



CAN/ULC-S716.1-12-R2018 (Reaffirmed 2018)

STANDARD FOR EXTERIOR INSULATION AND FINISH SYSTEMS (EIFS) - MATERIALS AND SYSTEMS



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Standard for Exterior Insulation and Finish Systems (EIFS) – Materials and Systems,
CAN/ULC-S716.1-12-R2018

Second Edition, Dated December 2012

Summary of Topics

This revision of CAN/ULC-S716.1 is being issued to update the title page to reflect the reaffirmation of this Second Edition National Standard of Canada. No changes in requirements are involved.

The revised requirements are substantially in accordance with Proposal(s) on this subject dated March 11, 2017.

PLEASE NOTE THAT CERTAIN CODES MAY REFER TO A SUPERSEDED VERSION OF THIS STANDARD. IN THOSE INSTANCES, THE RELEVANT VERSIONS ARE AVAILABLE FOR PURCHASE.

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STANDARD FOR EXTERIOR INSULATION AND FINISH SYSTEMS (EIFS) - MATERIALS AND SYSTEMS

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STANDARD FOR EXTERIOR INSULATION AND FINISH SYSTEMS (EIFS) - MATERIALS AND SYSTEMS

PREFACE

This is the Third Edition of the Standard for Exterior Insulation and Finish Systems (EIFS) – Materials and Systems, CAN/ULC-S716.1.

This Edition of the Standard has been formally approved by the ULC Standards Committee on Thermal Insulation Materials and Systems.

This Standard has been developed in compliance with the requirements of Standards Council of Canada (SCC) for accreditation of a Standards Development Organization.

Only metric SI units of measurement are used in this Standard. If a value for measurement is followed by a value in other units in parentheses, the second value may be approximate. The first stated value is the requirement.

Annexes A, B, C, D, E and F, identified as normative, form a mandatory part of this Standard.

Annexes G, H and I, identified as informative, are for informational purposes only.

In Canada, there are two official languages, English and French. All safety warnings must be in French and English. Attention is drawn to the possibility that some Canadian authorities may require additional markings and/or installation instructions to be in both official languages.

This Third Edition National Standard of Canada was based on the Second Edition, and has now been reaffirmed.

Attention is drawn to the possibility that some of the elements of this Canadian standard may be the subject of patent rights. ULC Standards shall not be held responsible for identifying any or all such patent rights.

Requests for interpretation of this Standard should be sent to ULC Standards. The requests should be worded in such a manner as to permit a “yes” or “no” answer based on the literal text of the requirement concerned.

This CAN/ULC-S716.1 Standard is under continuous maintenance, whereby each revision is approved in compliance with the requirements of SCC for accreditation of a Standards Development Organization. In the event that no revisions are issued for a period of four years from the date of publication, action to revise, reaffirm, or withdraw the standard shall be initiated.

Comments or proposals for revisions on any part of the Standard may be submitted at any time. Proposals should be submitted via a Proposal Request in the On-Line Collaborative Standards Development System (CSDS) at <https://csds.ul.com/canada>.

This Standard is intended to be used for conformity assessment.

1 SCOPE

1.1 This Standard outlines requirements for Exterior Insulation and Finish Systems (EIFS), used in combination with a drained air space as an exterior wall cladding system. It also outlines requirements for water resistive barrier systems (WRBs) that can be used with EIFS.

1.2 The EIFS wall cladding system is comprised of thermal insulation boards, an adhesive for attachment of the thermal insulation boards to the substrate, a glass fibre reinforcing mesh embedded in a base coat on the face of the thermal insulation boards and a finish coat.

1.3 The use of mechanical fasteners is outside the scope of this Standard, but is acceptable as a complement and/or as an alternate to adhesive for attachment where the substrate will not support adhesive attachment of the EIFS.

NOTE: Refer to CAN/ULC-S716.2 and CAN/ULC-S716.3, Annex A for further information.

1.4 In EIFS, the thermal insulation boards support the base coat with integral glass fibre reinforcing mesh. Systems where the reinforcement is the supporting element of the rendering, e.g., conventional stucco, are not covered by this Standard.

1.5 This document does not purport to address all the health and safety aspects associated with its use. Anyone using this Standard has the responsibility to consult the appropriate authorities and to establish health and safety practices, in conjunction with any existing applicable regulatory requirements, prior to its use.

2 REFERENCE PUBLICATIONS

2.1 The following referenced documents are indispensable for the application of this standard. The referenced documents indicate the edition and/or revision of the document that shall be used with this standard.

