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**PERFORMANCE EVALUATION OF THE ENGINEERED ARCHITECTURALS LTD.,  
“ENGINEERED ARCHITECTURALS™ - 500 SERIES ACM  
DRY JOINT RAINSCREEN SYSTEM”**

**IN ACCORDANCE WITH AAMA 508-14 STANDARD**

***FOR PRESSURE EQUALIZATION BEHAVIOR & WATER PENETRATION RESISTANCE***

Report to:	<b>Engineered Architecturals Ltd.</b> #400 – 319 W Hastings St. Vancouver, BC V6B 1H6
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Revised Report No.:	19-06-B0176 RV1
Original Report No.:	17-06-M0258 8 Pages, 3 Appendices
Revised Proposal No.:	19-006-110043 Revision 1
Original Proposal No.:	17-006-530736 Revision 1
Revised Date:	February 7, 2020
Original Date:	January 10, 2018

## 1.0 INTRODUCTION

Exova was retained to evaluate the “ENGINEERED ARCHITECTURALS™ - 500 SERIES ACM DRY JOINT RAINSCREEN” exterior wall panel system based on equal panel scheme (4 panels, not individually pressure isolated) in accordance with AAMA 508-14 standard for pressure equalization behavior and water penetration resistance as outlined in Proposal number 17-006-530736 Revision 1.

*Note: Exova Inc. was rebranded to Element Materials Technology Inc. in April 2019. This report has been reissued under the Element name but the body of the test report and laboratory accreditations remain the same.*

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

**Client Specimen Description**

ENGINEERED ARCHITECTURALS™ - 500 SERIES  
ACM DRY JOINT RAINSCREEN

**Exova Specimen No.**

17-06-M0258

**As per client request, the following construction configuration was used:**

Steel Studs: 20 ga. channel-shaped nominal 92 mm (3-5/8”) deep on nominal 406 mm (16”) centres  
Exterior Sheathing: Simulated sheathing via clear 12.7 mm (1/2”) plexiglass.  
ACM Panel: 4mm Thick

## 2.0 PROCEDURE

Test Description	Test Method
Voluntary Test Method and Specification for Pressure Equalized Rain Screen Wall Cladding Systems – Pressure Equalization Behaviour	AAMA 508-14, Section 5.5 – <i>Referencing ASTM E1233 (Modified)</i>
Voluntary Test Method and Specification for Pressure Equalized Rain Screen Wall Cladding Systems – Water Penetration Resistance	AAMA 508-14, Section 5.6 – <i>Referencing ASTM E331-00 (16)</i>
Voluntary Test Method and Specification for Pressure Equalized Rain Screen Wall Cladding Systems – Dynamic Water Test	AAMA 508-14, Section 5.7 – <i>Referencing AAMA 501.1-05</i>

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:

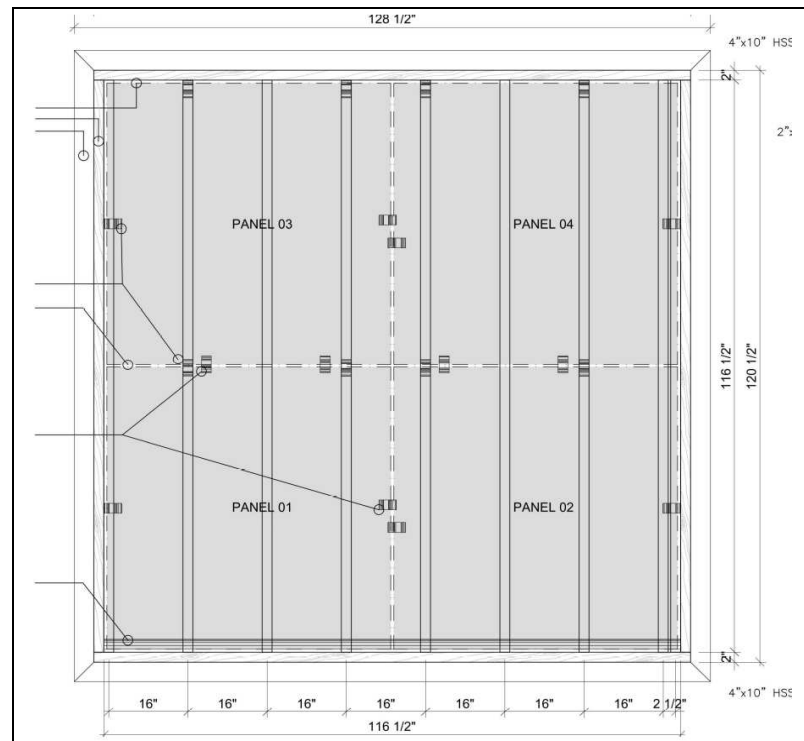


Figure 1 – Client provided wall configuration

### Base Wall Section

The 2959 mm x 2959 mm (116.5" x 116.5") test wall section was constructed using commercially purchased steel studs, fasteners, and simulated sheathing (via Plexiglass) and built as per the construction details located in Figure 1. The 20 ga. channel-shaped galvanized steel studs measured 92 mm (3-5/8") deep with 33.7 mm (1-21/64") long returns. The 18 ga galvanized steel top and bottom channels measured nominally 92 mm (3-5/8") deep (inside dimension) with 33 mm (1-5/16") returns.

