BS ISO 17738-1:2021

BSI Standards Publication

Thermal insulation products — Exterior insulation finish systems

Part 1: Materials

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National foreword

This British Standard is the UK implementation of ISO 17738-1:2021. It supersedes BS ISO 17738-1:2017, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee B/540/8, Mirror committee for ISO/TC 163 - Thermal Performance and Energy use in the built Environment.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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Part 1: Materials

Produits isolants thermiques — Systèmes de finition d'isolation externe —

Partie 1: Materiaux

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CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
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Contents

Page

Foreword ... **v**

Introduction ... **vi**

1 Scope ... **1**

2 Normative references ... **1**

3 Terms definitions and symbols ... **2**
3.1 Terms and definitions ... 2
3.2 Symbols ... 5

4 Requirements ... **5**
4.1 EIFS constituent products ... 5
4.2 LA-WRB ... 5

5 Test methods ... **5**
5.1 Requirments ... 5
5.2 Sampling ... 6
5.3 Preparation of sample panels ... 6
5.4 EIFS material tests ... 7
5.4.1 Ash content ... 7
5.4.2 Infrared analysis ... 7
5.4.3 Bond strength tests ... 8
5.4.4 Water vapour permeance of the lamina ... 8
5.4.5 Base coat water impermeability test ... 8
5.4.6 Water absorption of the base coat ... 8
5.4.7 Finish coat fungus resistance test ... 9
5.4.8 Lamina salt resistance test ... 9
5.4.9 Lamina ultraviolet resistance test ... 9
5.4.10 Reinforcing mesh strength and alkalinity resistance ... 10
5.4.11 Dry thickness of the base coat ... 11
5.5 LA-WRB tests ... 11
5.5.1 Ash content ... 11
5.5.2 Infrared analysis ... 11
5.5.3 Bond strength test of the LA-WRB ... 11
5.5.4 Water absorption coefficient of the LA-WRB ... 12
5.5.5 Water vapour permeance of the LA-WRB ... 12
5.5.6 Accelerated weathering resistance test of the LA-WRB ... 12
5.5.7 LA-WRB joint durability test ... 13
5.5.8 Nail popping resistance test ... 13
5.5.9 Air flow rate ... 13
5.6 EIFS tests ... 13
5.6.1 EIFS impact resistance test ... 13
5.6.2 Durability under cyclic environmental conditions test ... 14
5.6.3 Drainage capacity test ... 15
5.6.4 Wind load testing ... 15
5.7 Reporting requirements ... 15

6 Marking, packaging and labelling ... **16**
6.1 Packaging ... 16
6.2 Labelling ... 16

Annex A (normative) **Bond strength testing (5.3.3 and 5.4.3)** ... **21**

Annex B (normative) **Water absorption coefficient of the LA-WRB (5.5.4)** ... **24**

Annex C (normative) **Joint durability test (5.5.7)** ... **31**

Annex D (normative) **Nail popping resistance test (5.5.8)** ... **38**

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Full document details: BS ISO 17738-1:2021

Annex E (normative) **Assessing durability of EIFS under cyclic environmental conditions (5.6.2)** **42**

Annex F (normative) **Assessing drainage performance of EIFS (5.6.3)** **54**

Annex G (normative) **Wind load testing (5.6.4)** **62**

Annex H (normative) **Test method for pull-off strength of adhered air and water resistive barriers using adhesion tester** **70**

Annex I (normative) **Test specimen preparation for infrared analysis** **74**

Bibliography **75**

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Document Sharing Hub

Full document details: BS ISO 17738-1:2021

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 163, *Thermal performance and energy use in the built environment*, Subcommittee SC 3, *Thermal insulation products, components and systems*.

This second edition cancels and replaces the first edition (ISO 17338-1:2017), which has been technically revised.

The main changes are as follows:

— The Introduction has been modified to include the three parts of the ISO 17738 series of standards, including ISO 17738-2 and ISO 17738-3.

— The definition of exterior insulation and finish systems (EIFS) has been clarified to include the function of the materials that comprise the system.

— The water resistive barrier definitions have been expanded to include the components that connect the EIFS water resistive barrier with adjacent componets that offer the same function but are part of a different cladding assembly.

— Testing to determine the air flow rate of the water resistive barrier has been added.

— Testing to demonstrate the ability of EIFS to withstand wind loading (Annex G) has been expanded and changed from informative to normative.

— A new Annex H (normative) test method for pull-off strength of adhered air and water resistive barriers using adhesion tester has been added.

A list of all parts in the ISO 17738 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

Exterior insulation and finish systems (EIFS) is a wall cladding assembly consisting of six components:

— A water resistive barrier to protect the substrate; the substrate has a means for drainage to the exterior;

— a means of attaching the system to the substrate;

— a thermal insulation layer;

— a base coat material;

— a reinforcing mesh embedded into the base coat;

— a finish material to provide the aesthetic appearance of the cladding assembly.

The ISO 17738 series comprises three parts: ISO 17738-1 (this document) deals with the material performance of exterior insulation and finish systems (EIFS), ISO 17738-2 provides guidance on installation and ISO 17738-3 gives guidance on the design and detailing of a durable and resiliant EIFS system.