Documents Published by the American Society for Testing and Materials (ASTM International)
100 Barr Harbour Drive, PO Box C700, West Conshohocken, PA 19428-2959 U.S.A.
Telephone: (610) 832-9585
www.astm.org

- ASTM B117-11, Standard Practice for Operating Salt Spray (Fog) Apparatus
- ASTM C612-10, Standard Specification for Mineral Fiber Block and Board Thermal Insulation
- ASTM C1177/C1177M-08, Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
- ASTM C1338-08, Standard Test Method for Determining the Fungi Resistance of Insulation Materials and Facings
- ASTM D1623-09, Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics
- ASTM D5035-11, Standard Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method)
- ASTM E74-06, Standard Practice of Calibration of Force-Measuring Instruments for Verifying the Force Indication of Testing Machines

- ASTM E96/E 96M-10, Standard Test Methods for Water Vapor Transmission of Materials
- ASTM E330-02(R 2010), Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
- ASTM E331-00(R 2009), Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
- ASTM E1131-08, Standard Test Method for Compositional Analysis by Thermogravimetry
- ASTM E1252-98(R 2007), Standard Practice for General Techniques for Obtaining Infrared Spectra for Qualitative Analysis
- ASTM E2098-00(R 2006), Standard Test Method for Determining Tensile Breaking Strength of Glass Fiber Reinforcing mesh for Use in Class PB Exterior Insulation and Finish Systems (EIFS), after Exposure to a Sodium Hydroxide Solution
- ASTM F410-08, Standard Test Method for Wear Layer Thickness of Resilient Floor Coverings by Optical Measurement
- ASTM G154-06, Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials
- ASTM G155-05a, Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials

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- CSA B111-1974, Wire Nails, Spikes and Staples
- CAN/CSA O325-07 (UPD 1 2008), Construction Sheathing

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- CSSBI 55-99, Residential Steel Framing Installation Manual

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www.scc.ca

- ISO 7895:1987, Facades made of components - Tests for resistance to positive and negative static pressure generated by wind
- ISO 15148:2002, Hygrothermal performance of building materials and products – Determination of water absorption coefficient by partial immersion

Documents Published by ULC Standards (prior to May, 2010, identified as Underwriters Laboratories of Canada)

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- CAN/ULC-S101-07, Standard Methods of Fire Endurance Tests of Building Construction and Materials
- CAN/ULC-S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies
- CAN/ULC-S102.2-10, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies
- CAN/ULC-S114-05, Standard Method of Test for Determination of Non-Combustibility in Building Materials
- CAN/ULC-S134-92 (R1998), Standard Method of Fire Test of Exterior Wall Assemblies
- CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering
- CAN/ULC-S704-11, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate, Boards, Faced
- CAN/ULC-S716.2-12, Standard for Exterior Insulation and Finish Systems (EIFS) – Installation of EIFS Components and Water Resistive Barrier
- CAN/ULC-S716.3-12, Standard For Exterior Insulation and Finish Systems (EIFS) – Design Application
- CAN/ULC-S773-09, Standard for Thermal Insulation Terminology

3 TERMINOLOGY

3.1 Some terms used in this Standard are common to ULC Standards Thermal Insulation Standards, and may be found in CAN/ULC-S773, Standard for Thermal Insulation Terminology. Additional definitions not listed in CAN/ULC-S773 but required for this Standard have also been listed below. Defined terms used in this Standard appear in italics throughout the text.

ADHESIVE — A product for adhering the *thermal insulation board* to the *substrate* or *water resistive barrier system*.

BASE COAT — A polymer based coating, either *factory-blended* or *field-mixed*, applied directly to the *thermal insulation board*, fully *embedding* the *reinforcing mesh* providing the primary barrier to water penetration.

COMBUSTIBLE — A material that does not meet the requirements of CAN/ULC-S114.

COMBUSTIBLE CONSTRUCTION — A type of building construction that does not meet the requirements for *noncombustible construction*.

CURE — To develop the ultimate properties of an initial wet state material by a chemical reaction.

DRAINAGE CAVITY — A space between the *substrate* and *thermal insulation board* that allows for the free drainage of water that penetrates the *EIFS*.

DRY — To develop the ultimate properties of an initial wet state material solely by evaporation of volatile ingredients.

DURABILITY — The ability of a building or any of its components to perform its required functions in its service environment over a period of time without unforeseen cost for maintenance or repair.

EIFS MANUFACTURER — The producer of the materials and components forming a proprietary *EIFS*.

EMBED — To press into and encapsulate the *reinforcing mesh* in the wet *base coat*.

EXTERIOR INSULATION AND FINISH SYSTEM (EIFS) — A wall cladding system comprised of *thermal insulation board*, an *adhesive* for attachment of the *thermal insulation board* to the *substrate*, a glass fibre *reinforcing mesh* embedded in a *base coat* on the face of the *thermal insulation board*, and a *finish coat*.

