

CLIENT: GENYK
1701, 3E Avenue, Shawinigan, QC
G9T 2W6

Engineering Evaluation Report No: T1296-5a

Issue Date: December 11, 2020

PRODUCT ID: Genyk wall assembly containing Boreal Nature Elite medium density spray-applied polyurethane foam insulation with a cement board and stucco finish and Genyk wall assembly containing Boreal Nature Elite medium density spray-applied polyurethane foam insulation with a steel face.

Detailed description of the evaluated product can be found on page 2 and 3.

AUTHORIZATION: QAI Proposal 20JL09253 to a Genyk Solution Polyurethane authorized by Yves Rondeau dated October 1, 2020.

EVALUATION REQUESTED: Engineering Services / Engineering Evaluation of Genyk wall assembly containing Boreal Nature Elite medium density spray-applied polyurethane foam insulation with a cement board and stucco finish and Genyk wall assembly containing Boreal Nature Elite medium density spray-applied polyurethane foam insulation with a steel face to evaluate the effect of:
Using a thicker gauge steel on the exterior cladding then tested.
Using a corrugated steel skin in lieu of the flat steel skins tested.
Use of a range of Foam insulation thicknesses up to a maximum of what was tested.

CONCLUSION: It is QAI's opinion based on the rational noted in this report the following systems will meet the requirements of NBC Article 3.2.3.8. Sentence 2 when exposed to the time temperature curve of CAN/ULC S101 for 15 minutes duration:

ASSEMBLY	FRAMING	SHEATHING	EXTERIOR INSULATION	CLADDING
1	Steel Stud	Minimum 13 (1/2 inch) exterior gypsum	≤ 102 mm (4 inches) Boreal Nature Elite medium density Spray-applied polyurethane foam insulation	≥ 24 Gauge galvanized sheet steel, with 51 mm (2 inch) joint overlap, self-drilling screws spaced at 305 mm (12 inch) on center maximum.
2	Steel Stud	Minimum 13 (1/2 inch) exterior gypsum	102 mm (4 inches) Boreal Nature Elite medium density Spray-applied polyurethane foam insulation	≥ 24 Gauge galvanized corrugated steel, with 51 mm (2 inch) joint overlap, self-drilling screws spaced at 305 mm (12 inch) on center maximum.
3	Steel Stud	Minimum 13 (1/2 inch) exterior gypsum	≤ 102 mm (4 inches) Boreal Nature Elite medium density Spray-applied polyurethane foam insulation	51 mm (1/2 inch) Cement Board with stucco finish of 4 mm thickness.

Prepared By

**Signed for and on behalf of
QAI Laboratories Ltd.**



**Scott Leduc
Fire Lab Supervisor**

**Lawrence Gibson, P. Eng.
Executive Vice-President**

1.0 EVALUATION PURPOSE:

At the request of Genyk Solution Polyurethane, QAI has evaluated the following alternate constructions for of Genyk wall assembly containing Boreal Nature Elite medium density spray-applied polyurethane foam insulation with a cement board and stucco finish or the Genyk wall assembly containing Boreal Nature Elite medium density spray-applied polyurethane foam insulation with a steel face:

- 1) Using thicker gauge steel on the exterior cladding then tested.
- 2) Using a corrugated steel skin in lieu of the flat steel skins tested.
- 3) Use of a range of Foam insulation thicknesses up to a maximum of what was tested.

2.0 PRODUCT DESCRIPTION:

Original Tested Systems:

Assembly Description 1: Genyk wall assembly containing Boreal Nature Elite medium density spray-applied polyurethane foam insulation with a steel face

