Evaluation Report CCMC 14077-R
WALLTITE® XL

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1. Opinion

It is the opinion of the Canadian Construction Materials Centre (CCMC) that "WALLTITE® XL," when used as a thermal insulation in accordance with the conditions and limitations stated in Section 3 of this Report, complies with the National Building Code (NBC) of Canada 2010 and 2015:

- Clause 1.2.1.1.(1)(b) of Division A, as an alternative solution that achieves at least the minimum level of performance required by Division B in the areas defined by the objectives and functional statements attributed to the following applicable acceptable solutions:
  - Article 5.9.1.1., Compliance with Applicable Standards (NBC 2015)
  - Article 5.10.1.1., Compliance with Applicable Standards (NBC 2010)
  - Clause 9.25.2.2.(1)(g), Insulation Materials (NBC 2010)
  - Clause 9.25.2.2.(1)(h), Insulation Materials (NBC 2015)
  - Article 9.25.2.5., Installation of Spray-Applied Polyurethane (NBC 2010 and NBC 2015)

This opinion is based on CCMC's evaluation of the technical evidence in Section 4 provided by the Report Holder.

Ruling No. 18-04-353 (14077-R) authorizing the use of this product in Ontario, subject to the terms and conditions contained in the Ruling, was made by the Minister of Municipal Affairs and Housing on 2018-04-12 pursuant to s.29 of the Building Code Act, 1992 (see Ruling for terms and conditions). This Ruling is subject to periodic revisions and updates.

2. Description

"WALLTITE® XL" is a spray-applied rigid polyurethane foam of medium density that has a closed-cell structure. The foaming system consists of two components that must be labelled with "CCMC 14077-R" and the following information:

- Isocyanate (Component A): "Elastospray® 8000A"; and
- Resin (Component B): "WALLTITE® XL."

The two components are mixed on site by a BASF Canada Inc.'s qualified installer (see Section 3.2) with fixed-ratio positive displacement equipment.

A thick layer of "WALLTITE® XL" can be applied in a single pass. The product is installed at a maximum nominal thickness of 125 mm and a minimum nominal thickness of 50 mm. By contrast, this installation method differs from CAN/ULC-S705.2-05, "Standard for Thermal Insulation – Spray Applied Rigid Polyurethane Foam, Medium Density – Application" that specifies a 50-mm maximum nominal thickness for spray foam installed in one pass.

The final cured product has a density of 34.0 kg/m^3 and is available in the following colours:

- purple (until April 30, 2019)
- dark purple (from February 11, 2019, onward)

At 50-mm thick, the design long-term thermal resistance (LTTR) is 2.05 (m^2·K)/W.

The product is available in winter grade and regular grade formulations.

3. Conditions and Limitations

CCMC's compliance opinion in Section 1 is bound by "WALLTITE® XL" being used in accordance with the conditions and limitations set out below.

