



**Project 21-088**

**ASTM D7032-17 Mechanical Fastener  
Holding Test – Uplift Resistance**

**for**

**MoistureShield**

**PFS Corporation dba PFS TECO**

Wisconsin Laboratory  
1507 Matt Pass, Cottage Grove, WI 53527  
USA

Phone: 608-839-1013



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## 1. Introduction

PFS TECO conducted uplift resistance tests on the deck board profile, Elevate, manufactured by MoistureShield located in Springdale, AR. Details about the client and product under evaluation are presented in **Tables 1** and **2**. Testing was performed in accordance with ASTM E330/E330M-14, *Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls by Uniform Static Air Pressure Difference*, using guidelines from ASTM D7032-17, *Standard Specification for Establishing Performance Ratings for Wood-Plastic Composite and Plastic Lumber Deck Boards, Stair Treads, Guards, and Handrails*, at PFS TECO's ISO 17025 accredited laboratory in Cottage Grove, Wisconsin. Material for this testing program was sampled by a PFS TECO representative.

**Table 1. Client Information**

Client	Contact
MoistureShield 8145, Bombardier Montreal, Quebec H1J1A5, Canada	Nader Assad Director of R&D, Product Manager nader.assad@oldcastle.com

**Table 2. Product Information**

Product ID	Sample Source	Quantity	Received Date(s)	Description
Deck board: Elevate Profile	PFS TECO Test Sample Selection Report: SMP- 210519 (Attachment 1)	18	June 1, 2021	62-inch long, Grooved edge (Photo 1)
MoistureShield Aegis Clip		90 fasteners		PVC & Composite Epoxy coated, Carbon steel deck screws (Photo 2)



## 2. Test Methods

The tests for evaluation of uplift resistance of the deck board profile and fastening system configuration are summarized in **Table 3**. Samples were received on June 1, 2021. Testing of the Elevate deck board profile was performed between June 24 and June 28, 2021.

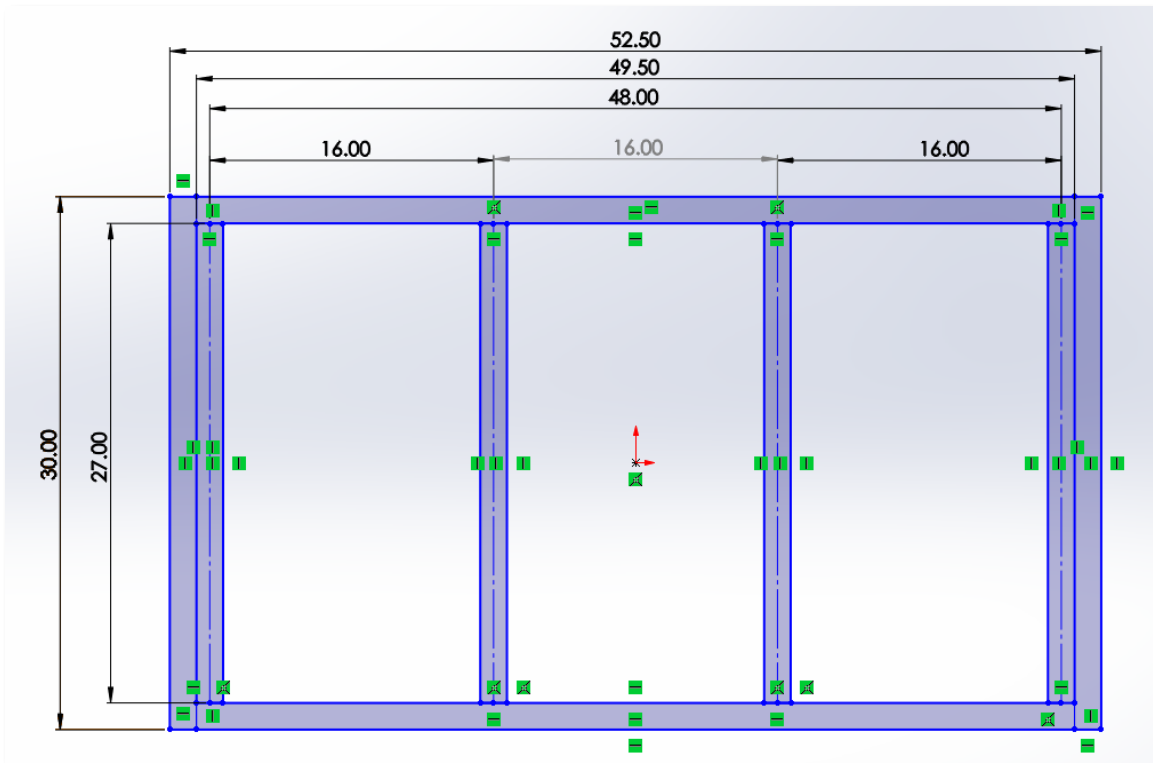
**Table 3. Conducted Tests and Related Information**