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Thermal insulation products — Exterior insulation finish systems —

Part 1:
Materials

WARNING — This document does not purport to address all the health and safety aspects associated with its use. Anyone using this document has the responsibility to establish health and safety practices for its use.

1 Scope

This document outlines requirements for exterior insulation and finish systems (EIFS), used in combination with a drained air space as an exterior wall cladding system. The document includes requirements for a water resistive barrier assembly that are used as part of EIFS.

This document outlines testing procedures with pass/fail criteria for an exterior insulation and finish system. The procedures cover the liquid applied water resistive barrier, which forms a second line of defense against water penetration, individual material components and the complete system to demonstrate durability.

The use of mechanical fasteners is outside the scope of this document.

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 document.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 846, *Plastics — Evaluation of the action of microorganisms*

ISO 1463, *Metallic and oxide coatings — Measurement of coating thickness — Microscopical method*

ISO 1663, *Rigid cellular plastics — Determination of water vapour transmission properties*

ISO 1926, *Rigid cellular plastics — Determination of tensile properties*

ISO 3451-1, *Plastics — Determination of ash — Part 1: General methods*

ISO 4606, *Textile glass — Woven fabric — Determination of tensile breaking force and elongation at break by the strip method*

ISO 4611, *Plastics — Determination of the effects of exposure to damp heat, water spray and salt mist*

ISO 4650, *Rubber — Identification — Infrared spectrometric methods*

ISO 4898, *Rigid cellular plastics — Thermal insulation products for buildings — Specifications*

ISO 6612, *Windows and door height windows — Wind resistance tests*

ISO 7345, *Thermal performance of buildings and building components — Physical quantities and definitions*

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ISO 8145, *Thermal insulation — Mineral wool board for overdeck insulation of roofs — Specification*

ISO 9229, *Thermal insulation — Vocabulary*

ISO 12572, *Hygrothermal performance of building materials and products — Determination of water vapour transmission properties — Cup method*

ISO 14857:2014, *Thermal performance in the built environment — Determination of air permeance of building materials*

ISO 15821, *Doorsets and windows — Water-tightness test under dynamic pressure — Cyclonic aspects*

ISO 16474-3, *Paints and varnishes — Methods of exposure to laboratory light sources — Part 3: Fluorescent UV lamps*

ISO 16894, *Wood-based panels — Oriented strand board (OSB) — Definitions, classification and specifications*

ISO 17738-2, *Thermal insulation products — Exterior insulation and finish systems (EIFS) — Part 2: Installation*

ISO 29465, *Thermal insulating products for building applications — Determination of length and width*

ISO 29466, *Thermal insulating products for building applications — Determination of thickness*

ISO 29470, *Thermal insulating products for building applications — Determination of the apparent density*

3 Terms definitions and symbols

For the purposes of this document, the terms and definitions given in ISO 7345, ISO 9229 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1 Terms and definitions

3.1.1
adhesive
product for adhering the *thermal insulation board* (3.1.22) to the *substrate* (3.1.19) or *water resistive barrier assembly* (3.1.24)

3.1.2
attachment method
means by which the *thermal insulation board* (3.1.22) or *thermal insulation board/base coat* (3.1.3) and *reinforcing mesh* (3.1.18) composite is secured to the substrate which provides the wind load resistance of the wall assembly

3.1.3
base coat
polymer-based coating, either *factory-blended* (3.1.11) or *field-mixed* (3.1.12), applied directly to the *thermal insulation board* (3.1.22), fully *embedding* (3.1.9) the *reinforcing mesh* (3.1.18) providing the primary barrier to water penetration

3.1.4
cure
develop the ultimate properties of an initial wet state material by a chemical process

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3.1.5
drainage cavity
space between the water resistive barrier material (*WRB)* (3.1.26) and *thermal insulation board* (3.1.22) that allows for the free drainage of water that penetrates the exterior insulation and finish system *(EIFS)* (3.1.10)

3.1.6
dry
develop the ultimate properties of an initial wet state material solely by evaporation of volatile ingredients

3.1.7
durability
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

3.1.8
EIFS manufacturer
exterior insulation and finish system (EIFS) manufacturer
producer of the materials and components forming a proprietary *EIFS* (3.1.10)

3.1.9
embed
press into and encapsulate the *reinforcing mesh* (3.1.18) in the wet *base coat* (3.1.3)

3.1.10
EIFS
exterior insulation and finish system
exterior wall system with capacity to provide heat, air and moisture control functions, inclusive of a *water resistive barrier assembly* (3.1.24), *thermal insulation board* (3.1.22) and *attachment method* (3.1.2) for securing the system to the *substrate* (3.1.19), and protected by a *base coat* (3.1.3) material and glass fibre *reinforcing mesh* (3.1.18) installed over the face and termination surfaces of the thermal insulation board and completed with a *finish material* (3.1.13)

3.1.11
factory-blended
material that arrives from the manufacturer requiring no additions apart from water to produce the wet state material

3.1.12
field-mixed
materials that are mixed in the field by combining two or more materials, other than, or in addition to, water

3.1.13
finish material
outermost layer installed over the *base coat* (3.1.3) and forming part of the system, providing the exterior insulation and finish system *(EIFS)* (3.1.10) with its aesthetic while contributing to the system's exposure resistance

