Research Summary
Updated: 2019-03-27

Drainage Balance Testing and Wall Comparison

Analysis of drainage and drying potential of ROCKWOOL® stone wool exterior insulation in comparison to extruded polystyrene (XPS)

Implications have been made that ROCKWOOL™ stone wool insulation absorbs water when installed on the exterior side of assembly; and that this absorption negatively affects the performance of the insulation. In-situ applications indicate that altered performance is not detected. In order to adequately demonstrate the implications to be untrue, a third-party investigation was conducted.

RDH Building Science Laboratories (formerly Building Science Labs) was contracted to conduct a laboratory study to determine if ROCKWOOL CAVITYROCK® DD, when installed as rainscreen/drained system, would absorb water during rain events; and compare the results to those of the competitive alternative.

Test Methodology

Full-scale wall assemblies, representative of real-life rainscreen/drained wall assemblies, were built to the following specifications:

- Light gauge steel framing
- Exterior-grade glass-mat faced gypsum board
- Fully-adhered air and water membrane
- Continuous Exterior Insulation
- 3” ROCKWOOL CAVITYROCK® DD
- 2” Extruded Polystyrene (XPS)
- Vertical Z-girts fastened with screws
- Horizontal open-joint cladding of acrylic sheet 6” high with a 1/2” gap between pieces

Figure 1: ROCKWOOL CAVITYROCK® DD test wall assembly

Figure 2: XPS test wall assembly

A spray rack was used to evenly apply water at a spray intensity of 3.4 L/m2·min (5.0 US gal/ft2·hr)[1], based on ASTM Standard E547 (approx. 70 times more rain than 94% of the driving rain rates in Toronto).

[1] Flow Rate of 2.6 GPM (9.8 L/min)

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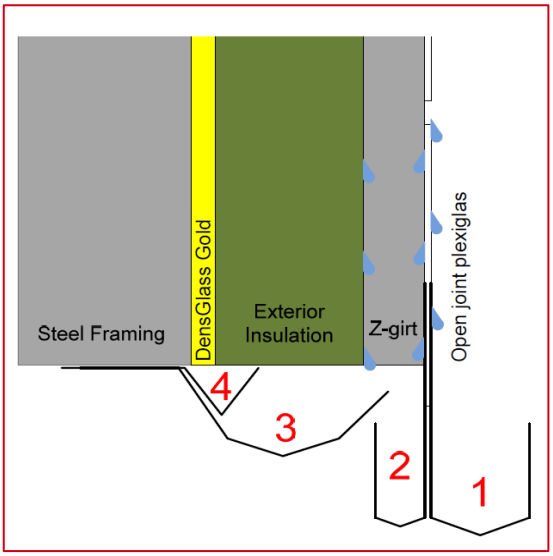

Figure 3: Schematic of drainage trough

The distribution of water through the assembly was measured using a combination of troughs that collected the water at 4 different layers.

1. Exterior surface of the cladding
2. Interior surface of the cladding
3. Exterior surface of the insulation layer
4. Exterior surface of fully adhered membrane

A series of 18 tests were conducted - 8 on the XPS Test Wall and 10 on the ROCKWOOL Test Wall. Between the 18 tests, 2 different application methods were conducted: either a 10 min. application with or without troughs; or a series of 3 min intervals at 15min. apart. The ROCKWOOL Test Assembly was also tested with closed-joint cladding (taped openings) and vinyl siding.

Results and Analysis

The performance of the test walls was compared based on 3 main analysis criteria:

1. The amount of water stored in the assembly following the application of water.
2. The measured volume of water that was collected from each wall surface in the drainage troughs.
3. The length of time required for the wall to dry any stored water.

Water Storage in Assemblies

The difference in storage between the ROCKWOOL test wall and XPS test wall was an average below 270g (10 oz).

Table 1: Water storage comparison- ROCKWOOL® test assemblies and XPS test assemblies (after completion of water application)

	ROCKWOOL CAVITYROCK® DD Test Wall	XPS Test Wall	Difference
2.6 GPM (9.8 L/min) 10 minutes, w/ drainage troughs	682g (24oz) [Avg. Tests 9, 10, 11]	450g (17oz) [Avg. Tests 3, 4, 5]	**203g (7oz)**
2.6 GPM (9.8 L/min) 10 minutes, no drainage troughs	562g (20oz) [Test 13]	306g (11oz) [Test 6]	**255g (9oz)**
2.6 GPM (9.8 L/min) 4 x 3 minutes	589g (21oz) [Test 14]	391g (11oz) [Test 8]	**270g (10oz)**

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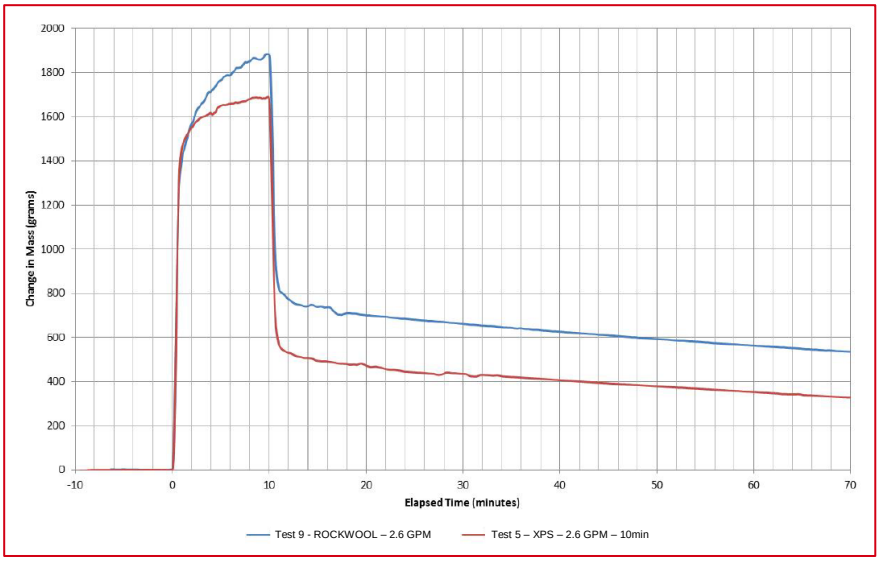