3.1 General

- The cured polyurethane foam must have a minimum nominal thickness of 50 mm and a maximum nominal thickness of 125 mm. Any product sprayed to a thickness greater than 140 mm (maximum nominal thickness + 15 mm) must be removed immediately from the substrate and sprayed again. Spraying to a thickness greater than 140 mm may result in spontaneous combustion and poor foam quality.
- The application of the foam in multiple passes is beyond the scope of this evaluation.
- The polyurethane foam can be applied on the substrates listed in Table 4.2.1. Substrates must be clean, dry, and free of grease, frost, dust, rust and other contaminants that may affect the adhesion performance of the foam to the substrate.
- Below-grade application (exterior side of foundation wall) and attic application are beyond the scope of this evaluation.
- As required in Article 9.25.2.3., Installation of Thermal Insulation, of Division B of the NBC 2010 and NBC 2015, the insulation shall have a reasonably uniform insulation value over the entire face of the insulated area.
- The assessment of the fire hazard-peak temperature reached during foam application is only valid for the tested substrates specified in Table 4.4.1 and for foam applied in one single pass with a maximum nominal thickness of 125 mm.
- The peak temperatures of the thick single pass may affect the performance and durability of material and equipment in contact with the foam, such as ducts and pipes. Performance of such components is beyond the scope of this evaluation. The measured maximum temperature of the foam while curing is published in Table 4.4.1 for designers, builders, authorities having jurisdiction (AHJ), and other users to verify the potential fire hazard on utility services installed in the wall prior the foam installation. It is important to consider the timeframe for the foam to reach ambient temperature in order to lower the risk of damage especially when installed over melting materials. For further details, see Table 4.4.1.
- The interior side of the polyurethane foam insulation must be covered with an approved thermal barrier as per:
    - Article 3.1.4.2., Protection of Foamed Plastics, of Division B of the NBC 2010 or NBC 2015;
    - Article 3.1.5.12., Combustible Insulation and its Protection, of Division B of the NBC 2010;
    - Article 3.1.5.15., Foamed Plastic Insulation, of Division B of the NBC 2015; or
    - Article 9.10.17.10., Protection of Foamed Plastics, of Division B of the NBC 2010 or NBC 2015.
- The exterior surface of an exterior wall containing this insulation must be designed in accordance with Section 9.10, Fire Protection, of Division B of the NBC 2010 or NBC 2015, or Section 3.2, Building Fire Safety, of Division B of the NBC 2010 or NBC 2015, when applicable. The product must not be used in exposed interior or exterior locations.
- The insulation must be kept away at least 75-mm (or as required by building regulations and safety codes) from heat-emitting devices, such as recessed lighting fixtures and chimneys. The insulation must not be used inside electrical outlets or junction boxes.
- For retrofit construction the time to occupancy is one (1) day when installed with the requisite ventilation of the segregated retrofit area as per CAN/ULC-S705.2. See further details in Note 3 of Table 4.1.1.
- When the product is installed in an exterior insulation sheathing-type application, the low air and water vapour-permeance value of the product requires that the wall assembly conform to Table 9.25.5.2., Ratio of Outboard to Inboard Thermal Resistance, of Division B of the NBC 2010 or NBC 2015.
- The product must not be installed after the expiry date printed on the label of each container. The product has a shelf life of 9 months from the date of manufacture.
- The substrate temperatures are −10°C to 5°C for the winter formulation and 0°C to 40°C for the regular formulation. Appropriate formulation must be chosen for the specific temperature conditions of application in consultation with BASF Canada Inc.
- The installation of the product must conform to the general requirements of CAN/ULC-S705.2-05, manufacturer's installation instructions and Section 3.1 and 3.2 of this Evaluation Report.
- The continuous in-service temperature of the insulation must not exceed the range of −60°C to 80°C.
- The building envelope in which this product is installed must conform to the requirements of Division B of the NBC 2010 or NBC 2015 for vapour barrier, air barrier and dampproofing (interior below-grade walls).

- The product must be protected from ultraviolet radiation within 90 days of installation.
- The installation must be carried out by certified installers in accordance with the manufacturer's instruction manual, which must be available at the job site at all times during the installation for review by the building official.
- The components, "Elastospray® 8000A" isocyanate and "WALLTITE® XL" resin, must have their respective containers (i.e. drums) identified by the phrase "CCMC 14077-R."

3.2 Qualified Installers

This is a site-manufactured product whereby BASF Canada Inc. requires that only specific qualified installers be authorized to install their proprietary spray polyurethane insulation in buildings. In accordance with the BASF Canada Inc. site quality assurance program (SQAP), the certification organization (CO) Caliber Quality Solutions Inc. (Caliber) has been commissioned to license the specified installers and issue them the required CO identification card. All specified installers must have a Caliber identification card.

3.3 Third-party Site Auditing of Qualified Installers

As part of their SQAP, BASF Canada Inc., also stipulates site audit inspections be conducted by site inspectors licensed by Caliber. Upon completion of the site audit, Caliber will report the product's conformity results and any corrective action, if necessary, to BASF Canada Inc. Building officials who would like site-audit inspections to be conducted on specific building sites can contact Caliber at:

Caliber Quality Solutions Inc. (Caliber)
120 Eglington Avenue East
Suite 1000
Toronto, ON M4P 1E2
888-572-7435

4. Technical Evidence

The Report Holder has submitted technical documentation for CCMC's evaluation. Testing was conducted at laboratories recognized by CCMC. The corresponding technical evidence for this product is summarized below.

The following were the key performance requirements for the evaluation:

- **Material qualification**:
  - foam basic properties following CAN/ULC-705.1 requirements except for the sample preparation. Samples were sprayed at the maximum nominal thickness of 125 mm using one pass instead of two passes of 30-mm each nominal thickness as specified in CAN/ULC-705.1. Foam application of regular formulation at 23°C was used for testing as required in CAN/ULC-705.1.
  - key physical properties in high and low temperature application.
- **Adhesion performance:** foam adhesion strength to different substrates (the manufacturer-selected substrates were wood, gypsum and concrete). Foam application of regular formulation at high temperature was considered worst-case scenario.
- **Foam uniformity:** foam cells uniformity when sprayed in different wall cavity dimensions. Foam application of regular formulation at high temperature was considered worst-case scenario.
- **Fire hazard:** maximum temperature achieved in the foam due to exothermic reaction (high temperature generated while curing). Foam application of winter formulation at high temperature was considered worst-case scenario.

