
**Thermal insulation products —
Exterior insulation finish systems —**

**Part 1:
Materials**

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

Partie 1: Matériaux

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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).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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 components 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.

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 resilient 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*

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

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)

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 accessory

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

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 ·s ^{0,5})
A_{wt}	water absorption coefficient related to a specific time, t , in seconds	kg/(m ² ·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 ·h ^{0,5})
W_{wt}	water absorption coefficient related to a specific time, t , in hours	kg/(m ² ·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:
- joint durability test;
 - nail popping resistance test.

5 Test methods**5.1 Requirements**

The EIFS shall be tested as an assembly as required in [5.5](#) and meet the requirements in [Table 3](#).

5.2 Sampling

Random sampling of the materials required for testing, shall be carried out to determine conformance 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.

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. $\text{Mass (g)} = \text{density (kg/m}^3) \times \text{area of test sample panel (mm}^2) \times \text{thickness (mm)} \times 10^{-6}$.

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

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 accordance with [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 $\text{ng}/(\text{Pa}\cdot\text{s}\cdot\text{m}^2)$.

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 $200\text{ mm} \times 200\text{ mm}$ 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 $100\text{ mm} \times 100\text{ mm}$ 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 $(5 \pm 0,25)\text{ mm}$ 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 $100\text{ mm} \times 100\text{ mm}$, 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.

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 $(50 \% \pm 5 \%)$ 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) 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.

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 ($\text{Ca}(\text{OH})_2$), 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 % \pm 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.

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).

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 $\text{g}/(\text{m}^2 \cdot \text{s}^{1/2})$.

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 $\text{ng}/(\text{Pa} \cdot \text{s} \cdot \text{m}^2)$.

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 $(63 \pm 2) \text{ }^\circ\text{C}$ and $(50 \% \pm 5) \% \text{ RH}$];
- b) 18 min of light exposure with water spray [water temperature at $(16 \pm 3) \text{ }^\circ\text{C}$];
- c) the above cycle [a) and b)] is repeated for 18 h;
- d) 6 h of darkness, no water spray [black panel temperature of $(24 \pm 2) \text{ }^\circ\text{C}$ 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).

5.5.6.4 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.

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.

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.

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/m².

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](#).

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 than 50 %	For both weft and warp

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 than 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 ^{1/2})	
Water vapour permeance	5.5.5	Report value in ng/(Pa·s·m ²). There is no pass/fail criterion for 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	

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)

EIFS CONSTITUENT MATERIAL TESTS			
Test	Requirement	Product ID	Report
Reinforcing mesh tensile strength after cement solution exposure	≥15 N/mm and loss in ultimate tensile strength of not more than 60 % (weft and warp)		(Pass/Fail)
Base coat thickness	N/A		(Average result in mm)

LA-WRB TESTS				
Test	Substrate	Requirement	Product ID	Report
Bond strength of the LA-WRB	To concrete block	≥80 kPa (wet state) ≥250 kPa (initial and dry states)		(Pass/Fail)
Bond strength of the LA-WRB	(To specified substrate)	≥80 kPa (wet state) ≥250 kPa (initial and dry states)		(Pass/Fail)
Water absorption coefficient		<4,0 g/(m ² ·s ^{1/2})		(Pass/Fail)
Water vapour permeance		N/A		[Result in ng/(Pa·s·m ²)]
Accelerated weathering resistance		No cracking, delamination, flaking		(Pass/Fail)
Joint durability		No water transmission		(Pass/Fail)
Nail popping resistance				(Pass/Fail)

EIFS SYSTEM TESTS			
Test	Requirement	Product ID	Report
Impact resistance	6 of 10 drops no cracking at 3 J energy level and no perforation at 10 J level.		(Pass/Fail)
Durability under environmental cyclic conditions	≥80 % tensile strength and no visible deterioration		(Pass/Fail)
Drainage capacity	Water retention ≤40 g/m ²		(Pass/Fail)