An 18 ga. horizontal channel-shaped galvanized steel bridging bar spanned the studs, passing through the pre-punched openings in the studs, approximately 1727 mm (68") up from the bottom of the test sample. The bridging bar measured 38.1 mm (1-1/2") wide with 12.7 mm (1/2") returns. The bridging bar was fastened to the studs via a 82.6 mm (3-1/4") long section of 38.1 mm x 38.1 mm (1-1/2" x 1-1/2") galvanized steel angle (bridging clip), one per stud. Two #8 x 12.7 mm (1/2") long modified truss-head self-drilling screws secured each bridging clip to the adjacent stud, and two #8 x 12.7 mm (1/2") long modified truss-head self-drilling screws secured each bridging clip to the bridging bar. The bridging bar spanned the intermediate studs.

Upon completion of the back wall section, 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, 3 mm (0.118 inch) diameter holes were introduced equally spaced 150 mm (5.91 inches) 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> (0.12 cfm/ft<sup>2</sup>) ±10%.

## 2.0 PROCEDURE (CONTINUED)

The application of the cladding system based on equal panel scheme (*4 panels, not individually pressure isolated*) installed on the test back-up wall was performed by Engineered Architecturals Ltd. (formerly CM Engineered Aluminum Ltd.), authorized personnel on December 11th, 2017. 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 (5.01 PSF) to 1200 Pa (25.07 PSF) to 240 Pa (5.01 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 501.1-05 at 300 Pa (6.24 PSF).

**Test Date: December 11, 2017 (AAMA 508-14, Section 5.7)**  
**December 12, 2017 (AAMA 501.1-05)**

## 3.0 RESULTS

Table 1 – Pressure Equalization Behavior Analysis Exova Specimen Number: 17-06-M0258					
Compartment Tested	Maximum External Gust Pressure of Pulse	Maximum Cavity Pressure of Pulse	Requirements		Comments
			Pressure Differential	Maximum Time Shift of Pulse	
Primary Compartment	1218 Pa (25.44 PSF)	1219 Pa (25.44 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): **0.55 L/sm<sup>2</sup> (0.119 cfm / ft<sup>2</sup>)**
- Ratio of cavity volume to vent area (Upper Panels): **1261 m<sup>3</sup> / m<sup>2</sup> (4137 ft<sup>3</sup> / ft<sup>2</sup>)**
- Ratio of cavity volume to vent area (Lower Panel): **1261 m<sup>3</sup> / m<sup>2</sup> (4137 ft<sup>3</sup> / ft<sup>2</sup>)**