COMPONENT	DESCRIPTION – See QAI Test Report T1296-5 dated December 7, 2020	
Wall Assembly	Size:	3.05 m (10 ft.) wide by 3.05 m (10 ft.) high by 152 mm (6 in.) thickness.
	Type:	Exterior Insulated wall system.
	Framing:	25 Gauge 92 mm by 32 mm (3.625 in. by 1.25 in.) steel stud.
	Sheathing:	13 mm (0.5 in.) DenseGlass Gold fiberglass mat gypsum.
	Insulation:	102 mm (4 in.) Boreal Nature Type 2 spray-applied polyurethane foam insulation.
	Exterior Perimeter Channel:	20 Gauge galvanized steel C-channel with dimensions of 127 mm (5 in.) depth, one 38 mm (1.5 in.) leg and one 25 mm (1 in.) leg.
	Exterior Z-Bar:	20 Gauge galvanized steel Z-Bar with dimensions of 127 mm (5 in.) depth and 38 mm (1.5 in.) legs mounted horizontally spaced 406 mm (16 in.) on center.
	Exterior Panel:	24 Gauge galvanized sheet steel with 51 mm (2 in.) overlap at the joints. The sheet was fastened with self-drilling sheet metal screws spaced 305 mm (12 in.) on center.

Assembly Description 2: Genyk Solution Polyurethane, QAI has evaluated the following alternate constructions for of Genyk wall assembly containing Boreal Nature Elite medium density spray-applied polyurethane foam insulation with cement board and stucco finish

COMPONENT	DESCRIPTION See QAI Test Report T1296-6 dated December 7, 2020	
Wall Assembly	Size:	3.05 m (10 ft.) wide by 3.05 m (10 ft.) high by 152 mm (6 in.) thickness.
	Type:	Exterior Insulated wall system.
	Framing:	25 Gauge 92 mm by 32 mm (3.625 in. by 1.25 in.) steel stud.
	Sheathing:	13 mm (0.5 in.) DenseGlass Gold fiberglass mat gypsum.
	Insulation:	102 mm (4 in.) Boreal Nature Type 2 spray-applied polyurethane foam insulation.
	Exterior Perimeter Channel:	20 Gauge galvanized steel C-channel with dimensions of 127 mm (5 in.) depth, one 38 mm (1.5 in.) leg and one 25 mm (1 in.) leg.
	Exterior Z-Bar:	20 Gauge galvanized steel Z-Bar with dimensions of 127 mm (5 in.) depth and 38 mm (1.5 in.) legs mounted horizontally spaced 406 mm (16 in.) on center.
	Exterior Panel:	51 mm (0.5 in.) thick PermaBase cement board fastened to the perimeter C-channel and Z-bar using no. 8 by 32 mm (1.25 in.) self-drilling cement board screws spaced 305 mm (12 in.) on center. The board was mounted horizontally and included horizontal and vertical joints.
Stucco Finish:	Base coat was applied using ADEX Drymix basecoat applied to an approx. thickness of 4 mm with ADEX standard 4.5 oz. glass fiber-reinforced mesh embedded. The finish coat was applied to coverage of approx. 0.4 m ² /kg with ADEX Elasticoat Fine Regular.	

Both wall assemblies were tested with the exterior face oriented towards the fire

Proposed System:

- 1) For the above described Assembly 1, substitute the exterior panel, 24 Gauge galvanized sheet steel with thicker gauge steel.
- 2) For the above described Assembly 1, substitute the exterior panel, 24 Gauge galvanized sheet steel with a 24 Gauge or thicker corrugated steel skin.
- 3) For the above described Assembly 1 or 2, the use of a range of Foam insulation thicknesses up to a maximum of what was tested.

3.0 REFERENCED STANDARDS AND REPORTS:

- National Building Code of Canada 2015 (NBC), Article 3.2.3.8. Protection of Exterior Building Face, Sentence 2 CAN/ULC S101 15-Minute Stay In Place test.
- CAN/ULC S101 Standard Methods of Fire Endurance Tests of Building Construction and Materials
- Genyk wall assembly containing Boreal Nature Elite medium density spray-applied polyurethane foam insulation with cement board and stucco finish, Report No: QAI T1296-6, dated December 7, 2020.
- Genyk wall assembly containing Boreal Nature Elite medium density spray-applied polyurethane foam insulation with a steel face. Report No: QAI T1296-5, dated December 7, 2020.