3.1.14
GDDC
geometrically defined drainage cavity
path created between the water resistive barrier material (*WRB)* (3.1.26) and *thermal insulation board* (3.1.22) using thermal insulation board that has a pattern cut into its back surface

3.1.15
lamina
composite of *base coat* (3.1.3), *reinforcing mesh* (3.1.18) and *finish material* (3.1.13)

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3.1.16
LA-WRB
liquid-applied water resistive barrier
fluid applied material, that dries to a membrane possessing low water absorption properties becoming a component of the *water resistive barrier assembly* (3.1.24)

3.1.17
manufacturer's installation instruction
written installation instructions provided by the exterior insulation and finish system *(EIFS) manufacturer* (3.1.8) that include information that will assist in the correct use and installation of the materials and components that comprise their system

3.1.18
reinforcing mesh
woven or non-woven glass fibre fabric component of the exterior insulation and finish system *(EIFS)* (3.1.10) encapsulated in the *base coat* (3.1.3) to strengthen the system

3.1.19
substrate
structural component supporting the exterior insulation and finish system *(EIFS)* (3.1.10), which is resistant to deterioration caused by water or is protected by a *water resistive barrier assembly* (3.1.24)

3.1.20
test sample
prepared materials or systems from which *test specimens* (3.1.21) are taken

3.1.21
test specimen
portion of a *test sample* (3.1.20) taken for measurement of a material property or characteristic

3.1.22
thermal insulation board
material that reduces heat flow through itself and provides the surface for applying the *base coat* (3.1.3)

3.1.23
water resistive barrier accesssory
product designated to maintain *water resistive barrier assembly* (3.1.24) continuity between *water resistive barrier material(s)* (3.1.26) and other wall assembly components, or at joints and openings not bridged by the water resistive barrier material

3.1.24
WRBA
water resistive barrier assembly
combination of *water resistive barrier material(s)* (3.1.26) and *water resistive barrier accessories* (3.1.23) designed to create a continuous secondary barrier against water penetration to direct and/or deflect water to the exterior

3.1.25
water absorption coefficient
mass of water absorbed by a *test specimen* (3.1.21) under specified time and pressure, per unit area

3.1.26
WRB
water resistive barrier material
material designed to provide the secondary plane of protection against water penetration and forming part of the *water resistive barrier assembly* (3.1.24)

3.1.27
water retention ratio
weight of water retained in the *test specimen* (3.1.21) following the drainage capacity test divided by the area of wetted wall

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3.1.28
wrap
extend the base coat and glass fibre *reinforcing mesh* (3.1.18) over the edge and back of the *thermal insulation board* (3.1.22) to protect the exposed edges of board

3.2 Symbols

Symbol	Description	Unit
A	face area	m^2
A_w	water absorption coefficient	$kg/(m^2 \cdot s^{0,5})$
A_{wt}	water absorption coefficient related to a specific time, t, in seconds	$kg/(m^2 \cdot s^{0,5})$
Δm_t	mass gain per face area after time t	kg/m^2
m_i	initial mass of specimen	kg
m_t	mass of specimen after time t	kg
t	time	s or h
W_w	water absorption coefficient	$kg/(m^2 \cdot h^{0,5})$
W_{wt}	water absorption coefficient related to a specific time, t, in hours	$kg/(m^2 \cdot h^{0,5})$

NOTE Water absorption coefficient is defined in terms of seconds in ISO 9346. The alternative definition in terms of hours is widely used.

4 Requirements

4.1 EIFS constituent products

4.1.1 The material that comprise EIFS shall meet the requirements listed in Table 1.

4.1.2 Rigid cellular plastic thermal insulation board shall meet the requirements of ISO 4898.

4.1.3 Semi-rigid mineral fibre thermal insulation board shall meet the requirements of ISO 8145.

4.2 LA-WRB

4.2.1 Type 1 - The LA-WRB shall meet the technical requirements listed in Table 2.

4.2.2 Type 2 - The LA-WRB shall meet the technical requirements listed in Table 2 except for:

a) joint durability test;

b) nail popping resistance test.

5 Test methods

5.1 Requirments

The EIFS shall be tested as an assembly as required in 5.5 and meet the requirements in Table 3.

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5.2 Sampling

Random sampling of the materials required for testing, shall be carried out to determine comformance with this document. The materials selected shall be identified at the production or main storage facility and sent directly to where the testing takes place. The number of samples shall be determined by the party in charge of the testing.

5.3 Preparation of sample panels

5.3.1 Sample panels or test specimens shall be prepared following manufacturer's installation instructions.

5.3.1.1 One nominal 610 mm × 610 mm panel or individual specimens 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 EIFS manufacturer, determined for the purpose of confirmation as a mass per unit area, as per 5.3.5. This test sample panel/specimens shall be used for the following tests:

a) bond strength test of the base coat;

b) base coat water impermeability test;

c) water absorption of the base coat test.