Test	Description/Test Direction	No. of Replicates	Referenced Standards	Test Method
Uplift Resistance – Proprietary Fastening System	Uniform load across a deck assembly approximately 4 ft. long and 2 ft. wide	2 deck assemblies	Section 5.5 of ASTM D7032-17	ASTM E330/E330M-14, Procedure B

### 2.1 Uplift Resistance

As specified by Section 5.5 of ASTM D7032, the proprietary fastener system was evaluated in accordance with ASTM E330/E330M-17 Procedure B. The method in ASTM E330/E330M is deemed appropriate for determining the allowable capacity of the fastening system. A 52.5-inch long by 30.0-inch wide frame consisting of 3 span lengths at 16 inches on center was fabricated using nominal 2×10 No. 2 White Fir dimensional lumber as shown in **Figure 1**. Additional blocking was added to the intermediate joists where two boards meet end-to-end over a single joist according to the instructions in the fastener’s installation manual. A 10-mil, 10-foot long by 7-foot wide, plastic sheet was laid on top of the frame before installation of the deck boards. A 49.5-inch long deck board specimen used at the top and bottom rows. A 16.75-inch long and 32.75-inch long deck board specimens were used in the intermediate rows with a staggered arrangement (**Photo 3**). Installation of the deck boards onto the deck frame was performed in accordance with manufacturer’s instructions except the fastening location. The deck assembly was tested immediately fabrication.

Deck assembly was placed onto test chamber with all four edges of frame supported to prevent failure at the joists. The 10-mil plastic sheet was overlapped with the existing plastic sheet on the test machine and the edges were sealed with duct tape. The deck assembly was loaded at 25-psf load increments until failure was achieved. Each load cycle was held for 5 minutes. Upon completion of each load cycle, the deck assembly was allowed to rest for 5 minutes. A displacement transducer was mounted at the center of the deck assembly to continuously monitor and record deflection.



**Figure 1.** Diagram of deck frame for uplift resistance test (all shown values are in inches).

## 2.2 Moisture Content and Specific Gravity

Moisture content of the lumber used for the deck frame was performed in accordance with ASTM D4442, and specific gravity was performed in accordance with ASTM D2395. A sample block was cut from each joist and blocking, and the weight was recorded soon after the completion of the tests. The blocks were dried in an oven with air circulation maintained at 220 °F for 48 hours. The moisture content and specific gravity were based on oven-dry weight and volume.

### 3. Results and Data Analyses

#### 3.1 Uplift Resistance

The uplift resistance test results are summarized in **Table 4**, and the individual test results are presented in **Tables A1** in the **Appendix**. The Appendix also includes deflection graphs shown in **Figure 2**.

A safety factor of 3 in accordance with Section 5.5 of ASTM D7032 yields the allowable load shown in **Table 4**. The predominant failure mode was due to rupture of the clips (**Photo 4**).

**Table 4. Uplift Resistance Results**

Fastener	Ultimate Load (lbf/ft. <sup>2</sup> )	Allowable Load (lbf/ft. <sup>2</sup> )
MoistureShield Aegis Clip	327	109

#### 3.2 Moisture Content and Specific Gravity

The test results for moisture content and specific gravity of the joists used for the deck frame are summarized in **Table 5**, and the individual test results are presented in **Table A2** in the **Appendix**.

