RDH BUILDING SCIENCE LABORATORIES

RDH Building Science Laboratories
167 Lexington Court #6
Waterloo, ON N2J 4R9

Making Buildings Better™

TO **Mr. Mike Richmond**
EMAIL **mikerichmond@genyk.com**
Genyk Polyurethane Solution
1701, 3rd Avenue
Shawinigan QC G9T 2W6

10998.000
Genyk Spray Foam Adhesion Testing

DATE December 13, 2016

REGARDING **Adhesion Testing Results**

Dear Mr. Richmond,

As requested by Genyk Polurethane Solution (Genyk), RDH Building Science Laboratories (RDH) is pleased to provide you with this report regarding adhesion testing of Genyk 'Boreal' 2.0 pcf closed cell spray foam (CCMC#14025-L).

Testing Procedure

The 2.0 pcf Genyk spray foam was installed in our lab on two assemblies:

1) Directly on DensGlass Gold exterior gypsum sheathing
2) Blueskin SA adhered to the DensGlass Gold with Blueskin Primer as per the manufacturer's recommendations.

Testing was completed in substantial compliance with ASTM D1623-03 (Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics) for a Type C specimen. Samples 4" by 4" (16 sq. inches) in surface area and 4" in total thickness (including DensGlass sheathing) were chosen. A photograph of a sample is shown in Figure 1. The objective of the test was to demonstrate that the adhesion of the spray foam to the substrate (DensGlass or Blueskin SA in this case) exceeded the Air Barrier Association of America (ABAA) adhesion requirement for an air barrier material on a substrate of 16 psi (110kPa). For the 4"x4" sample size chosen, a load of 256 lbs was the minimum target.

Figure 1 : Prepared Foam sample installed on Blueskin SA for testing

For testing, a steel plate was glued to the gypsum and another steel plate was glued to the surface of the foam on the opposite end of the sample using polyurethane adhesive (Gorilla Glue). The prepared sample was mounted in the test frame as shown in Figure 2. The sample was placed in tension with a rate of applied tension of 1.3mm/minute as per ASTM D1623. A 1000 lb load cell was used to measure the force at a sampling rate of 10Hz. The samples were tested until visible failure.

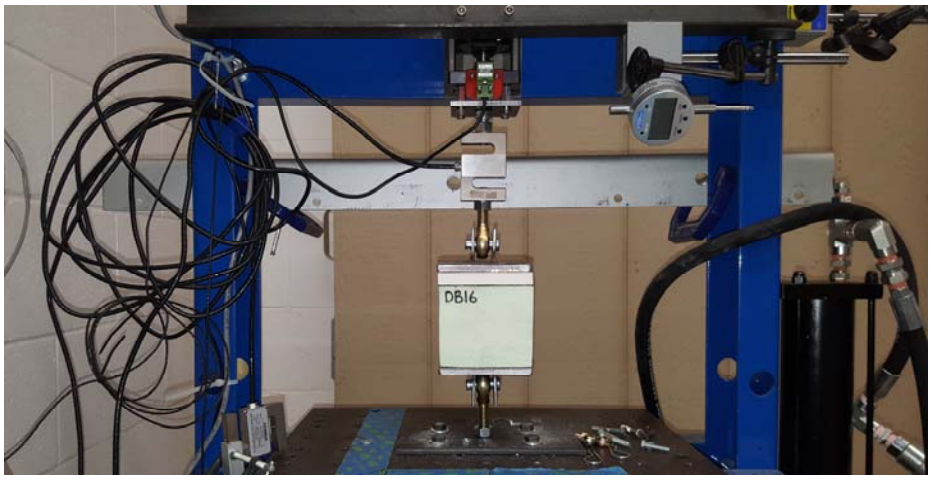

Figure 2 : Sample for adhesion testing mounted in load frame

Testing Results

Table 1 shows a summary of the testing results for five samples of Genyk Boreal installed directly against DensGlass exterior gypsum (D1-D5). The location of adhesion failure was also noted in the results table. For samples D1-D5 which are all direct applied to DensGlass, the foam broke interstitially on four of the samples, and on the remaining sample, the glass facer began peeling off the exterior gypsum. The foam did not fail in adhesion at the surface of the DensGlass/Foam interface in any of the five tests which means that the foam adhesion to DensGlass exceeded 18.7 PSI in every specimen which is above the 16psi requirement.

