1.6 mm <i>(0.063 inches)</i> | 1.5 mm <i>(0.059 inches)</i> | 0.5 mm <i>(0.020 inches)</i> |



Figure 6 - Net Deflection vs Time, Negative Wind Direction, SI Units



Figure 7 - Net Deflection vs Time, Negative Wind Direction, IP Units

Note: The default deflection limit of the support framing was restricted to L/180 referencing AAMA 508, Section 5.1.2.

| Positive Loading Net Deflection Design Load: (+3591 Pa) = | <u>7.8 mm</u> < 16.4 mm Requirement |
|--|---------------------------------------|
| Negative Loading Net Deflection Design Load (-3591 Pa) = | <u>8.5 mm</u> < 16.4 mm Requirement |
| Positive Loading Net Deflection Design Load: $(+75.0 \text{ lbs. }/\text{ft}^2) =$ | 0.307 inches < 0.646 inch Requirement |
| Negative Loading Net Deflection Design Load $(-75.0 \text{ lbs. }/\text{ft}^2) =$ | 0.334 inches < 0.646 inch Requirement |

⁽¹⁾ 3,591 Pa = 76.5 m/s or 272 km/h *(169 mph)*.

Calculation based on the Ensewiler formula, where $P = 0.613 V^2$, V is m/s & P is N/m²

⁽²⁾ 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".





Figure 8 – Deflection Gauge Loactions

Evaluation of the "FUSION™ DRILLFREE™ Panel System" For Carter Architectural Panels, Inc.

| Table No. 7 - Summarized Structural Results ASTM E330 – SI & IP Units Element Specimen No.: 15-06-M0159 <i>(Test Date: July 14, 2020)</i> | |
|---|---|
| Test Pressure Sustained/Achieved | Comments |
| + 5,387 Pa ⁽³⁾ (<i>112.5 lbs. /ft</i> ²) | Cladding System did not disengage from wall assembly. |
| - 5,387 Pa ⁽³⁾ (112.5 lbs. /ft²) | Cladding System did not disengage from wall assembly and sustained at test pressure. However soon after sustaining the test pressure, the vertical supporting steel studs buckled in the center. |

⁽³⁾ 5,387 Pa = 93.7 m/s or 337 km/h *(210 mph)*.

Load Calculation based on the Ensewiler formula, where $P = 0.613 V^2$, V is m/s & P is N/m²



Figure 9 – Differential Pressure & Equivalent Wind Speed vs Time



Figure 10 - Differential Pressure & Equivalent Wind Speed vs Time

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

Evaluation of the "FUSION™ DRILLFREE™ Panel System" For Carter Architectural Panels, Inc.

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4.0 SYSTEM MODIFICATIONS

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

5.0 DISCUSSION

The "FUSION[™] DRILLFREE[™] Panel System" identified in this report met the requirements of AAMA 508-14 for cavity pressure differential, time shift of pulse, water penetration, and structural overload performance of 5,387 Pa (*112.5 lbs. /ft²*).

The system contained a cavity volume to vent area ratio of 372 m³ / m² (*1220 ft*³/*ft*²) for the upper panels and 903 m³ / m² (*2963 ft*³/*ft*²) for the lower panels. Each upper panel had three (3) Ø9.5 mm (0.375 in) drain/vent holes and the lower panel had five (5) Ø9.5 mm (0.375 in).

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

6.0 REPORT REVISION HISTORY

Date: July 31, 2020 Revision: Original Document

Reported by:

Allan Lawrence, Ext 11412 Supervisor, Building Science Building Science Division Comments: N/A

Reviewed and Authorized by:

Jordan M. Church, B.Tech., Ext. 11546 Ops Manager, Building Science & Fire Testing Technical Manager, Building Systems Building Science Division

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APPENDIX A

Specimen Bill of Materials and Detailed Drawing

(6 Pages)

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4MM FUSION[™] with etalbond[®] ACM - Bill of Materials

Framework:

- 6 pcs 1.0" x 1.0" x 2" x 1.0" x 1.0" Pre-punched Hat channel 18 Gauge G-90 Galvanized profile
- 4 pcs 2" x 1.0" x 2" Pre-punched U-channel 18 Gauge G-90 Galvanized profile
- 100 pcs #12 x 1.5" self-drilling screws