FACTORY-BLENDED — Any material that arrives from the manufacturer requiring no additions apart from water to produce the wet state material.

FIELD-MIXED — Materials that are mixed in the field by combining two or more materials, other than, or in addition to, water.

FINISH COAT — The outermost coat applied over the *base coat*, which gives the *EIFS* its colour and texture, exclusive of sealers and paints.

FLASHING — Continuous material(s) that stops the flow of water within a wall assembly or system and directs the water, via gravity, to the exterior of the wall.

GEOMETRICALLY DEFINED DRAINAGE CAVITY (GDDC) — A space created between the *substrate* and *thermal insulation board* through the use of *thermal insulation board* that has a pattern cut or formed into its back surface.

LAMINA — A composite of the *base coat*, the *reinforcing mesh*, and the *finish coat*.

LIQUID APPLIED WATER RESISTIVE BARRIER (LA-WRB) — A fluid material applied by spray, roller or trowel, that dries to a membrane possessing low water absorption properties becoming a component of the *water resistive barrier system*.

MANUFACTURER'S INSTALLATION INSTRUCTIONS — Written installation instructions provided by the *EIFS manufacturer* that include information that will assist in the correct use and installation of the materials and components that comprise their system.

NONCOMBUSTIBLE — A description of a material that meets the requirements of CAN/ULC-S114.

NONCOMBUSTIBLE CONSTRUCTION — A type of building construction in which the degree of fire safety is attained by the use of *noncombustible* materials for structural members and other building assemblies.

REINFORCING MESH — A woven or non-woven glass fibre fabric component of the *EIFS* encapsulated in the *base coat* to strengthen the *EIFS*.

SUBSTRATE — The structural component supporting the *EIFS*, which is resistant to deterioration caused by water or is protected by a *water resistive barrier system*.

TEST SAMPLE — Prepared materials or systems from which *test specimens* are taken.

TEST SPECIMEN — The portion of a *test sample* taken for measurement of a given property or characteristic.

THERMAL INSULATION BOARD — A component that functions to reduce heat flow through the wall and serves as the surface to receive the *base coat*.

TRANSITION MEMBRANE — A component of the *water resistive barrier system* that maintains continuity of the *WRB* at joints and openings in the *substrate* that cannot be bridged with the *LA-WRB*.

WATER ABSORPTION COEFFICIENT — The mass of water absorbed by a *test specimen* under specified time and pressure, per unit area and per square root of time.

WATER RESISTIVE BARRIER SYSTEM (WRB) — Material(s) possessing low water absorption properties that are applied over *substrates* susceptible to water absorption to create a continuous surface that prevents water penetration into the wall assembly. The *WRB* is composed of the *LA-WRB* and *transition membranes*. The *WRB* is integrated with the *flashing*, which drains water to the exterior of the wall.

WATER RETENTION RATIO — The mass of water retained in the *test specimen* following the drainage capacity test divided by the projected area of wetted wall.

WRAP — To protect the exposed edges of *thermal insulation board* by back-wrapping or edge-wrapping.

4 REQUIREMENTS

4.1 EIFS CONSTITUENT PRODUCTS

4.1.1 The constituent products of *EIFS* shall meet the technical requirements listed in Table 1.

4.1.2 Cellular plastic *thermal insulation board* shall meet the requirements of:

- A CAN/ULC-S701; or
- B CAN/ULC-S704.

4.1.3 Mineral fibre *thermal insulation board* shall meet the requirements of ASTM C612.

4.2 LA-WRB

4.2.1 The *LA-WRB* shall meet the technical requirements listed in Table 2. Where the *LA-WRB* is not intended by the *EIFS manufacturer* for application to a wood *substrate*, the *LA-WRB* does not have to meet the requirements for the following:

- A Joint *durability* test;
- B Nail popping resistance test.

NOTE: The type of wood *substrate* may have an effect on the adhesion of the *LA-WRB* to the *substrate*. Given the properties of oriented strand board (OSB), it is deemed to represent a worst-case scenario in this regard. Therefore, any *LA-WRB* that passes the tests required in Subsection 5.4, LA-WRB Tests, when applied to OSB shall be deemed suitable for use on plywood.

4.3 EIFS ASSEMBLY

4.3.1 The *EIFS* shall meet the technical requirements for the system listed in Table 3. The *EIFS* shall be tested as an assembly as required in Subsection 5.5, EIFS Tests.

4.4 SPECIAL APPLICATIONS

4.4.1 Special applications may require properties other than, or in addition to, those specified in this Standard. These properties, when agreed upon by the interested parties, may be added to the requirements of this Standard.