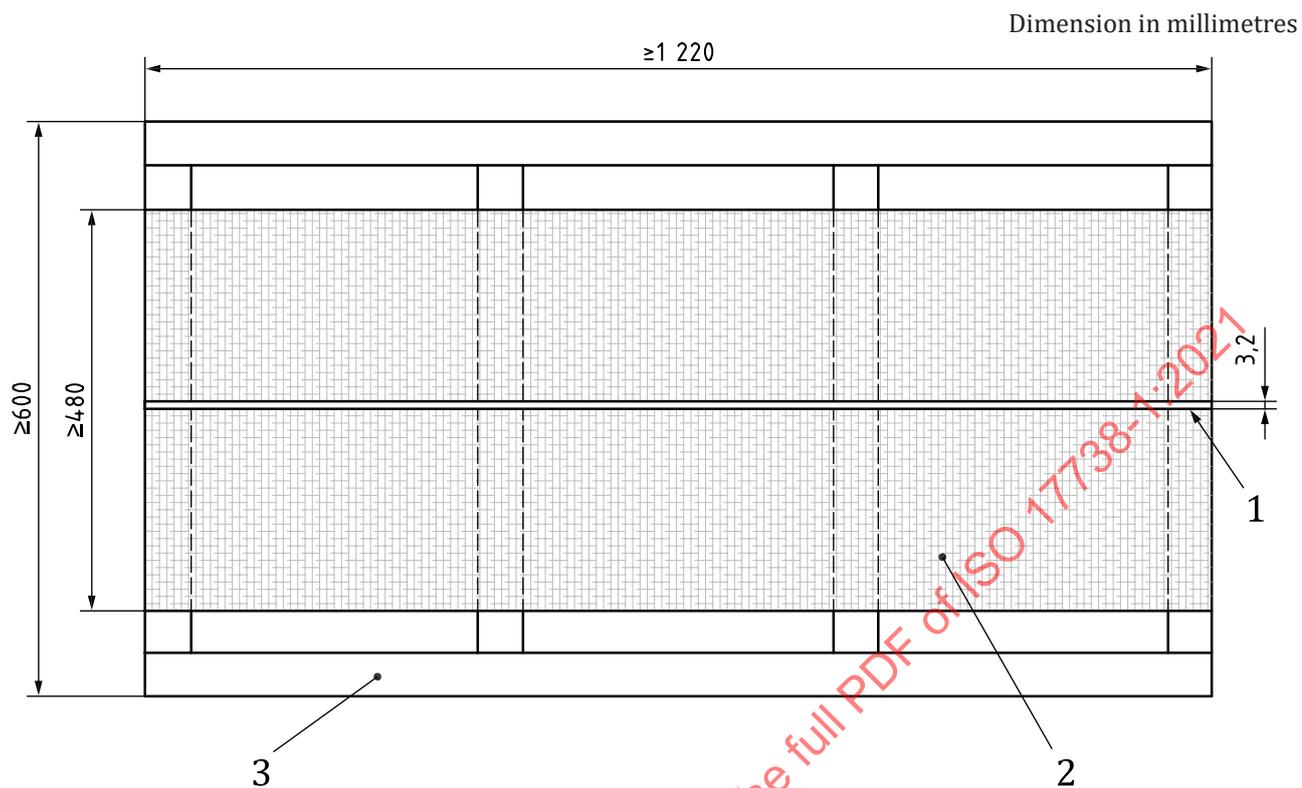
Testing Agency:

Address:

Telephone:

Fax:

Name: Signature: Date:



Key

- 1 gap
- 2 OSB
- 3 wood frame

NOTE 1 [Figure 1](#) is not drawn to scale, the schematic is only to demonstrate configuration of panel.

NOTE 2 Additional bracing can be required to support samples when cut out of the panel, prior to placing in the test apparatus.

Figure 1 — Test sample panel construction (reference: [5.3.1.3](#))

Annex A (normative)

Bond strength testing ([5.3.3](#) and [5.4.3](#))

A.1 General

A.1.1 This test method evaluates the bond strength of the following:

- a) the LA-WRB to a concrete block or paving stone;
- b) the LA-WRB to other substrates, as determined by the EIFS manufacturer;
- c) the adhesive to the LA-WRB;
- d) the adhesive to concrete block;
- e) the adhesive to the thermal insulation board;
- f) the base coat to the thermal insulation board;
- g) the finish coat to the base coat.