Panel Assemblies:

56.750" X 57.125" 4mm FUSION™ Panel assembly (Below list is per panel, 2 panels used in assembly)

- 2 pcs Patented FUSION™ DRILLFREE™ perimeter extrusion square cut @ 54.125" 6061-T6
- 2 pcs Patented FUSION™ DRILLFREE™ perimeter extrusion square cut @ 54.625" 6061-T6
- 4 pcs FUSION[™] 4mm AAMA 508 FUSION[™] 60 Durometer High Temp Silicon Corner blocks
- 4 pcs FUSION[™] corner bracket 3003 Alloy
- 4mm etalbond[®] Fire Rated Aluminum Composite Material.
- 30 EVO Torxalig zinc coated screws
- 30 FUSION™ DRILLFREE™ RIVETS
- 3 pcs Patented EVO[™] Integrated stiffener square cut to 54.5" 6061-T6
- 2 tubes of Dymonic FC adhesive
- 3 pcs 1" x .5" bug screen to cover weep holes

56.750" X 115" 4mm FUISON Panel assembly (1 pc in assembly)

- 2 pcs Patented FUSION™ DRILLFREE™ perimeter extrusion square cut @ 54.125" 6061-T6
- 2 pcs Patented FUSION™ DRILLFREE™ perimeter extrusion square cut @ 112.5" 6061-T6
- 4 pcs FUSION™ 4mm AAMA 508 60 Durometer High Temp Silicon Corner block
- 14 pcs FUSION[™] corner bracket 3003 Alloy
- 4mm etalbond[®] Fire Rated Aluminum Composite Material.
- 32 EVO[™] Torxalig zinc coated screws
- 25 FUSION™ DRILLFREE™ RIVETS
- 5 pcs Patented EVO[™] Integrated stiffener square cut to 54.54" 6061-T6
- 1 tube of Dymonic FC adhesive
- 5 pcs 1" x .5" bug screen to cover weep holes

Wall assembly:

1 pc Patented FUSION™ DRILLFREE™ Starter Strip 6061-T6 profile square cut to 115.5"

12 pc Patented FUSION[™] DRILLFREE[™] Mid-Clip 6061 -T6 profile square cut to 3" with pre-punched slot (Mounted on 16" maximum centre distance)

24 pc Patented FUSION[™] DRILLFREE[™] Half-Clip 6061- T6 profile square cut to 3" with pre-punched slot (Mounted on 16" maximum centre distance)

1 pc 4mm etalbond[®] Fire Rated Aluminum Composite Material, cut 2" x 115.5" long (Horizontal Centre Filler Strip)

2 pc 4mm etalbond[®] Fire Rated Aluminum Composite Material cut to 1.25" x 115.5" long (Top and bottom Filler Strip)

2 pc 4mm etalbond[®] Fire Rated Aluminum Composite Material cut to 1.25" x 115.5" long (Side Filler Strips)

2 pc 4mm etalbond[®] Fire Rated Aluminum Composite Material cut to 1.25" x 54" long (Vertical Centre Filler Strip)

etalbond® ACM is manufactured by ELVAL COLOUR



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😑 element



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APPENDIX B

Photographs of Rain Screen System

(2 Pages)

Evaluation of the "FUSION™ DRILLFREE™ Panel System" For Carter Architectural Panels, Inc. Appendix B Report No. 20-06-B0075-2



Figure B1 – Test Specimen (Exterior View)

Evaluation of the "FUSION™ DRILLFREE™ Panel System" For Carter Architectural Panels, Inc.

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Figure B2 – Test Specimen (Interior View)



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PERFORMANCE EVALUATION OF THE CARTER ARCHITECTURAL PANELS, INC. "FUSION™ DRILLFREE™ PANEL SYSTEM" IN ACCORDANCE WITH ASTM E283, E331, AND E330 FOR AIR INFILTRATION, WATER PENETRATION AND STRUCTURAL PERFORMANCE

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Report No.:

Proposal No.:

20-006-162693 RV1

8 Pages, 2 Appendices

Report Date:

July 31, 2020

20-06-B0075-1

1.0 INTRODUCTION

Element was retained to evaluate an exterior panel system identified as the "FUSION[™] DRILLFREE[™] Panel System" in accordance with ASTM E283, E331, and E330 as defined in Proposal Number 20-006-162693 RV1.