5 TESTING

5.1 SAMPLING

5.1.1 Random sampling, of a minimum number of material components required to complete the necessary testing, shall be carried out by a testing agency determining compliance with this Standard. A random selection of materials is to be obtained from the production or main storage facility for identification before they are sent to the testing laboratory. The identified samples are then to be forwarded directly to the testing laboratory.

5.2 PREPARATION OF SAMPLE PANELS

5.2.1 Panel Types and Quantities

5.2.1.1 A minimum of one nominal 610 mm x 610 mm panel consisting of 25 mm thick *thermal insulation board* and *base coat*, including *reinforcing mesh* shall be prepared. The *base coat* and *reinforcing mesh* shall be applied at the thickness stipulated by the *manufacturer's installation instructions*, determined for the purpose of confirmation as a mass per unit area, according to the requirements of Subsection 5.2.3, Verification of Applied Material Thickness for Sample Panels via Mass Per Unit Area. This *test sample* panel shall be used for preparation of the *test specimens* for the following tests:

- A Bond Strength of the *Base Coat*;
- B Water Impermeability of the *Base Coat*;
- C Water Absorption of the *Base Coat*.

5.2.1.2 A minimum of five nominal 610 mm x 610 mm panels consisting of 25 mm thick *thermal insulation board* and *base coat*, including *reinforcing mesh*, and *finish coat* shall be prepared. The edges of four of the panels shall be *wrapped* with *base coat*, *reinforcing mesh* and *finish coat*. The *base coat* shall be allowed to *cure* for a minimum of 24 h prior to application of the *finish coat*. The *base coat* and *reinforcing mesh* and *finish coat* shall be applied at the thicknesses stipulated by the *manufacturer's installation instructions*, determined for the purpose of confirmation as a mass per unit area, according to the requirements of Subsection 5.2.3, Verification of Applied Material Thickness for Sample Panels via Mass Per Unit Area. This *test sample* panel shall be used for preparation of the *test specimens* for the following tests:

- A Bond Strength of the *Lamina*;
- B Water Vapour Permeance of the *Lamina*;
- C Salt Spray Resistance of the *Lamina*;
- D Ultraviolet Resistance of the *Lamina*;
- E Impact Resistance of the *EIFS* (the *wrapped* panels).

5.2.1.3 A minimum of one nominal 610 mm x 1220 mm vertical wood frame to which is attached 19 mm thick OSB sheathing meeting the requirements of CSA O325 and having a *water absorption coefficient* of $0.002 \pm 0.001 \text{ kg/m}^2\cdot\text{s}^{1/2}$ shall be prepared. The OSB sheathing shall include a joint with a width of 3.2 mm, as shown in Figure 1. The OSB shall be free of any dirt, dust or other deleterious substances that may affect the adhesion of the *LA-WRB*. The *LA-WRB* shall be applied to the OSB in strict accordance with the *manufacturer's installation instructions* and at the minimum thickness recommended by the manufacturer, determined for the purpose of confirmation as a mass per unit area, according to the requirements of Subsection 5.2.3, Verification of Applied Material Thickness for Sample Panels via Mass Per Unit Area. This *test sample* panel shall be used for preparation of the *test specimens* for the following tests:

- A Bond Strength of the *LA-WRB*;
- B *Water Absorption Coefficient* of the *LA-WRB*;
- C *Durability* of the Joints;
- D Accelerated Weathering Resistance of the *LA-WRB*.

5.2.1.4 A minimum of one nominal 610 mm x 610 mm panel consisting of *LA-WRB* applied to nominally 13 mm thick glass mat gypsum sheathing meeting the requirements of ASTM C1177 shall be prepared. The *LA-WRB* shall be applied in accordance with the *manufacturer's installation instructions* and at the thickness stipulated by the *EIFS manufacturer*, determined for the purpose of confirmation as a mass per unit area, according to the requirements of Subsection 5.2.3, Verification of Applied Material Thickness for Sample Panels via Mass Per Unit Area. This *test sample* panel shall be used for preparation of the *test specimens* for the following test:

- A Water Vapour Permeance of the *LA-WRB*.

5.2.2 Panel Preparation Procedure

5.2.2.1 The *test sample* panels shall be prepared in a vertical orientation.

5.2.2.2 The *manufacturer's installation instructions* shall be followed to ensure that the *EIFS* and *LA-WRB* are installed in accordance with the requirements of CAN/ULC-S716.2 and CAN/ULC-S716.3, and are consistent with the *EIFS* and *LA-WRB* tested to this Standard.

5.2.2.3 The *test sample* panels shall be conditioned at 23 ± 2 °C, and 50 ± 5 % relative humidity for a minimum of 14 d.

5.2.3 Verification of Applied Material Thickness for Sample Panels via Mass Per Unit Area

5.2.3.1 The applied material thickness shall be verified as a mass per unit area, as described in Clauses 5.2.3.2 to 5.2.3.5.