4.1 Material Requirements

4.1.1 Physical Properties from Ambient Temperature Application

The basis properties of the product's regular formulation, when sprayed over polyethylene board having a surface temperature of 23°C, are presented in Table 4.1.1. Test specimens used for Table 4.1.1 were extracted from the central area of foam samples sprayed at a nominal thickness of 125 mm except for the air permeance and VOC tests. For these two tests, foam samples were sprayed at 25 mm and 50 mm respectively for preparing the test specimens.

Table 4.1.1 Physical Properties

Property		Unit	Requirement	Result
Air permeance for a 25-mm-thick specimen		$L/(s \cdot m^2)$	≤ 0.020	0.0020
Apparent core density		kg/m^3	≥ 28.0	34.0
Compressive strength		kPa	≥ 170	263
Dimensional stability, without substrate volume change at:	**−20°C**	%	−1	−0.2
	80°C		+8	2.7
	70°C, 97 ± 3% RH		+14	6.9
Surface burning characteristics	**Flame-spread rating(1)**	–	≤ 500	315
Open-cell content volume		%	≤ 10	5.94
Initial thermal resistance for a 50-mm-thick specimen (after 11 days at 23°C)		$(m^2 \cdot K)/W$	Declare	2.54
Long-term thermal resistance (LTTR)(2) at	**140 mm**	$(m^2 \cdot K)/W$	Declare	6.05
	125 mm			5.37
	100 mm			4.22
	75 mm			3.12
	50 mm			2.05
Tensile strength		kPa	≥ 200	226
Volatile organic emissions (VOC)(3)		day	≤ 30	1
Water absorption by volume		%	≤ 4.0	1.05
Water vapour permeance (WVP) for a 50-mm-thick specimen	**Specimen with top skin removed**	$ng/(Pa \cdot s \cdot m^2)$	≤ 60	52
Fungi resistance		–	No growth	None

Notes to Table 4.1.1:

(1) The published value is based on average results from three specimens tested with skin intact for comparison purposes. For compliance with Part 9, Housing and Small Buildings, of Division B of the NBC 2010 and NBC 2015, flame-spread rating is not required. When the product is installed in other than Part 9 buildings, the flame-spread rating must be determined in compliance with the requirements of Part 3 of Division B of the NBC 2010 or NBC 2015.

(2) Testing was conducted in compliance with CAN/ULC-S770-09, Standard Test Method for Determination of Long-Term Thermal Resistance of Closed-Cell Thermal Insulating Foams.

(3) For retrofit constructions (e.g., occupied buildings), the time to occupancy is one (1) day when installed with the requisite ventilation of the segregated retrofit area as per CAN/ULC-S705.2. CAN/ULC-S705.2 requires that the ventilation rate shall be no less than 0.3 air changes per hour within the working area during the application of the product and that the working area be isolated during spraying. The same ventilation rate is required after the product has been sprayed and for the time period shown in Table 4.1.1.

4.1.2 Physical Properties in High Temperature Application

The air permeance and water vapour permeance of the product's regular formulation, when sprayed over polyethylene board having a surface temperature of 40°C, are presented in Table 4.1.2 . Test specimens used for Table 4.1.2 were extracted from foam samples sprayed at a nominal 125-mm thickness.

Table 4.1.2 Physical Properties in High Temperature Application

Property	Unit	Requirement	Result
Air permeance for a 34-mm-thick specimen	L/(s·m^2)	≤ 0.020	0.0014
Water vapour permeance (WVP) for a 50-mm-thick specimen with top skin removed	ng/(Pa·s·m^2)	≤ 60	73[(1)]

Note to Table 4.1.2:

(1) This result is deemed acceptable since spraying foam over substrate with a surface temperature of 40°C represents an extreme condition. The WVP obtained at ambient temperature and surface substrate temperature of 23°C meets the 60 ng/(Pa·s·m^2) criteria (see Table 4.1.1). The tested specimen was only 50 mm thick whereas this product can be installed at a maximum nominal thickness of 125 mm in one pass. An application of the foam thicker than 50 mm will lead to a lower vapour permeance.

4.1.3 Physical Properties in Low Temperature Application

The initial and long-term thermal resistance of the product's winter formulation, when sprayed over concrete tiles having a surface temperature of −10°C, are presented in Table 4.1.3. Test specimens used for Table 4.1.3 were extracted from foam samples sprayed at 64 mm thick.

Table 4.1.3 Physical Properties in Low Temperature Application

Property		Unit	Requirement	Result
Initial thermal resistance for a 50-mm-thick specimen (after 3 days at 23°C)		(m^2·K)/W	Declare	2.39
Long-term thermal resistance (LTTR)[(1)] at	**140 mm**	(m^2·K)/W	Declare	6.06
	125 mm			5.29
	100 mm			4.11
	75 mm			3.00
	50 mm			1.94

Note to Table 4.1.3:

(1) Testing was conducted in compliance with CAN/ULC-S770-09.