Figure 4: Water storage comparison in ROCKWOOL® assembly [Test Wall 9] and XPS Assembly [Test Wall 5]

The distribtuion of water between the drainage troughs was consistent between both the ROCKWOOL Test Assembly and the XPS Test Assembly for the open-joint rainscreen cladding. No water collection was noted in Trough 4 (exterior side of the membrane).

For the assemblies with taped joints and vinyl siding, the amount of water noted in the drainage troughs to the exterior side of the cladding was significantly higher; indicating less potential for water storage of the insulation with these cladding systems.

Table 2: Summary of Drainage Trough Water Collection

	Trough 1: Exterior of Cladding	Trough 2: Interior of Cladding	Trough 3: Exterior of Insulation
ROCKWOOL Test Assembly [open-joint cladding]	33%	22%	**29%**
XPS Test Assembly [open-joint cladding]	31%	23%	**29%**
ROCKWOOL Test Assembly [taped open-joint]	40%	7%	**11%**
ROCKWOOL Test Assembly [vinyl siding]	70%	0%	**0%**

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Drying Time

The drying of the test walls occurred in the lab, at a constant temperature to both sides of the test wall. The drying analysis indicates that the ROCKWOOL Test Wall dried to similar levels to that of the XPS Test Wall after 5 hours of drying.

Table 3: Drying Comparison – ROCKWOOL® Test Assemblies and XPS Test Assemblies (after 5 hours of drying)

	ROCKWOOL CAVITYROCK® DD Test Wall	XPS Test Wall	Difference
2.6 GPM (9.8 L/min), 10 minutes, drainage troughs	129g (5oz) [Avg. Tests 9, 10, 11]	100g (4oz) [Avg. Tests 3, 4, 5]	**28g (1oz)**
2.6 GPM (9.8 L/min), 10 minutes, no drainage troughs	102g (4oz) [Test 13]	20g (0.7oz) [Test 6]	**82g (3oz)**
2.6 GPM (9.8 L/min),	136g (5oz)	45g (2oz) [Test 8]	**91g (3oz)**

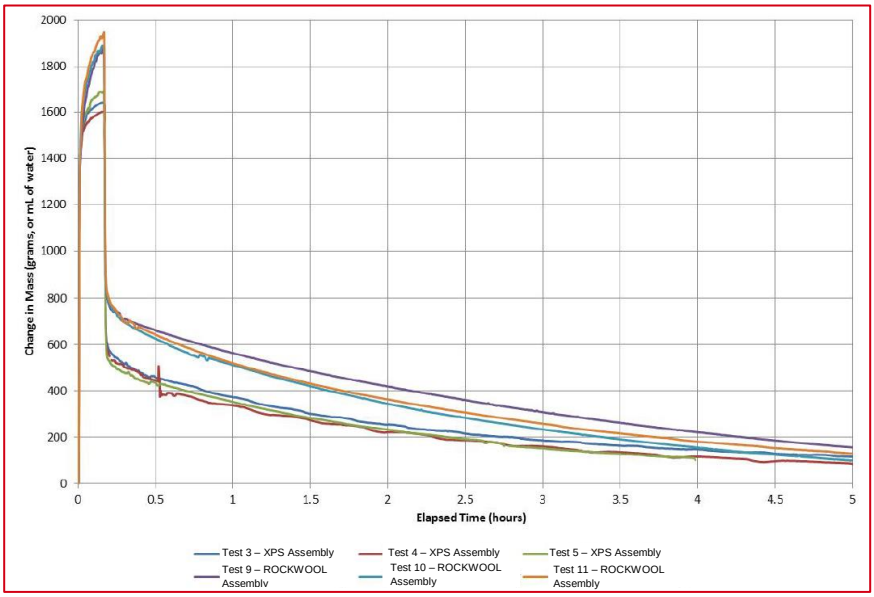

Figure 5: Drying Comparison ROCKWOL Assembly [Test Walls 9, 10, 11] and XPS Assembly [Test Walls 3, 4, 5]

Conclusions

The overall moisture storage in the wall assemblies were below 1%. Minimal differences in storage levels were noted between the ROCKWOOL test assemblies and the XPS test assemblies; with an average difference below 270g (10 oz). Both assemblies also experienced similar drying trends, with an average difference of 67g (2.3oz) after a 5 hour drying period. Based on these results, it can be said that ROCKWOOL CAVITYROCK® DD as an exterior insulation will not result in excessive moisture storage and performance will not be affected, in comparison to XPS as an exterior insulation. This conclusion takes into account that the amount of water applied on the test walls is significantly higher than a typical high rainfall occurrence.

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