5.2.3.2 In determining the area of the *test sample* panel, its linear dimensions shall be measured to an accuracy of 1 mm.

5.2.3.3 Using the thickness stipulated by the *EIFS manufacturer*, and the density of the material as provided by the *EIFS manufacturer*, the required mass of material to be applied to the *test sample* panel shall be determined as follows:

$$\text{Mass (g)} = \text{Density (kg/m}^3\text{)} \times \text{Area of } \textit{test sample} \text{ panel (mm}^2\text{)} \times \text{Thickness (mm)} \times 10^{-6}.$$

5.2.3.4 The initial mass of the material including its storage container shall be measured to an accuracy of 1/1000 of the mass.

5.2.3.5 Material shall be removed from the storage container and applied uniformly to the *test sample* panel until the mass of material removed is equal to the mass determined in Clause 5.2.3.3. The mass of material removed shall be determined by measuring the mass of the remaining material, including its storage container, until the difference between the initial mass and the final mass is equal to the mass determined in Clause 5.2.3.3 to an accuracy of 1/1000 of the mass.

NOTE: Care must be taken in removing material from the storage container and in its application that all material is applied to the *test sample* panel. If any material is lost (i.e., dropped before it reaches the *test sample* panel), its mass must be determined and taken into consideration when determining the amount of material applied to the *test sample* panel.

5.2.4 *Test specimens*, unless otherwise specified in the test methods, shall be obtained from the conditioned *test sample* panels described in Clauses 5.2.1.1 through 5.2.1.4. Care and caution must be exercised when cutting the *test specimens* from the *test sample* panels so that the bond between materials is not affected. The speed of the saw blade, the number of teeth per inch, and other cutting variables shall be considered in *test specimen* preparation in order to avoid excess vibrations or heat build-up.

5.3 EIFS CONSTITUENT MATERIALS TESTS

5.3.1 Ash Content

5.3.1.1 This procedure shall be conducted only if deemed necessary by the testing agency as a means of identification of the *test sample* materials submitted.

5.3.1.2 When conducted, *test specimens* shall be prepared and the ash content of the *base coat* and *finish coat* material shall be determined in accordance with ASTM E1131. The results shall be expressed as a percentage of the initial mass of the dry *test specimen*.

5.3.2 Infrared Analysis

5.3.2.1 This procedure shall be conducted only if deemed necessary by the testing agency as a means of identification of the *test sample* materials submitted.

5.3.2.2 *Test specimens* shall be prepared and the absorption spectrum of the organic fraction of the binder used in the formulation of the *base coat* and *finish coat* shall be determined in accordance with ASTM E1252 and Annex I. The results shall be recorded on a plot of percent transmittance vs. wavelength.

5.3.3 Bond Strength Tests

5.3.3.1 *Test specimen* preparation and testing of the bond strength of the *adhesive*, *base coat* and *finish coat* shall be according to Annex A.

5.3.3.2 The average of the results of the bond strength test shall be reported in kilopascals (kPa) for each state tested (Initial, Wet and Dry).

5.3.4 Water Vapour Permeance of the Lamina

5.3.4.1 Three *test specimens* of a size suitable for the test equipment to be used shall be cut from the *test sample* panel specified in Clause 5.2.1.2 and the *lamina* carefully removed from the *thermal insulation board*. The dry thickness of the *lamina* shall be measured in at least five locations on each *test specimen* and the average thickness reported.

5.3.4.2 The water vapour permeance of the *lamina* shall be determined according to ASTM E96, Desiccant Method, Procedure A, with the face coat of the *lamina* exposed to the test chamber.

5.3.4.3 The average water vapour permeance of the *lamina* shall be reported in $\text{ng}/(\text{Pa}\cdot\text{s}\cdot\text{m}^2)$.

5.3.5 Base Coat Water Impermeability Test

5.3.5.1 Three *test specimens* measuring 200 mm x 200 mm shall be cut from the *test sample* panel described in Clause 5.2.1.1. The edges of each *test specimen* shall be sealed with wax or other suitable waterproof material.

NOTE: A wax meeting the requirements of ASTM E96, Appendix X2, "Paraffin and microcrystalline wax mix", would be a suitable material to use for sealing the edges of the *test specimens*.

5.3.5.2 Over a surface area of 100 mm x 100 mm in the centre of the *test specimens*, the *thermal insulation board* shall be removed, by scraping, down to the back of the *base coat*. Methyl Violet 2B powder shall be brushed onto the back of the *base coat*.

5.3.5.3 The *test specimens*, with the coatings facing downward, shall be placed in a tank of water to a depth of 5 ± 0.25 mm for at least 2 h.