4.2 Adhesion Requirements

The adhesion strength of the product's regular formulation, when sprayed over wood, gypsum and concrete substrates having a surface temperature of 40°C, is presented in Table 4.2.1. Foam samples were sprayed to a thickness of 125 mm. The adhesion test was conducted using specimens for which some foam was removed to obtain a 50-mm-thick specimen in order to facilitate testing.

Table 4.2.1 Adhesion Strength to Substrate

Property		Unit	Requirement	Result
Adhesion strength[1] over:	**Exterior gypsum board**	kPa	≥ 2.6	145
	OSB			100
	Plywood			174
	Concrete slab			265
	Wood			105

Note to Table 4.2.1:

(1) Testing was conducted in compliance with ASTM D1623.

4.3 Foam Uniformity

The average cell sizes of the product's regular formulation, when sprayed in wood frame cavities made of OSB sheathing and 89-mm x 140-mm wood studs spaced at 600 mm o.c., 400 mm o.c. and 300 mm o.c., are presented in Table 4.3 The substrate surface temperature was 40°C. Foam samples were sprayed to a thickness of 127 mm.

Table 4.3.1 Foam Uniformity – Summary of Cell Sizes

Property		Unit	Requirement	Result
Average cell sizes	**Panel with two cavities of 600 mm o.c.**	mm	< 0.5	Pass[1]
	Panel with three cavities of 400 mm o.c.	mm	< 0.5	Pass[2]
	Panel with four cavities of 300 mm o.c.	mm	< 0.5	Pass[3]

Notes to Table 4.3.1:

(1) Tiny cells of less than 0.5 mm wide were mostly observed with some occasional isolated cells of 4.5-mm wide.

(2) Tiny cells of less than 0.5 mm wide were mostly observed with some occasional isolated cells of 2.7-mm wide.

(3) Tiny cells of less than 0.5 mm wide were mostly observed with some occasional isolated cells of 2.8-mm wide.

4.4 Material Temperature Requirements Due to Exothermic Reaction

Maximum temperature and time frame to cool down of the product's winter formulation, when sprayed over wood and gypsum substrate having a surface temperature of 5°C, are presented in Table 4.4. Spraying over concrete substrate was not part of the testing protocol since it is a non-combustible material. Foam sample thicknesses were 125 to 140 mm.

Table 4.4.1 Material Temperature Requirements Due to Exothermic Reaction

Property			Unit	Requirement	Result
Maximum recorded temperature at any place in the foam	**OSB substrate**		°C	< 200	181.7
	Gypsum substrate				184.1
Temperatures in the foam vs. time			°C	Temperature vs. time must be decreasing after the peak(1)	Pass
Maximum recorded temperature at wood frame – foam interface	**OSB substrate**		°C	< 170	90.6
	Gypsum substrate				59.0
Maximum recorded temperature at substrate – foam interface:	**Wood material and gypsum board**	**OSB substrate**	°C	< 170	122.5
		Gypsum substrate			89.6
	Melting material		°C	Foam temperature must be less than melting temperature of the material(2)	n/a
	Non-combustible materials		–	Not required	n/a
Time frame for the foam temperature to cool down to 21°C	**OSB substrate**		hh:mm	Report value	16:40(3)
	Gypsum substrate				03:07(3)
Effect of maximum recorded temperature on electrical wires	**OSB substrate(4)**		–	No damage to the electrical wire jacket where maximum foam temperature is reached	183.6°C(4) was recorded near the wire and no visual effect was observed on the wire jacket

Notes to Table 4.4.1:

(1) Any subsequent temperature peak must be lower than the initial peak.

(2) Any materials such as ABS, polypropylene and polyethylene over which the foam will be sprayed must have a softening temperature reasonably higher than 184°C. Softening temperature of such materials must be determined using a recognized test method.

(3) Construction material such as a polyethylene vapour barrier sheet may be affected by the foam temperature if installed too early following the foam installation. The timeframe for the foam to reach ambient temperature must be considered to lower the risk of damaging any melting materials installed against the foam afterwards.

(4) A minimum of 140-mm-thick foam was sprayed in a wood frame cavity made of OSB sheathing and 38-mm × 140-mm wood studs. Two electrical wires (12 AWG and 14 AWG) were installed in the cavity at different heights before the foam application. The maximum recorded temperatures near the wires were 183.6°C and 145.7°C.

Report Holder

BASF Canada Inc.
10 Constellation Court
Toronto, ON M9W 1K1

Telephone: 416-674-2862

Web site: www.basf.com

Site-finished Product

The foam insulation is a site-manufactured product.

Plant(s) – Raw Materials

Blackie, AB
Toronto, ON

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