### 3.0 RESULTS (CONTINUED)

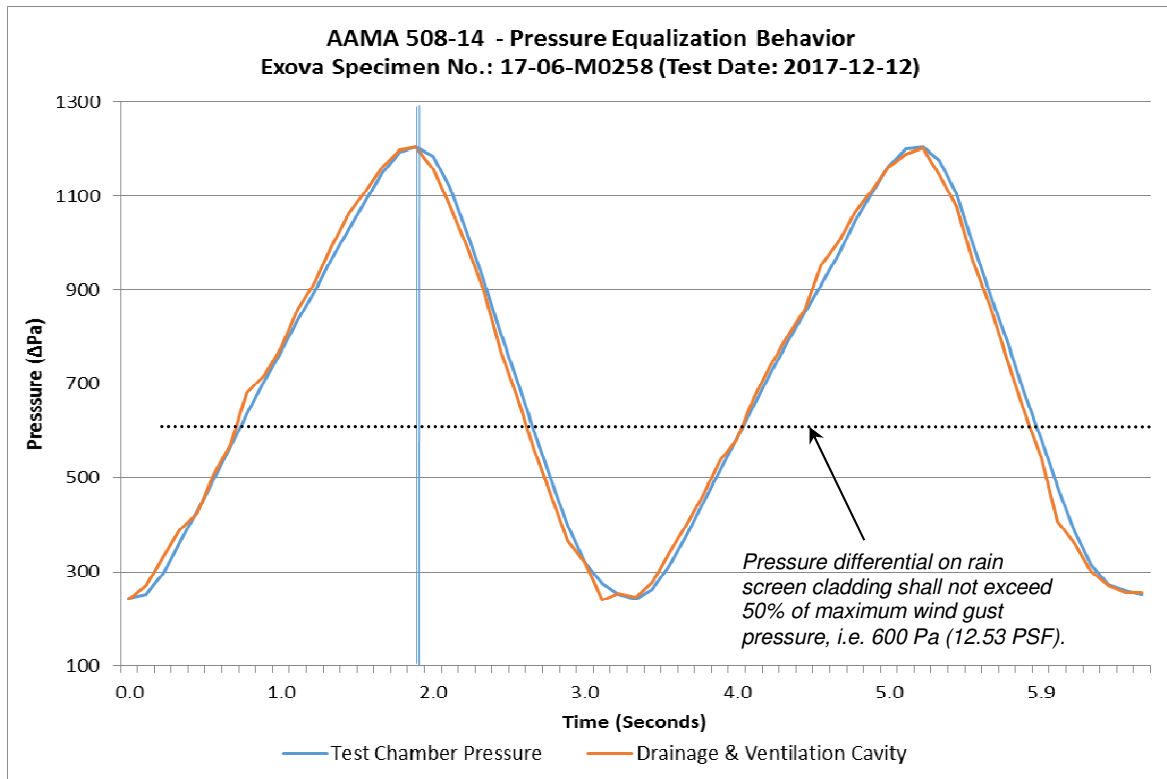


Figure 2 – Pressure Equalization Behavior

<b>Table 2 – Static Water Penetration Resistance</b> <b>AAMA 508-14, Section 5.6, Referencing ASTM E331-00 (16)</b> <b>Exova Specimen Number: 17-06-M0258</b>			
Test Pressure (Pa)	Requirements	Results	Comments
300 Pa (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>No Water mist and/or droplets were observed. No continuous streaming was observed.</p> <p>0.0 % of air/water barrier surface area had water misting and / or water droplets.</p>	<p><b>Meets Requirement</b></p>

### 3.0 RESULTS (CONTINUED)

<b>Table 3 – Support Wall Deflection Measurements</b> <b>AAMA 508-14, Section 5.8, Referencing ASTM E330-14 <sup>(2)</sup></b> <b>Exova Specimen Number: 17-06-M0258</b>			
Test	Requirements	Test Results	Comment
<b>Uniform Load Deflection</b> (Clause 5.1.2)	<b>ASTM E330 Modified:</b> +/- 1,410 Pa (29.45 PSF)  <b>Requirements:</b> - No permanent damage - Report Support Wall Deflection	Stud Length (L) = 2,950 mm (116.1 inches) Allowable (L/180) = 16.4 mm (0.646 inches)  Net Deflection at Design Pressure:  Infil: 1,410 Pa = -1.1 mm (-0.043 inches) Exfil: - 1,410 Pa = 2.2 mm (0.087 inches)  Residual:  Infil: -0.0 mm (-0.000 inches) Exfil: -0.3 mm (-0.018 inches)  - No Permanent Damage Observed	<b>Meets Requirements</b>  L/180 @  1,410 Pa (29.45 PSF)

(1) 1,410 Pa = 48.0 m/s (or 108 mph / 173 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>

(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 E330-14 at 0.5, 1.0 and 1.5 times the specified positive and negative design pressures.” As per client request, Exova performed structural testing of the AAMA 508-14 system in accordance with ASTM E330-14 to a design pressure of  $\pm 1,410$  Pa (29.45 PSF) (108 mph / 173 km/h).