5.3.5.4 After 2 h, the area of dampness on the *test specimen* as determined by a colour change in the Methyl Violet 2B powder shall be recorded as a percentage of the total exposed *base coat* area.

5.3.6 Water Absorption of the Base Coat

5.3.6.1 Two *test specimens* measuring 100 mm x 100 mm shall be cut from the *test sample* panel described in Clause 5.2.1.1 and the *thermal insulation board* shall be detached from each of them.

5.3.6.2 The *test specimens* shall be dried in a well-ventilated oven for 24 h at a temperature of 105 ± 2 °C. After cooling at room temperature for 15 min, the dry mass of the *test specimens* shall be measured and reported to the nearest 0.01 g.

5.3.6.3 Each *test specimen* shall then be immersed flat, 50 mm below the surface of distilled (20 ± 5 °C) water for a period of 48 h.

5.3.6.4 After 48 h immersion, the mass of each *test specimen* shall be measured to the nearest 0.01 g. The water absorption shall be determined by the increase in mass in relation to the dry mass of the *test specimen* expressed as a percentage of the dry mass of the *test specimen*. The average percentage water absorption of the two *test specimens* shall be reported.

5.3.7 Finish Coat Fungus Resistance Test

5.3.7.1 One *test specimen* shall be prepared by applying *finish coat* onto a clean 50 mm x 50 mm glass slide. The *finish coat* shall be applied according to *manufacturer's installation instructions*.

5.3.7.2 The fungus resistance test shall be conducted according to ASTM C1338. The *test specimen* shall be incubated for a minimum of 28 d.

5.3.7.3 At the end of the test period, the *test specimen* shall be examined for fungal growth on the *finish coat* material and the observations recorded according to the requirements of ASTM C1338.

5.3.8 Lamina Salt Spray Resistance Test

5.3.8.1 Three *test specimens* measuring 100 mm x 300 mm shall be cut from the *test sample* panel described in Clause 5.2.1.2. The edges of each *test specimen* shall be sealed with wax.

5.3.8.2 The *test specimens* shall be tested according to ASTM B117 for 300 h.

5.3.8.3 The *test specimens* shall be visually examined without magnification.

5.3.8.4 Any deleterious effects, such as cracking or flaking, shall be recorded.

5.3.9 Lamina Ultraviolet Resistance Test

5.3.9.1 Three *test specimens* measuring 100 mm x 300 mm shall be cut from the *test sample* panel described in Clause 5.2.1.2.

5.3.9.2 The *test specimens* shall be tested according to ASTM G155. The xenon arc device shall be used with a borosilicate inner filter and a borosilicate outer filter. The parameters of testing shall be as follows:

- A 102 min of light exposure with no water spray (black panel temperature of 63 ± 2 °C and $50 \% \pm 5 \%$ RH);
- B 18 min of light exposure with water spray (water temperature at 16 ± 3 °C);
- C The above cycle (A and B) is repeated for 18 h;
- D 6 h of darkness, no water spray (black panel temperature of 24 ± 2 °C and $95 \pm 5 \%$ RH);
- E The above cycle (A through D) represents 24 h or 1 d exposure. The cycle is repeated for a total of at least 1998 h of light exposure (2664 h or 111 d total).

5.3.9.3 At the end of the testing, the *test specimens* shall be visually examined without magnification.

5.3.9.4 Any deleterious effects, such as cracking or flaking, shall be recorded.

5.3.10 Reinforcing Mesh Strength and Alkalinity Resistance

5.3.10.1 If the alkaline solution is to be prepared according to Clause 5.3.10.3A, then a minimum of 20 *test specimens*, each measuring 50 mm wide and 300 mm long, shall be prepared from the lowest density of *reinforcing mesh* used with a proprietary system. At least 10 *test specimens* shall have the long dimension in the direction of the weft and ten *test specimens* shall have the long dimension in the direction of the warp. If the alkaline solution is to be prepared according to Clause 5.3.10.3B, then a minimum of 40 *test specimens*, each measuring 50 mm wide and 300 mm long, shall be prepared from the lowest density of *reinforcing mesh* used with a proprietary system. At least 20 *test specimens* shall have the long dimension in the direction of the weft and 10 *test specimens* shall have the long dimension in the direction of the warp. *Test samples* shall be taken at least 150 mm from the edges of the roll and in such a manner that different *test samples* do not have the same weft and/or warp threads.

5.3.10.2 The area density (kg/m^2) of the mesh and the mesh dimensions shall be measured in accordance with ASTM D5035, Section 12.