The wall assembly was assigned the following Element Specimen Number:

Client Specimen Description

Element Specimen No. 20-06-B0075-1

FUSION[™] DRILLFREE[™] Panel System (*"T" Panel Scheme / 3 panels, not individually pressure isolated*)

Note: The ACM used in the "FUSION[™] DRILLFREE[™] Panel System" by Carter Architectural Panels, Inc., is "etalbond[®] by ELVAL COLOUR." A complete bill-of-materials and details for the specimen identified above is located in Appendix A.

Test Backup Wall Description:

9.7 ft. x 9.7 ft Opaque wall comprising of two vertical sheathing joint (with joints sealed)
Frame Construction:
6" Steel studs (vertical), 18 ga / 16" O/C
1.5" Steel bridging (horizontal), 18 ga at centre
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 E331-02 (2009) | Water Penetration of Exterior Windows, Skylights, Doors and Curtain Walls by Uniform Static Air Pressure Difference |
| ASTM E330-14 (2014) | 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 Element)*. 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.



3.0 RESULTS

| Table No. 1 - Summarized Air Leakage Results Configuration 1 – ASTM E283-04 (2012) Element Specimen No.: 20-06-B0075-1 <i>(Test Date: July 9, 2020)</i> | | | |
|---|--|--|--|
| Test Pressure Differential | Infiltration | Exfiltration | |
| 75 Pa (1.57 lbs./ft²) | 0.001 L/s m ² (0.0002 CFM/ft ²) | 0.002 L/s m ² (0.0003 CFM/ft ²) | |
| 300 Pa <i>(6.24 lbs./ft²</i>) | 0.009 L/s m ² (0.0017 CFM/ft ²) | 0.008 L/s m ² (0.0015 CFM/ft ²) | |

| Table No. 2 - Summarized Air Leakage Results Configuration 2 – ASTM E283-04 (2012) Element Specimen No.: 20-06-B0075-1 <i>(Test Date: July 9, 2020)</i> | | |
|---|---|--|
| Test Pressure Differential | Infiltration ⁽¹⁾ | |
| 75 Pa (1.57 <i>lbs./ft²</i>) | 0.61 L/s m ² (0.12 CFM/ft ²) | |

⁽¹⁾ Ninety-one (91) 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.

| Table No. 3 - Summarized Water Penetration Resistance ResultsConfiguration 2 – ASTM E331-02 (2012)Element Specimen No.: 20-06-B0075-1 (Test Date: July 10, 2020) | | | |
|--|-------------|---|-------------------------------------|
| Test Pressure Differential | Test Period | Observations | Comments |
| 137 Pa (<i>2.86 lbs./ft²</i>) | 15 minutes | 1.55 % 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⁾ |
| 300 Pa <i>(6.27 lbs./ft²</i>) | 15 minutes | 2.80 % 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.

| Table No. 4 - Summarized Structural Results, Positive Wind Load Direction Configuration 2 – ASTM E330/E330M-14 – SI & IP Units Element Specimen No.: 20-06-B0075-1 <i>(Test Date: July 14, 2020)</i> | | | | |
|--|----------------------------|-----------------------------|----------------------------|----------------------------|
| Toot Proceuro | Gauge No. and Deflection | | | |
| Test Pressure | 1 | 2 | 3 | Net Deflection |
| 3,591 Pa ⁽¹⁾ (75.0 lbs. /ft²) | -2.9 mm (-0.114 inches) | -10.9 mm (-0.429 inches) | -3.5 mm (-0.138 inches) | -7.8 mm (-0.307 inches) |
| Residual Deflection | -0.4 mm (-0.016 inches) | -0.8 mm (-0.031 inches) | -0.8 mm (-0.031 inches) | -0.3 mm (-0.011 inches) |