A.1.2 This annex provides information on the preparation of test specimens and describes the test apparatus to be used and the procedure to be used.

A.2 Summary of test method

A.2.1 This test method involves the use of a test apparatus that grips opposite sides of the test specimen and applies a tensile load to the test specimen at a pre-determined rate of speed, until the test specimen ruptures. The bond strength is then calculated as the breaking load divided by the minimum cross-sectional area of the test specimen.

A.2.2 For each bond strength test, a total of 15 test specimens shall be tested. Five test specimens shall be tested after initial conditioning (initial state). 10 test specimens shall be further conditioned by exposure to water for a period of 48 h. Five of those test specimens shall be tested after drying for 2 h (wet state) and five shall be tested after drying for 7 d (dry state).

A.3 Significance and use

This test evaluates the ability of the EIFS and LA-WRB to resist lateral loads that would be caused by wind or other forces. The test also considers the bond strength of the materials should they become wetted and dried in use.

A.4 Test apparatus

The test apparatus shall be as described in ISO 1926.

A.5 Test specimen preparation

A.5.1 The test specimens shall be square or rectangular with the minimum length and width dimension of each test specimen equal to or greater than the thickness of the test specimen, but in no case shall a test specimen be less than 500 mm × 50 mm in size. The test specimen shall not be larger than the setting blocks of the testing equipment that are glued to the test specimen.

A.5.2 The following test samples shall be prepared:

- a) **Bond strength of the LA-WRB to concrete block or paving stone.** The LA-WRB shall be applied on a non-patterned concrete block or paving stone at least 40 mm thick, capable of withstanding the loads required for this test method;
- b) **Bond strength of the LA-WRB to other substrates.** The LA-WRB shall be applied to such other substrates as specified by the EIFS manufacturer. Each substrate shall be capable of withstanding the loads required for this test method. Where the bond strength of the LA-WRB to OSB is to be evaluated, test specimens shall be cut from the test sample panel described in [5.3.1.3](#), such test specimens to exclude the framing and joint.
- c) **Bond strength of the adhesive to the LA-WRB.** The LA-WRB shall be applied to a substrate capable of withstanding the loads required for this test method and allowed to cure as per the EIFS manufacturer's installation instructions. The adhesive shall be applied to the LA-WRB at the thickness stipulated by the EIFS manufacturer then covered with a thermal insulation board to prevent the adhesive from becoming too dehydrated. The thermal insulation board shall be removed after the adhesive has been allowed to dry;
- d) **Bond strength of the adhesive to concrete block.** The adhesive shall be applied to a non-patterned concrete block or paving stone at least 40 mm thick, capable of withstanding the loads required for this test method and allowed to cure as per the EIFS manufacturer's installation instructions. The adhesive shall be applied at the thickness stipulated by the EIFS manufacturer then covered with a thermal insulation board to prevent the adhesive from becoming too dehydrated. The thermal insulation board shall be removed after the adhesive has been allowed to dry;
- e) **Bond strength of the adhesive to the thermal insulation board.** The adhesive shall be applied to the thermal insulation board at the thickness stipulated by the EIFS manufacturer then covered with a secondary thermal insulation board to prevent the adhesive from becoming too dehydrated. The secondary thermal insulation board shall be removed after the adhesive has been allowed to dry;
- f) **Bond strength of the base coat to the thermal insulation board.** Test specimens shall be cut from the test sample panels described in [5.3.1.1](#);
- g) **Bond strength of the base coat to the finish coat.** Test specimens shall be cut from the test sample panels described in [5.3.1.2](#).

A.5.3 For all test specimens, the LA-WRB, base coat and reinforcing mesh and finish coat 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](#).

A.5.4 For each bond strength test, a total of 15 test specimens shall be tested.

A.5.5 The test specimens shall be initially conditioned for 14 days at (23 ± 2) °C and (50 ± 5) % RH (initial state).

A.6 Test procedure

A.6.1 The bond strength tests are carried out after each set of test specimens has cured and the setting blocks are adhered to each test specimen using an ad-hoc adhesive.

The adhesive used for tensile load testing in [A.6.1](#) shall be at least as strong as the required loads stated herein. One material that can be used is epoxy.