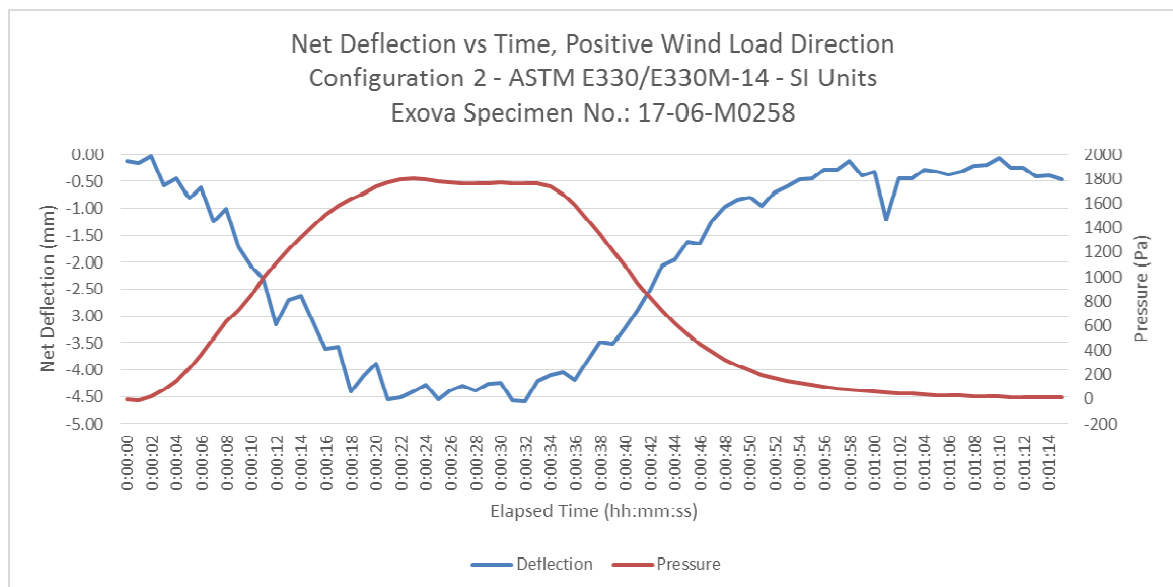


Figure 3 – Differential Pressure (Positive) vs. Deflection, ASTM E330-14

### 3.0 RESULTS (CONTINUED)

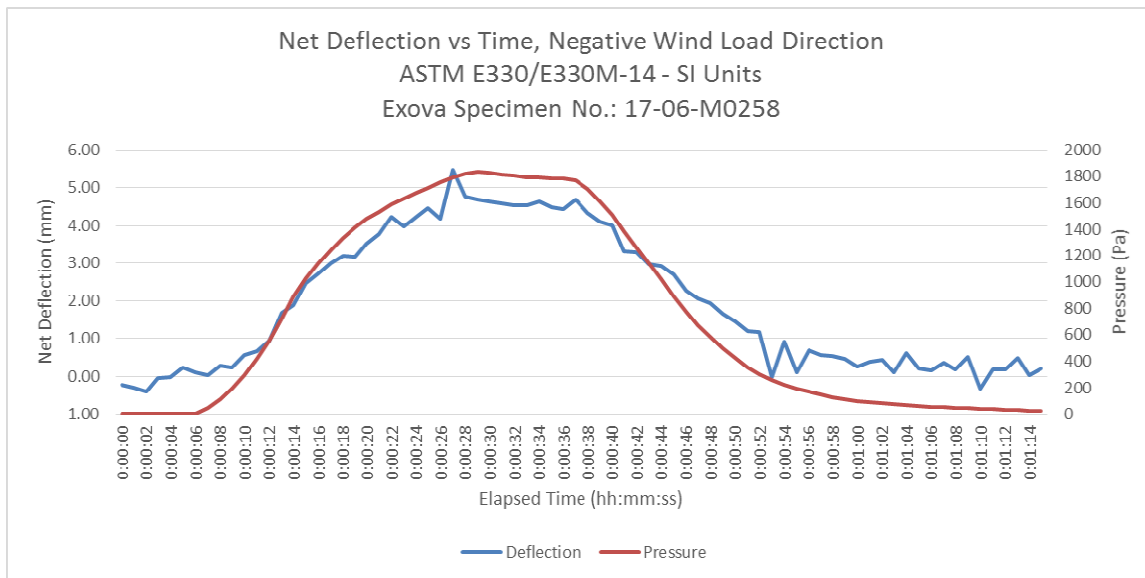


Figure 4 – Differential Pressure (Negative) vs. Deflection, ASTM E330-14

<b>Table 4 – Water Penetration Resistance Using Dynamic Pressure</b> <b>AAMA 508-14, Section 5.7, Referencing AAMA 501.1-05</b> <b>Exova Specimen Number: 17-06-M0258</b>			
Test Pressure (Pa)	Requirements	Test Results	Comment
300 Pa (6.24 PSF) <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.	No Water mist and/or droplets were observed. No continuous streaming was observed.  0.0 % of air/water barrier surface area had water misting and / or water droplets.	<b>Meets Requirement</b>

<sup>(2)</sup> 300 Pa (6.24 PSF) = 22.1 m/s (or 50 mph / 80.5 km/h). Calculation based on the Ensewiler formula, where  $P = 0.613 \cdot V^2$ , V is m/s & P is N/m<sup>2</sup>

#### Ambient Condition during AAMA 501.1 Test:

Temperature: 4°C  
 Relative Humidity: 55%  
 Barometric Pressure: 101.9kPa

**\*Note:** Luke warm water was used during testing. Upon completion of testing, no icing was formed on the test wall's vertical and horizontal joint and drainage holes

#### 4.0 SYSTEM MODIFICATIONS

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

#### 5.0 DISCUSSION

The “ENGINEERED ARCHITECTURALS™ - 500 SERIES ACM DRY JOINT RAINSCREEN” based on equal panel scheme (*4 panels, not individually pressure isolated*) identified in this report met the requirements of AAMA 508-14 standard for cavity pressure differential, time shift of pulse, dynamic water penetration and structural performance.

The system contained a cavity volume to vent area ratio of  $1261 \text{ m}^3/\text{m}^2$  ( $4137 \text{ ft}^3 / \text{ft}^2$ ) *for Upper Panels & 1261  $\text{m}^3/\text{m}^2$  ( $4137 \text{ ft}^3 / \text{ft}^2$ ) for Lower Panel* and used four Ø9.0 mm drain/vent holes per upper panel and four Ø9.0 mm drain/vent holes on the lower panel.

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

#### 6.0 REPORT REVISION SUMMARY

**Revision No.:**

17-06-M0258

19-06-B0176

19-06-B0176 RV1

**Date:**

January 8, 2018

November 22, 2019

February 7, 2020

**Description of Revisions:**

Original Document

Report No.: 17-06-M0258 re-issued to  
Engineered Architecturals Ltd.

Updated company name on title page and in  
Section 2.0, page 4.