5.3.1.2 Five nominal 610 mm × 610 mm panels or individual specimens consisting of 25 mm thick thermal insulation board and base coat, including reinforcing mesh, and finish coat. The edges of four of the panels/specimens 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 EIFS manufacturer, determined for the purpose of confirmation as a mass per unit area, as per 5.3.5. This test sample panel/specimens shall be used for preparation of the test specimens for the following tests:

a) bond strength of the finish coat;

b) water vapour permeance of the lamina;

c) lamina salt spray resistance;

d) lamina ultraviolet resistance;

e) EIFS impact resistance (wrapped panels).

5.3.1.3 One nominal 610 mm × 1 220 mm vertical wood frame to which is attached 19 mm thick oriented strand board (OSB) sheathing meeting the requirements of ISO 16894. 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 weight per unit area, as per 5.3.5. This test sample panel shall be used for preparation of the test specimens for the following tests:

a) bond strength test of the LA-WRB;

b) water absorption coefficient of the LA-WRB test;

c) joint durability test;

d) accelerated weathering resistance test of the LA-WRB.

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5.3.1.4 One nominal 610 mm × 610 mm panel consisting of LA-WRB applied to nominally 13 mm thick glass mat gypsum sheathing. 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, as per 5.3.5. This test sample panel shall be used for preparation of the test specimens to test the water vapour permeance of the LA-WRB.

5.3.2 The test sample panels shall be prepared in either a vertical or horizontal orientation.

5.3.3 For producing the sample panels/specimens follow the installation requirements of EIFS and LA-WRB, in ISO 17738-2.

5.3.4 The test sample panels/specimens shall be conditioned at (23 ± 2) °C and (50 ± 5) % relative humidity (RH) for a minimum of 14 d.

5.3.5 The applied material thickness shall be verified as a mass per unit area, as follows.

5.3.5.1 Determine the area of the test sample panel/specimen, by measuring its linear dimensions to an accuracy of ±1 mm.

5.3.5.2 Determine the required mass of material required for the test sample panel/specimen using the thickness and density stipulated by the EIFS manufacture. Mass (g) = density (kg/m^3) × area of test sample panel (mm^2) × thickness (mm) × 10^{-6}.

5.3.5.4 Measure the initial mass of the material including its storage container to an accuracy of 1/1 000.

5.3.5.5 Remove material from the storage container and apply it uniformly to the test sample panel/specimen surface until the mass of material removed is equal to the mass required which is the difference between the initial mass of material and container and the mass of the remaining material, including its storage container, measured to an accuracy of 1/1 000.

5.2.5.6 Remove material from the storage container and apply the material to the sample panel/specimen carefully so that no material is lost (i.e. dropped before it reaches the test sample panel). If material is lost, its mass shall be determined and deducted from the amount of material applied when determining the amount of material applied to the sample panel/specimen.

5.3.6 Unless otherwise specified in the test methods, the test specimens shall be obtained from the conditioned test sample panels described in 5.3.1.1 to 5.3.1.4. Care and caution shall 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 tooth pitch measured per 25 mm and other cutting variables shall be considered in test specimen preparation in order to avoid excess vibrations or heat build-up.

5.4 EIFS material tests

5.4.1 Ash content

5.4.1.1 The ash content of the base coat and finish coat shall be determined in accordance with ISO 3451-1 with specimens prepared in accordance with ISO 3451-1. The results shall be expressed as a percentage of the initial weight of the dry test specimen.

5.4.2 Infrared analysis

5.4.2.1 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 ISO 4650 with specimens prepared

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in accordance with Annex I. The results shall be recorded on a plot of percent transmittance vs. wavelength.

5.4.3 Bond strength tests

5.4.3.1 The bond strength of the adhesive, base coat and finish coat shall be determined in according to Annex A with specimens prepared in accordance with Annex A.

5.4.3.2 The results shall be averaged and reported in Pa for each state tested (initial, wet and dry).

5.4.4 Water vapour permeance of the lamina

5.4.4.1 The water vapour permeance of the lamina shall be determined according to ISO 1663 with the face coat of the lamina exposed to the test chamber.

5.4.4.2 Three test specimens of a size suitable for the test equipment to be used shall be cut from the test sample panel specified in 5.3.1.2 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.

5.4.4.3 The results shall be averaged and reported in ng/(Pa·s·m^2).

5.4.5 Base coat water impermeability test

5.4.5.1 The base coat water impermeability shall be determined using three test specimens measuring 200 mm × 200 mm cut from the test sample panel described in 5.3.1.1. The edges of each test specimen shall be sealed with wax or other suitable vapour impermeable material.

NOTE A wax meeting the requirements of ISO 1663:2007, 5.8, “sealant wax”, is a suitable material to use for sealing the edges of the test specimens.

5.4.5.2 Over a surface area of 100 mm × 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. Specimens shall be examined for visible damage stemming from specimen preparation and if apparent, new specimens shall be produced.

5.4.5.3 The test specimens, with the coatings facing downward, shall be placed in a tank of water with a depth of (5 ± 0,25) mm for 2 h.

5.4.5.4 After two hours, 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. Any observation of liquid water shall be recorded.