Figure No. 2 - Net Deflection vs Time, Positive Wind Direction, IP Units

| Table No. 5 - Summarized Structural Results, Negative Wind Load Direction Configuration 2 – ASTM E330/E330M-14 – SI & IP Units Element Specimen No.: 20-06-B0075-1 <i>(Test Date: July 14, 2020)</i> | | | | |
|--|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| Toot Proceuro | Gauge No. and Deflection | | | |
| Test Pressure | 1 | 2 | 3 | Net Deflection |
| 3,591 Pa ⁽¹⁾ (75.0 lbs. /ft²) | 2.6 mm <i>(0.102 inches)</i> | 11.9 mm (0.469 inches) | 4.2 mm <i>(0.165 inches)</i> | 8.5 mm <i>(0.334 inches)</i> |
| Residual Deflection | 0.6 mm <i>(0.024 inches)</i> | 1.6 mm <i>(0.063 inches)</i> | 1.5 mm <i>(0.059 inches)</i> | 0.5 mm <i>(0.020 inches)</i> |







Figure No. 4 - Net Deflection vs Time, Negative Wind Direction, IP Units

Note: The default deflection limit of the support framing was restricted to L/180 referencing AAMA 508, Section 5.1.2.

Positive Loading Net Deflection Test Load: (+3591 Pa) = Negative Loading Net Deflection Test Load (-3591 Pa) = <u>7.8 mm</u> < 16.4 mm Requirement <u>8.5 mm</u> < 16.4 mm Requirement

Positive Loading Net Deflection Test Load: $(+75.0 \text{ lbs. /ft}^2) = \frac{0.307 \text{ inches}}{0.334 \text{ inches}} < 0.646 \text{ inch Requirement}$ Negative Loading Net Deflection Test Load $(-75.0 \text{ lbs. /ft}^2) = \frac{0.334 \text{ inches}}{0.334 \text{ inches}} < 0.646 \text{ inch Requirement}$

⁽¹⁾ 3,591 Pa = 76.5 m/s or 272 km/h (169 mph). Calculation based on the Ensewiler formula, where $P = 0.613 \cdot V^2$, V is m/s & P is N/m²

Note: Deflection measurement (gauge) locations employed during structural loading are shown below.



Figure No. 5 – Deflection Gauge Loactions

| Table No. 6 - Summarized Structural Results Test to Failure in the Negative Wind Load Direction Configuration 2 – ASTM E330 – SI & IP Units Element Specimen No.: 15-06-M0159 (Test Date: July 14, 2020) | | |
|---|---|--|
| Maximum Pressure Achieved | Comments | |
| 5,387 Pa ⁽²⁾ (112.5 lbs. /ft²) | Cladding System did not disengage from wall assembly. However, vertical supporting steel studs buckled in the center | |

⁽²⁾ 5,387 Pa = 93.7 m/s or 337 km/h (210 mph).

Load Calculation based on the Ensewiler formula, where $P = 0.613 \cdot V^2$, V is m/s & P is N/m²



Figure No. 6 – 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.

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5.0 CONCLUSION

The Carter Architectural Panels, Inc. exterior panel system identified as the "*FUSION™ DRILLFREE*[™] *Panel System*" as detailed in this report was tested in accordance ASTM E283-04(2012), ASTM E331-00(2009) and ASTM E330-14 and achieved the following:

- Air Infiltration: 0.001 L/s m² (0.0002 CFM/ft²) @ 75 Pa (1.57 lbs/ft²) 0.009 L/s m² (0.0008 CFM/ft²) @ 300 Pa (6.24 lbs/ft²)
- Water Penetration 300 Pa (6.27 lbs/ft²)

Revision:

20-06-B0075-1

- Structural Performance: 3,591 Pa (*75.0 lbs. /ft²*) Specified Test Pressure 5,387 Pa⁽³⁾ (*112.5 lbs. /ft²*) Maximum Pressure Achieved (-) (Equivalent to 337 km/h (*210 mph*) based on Ensewiler formula)
- ⁽³⁾ Cladding system did not disengage from the wall assembly. The "FUSION[™] DRILLFREE[™] Panel System" did not fail at 5,387 Pa *(112.5 lbs. /ft²)*, whereas, the vertical steel studs behind the wall assembly buckled in the center, thereby, concluding the test procedure.