A.6.2 The tests shall be conducted according to ISO 1926. The traction speed, or the rate at which test specimens are placed under tensile load, shall be 1 mm to 2 mm per min.

A.6.3 For each bond strength test, five test specimens shall be tested in the initial state. 10 test specimens shall be tested after further conditioning as per [A.6.4](#).

A.6.4 After initial conditioning, the edges of ten of the test specimens shall be sealed with a waterproof material to prevent water absorption through the edge of the test specimens. The test specimens shall then be immersed 5 mm into water maintained at a temperature of $(23 \pm 2)^\circ\text{C}$ for at least 48 h.

The waterproof material used to seal the edges of each test specimen in [A.6.4](#) shall have sufficient hydrostatic water resistance to prevent water ingress into the test specimens. Sealant materials found to perform this function include paraffin wax, neutral cure silicone and epoxy.

A.6.5 After immersion, five test specimens shall be tested after being dried for 2 h at $(23 \pm 2)^\circ\text{C}$ and $(50 \pm 5)\%$ RH (wet state). The bond strength tests shall be conducted within 30 min after 2 h drying.

A.6.6 After immersion, five test specimens shall be tested after being dried for 7 d at $(23 \pm 2)^\circ\text{C}$ and $(50 \pm 5)\%$ RH (dry state). The bond strength tests shall be conducted within 30 min after 7 d drying.

A.6.7 The bond strength for each test specimen shall be calculated by dividing the breaking load in kN by the original minimum cross-sectional area of the test specimen in m^2 . The average of the five results for each state (initial, wet and dry) shall be reported. The mode of ultimate failure shall also be reported.

A.7 Assessment

In addition to the information required in [5.7](#), the following information shall be reported:

- a) the bond strength of each test specimen and the calculated average bond strength for each test state (initial, dry, wet);
- b) the mode of ultimate failure.

Annex B (normative)

Water absorption coefficient of the LA-WRB ([5.5.4](#))

B.1 General

This test method is intended to identify the water resistance characteristics of the LA-WRB to be used for providing a second line of defence in conjunction with EIFS. The water resistance of the LA-WRB is assessed by measuring the absorption due to water-film formation at the surface and/or to standing water on the surface of the barrier.

B.2 Summary of test method

B.2.1 This test follows the methodology described in ISO 15148.

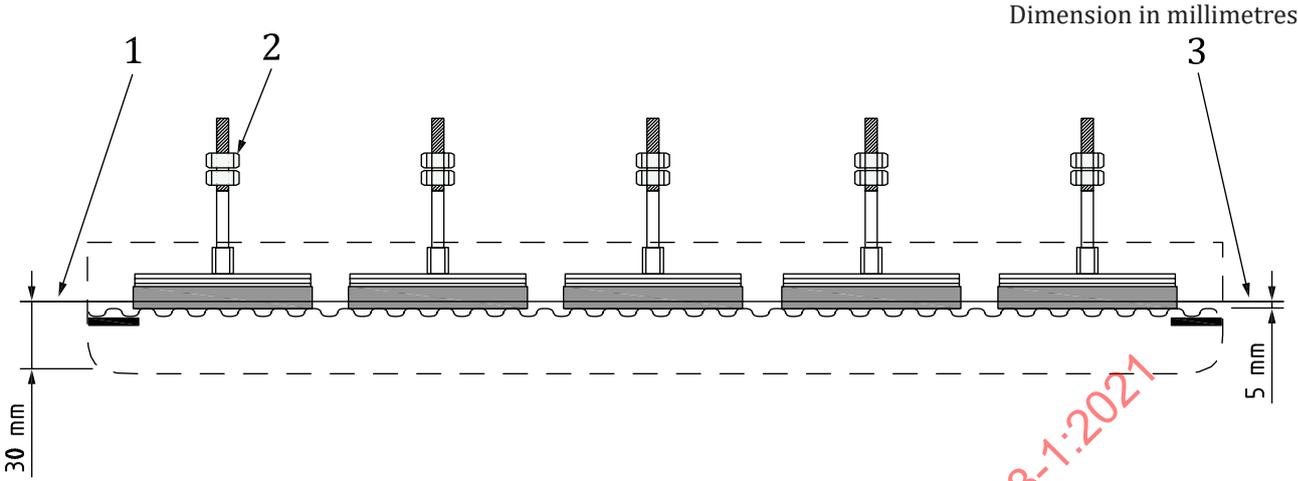
B.2.2 The water absorption characteristic of the LA-WRB is determined by submerging the coated surface under 5 mm of water and measuring the changes in mass over time, for a period of at least 72 h.