***Reported by:***



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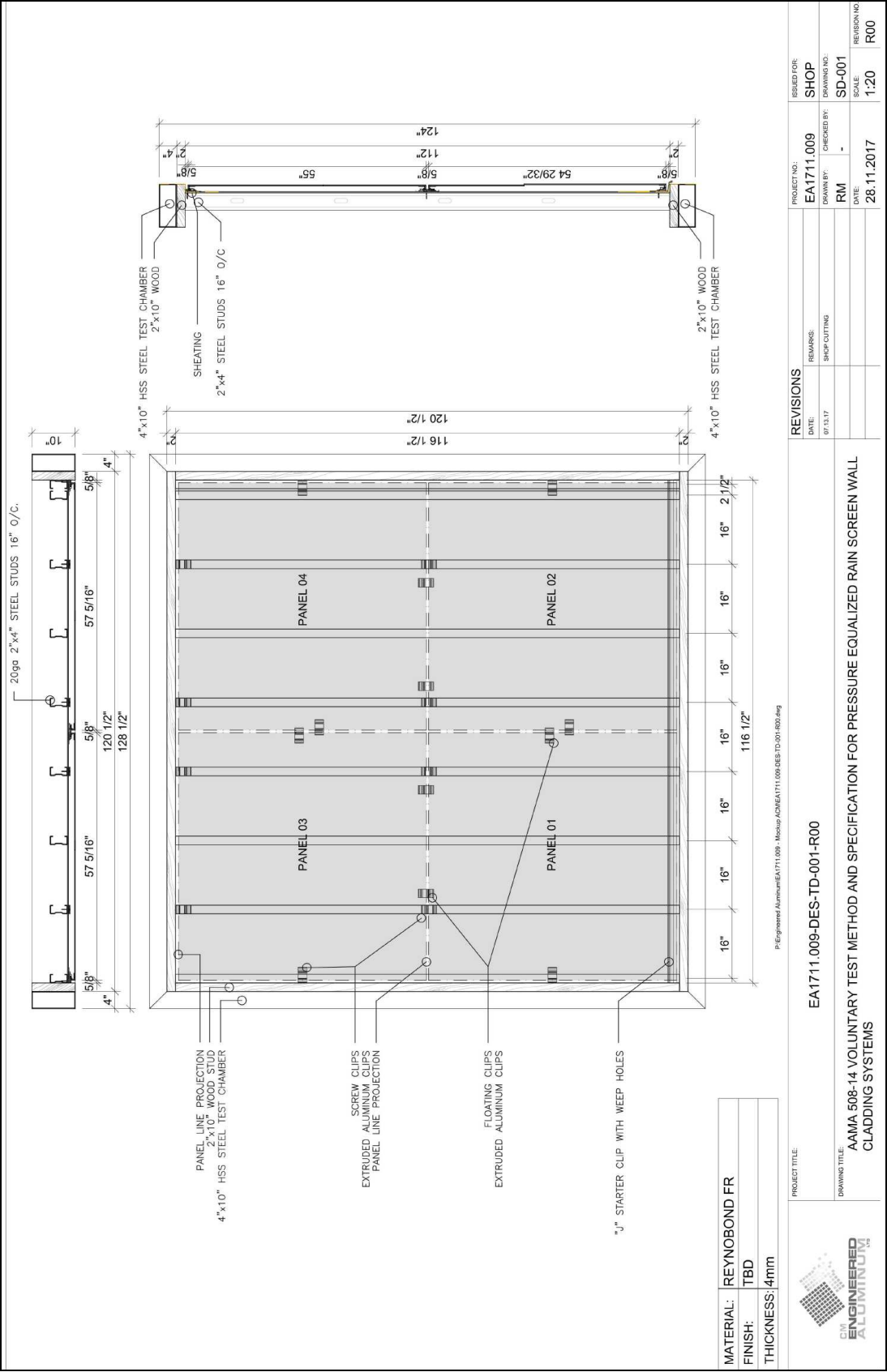
*This report and service are covered under Element Materials Technology Inc.'s. Standard Terms and Conditions of Contract which may be found on our company's website [www.element.com](http://www.element.com), or by calling 1-866-263-9268*