5.4.5.5 If ponding water occurs, it shall be recorded.

5.4.6 Water absorption of the base coat

5.4.6.1 The water absorption of the base coat shall be determined using two test specimens, measuring 100 mm × 100 mm, cut from the test sample panel described in 5.3.1.1. The thermal insulation board shall be carefully removed from the specimens by first slicing the base coat from the insulation using long, sharp knife. Any remaining insulation shall be carefully scraped from the base coat, avoiding any chipping or flexing of base coat material.

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5.4.6.2 The test specimens shall be dried in a well-ventilated oven for 24 h at a temperature of (105 ± 2) °C. The specimens shall be cooled for 15 min at room temperature, then the specimens shall be weighed to the nearest 0,01 g and the results recorded.

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

5.4.6.4 After 48 h immersion, the weight 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 weight of the specimen expressed as a percentage of the dry weight of the test specimen. The average percentage water absorption of the two test specimens shall be reported.

5.4.7 Finish coat fungus resistance test

5.4.7.1 The fungus resistance of the finish coat shall be determined in accordance with ISO 846 using one test specimen. The test specimen shall be prepared by applying finish coat according to manufacturer's installation instructions onto a 50 mm × 50 mm (minimum) clean glass slide.

5.4.7.2 The test specimen shall be incubated for a minimum of 28 d.

5.4.7.3 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 ISO 846.

5.4.8 Lamina salt resistance test

5.4.8.1 The salt resistance of the lamina shall be determined in accordance with ISO 4611 for 300 h using three test specimens measuring 100 mm × 300 mm cut from the test sample panel described in 5.3.1.2. The edges of each test specimen shall be sealed with wax.

5.4.8.2 The test specimens shall be visually examined without magnification.

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

5.4.9 Lamina ultraviolet resistance test

5.4.9.1 The ultraviolet resistance of the lamina shall be determined in accordance with ISO 16474-3 using three test specimens measuring 100 mm × 300 mm cut from the test sample panel described in 5.3.1.2. The edges of each test specimen shall be sealed with wax.

5.4.9.2 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 % ± 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 % ± 5%) RH];

e) the above cycle [a) throughd)] represents 24 h or 1 d exposure. The cycle is repeated for a total of at least 1 998 h of light exposure (2 664 h or 111 d total).

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

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

5.4.10 Reinforcing mesh strength and alkalinity resistance

5.4.10.1 The strength and alkalinity resistance of the reinforcing mesh shall be determined in accordance with ISO 4606 using test specimens measuring 50 mm wide and 300 mm long, prepared from the lowest density of reinforcing mesh used with the proprietary system.

5.4.10.2 Test specimens shall be taken at least 150 mm from the edges of the roll and in such a manner that different test specimens do not have the same weft and/or warp threads. Half the test specimens cut shall have the long dimension in direction of the warp and half in the direction of the weft.

5.4.10.3 The density (kg/m^2) of the mesh shall be determined in accordance with ISO 29470.

5.4.10.4 The dimensions of the mesh shall be measured in accordance with ISO 29465 and ISO 29466.

5.4.10.5 The test specimens shall be conditioned with an alkali solution.

5.4.10.5.1 A minimum of 20 test specimens shall be prepared according to 5.4.10.1. More than the minimum number of test specimens shall be prepared to ensure that the minimum acceptable test results are obtained for each state.

5.4.10.5.2 Submerge a minimum of 10 test specimens in a tri-alkali solution composed of:

a) 1 g of reagent grade sodium hydroxide (NaOH), minimum purity of 97 %;

b) 4 g of reagent grade potassium hydroxide (KOH), minimum purity of 85 %;

c) 0,5 g of reagent grade calcium hydroxide ($Ca(OH)_2$), minimum purity of 96 %;

added to 1 L of distilled water (a minimum of 4 L shall be required).

5.4.10.5.3 Maintain the tri-alkali solution at a temperature not exceeding 23 °C for a conditioning period of 28 days.

5.4.10.5.4 The test specimens shall be removed from the tri-alkali solution and 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 allowed to dry at 23 °C and 50 % ± 5% RH for 2 d prior to tensile strength testing.

5.4.10.5.5 Following conditioning in 5.4.10.5.4, the strength of the reinforcing mesh shall be tested according to ISO 4606 and the results determined in N/mm for the following:

a) five test specimens in their initial state in the weft;

b) five test specimens in their initial state in the warp;

c) five test specimens after tri-alkali exposure in the weft;

d) five test specimens after tri-alkali exposure in the warp.

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5.4.10.6 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.

5.4.10.7 Discard results of test specimens that:

a) slip in the jaws of the testing apparatus,

b) break at the edge of or in the jaws of the testing apparatus, or

c) tear in a cascading effect.

5.4.10.8 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.

5.4.10.9 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.

5.4.11 Dry thickness of the base coat

5.4.11.1 The dry thickness of the base coat shall be determined in accordance with ISO 1463 in three places on each test specimen to an accuracy of 0,1 mm.

5.4.11.2 Following the completion of each test described in 5.4.3, 5.4.5 and 5.4.6, a set of six test specimens measuring at least 50 mm × 50 mm shall be taken from random spots from the remaining pieces of the test sample panel described in 5.3.1.1.

5.4.11.3 Following the completion of the testing described in 5.4.3, 5.4.4, 5.4.8 and 5.4.9, a set of six test specimens measuring at least 50 mm × 50 mm shall be taken from random spots from the remaining pieces of the unwrapped test sample panel described in 5.3.1.2.