B.3 Significance and use

This test is intended as a means of measuring the absorption of liquid water into the surface of the LA-WRB, and to provide an indication of its liquid transport performance should it be exposed to continuous or driving rain while it is unprotected by EIFS.

B.4 Test apparatus

The test apparatus shall consist of a watertight tank capable of holding at least 30 mm of water and a clamp assembly to hold the test specimens off the bottom of the tank. See [Figure B.1](#) for an example of a suitable test apparatus.



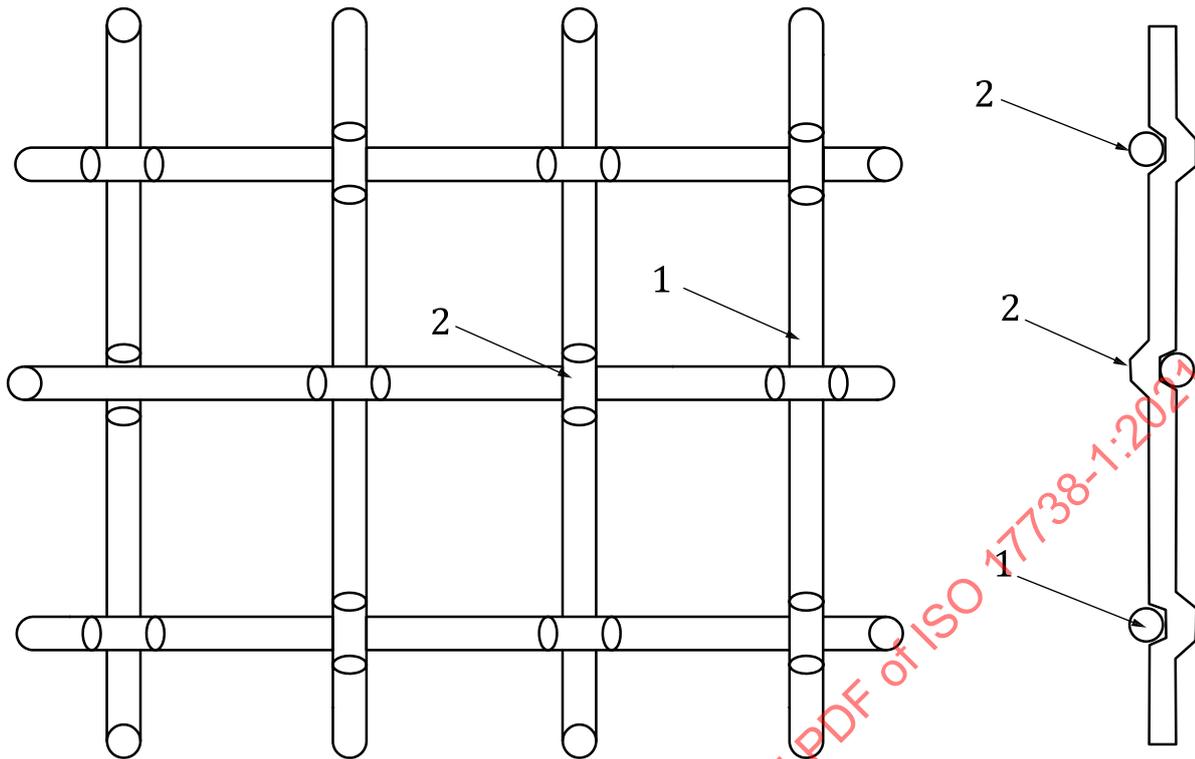
Key

- 1 water level
- 2 nuts added, as required, to submerge specimens and achieve contact with support screen
- 3 measurement from peaks of wire mesh

NOTE Side view of reservoir with test rig. Water reservoir can be serviced by a drip feed to maintain constant water level. Rig supported to keep water level in all directions.