5.3.10.3 An alkaline solution shall be prepared according to one of the following methods:

- A Tri-alkali Solution: A tri-alkali solution composed of 1 g of sodium hydroxide (NaOH), 4 g of potassium hydroxide (KOH) and 0.5 g of calcium hydroxide ($\text{Ca}(\text{OH})_2$) added to 1 L of distilled water (4 L of such solution shall be required); or
- B Cement Solution: A solution to be made alkaline by the addition of 25 % by mass of white cement. The solution shall attain and maintain a constant 12.5 pH level through the testing period. The level of the pH shall be verified on a weekly basis.

NOTE: The characteristics of the three chemicals shall be as follows: the NaOH shall have a minimum purity of 97 %; the KOH shall have a minimum purity of 85 %; the $\text{Ca}(\text{OH})_2$ shall have a minimum purity of 96 %.

5.3.10.4 At least 5 of each type of *test specimen* shall be exposed to the Tri-alkali Solution at a temperature that shall not exceed 23 °C for a period of 28 d or at least 10 of each type of test specimen shall be exposed to the Cement Solution at a temperature that shall not exceed 23 °C for a period of 90 d.

5.3.10.5 Following the alkaline immersion, the *test specimens* shall be removed and shall undergo the following conditioning:

- A The *test specimens* shall be immersed in a neutralizing acid solution consisting of 5 ml of 35% hydrochloric acid diluted in 4 L of water;
- B The *test specimens* shall be rinsed in 3 consecutive water baths, each bath consisting of 4 L of water, and for a 5 min duration in each bath;
- C The *test specimens* shall be allowed to dry at 23 °C and 50 % relative humidity conditions for:
 - (i) 2 d if the tri-alkali solution is used according to Clause 5.3.10.3A;
 - (ii) 7 d if the cement solution is used according to Clause 5.3.10.3B.

5.3.10.6 The clamps of the testing machine shall be covered with a suitable rubber surface and be sufficiently rigid to resist deformation during the test. The clamps shall hold the whole width of the *test specimens* (i.e. minimum 50 mm wide).

NOTE 1: The results of *test specimens* that slip in the jaws of the testing machine, which break at the edge of or in the jaws, or which tear in a cascading effect, shall be discarded. Therefore, it is recommended that more than the minimum number of *test specimens* be prepared to ensure five acceptable test results are obtained for each state.

NOTE 2: Where wider specimens are used and kerfed at the specimen's centre-line to reduce to the 50 mm test width, the clamps must be wide enough to span full width of the specimen at its ends. Meaning a 70 mm wide specimen requires minimum 70 mm wide clamps, the minimum clamp width is otherwise 50 mm.

5.3.10.7 The strength of the *reinforcing mesh* shall be tested according to ASTM E2098 and the results determined in N/mm, for the following:

A If the tri-alkali solution is used according to Clause 5.3.10.3A,

- (i) Five *test specimens* in their initial state in the weft;
- (ii) Five *test specimens* in their initial state in the warp;
- (iii) Five *test specimens* after exposure in the weft; and
- (iv) Five *test specimens* after exposure in the warp.

OR

B If the cement solution is used according to Clause 5.3.10.3B,

- (i) Ten *test specimens* in their initial state in the weft;
- (ii) Ten *test specimens* in their initial state in the warp;
- (iii) Ten *test specimens* after exposure in the weft; and
- (iv) Ten *test specimens* after exposure in the warp.

5.3.10.8 The strength of each *test specimen* and the average strength of the *test specimens* in their initial state shall be reported in N/mm for both the weft and warp.

5.3.10.9 The strength of each *test specimen* and the average strength of the *test specimens* after exposure to the alkaline solution shall be reported in N/mm for both the weft and warp.

5.3.11 Dry Thickness of the Base Coat

5.3.11.1 Following the completion of the testing described in Subsections 5.3.3, Bond Strength Tests, 5.3.5, Base Coat Water Impermeability Test, and 5.3.6, Water Absorption of the Base Coat, six *test specimens* measuring at least 50 mm x 50 mm shall be taken from random spots from the remaining pieces of the *test sample* panel described in Clause 5.2.1.1.

5.3.11.2 The dry thickness of the *base coat* shall be measured in accordance with ASTM F410 in three places on each *test specimen* to an accuracy of 0.1 mm. The maximum, minimum and average of the 18 measurements shall be reported.

5.3.12 Dry Thickness of the Lamina

5.3.12.1 Following the completion of the testing described in Subsections 5.3.3, Bond Strength Tests, 5.3.4, Water Vapour Permeance of the Lamina, 5.3.8, Lamina Salt Spray Resistance Test, and 5.3.9, Lamina Ultraviolet Resistance Test, six *test specimens* measuring at least 50 mm x 50 mm shall be taken from random spots from the remaining pieces of the *unwrapped test sample* panel described in Clause 5.2.1.2.