5.4.11.4 The dry thickness of the base coat shall be measured 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 for panels described in 5.3.1.1 and for pabels described in 5.3.1.2.

5.5 LA-WRB tests

5.5.1 Ash content

The ash content of the base coat and finish coat shall be determined in accordance with ISO 3451-1 with specimens prepared in accordance with ISO 3451-1. The results shall be expressed as a percentage of the initial weight of the dry test specimen.

5.5.2 Infrared analysis

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 ISO 4650 with specimens prepared in accordance with Annex I. The results shall be recorded on a plot of percent transmittance vs. wavelength.

5.5.3 Bond strength test of the LA-WRB

5.5.3.1 The bond strength of the LA-WRB shall be determined in accordance with Annex A.

5.5.3.2 The average of the results of the bond strength tests shall be reported in Pa for each state tested (initial, wet and dry).

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5.5.4 Water absorption coefficient of the LA-WRB

5.5.4.1 The water absorption coefficient of the LA-WRB shall be determined in accordance with Annex B.

5.5.4.2 The water absorption coefficient of the LA-WRB shall be reported in $g/(m^2 \cdot s^{1/2})$.

5.5.5 Water vapour permeance of the LA-WRB

5.5.5.1 The water vapour permeance of the LA-WRB shall be determined in accordance with ISO 12572, aqueous saturated solution (wet cup) using distilled water. Four test specimens, including the substrate material, each measuring 305 mm × 305 mm, shall be cut from the test sample panel described in 5.3.1.4 shall be placed in the tray with the LA-WRB side face down.

5.5.5.2 The water vapour permeance of the substrate itself shall be determined in accordance with ISO 12572, aqueous saturated solution (wet cup) using distilled water. Four test specimens of the substrate material, each measuring 305 mm × 305 mm, shall be cut from the test sample panel described in 5.3.1.4.

5.5.5.3 The water vapour permeance of the LA-WRB with the substrate material and the substrate itself shall be reported in $ng/(Pa \cdot s \cdot m^2)$.

5.5.5.4 The water vapour permeance of the LA-WRB shall be reported as the average difference between the results of the LA-WRB with the substrate attached and the substrate itself.

5.5.6 Accelerated weathering resistance test of the LA-WRB

5.5.6.1 The accelerated weathering resistance of the LA-WRB shall be determined in accordance with ISO 16474-3 utilizing a UVA-340 lamp.

5.5.6.2 Three test specimens of a size suitable for the test apparatus, but in no case smaller than 100 mm × 150 mm, shall be cut from the test sample panel described in 5.3.1.3. The test specimens shall not include the joint in the OSB or the framing members.

5.5.6.3 The test shall be conducted with the following cycle:

a) 102 min of light exposure with no water spray [black panel temperature of (63 ± 2) °C and (50 % ± 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 ± 5) % 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).

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

5.5.6.5 Any deleterious effects, such as cracking, delamination or flaking, shall be recorded. Cracking shall be determined following the definition in ISO 4628-4:2016, Table 2, Rating 3(c) or higher.

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5.5.7 LA-WRB joint durability test

5.5.7.1 The joint durability of the LA-WRB shall be determined in accordance with Annex C using test specimens constructed in accordance with Annex C.

5.5.7.2 The visual condition of the test specimens after the cycling shall be reported including 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.

5.5.7.3 Moisture seepage through the test specimens after the water penetration test shall be reported.

5.5.8 Nail popping resistance test

5.5.8.1 The resistance to nail popping shall be determined in accordance with Annex D using test specimens constructed according to Annex D.

5.5.8.2 Following the test, the test specimen shall be removed from the test apparatus and the condition of the LA-WRB shall be visually examined without magnification.

5.5.8.3 Any aspect of deterioration or deleterious effects, such as cracking or delamination of the LA-WRB around the nail head, shall be recorded.

5.5.9 Air flow rate

The air flow rate shall be determined in accordance with ISO 14857 using test specimens constructed in accordance with 5.2. and subjected to ISO 14857:2014, 8.1.2. Non-self-supporting materials.

5.6 EIFS tests

5.6.1 EIFS impact resistance test

5.6.1.1 The impact resistance of EIFS is tested according to this clause using four test sample panels prepared as per 5.3.1.2 with their edges wrapped.

5.6.1.2 A 0,5 kg steel impactor with a 49 mm diameter spherical end shall be dropped from a height of 0,61 m onto the test specimens to impart an impact energy of 3 J. The ball shall be dropped a total of 10 times onto two different test panels (five times per test specimen, all at different locations on the test specimen).

5.6.1.3 A 1,0 kg steel impactor with a 63 mm diameter spherical end shall be dropped from a height of 1,02 m onto the test specimens to impart an impact energy of 10 J. The ball shall be dropped a total of 10 times onto two different test panels (five times per test specimen, all at different locations on the test specimen).

5.6.1.4 Following each drop, the test specimen shall be visually examined without magnification for cracks and perforations. For the purposes of this test, a crack is an opening through the finish coat and base coat which allows the reinforcing mesh to be seen. For the purpose of this test, a perforation is broken reinforcing mesh.