6.0 REVISION HISTORY

<u>Date:</u> July 31, 2020

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Reported by:

Allan Lawrence, Ext 11212 Supervisor, Building Science Building Science Division

Comments: Original Document

Reviewed and Authorized by:

Jordan M. Church, B.Tečh., Ext. 11546 Ops Manager, Building Science & Fire Testing Technical Manager, Building Systems Building Science Division

This report and service are covered under Element Materials Technology Inc.'s. Standard Terms and Conditions of Contract which may be found on our company's website <u>www.element.com</u>, or by calling 1-866-263-9268.





APPENDIX A

Specimen Bill of Materials and Detailed Drawing

(6 Pages)

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4MM FUSION[™] with etalbond[®] ACM - Bill of Materials

Framework:

- 6 pcs 1.0" x 1.0" x 2" x 1.0" x 1.0" Pre-punched Hat channel 18 Gauge G-90 Galvanized profile
- 4 pcs 2" x 1.0" x 2" Pre-punched U-channel 18 Gauge G-90 Galvanized profile
- 100 pcs #12 x 1.5" self-drilling screws

Panel Assemblies:

56.750" X 57.125" 4mm FUSION™ Panel assembly (Below list is per panel, 2 panels used in assembly)

- 2 pcs Patented FUSION™ DRILLFREE™ perimeter extrusion square cut @ 54.125" 6061-T6
- 2 pcs Patented FUSION™ DRILLFREE™ perimeter extrusion square cut @ 54.625" 6061-T6
- 4 pcs FUSION™ 4mm AAMA 508 FUSION™ 60 Durometer High Temp Silicon Corner blocks
- 4 pcs FUSION[™] corner bracket 3003 Alloy
- 4mm etalbond[®] Fire Rated Aluminum Composite Material.
- 30 EVO Torxalig zinc coated screws
- 30 FUSION™ DRILLFREE™ RIVETS
- 3 pcs Patented EVO[™] Integrated stiffener square cut to 54.5" 6061-T6
- 2 tubes of Dymonic FC adhesive
- 3 pcs 1" x .5" bug screen to cover weep holes

56.750" X 115" 4mm FUISON Panel assembly (1 pc in assembly)

- 2 pcs Patented FUSION™ DRILLFREE™ perimeter extrusion square cut @ 54.125" 6061-T6
- 2 pcs Patented FUSION[™] DRILLFREE[™] perimeter extrusion square cut @ 112.5" 6061-T6
- 4 pcs FUSION™ 4mm AAMA 508 60 Durometer High Temp Silicon Corner block
- 14 pcs FUSION[™] corner bracket 3003 Alloy
- 4mm etalbond[®] Fire Rated Aluminum Composite Material.
- 32 EVO[™] Torxalig zinc coated screws
- 25 FUSION™ DRILLFREE™ RIVETS
- 5 pcs Patented EVO[™] Integrated stiffener square cut to 54.54" 6061-T6
- 1 tube of Dymonic FC adhesive
- 5 pcs 1" x .5" bug screen to cover weep holes

Wall assembly:

1 pc Patented FUSION™ DRILLFREE™ Starter Strip 6061-T6 profile square cut to 115.5"

12 pc Patented FUSION[™] DRILLFREE[™] Mid-Clip 6061 -T6 profile square cut to 3" with pre-punched slot (Mounted on 16" maximum centre distance)

24 pc Patented FUSION[™] DRILLFREE[™] Half-Clip 6061- T6 profile square cut to 3" with pre-punched slot (Mounted on 16" maximum centre distance)

1 pc 4mm etalbond[®] Fire Rated Aluminum Composite Material, cut 2" x 115.5" long (Horizontal Centre Filler Strip)

2 pc 4mm etalbond[®] Fire Rated Aluminum Composite Material cut to 1.25" x 115.5" long (Top and bottom Filler Strip)

2 pc 4mm etalbond[®] Fire Rated Aluminum Composite Material cut to 1.25" x 115.5" long (Side Filler Strips)

2 pc 4mm etalbond[®] Fire Rated Aluminum Composite Material cut to 1.25" x 54" long (Vertical Centre Filler Strip)

etalbond® ACM is manufactured by ELVAL COLOUR

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APPENDIX B

Photographs of Rain Screen System

(2 Pages)

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Figure B1 – Test Specimen (Exterior View)

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Figure B2 – Test Specimen (Interior View)