**Table 5. Moisture Content and Specific Gravity of Joists**

Statistics	Moisture Content (%)	SG <sub>oven-dry</sub>
Average	9.3	0.51
Std. Dev.	0.2	0.03
CoV	1.7	5.73
Maximum	9.5	0.54
Minimum	9.1	0.48

### 4. Conclusion

The uplift resistance of the MoistureShield Elevate deck board assembly installed with Aegis Clip hidden fastener according to the manufacturer’s installation guide was evaluated. The allowable capacity of Elevate deck board assembly with Aegis Clip was determined to be 109 psf,

## 5. References

ASTM International. West Conshohocken, PA.

- ASTM D2395-17, Standard Test Methods for Density and Specific Gravity (Relative Density) of Wood and Wood-Based Materials
- ASTM D4442-16, Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials
- ASTM D7032-17, Standard Specification for Establishing Performance Ratings for Wood-Plastic Composite and Plastic Lumber Deck Boards, Stair Treads, Guards, and Handrails
- ASTM DE330/E330M-14, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference

**Prepared by:**



**Michael Yee**  
Building Products Engineer

**Authorized by:**

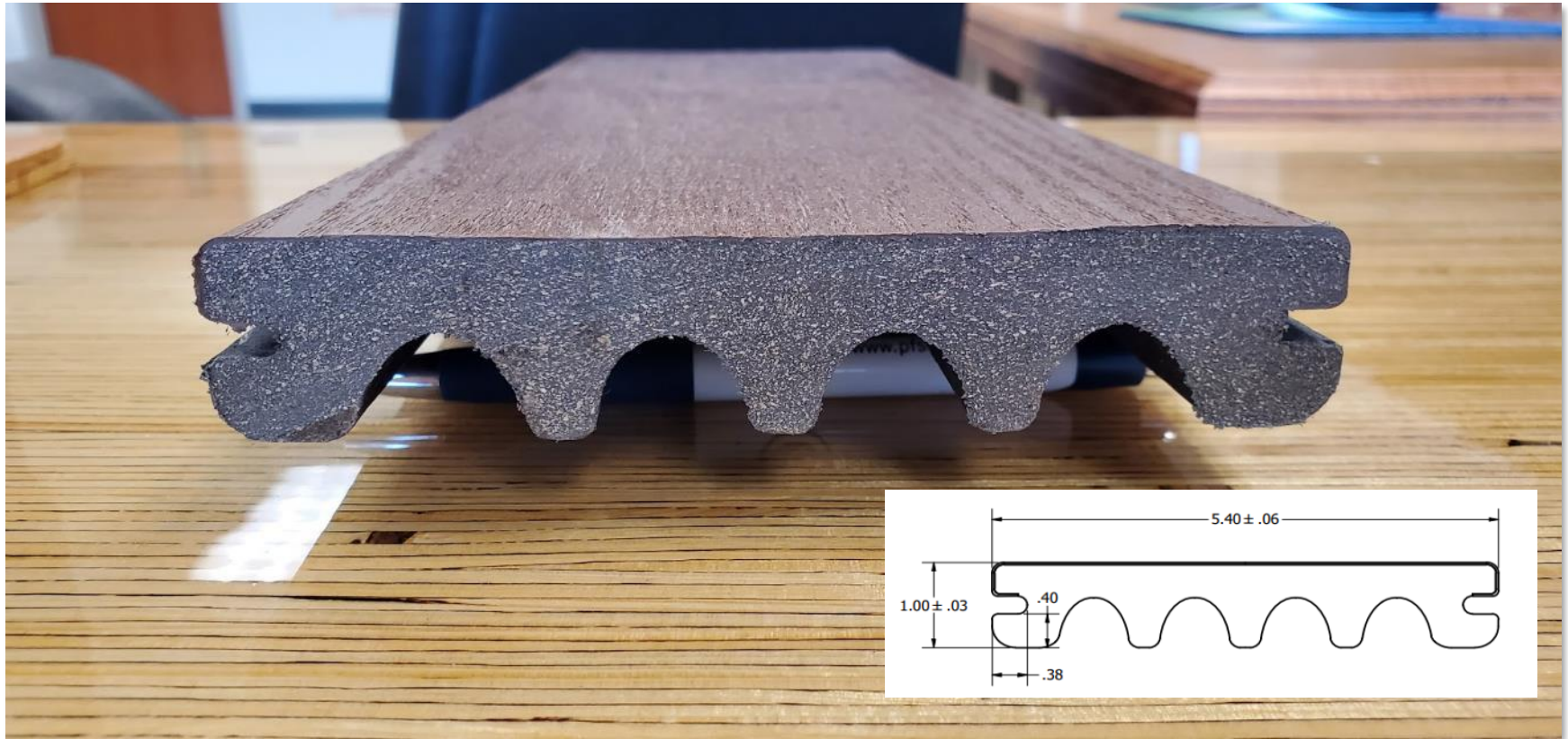


**Deepak Shrestha**  
Director – Building Products  
August 25, 2021

### Attachments

**Attachment 1:** PFS TECO Test Sample Selection Report: SMP-210519

## 6. Photos



**Photo 1.** Cross-sectional view of Elevate profile.





**Photo 2.** Fasteners used for this project. MoistureShield Aegis Clip.



**Photo 3.** Typical deck assembly with staggered deck boards orientation.



**Photo 4.** Predominant failure mode of the uplift resistance test.



## **Appendix A – Test Results**



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**Table A1. Uplift Resistance – Elevate Profile with Aegis Clip**

