Laboratory Water Penetration Testing

INTRODUCTION

The purpose of this testing was to evaluate the potential for water penetration at the interface of the Prebuck window and door buck with a concrete wall over an extended and extreme exposure period. The exposure period was set up to challenge the stability and durability of the Prebuck buck assembly when used in combination with poured-in-place concrete walls.

The test methods used, and wall assembly will be compared to those previously generated and detailed by ICF Wall Testing and Modeling – Lab Testing Report prepared by RDH Building Engineering Ltd. (RDH) (4975.10 ICF Phase 2, (2013).

TEST METHODOLOGY

Testing of a Prebuck window buck as installed in an ICF wall, with a six-inch concrete core, was performed at the Tremco CPG Building Science Laboratory in Cleveland, Ohio. This test facility can evaluate assemblies that are 20'x16' (6.10 m x 4.88 m), utilizing multi-directional blowers, Labview controller software, and a water recycling system. This facility performs air leakage, water penetration resistance, and structural testing. The equipment is periodically calibrated by a 3rd party for accuracy.

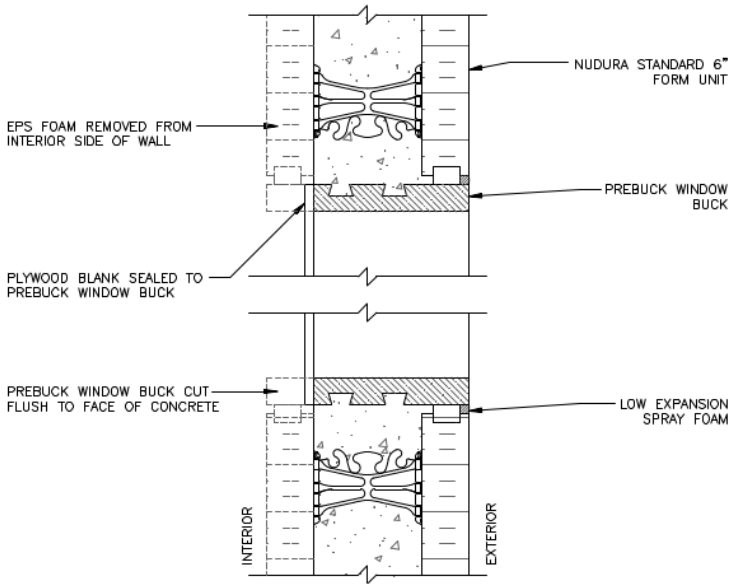
The objective of this testing was to demonstrate that the Prebuck bucking system performs as good or better than traditional walls when exposed to extended and extreme weathering. The testing represented exposed ICF without additional flashing or weather-resistive barriers or finishes installed.

TEST WALL ASSEMBLY CONSTRUCTION

The 8' x 4' (2.44 m x 1.22 m) wall was constructed with Nudura ICF and included a 35" x 35" (889 mm x 889 mm) Prebuck window buck. A plywood blank was used to seal the system and act as the "window" during the water test. The Prebuck Window and Door buck is an engineered solution for punched openings. Produced with 1 ½" (38 mm) thick, treated LSL with a double keyway to allow the buck frame to integrate directly with the concrete when poured.

Diagram 1: 8' x 4' (2.4 m x 1.2 m) Nudura Prebuck Assembly

Diagram 2: Prebuck design detail shown as tested below



Note: The inside face of the EPS foam was removed prior to the test to ensure a clear visual result could be verified.

TEST PROTOCOL

The water tightness of the assembly was evaluated according to ASTM E331, *Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.*

TEST RESULTS

Testing was conducted on April 19th and 20th, 2023. The assemblies were built in the fall of 2022 and left outside laying down horizontally to be weathered throughout the winter and early spring. The purpose of this was to maximize exposure during inclement weather and to provide a weathered assembly for the evaluation. This would represent the worst-case scenario for exposure as it was essentially a bathtub holding water throughout the freeze-thaw cycles of a Cleveland winter.

4.2 Water Penetration

Chapter 14 of the IBC requires ASTM E331 testing to a minimum pressure of 6.24 psf (300 Pa) for a duration of 2 hours. At the Tremco Building Science Lab, we like to extend the evaluation up to 25 psf (1200 Pa). This will include 15 minutes at the initial 1.57 psf (137 Pa), immediately following an increase of 6.24 psf (300 Pa) for 2 hours. The evaluation will include an increase in pressure differentials, at 15-minute intervals for a total duration of 3 hours and 45 minutes, up to and holding at 25 psf (1200 Pa). The table below includes the additional intervals for the Tremco evaluation and is compared to the RDH study, ICF Wall Testing and Modeling. The RDH study included evaluation at pressure differentials of 150 Pa, 300 Pa, and 700 Pa for most of the assemblies.

4.2.1 Water Penetration Test Results

Tremco Test Protocol			*Results from RDH Study				
Water Test Results	**Minutes at pressure differential**	**Nudura ICF with Prebuck Engineered wood**	Module 1A (Internal with buck flashing)	Module 1B (External with buck flashing)	Module 2 A (Direct to concrete)	Module 2 B (EIFS installed on exterior)	Module 2C (Sheathing paper)
2.68 psf (137 Pa)	**15**	**Pass**	150Pa Pass	150Pa Pass	150Pa Pass	150Pa Pass	150 Pa Fail
6.24 psf (300 Pa)	**120**	**Pass**	300 Pa Pass	300 Pa Pass	300 Pa Pass	300 Pa Pass	
9 psf (430 Pa)	**15**	**Pass**					
12 psf (575 Pa)	**15**	**Pass**					
15 psf (718 Pa)	**15**	**Pass**	700 Pa Pass	700 Pa Fail	700 Pa Pass	700 Pa Pass	
18 psf (862 Pa)	**15**	**Pass**					
21 psf (1005 Pa)	**15**	**Pass**					
25 psf (1200 Pa)	**15**	**Pass**					
Comments	**Evaluated successful from 137 pascals to 1200 pascals for a continued 3 hours and 45 minutes**		Evaluated up to 700 Pascals	Failed at 700 Pascals	Evaluated up to 5000 Pascals	Evaluated up to 700 Pascals	Failed at 150 Pa

CONCLUSION

The Prebuck Window buck assembly installed in an ICF wall exceeded the industry requirements for water leakage of the assemblies. This assembly also outperformed key assemblies evaluated in the RDH study. The extended and extreme exposure of the Prebuck assembly provided additional confidence in not only the performance of this critical interface but also when exposed during the construction cycle and throughout the life of the structure. Other tests associated with Prebuck can be found at www.prebuckproducts.com.

We welcome any inquiries into this testing and would appreciate any feedback on additional testing that you would like to see performed. Additionally, we extend the ability to evaluate your specific assembly or project-specific assembly at the Tremco Building Science lab so that we can incorporate your window, façade anchors or adhered veneer, below grade to wall, and roof to wall connections.