Table 1 : Adhesion Testing Results of Genyk Boreal on DensGlass Gypsum Sheathing

Sample ID	Substrate	Genyk Boreal applied over	Tensile Strength kPa (PSI)	Exceeds 16 psi	Failure Location
D1	DensGlass	Substrate	140.8 (20.4)	PASS	Interstitial Foam layer
D2	DensGlass	Substrate	180.2 (26.1)	PASS	Interstitial Foam layer
D3	DensGlass	Substrate	162.1 (23.5)	PASS	Gypsum Failure
D4	DensGlass	Substrate	166.5 (24.2)	PASS	Interstitial Foam layer
D5	DensGlass	Substrate	128.8 (18.7)	PASS	Interstitial Foam layer

Table 2 shows a summary of the testing results for thirteen samples of Genyk Boreal installed against Blueskin SA (DB1-DB5 and DB10-DB17). The location of adhesion failure was also noted in the results table. Eight of the thirteen samples did not reach the minimum 15.0 psi required to pass, although none of these samples failed at the interface of the foam and the Blueskin, so the adhesion of the Blueskin to the foam was not measured. In the remaining five samples the failure load was greater than 18.5 psi or

290 total pounds which means that in all cases the adhesion between the foam and the Blueskin exceeds the Pass criteria of 16 PSI. In only two of the five samples that passed did the foam adhesion to the Blueskin fail before another failure mechanism.

Table 2 : Adhesion Testing Results of Genyk Boreal on Blueskin SA

Sample ID	Substrate	Genyk Boreal applied over	Tensile Strength kPa (PSI)	Exceeds 16 psi	Failure Location
DB13	DensGlass	Blueskin SA	128.5 (18.6)	PASS	delamination of Foam from Blueskin
DB15	DensGlass	Blueskin SA	117.8 (17.1)	PASS	delamination of Foam from Blueskin
DB10	DensGlass	Blueskin SA	147.4 (21.4)	PASS	interstitial foam layer (midde)
DB14	DensGlass	Blueskin SA	141.2 (20.5)	PASS	delamination of Blueskin from Gypsum
DB17	DensGlass	Blueskin SA	129.3 (18.8)	PASS	delamination of Blueskin from Gypsum
DB1	DensGlass	Blueskin SA	73.7 (10.7)	FAIL	delamination of Blueskin from Gypsum
DB2	DensGlass	Blueskin SA	74.2 (10.8)	FAIL	delamination of Blueskin from Gypsum
DB3	DensGlass	Blueskin SA	57.4 (8.3)	FAIL	delamination of Blueskin from Gypsum
DB4	DensGlass	Blueskin SA	79.1 (11.5)	FAIL	delamination of Blueskin from Gypsum
DB11	DensGlass	Blueskin SA	92.6 (13.4)	FAIL	delamination of Blueskin from Gypsum
DB12	DensGlass	Blueskin SA	94.1 (13.7)	FAIL	delamination of Blueskin from Gypsum
DB16	DensGlass	Blueskin SA	78.3 (11.4)	FAIL	delamination of Blueskin from Gypsum
DB5	DensGlass	Blueskin SA	98.7 (14.3)	FAIL	delamination of Blueskin from Gypsum

Conclusions

In all tests of the Genyk Boreal 2.0pcf closed cell spray foam installed directly on DensGlass Gold exterior sheathing, the adhesion between the DensGlass and Boreal spray foam exceeded the pass criteria of 16 PSI (2300 pounds per square foot).

The adhesion tests that included Blueskin SA, had some adhesion failures of the Blueskin releasing from the DensGlass. There were no instances of adhesion failure of the Boreal spray foam on the Blueskin SA below the 16 PSI minimum requirement. Five samples exceeded the 16 PSI minimum requirements. In the two samples where the foam delaminated from the Blueskin SA before any other mechanisms of failure, the loads were 17.1 PSI (FB15) and 18.6 PSI (DB13). In samples DB14 and DB10, failure occurred at 20.5 PSI and 21.4 PSI respectively, and these failures were not at the interface between the spray foam and the Blueskin SA.

If you have any questions after reading this report, please do not hesitate to contact us by phone or email.

Yours truly,

Jonathan Smegal
Senior Project Manager
jsmegal@rdh.com
RDH Building Science Inc.

Aaron Grin P.Eng.
Senior Project Engineer
agrin@rdh.com
RDH Building Science Inc.