4.0 ENGINEERING EVALUATION:

4.1 Requirements

The proposed modifications to the tested system must not reduce the ability of the tested system to meet the requirements of Article 3.2.3.8. Protection of Exterior Building Face, Sentence 2 CAN/ULC S101 15-Minute Stay In Place test which reads as follows:

3.2.3.8 2) The criteria for testing and the conditions of acceptance for a wall assembly to satisfy the requirements of Clause (1)(b) are that:

- a) the fire exposed area of the wall assembly shall be not less than 9.3 m² and have no dimension less than 2.75 m,
- b) the exposed surface shall include typical vertical and horizontal joints,
- c) the test shall be continued for not less than 15 min and the standard time/temperature curve of the referenced standard shall be followed,
- d) the non-combustible protective material must remain in place and no through openings should develop that are visible when viewed normal to the face of the material, and
- e) the non-combustible protective material should not disintegrate in a manner that would permit fire to propagate along the surface of the test assembly.

4.3 Findings:

The essential requirements of 3.2.3.8 2) are that a representative test sample of sufficient size provides protection for a minimum of 15 minutes such that the wall system will not permit fire to propagate along the surface of the test assembly. QAI test reports T1296-5 and T1296-6 describe Genyk Solution Polyurethane wall systems that have met these requirements.

With respect to the proposed changes to the system:

- 1) For Assembly 1, substitute the exterior panel, 24 Gauge galvanized sheet steel with thicker gauge steel. In fire protection tests increasing the thickness of a steel sheet increases the fire resistance of the system. Thicker steel will absorb more energy so in a short test of 15 minutes the amount of thermal expansion, buckling, and distortion that would normally cause a failure will be reduced hence the system would be expected to perform better. It is assumed that any structural issues that may result from the increased weight of thicker steel panels will be appropriately engineered by others.
- 2) For the above described Assembly 1, substituting the exterior panel, 24 Gauge galvanized sheet steel with a 24 Gauge or thicker corrugated steel skin. In fire protection tests adding corrugations will increase the resistance of steel sheet to resist buckling and distortion that would normally cause a failure during a fire test hence the system would be expected to perform better. It is assumed that any structural issues that may result from the increased weight of thicker steel panels or change in the profile will be appropriately engineered by others.
- 3) For the above described Assembly 1 or 2, allow the use of a range of foam insulation thicknesses up to a maximum of what was tested. The above systems were tested with a maximum of 102 mm (4 in.) Boreal Nature Elite medium density spray-applied polyurethane foam insulation. Decreasing the thickness of the polyurethane foam should reduce the fuel contributed from the wall which should make the system perform better for fire resistance. The ULC S101 test is designed to follow a specific time-temperature curve, while most furnaces can accurately control to this curve, some wall systems that have a high fuel load may cause temperature to exceed the required time-temperature curve, by reducing the fuel load the likelihood of excessive temperatures are reduced hence the wall would be expected to perform equal or better. If the reduced insulation thickness does not change the ability of the furnace to meet the required time temperature curve the results of the test should be the same. A review of the T1296-5 and T1296-6 data shows there did appear to be some additional fuel contribution from the wall from 4 to 10 minutes into the test that caused the furnace to slightly exceed its required control curve. Reducing the fuel contributed would be expected to decrease the temperature closer to the required control curve resulting in better performance.

5.0 CONCLUSION:

It is QAI’s opinion based on the rational noted in this report that:

- 1) The use of thicker gauge steel on the exterior cladding of the tested Genyk wall assembly containing Boreal Nature Elite medium density spray-applied polyurethane foam insulation with a steel face will perform equivalent to the tested system for fire resistance.
- 2) The use of corrugated steel skin of the same gauge or thicker for the exterior cladding of the tested Genyk wall assembly containing Boreal Nature Elite medium density spray-applied polyurethane foam insulation with a steel face will perform equivalent to the tested system for fire resistance.
- 3) The use of a range of foam insulation thicknesses up to the maximum tested (102 mm 4in) in either the Genyk wall assembly containing Boreal Nature Elite medium density spray-applied polyurethane foam insulation with cement board and stucco finish or the Genyk wall assembly containing Boreal Nature Elite medium density spray-applied polyurethane foam insulation with a steel face will perform equivalent to the tested system for fire resistance.

5.0 REVISION HISTORY:

Date	Revision	Change Description	Initials
Dec. 11, 2020	-	Original Report	SL

*****<END OF REPORT>*****