5.6.1.5 When impacted at a 3 J energy level, a drop that causes no crack in the test specimen shall be considered a “pass”. The number of drops that result in a “pass” shall be reported.

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5.6.1.6 When impacted at a 10 J energy level, a drop that causes no perforation in the test specimen shall be considered a "pass". The number of drops that result in a "pass" shall be reported.

5.6.2 Durability under cyclic environmental conditions test

5.6.2.1 The durability of EIFS shall be determined in accordance with Annex E.

5.6.2.2 The EIFS constituent materials used to construct the test specimen for this test shall represent a "worst-case" scenario, and all other constituent materials shall be deemed to meet this test, by incorporating the following into the test specimen:

a) EIFS manufacturer's LA-WRB with the weakest bond strength in the wet state and the highest water absorption;

b) EIFS manufacturer's adhesive with the weakest bond strength to both the thermal insulation board and to the LA-WRB in the wet state;

c) EIFS manufacturer's base coat with the highest water absorption coefficient and the weakest bond strength in the wet state.

5.6.2.3 The test specimens shall be constructed in accordance with Annex E.

5.6.2.4 Where it is not possible to construct one test specimen incorporating the "worst-case" constituent materials identified in 5.6.2.1, then additional test specimens shall be constructed and tested such that all "worst-case" products are evaluated. The "worst-case" materials shall be incorporated into the test specimens in such combinations that as few as possible tests are conducted. Where the EIFS manufacturer has different LA-WRBs and one has the weakest bond strength in the wet state and another has the highest water absorption, this represents a situation when more than one test specimen shall be constructed.

5.6.2.5 Upon completion of the cyclic environmental testing, the condition of the test specimen shall be visually examined without magnification

5.6.2.6 The extent of visual deterioration, which includes the following, shall be reported:

a) blistering of the finish coat or detachment of the finish coat from the base coat;

b) cracking, blistering or sagging of the base coat or detachment of the base coat from the thermal insulation board;

c) changes in colour or texture of the finish or base coat;

d) water that passes through to the substrate.

5.6.2.7 When the deterioration following the cyclic environmental testing exceeds that indicated in Table 3, the results shall be highlighted in the test report. For the purposes of evaluation in this test, crazing or microcracking is not considered to be deterioration.

5.6.2.8 Once all visual assessments have been made, the adhesion of the lamina to the insulation shall be tested in accordance with Annex I. Specimens (finish through to and including the sheathing) are to be removed from the panels, three from area with finish, three from area without finish. The sample area must be large enough to allow for the testing of 50 mm × 50 mm areas, with minimum 50 mm clearance from all edges.

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5.6.3 Drainage capacity test

5.6.3.1 The drainage capacity of EIFS shall be determined in accordance with Annex F using a test specimen constructed according to Annex F.

5.6.3.2 The type of LA-WRB or the substrate used for the test is irrelevant to the results. If any changes are made to the drainage cavity that make the drainage path more restrictive, such as changes to the pattern of ribbons or the GDDC, new specimens shall be constructed and tested.

5.6.3.3 The water retention shall be reported in g/m^2.

5.6.4 Wind load testing

The ability of the EIFS to withstand wind loading shall be determined in accordance with Annex G.

5.7 Reporting requirements

All reports shall include the following information:

a) the identification of products (by name) used in the EIFS, including the LA-WRB;

b) the name and address of manufacturer or supplier;

c) the address(es) of manufacturing location(s);

d) the lot number;

e) the name and address of sampling agency;

f) the date and method of sampling and location of site(s) where sampling was performed, and test sample reference number(s);

g) a complete description of all test specimens, including all manufactured components (manufacturer name, component model number and related information), materials, construction details, application or installation instructions, relevant literature and other pertinent information;

h) the date of test sample and test specimen preparation and detailed test sample and test specimen preparation methods;

i) the descriptions of test apparatus, calibration standards and their source(s);

j) the start and end date(s) of test(s);

k) the test procedure identification;

l) the test results;

m) a statement of conformance with the requirements of this document shall be provided in the form of a chart, as shown in Table 4, including a reference that the components are part of a system and only meet the requirements of this document when used as part of a system;

n) the name and location of the laboratory performing the tests and, if applicable, the accreditation agency for the laboratory;

o) the manufacturer's installation instructions followed in preparation of the test sample panels according to 5.2.

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6 Marking, packaging and labelling

6.1 Packaging

Unless otherwise specified, the EIFS components shall be packed in the manufacturer's standard packages.

6.2 Labelling

Unless otherwise specified, each container shall be marked with the following:

a) manufacturer's name and address;

b) product name;

c) product description;

d) the statement, "ISO 17738-1";

e) manufacturer's lot or date code identification of the material in the container.