Step Number	Uplift Load (lbf/ft. <sup>2</sup> )	Deflection (in.)	Set Deflection (in.)	Uplift Load (lbf/ft. <sup>2</sup> )	Deflection (in.)	Set Deflection (in.)
	Assembly #1			Assembly #2		
1	0	0.000	0.000	0	0.000	0.000
2	25	0.002	0.003	24	0.001	0.002
3	51	0.009	0.005	46	0.006	0.002
4	73	0.013	0.001	67	0.008	0.004
5	100	0.019	0.002	90	0.012	0.003
6	117	0.027	0.001	124	0.024	-0.002
7	151	0.036	0.002	145	0.032	0.002
8	167	0.046	0.002	176	0.043	0.000
9	195	0.056	0.002	191	0.050	0.003
10	227	0.066	0.001	216	0.059	0.001
11	255	0.077	0.002	249	0.069	0.000
12	334	0.101	-	319	0.091	-
<b>Observation</b>	<b>Failure due to rupture of Aegis clips</b>			<b>Failure due to rupture of Aegis clips</b>		



**Figure 2.** Deflection versus load plot of the uplift resistance test.



**Table A2. Moisture Content and Specific Gravity of Joists**

Specimen ID	Weight		Dimensions (Oven-dry)			Moisture Content (%)	SG <sub>oven-dry</sub>
	Original mass (g)	Oven-dry mass (g)	Length (in.)	Width (in.)	Thickness (in.)		
21-088-1	86.95	79.5	1.328	4.648	1.474	9.4	0.53
21-088-2	77.52	70.95	1.284	4.640	1.473	9.3	0.49
21-088-3	81.06	74.03	1.723	3.688	1.485	9.5	0.48
21-088-4	87.75	80.42	1.724	3.578	1.479	9.1	0.54
<b>Average</b>	83.32	76.23	1.515	4.139	1.478	9.3	0.51
<b>Std. Dev.</b>	4.88	4.51	0.242	0.585	0.006	0.2	0.03
<b>CoV</b>	5.9	5.9	16.0	14.1	0.4	1.7	5.7
<b>Maximum</b>	87.75	80.42	1.724	4.648	1.485	9.5	0.54
<b>Minimum</b>	77.52	70.95	1.284	3.578	1.473	9.1	0.48