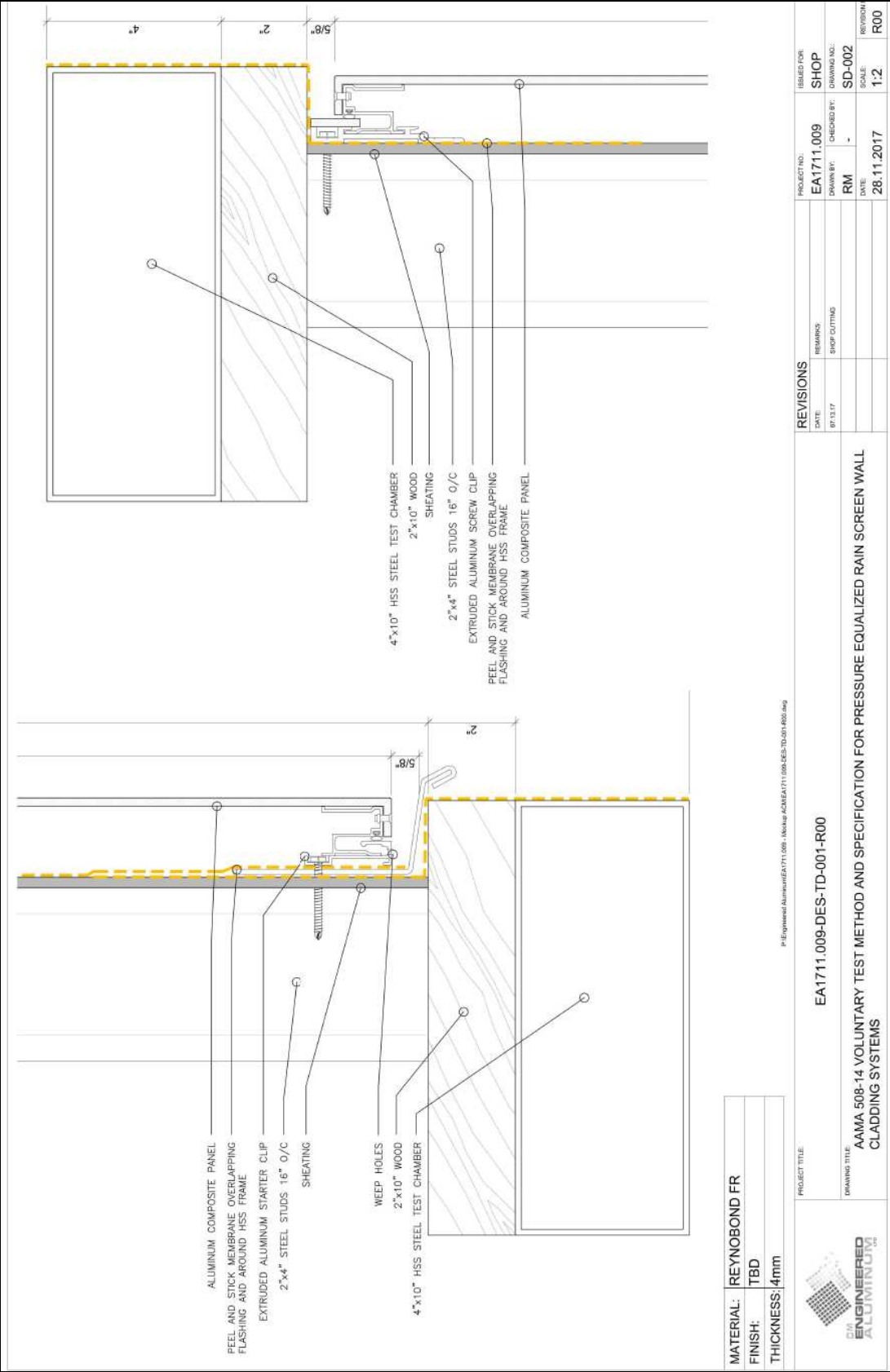


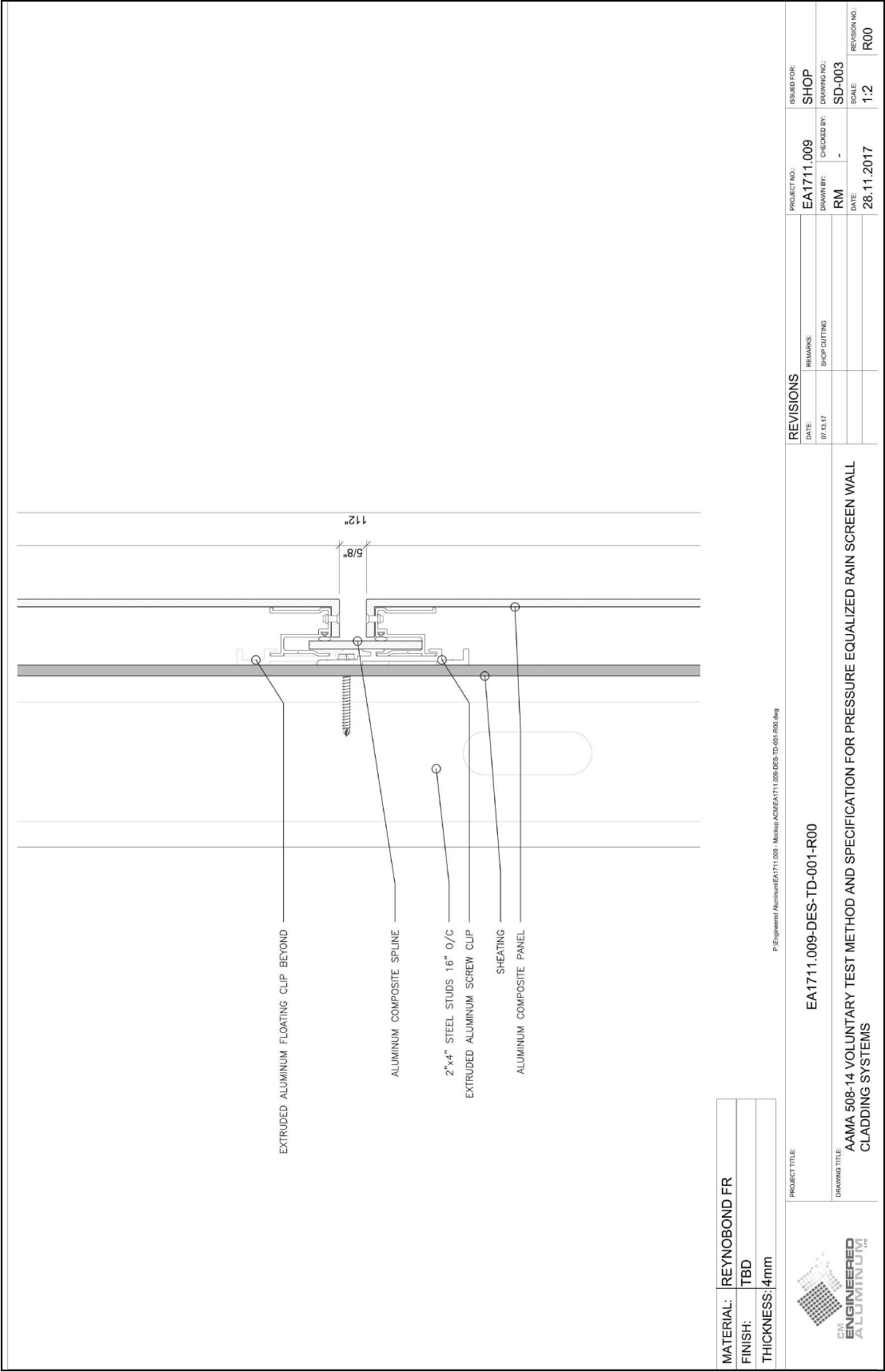
**APPENDIX A**