Table 1 — Technical requirements for constituent products of EIFS (reference: 4.1)

TEST	Reference	Requirement	Notes
Bond strength of adhesive to LA-WRB	5.4.3 and Annex A	≥80 kPa	Wet state
		≥250 kPa	Initial and dry state
Bond strength of adhesive to Concrete Block	5.4.3 and Annex A	≥80 kPa	Wet state
		≥250 kPa	Initial and dry state
Bond strength of base coat to thermal insulation board	5.4.3 and Annex A	≥80 kPa	All states
Bond strength of finish coat to base coat	5.4.3 and Annex A	≥80 kPa	All states
Water vapour permeance of the lamina	5.4.4	Report There is no pass/fail criterion for the water vapour permeance of the lamina.	Water vapour permeance of the lamina is included for potential hygrothermal design purposes.
Base coat water impermeability	5.4.5	<90 % of surface area damp no liquid water visible	
Base coat water absorption	5.4.6	<20 % avg. mass gain	
Finish coat fungus resistance	5.4.7	No fungal growth supported	
Lamina salt resistance	5.4.8	No deleterious effects visible	
Lamina ultraviolet resistance	5.4.9	No deleterious effects visible	
Strength of reinforcing mesh	5.4.10	Avg. initial strength ≥35 N/mm	For both weft and warp
Strength of reinforcing mesh after tri-alkali solution exposure	5.4.10.8	Avg. residual strength ≥20 N/mm and a loss in ultimate tensile strength of not more that 50 %	For both weft and warp

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Table 1 *(continued)*

TEST	Reference	Requirement	Notes
Strength of reinforcing mesh after cement solution exposure	5.4.10.8	Avg. residual strength ≥15 N/mm and a loss in ultimate tensile strength of not more that 60 %	For both weft and warp
Dry thickness of the base coat	5.4.11	There is no pass/fail criterion for the dry thickness of the base coat test.	Report dry thickness of the base coat is determined for verification purposes only.

Table 2 — Technical requirements for LA-WRB (reference: 4.2)

Test	Reference	Requirement	Notes
Bond strength	5.5.3 and Annex A	≥80 kPa	Wet state
		≥250 kPa	Initial and dry state
Water absorption coefficient	5.5.4 and Annex B	<4,0 g/(m^2·s^{½})	
Water vapour permeance	5.5.5	Report value in ng/(Pa·s·m^2). There is no pass/fail criterion water vapour permeance of the LA-WRB.	Water vapour permeance of the LA-WRB is included for potential hygrothermal design purposes. Test specimen shall be the maximum recommended thickness.
Accelerated weathering resistance	5.5.6	No cracking, delamination, or flaking	
Joint durability	5.5.7	No water transmission	
Nail popping resistance	5.5.8 and Annex D	No cracking or delamination of the LA-WRB around the nail head in any of the test specimens	A bulge in the LA-WRB at the location of the nail head that is not cracked or delaminated does not constitute a failure.
Air leakage resistance	5.5.9	0,02 L/(s·m^2) @ 75 Pa	Air leakage rate determined through [ISO 14857] assessment procedures

Table 3 — Technical requirements for EIFS

Test	**Reference**	**Requirement**	**Notes**
Impact resistance	5.6.1	6 of 10 drops no cracking at 3 J energy level and no perforation at 10 J level	
Assessing the durability of EIFS under cyclic environmental conditions	5.6.2 and Annex E	No visible deterioration	Crazing, or microcracking, is not considered to be deterioration.
	5.6.2 and Annex E	≤20 % bond strength loss compared to test specimens tested per 5.4.3 and 5.5.3	
Drainage capacity test	5.6.3 and Annex F	Water retention ≤40 g/m^2 based on projected drainage area	

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Table 3 *(continued)*

Test	Reference	Requirement	Notes
Wind-load resistance	5.6.4 and Annex G	Report values as per Annex G, Tables G.2 and G.3 (reporting tables)	

Table 4 — Sample conformance report (reference: 4.1.3)

NOTE Additional rows can be inserted as needed for additional products or substrates.

Manufacturer name: _____

Address: _____

Telephone: _____ Fax: _____

Website: _____

EIFS Identification: _____

EIFS CONSTITUENT MATERIAL TESTS			
Test	Requirement	Product ID	Report
Bond strength of adhesive to LA-WRB	≥80 kPa (wet state) ≥250 kPa (initial and dry states)		(Pass/Fail)
Bond strength of adhesive to concrete block	≥80 kPa (wet state) ≥250 kPa (initial and dry states)		(Pass/Fail)
Bond strength of adhesive to thermal insulation board	≥80 kPa (all states)		(Pass/Fail)
Bond strength of base coat to thermal insulation board	≥80 kPa (all states)		(Pass/Fail)
Bond strength of finish coat to base coat	≥80 kPa (all states)		(Pass/Fail)
Water vapour permeance of the lamina	N/A		[Average result in ng/(Pa·s·m^2)]
Base coat water impermeability test	<90 % of surface area damp		(Pass/Fail)
Water absorption of the base coat	<20 %		(Pass/Fail)
Fungus resistance test	No fungal growth		(Pass/Fail)
Lamina salt resistance test	No visible effects		(Pass/Fail)
Lamina ultraviolet resistance test	No visible effects		(Pass/Fail)
Ultimate tensile strength of reinforcing mesh	≥35 N/mm (weft and warp)		(Pass/Fail)
Reinforcing mesh tensile strength after tri-alkali solution exposure	≥20 N/mm and loss in ultimate tensile strength of not more than 50 % (weft and warp)		(Pass/Fail)

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