5.3.12.2 The dry thickness of the *lamina* shall be measured in accordance with ASTM F410 in three places on each *test specimen* to an accuracy of 0.1 mm. The maximum, minimum and average of the 18 measurements shall be reported.

5.4 LA-WRB TESTS

5.4.1 Ash Content

5.4.1.1 This test shall be conducted only if deemed necessary by the testing agency as a means of identification of the *test sample* materials submitted.

5.4.1.2 When conducted, *test specimens* shall be prepared and the ash content of the *LA-WRB* material shall be determined in accordance with ASTM E1131 and the results shall be expressed as a percentage of the initial mass of the dry *test specimen*.

5.4.2 Infrared Analysis

5.4.2.1 This test shall be conducted only if deemed necessary by the testing agency as a means of identification of the *test sample* materials submitted.

5.4.2.2 When conducted, *test specimens* shall be prepared and the absorption spectrum of the organic fraction of the binder used in the formulation of the *LA-WRB* shall be determined in accordance with ASTM E1252 and Annex I, and the results shall be recorded on a plot of percentage transmittance vs. wavelength.

5.4.3 Bond Strength Test of the LA-WRB

5.4.3.1 *Test specimen* preparation and testing of the bond strength of the *LA-WRB* shall be according to Annex A.

5.4.3.2 The average of the results of the bond strength tests shall be reported in kPa for each state tested (Initial, Wet and Dry).

5.4.4 Water Absorption Coefficient of the LA-WRB

5.4.4.1 *Test specimen* preparation and testing of the *water absorption coefficient* of the *LA-WRB* shall be in accordance with the requirements of Annex B of this Standard.

5.4.4.2 The *water absorption coefficient* of the *LA-WRB* shall be reported in $\text{g}/(\text{m}^2 \cdot \text{s}^{1/2})$ in accordance with the procedures described in Annex B of this Standard.

5.4.5 Water Vapour Permeance of the LA-WRB

5.4.5.1 Four *test specimens*, each measuring 305 mm x 305 mm, shall be cut from the *test sample* panel described in Clause 5.2.1.4.

5.4.5.2 The *test specimens* shall be tested according to ASTM E96, Water Method, Procedure B, with the *LA-WRB* side face down to the tray.

5.4.5.3 The water vapour permeance of the *LA-WRB* shall be determined according to the requirements of ASTM E96 in $\text{ng}/(\text{Pa}\cdot\text{s}\cdot\text{m}^2)$.

5.4.5.4 The water vapour permeance of the *LA-WRB* shall be reported as the average of the four results in $\text{ng}/(\text{Pa}\cdot\text{s}\cdot\text{m}^2)$.

5.4.6 Accelerated Weathering Resistance Test of the LA-WRB

5.4.6.1 Three *test specimens* of a size suitable for the test apparatus, but in no case smaller than 100 mm x 150 mm, shall be cut from the *test sample* panel described in Clause 5.2.1.3.

NOTE: The *test specimens* shall not include the joint in the OSB or the framing members.

5.4.6.2 The test shall be conducted in accordance with ASTM G154 utilizing a UVA-340 lamp and the following cycle:

- A 102 min of light exposure with no water spray (black panel temperature of $63 \pm 2^\circ\text{C}$ and $50\% \pm 5\% \text{ RH}$);
- B 18 min of light exposure with water spray (water temperature at $16 \pm 3^\circ\text{C}$);
- C The above cycle (A and B) is repeated for 18 h;
- D 6 h of darkness, no water spray (black panel temperature of $24 \pm 2^\circ\text{C}$ and $95 \pm 5\% \text{ RH}$);
- E The above cycle (A through D) represents 24 h or 1 d exposure. The cycle is repeated for a total of 252 h of light exposure (336 h or 14 d total).

5.4.6.3 At the end of the testing, the *test specimens* shall be visually examined without magnification.

5.4.6.4 Any deleterious effects, such as cracking, delamination or flaking, shall be recorded.

5.4.7 LA-WRB Joint Durability Test

5.4.7.1 The *test specimens* shall be constructed and tested according to the method outlined in Annex C of this Standard.

5.4.7.2 The visual condition of the *test specimens* after the cycling shall be reported if there is any damage to the integrity of any joint involving separation that would allow water to penetrate in the middle 100 mm of the *test specimen*.

5.4.7.3 Any indications of moisture seepage through the *test specimens* after the water penetration test shall be reported.

5.4.7.4 All *test specimens* undergoing the water transmission test shall meet the performance requirements specified in Table 2.

5.4.8 Nail Popping Resistance Test

5.4.8.1 The *test specimens* shall be constructed and tested according to the method outlined in Annex D of this Standard.