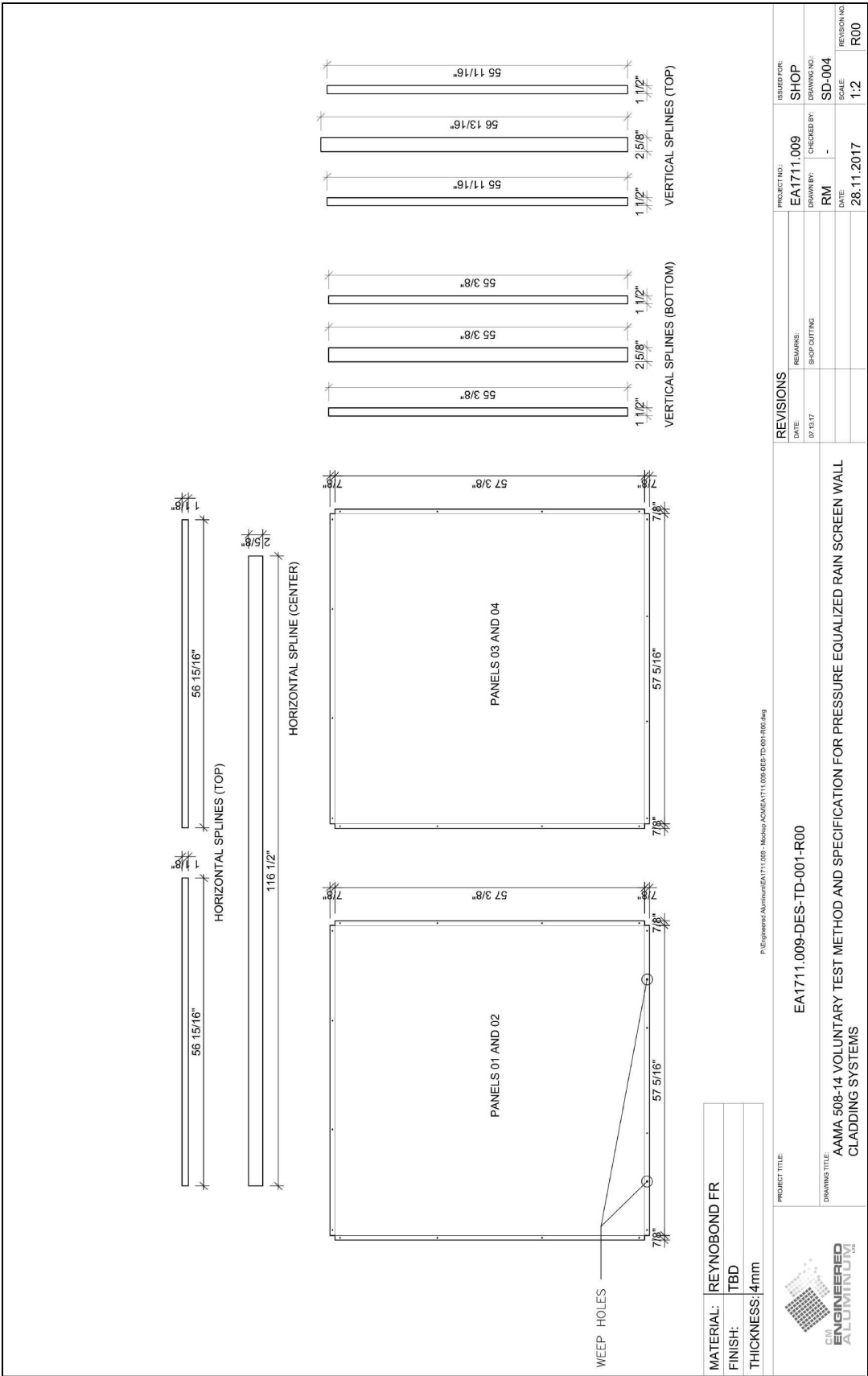
Specimen Bill of Materials and Detailed Drawing as Provided by for Engineered Architecturals Ltd.

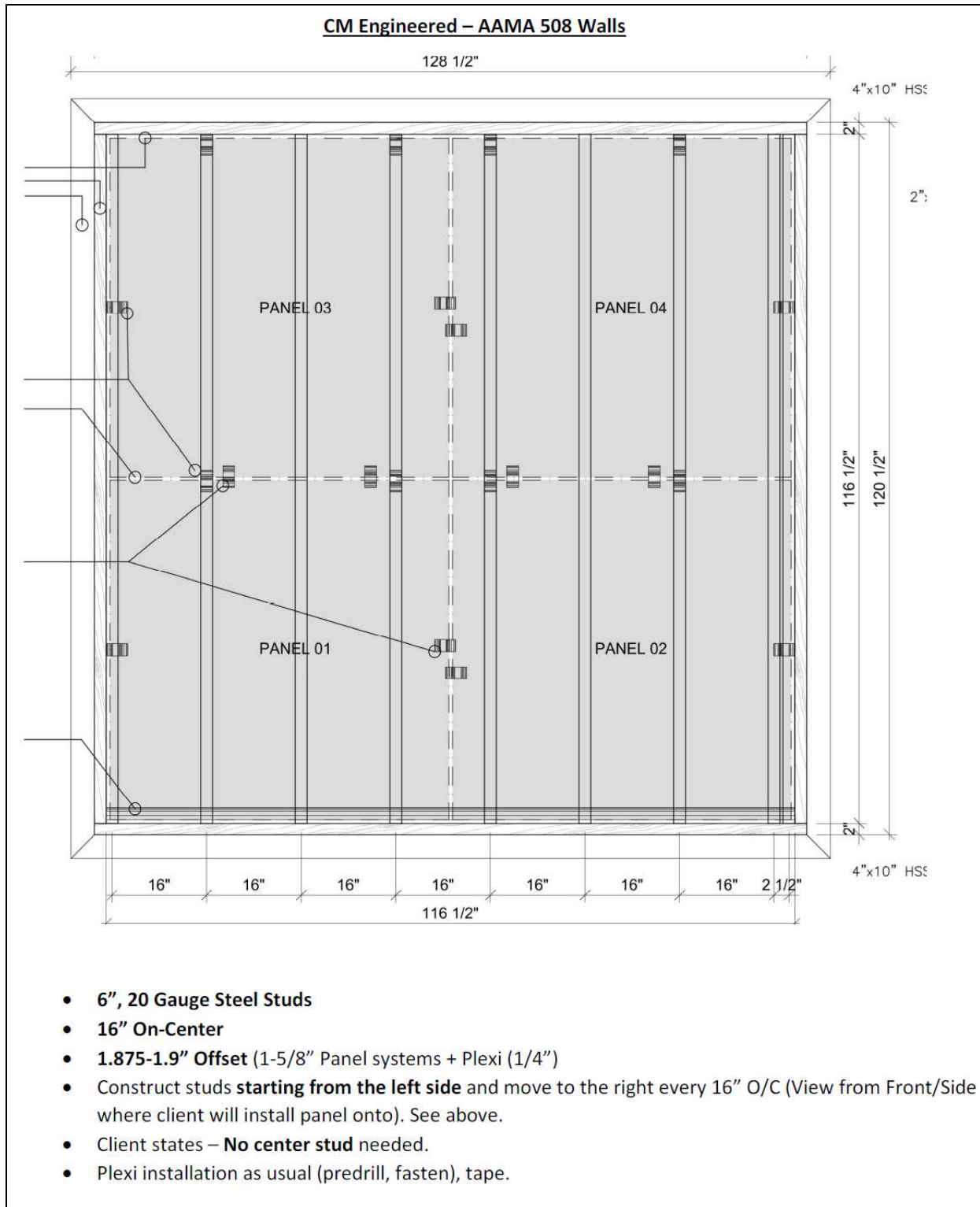
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## **APPENDIX B**

Specimen Construction and Test Photographs

(2 Pages)



Figure B1 – Backup Wall Framing and Plexiglas Installation



Figure B2 – Completed rain screen system within Exova's test frame.





Figure B3 – Test wall mounted within test chamber with spray rack



Figure B4 – Exova's Chamber Prior to Specimen Installation Displaying Location of Air Seal

## **APPENDIX C**

AAMA 501.1-05 Photograph (*Dynamic Pressure Test*)

(1 Page)



Figure C1 – AAMA 501.1 Setup