Figure B.1 — Test apparatus

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Key

- 1 stainless steel, single or double crimp, min 2 mm wire, 15 X 15 mm grid pattern
- 2 orient screen in reservoir so peaks of crimps support the test specimens.

NOTE Long edge supports finished for resting on tray edge supports. Illustration not drawn to scale, meant to show type of weave.

Figure B.2 — Sample support mesh

B.5 Test specimens

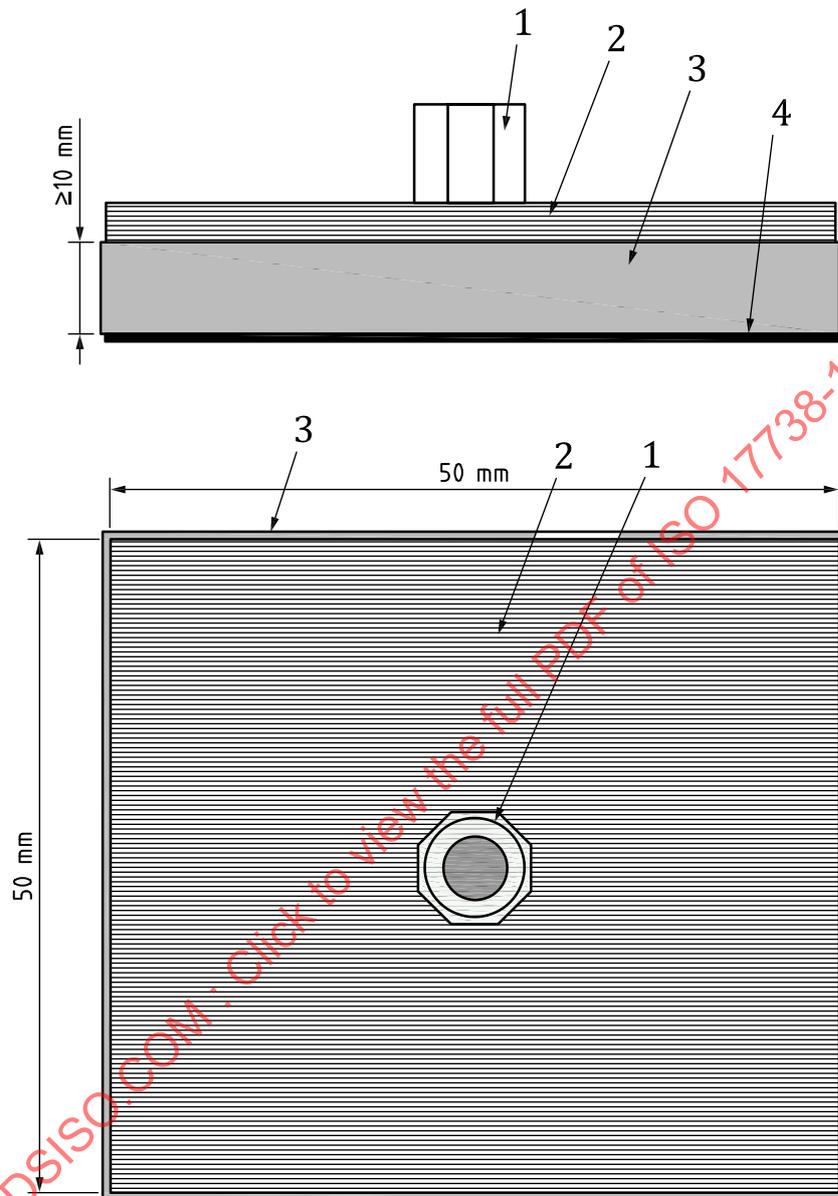
B.5.1 10 test specimens, each measuring 50 mm × 50 mm, shall be cut from the test sample panel described in 5.3.1.3. The test specimens shall not include the joint in the sheathing or the framing members.

B.5.2 The edges of the test specimens shall be attached to the surfaces of a hollow column providing an exposed surface area of the LA-WRB on 25 cm² and waterproofing of the four vertical edges of the specimens for emersion in 5 mm of water. Alternatively, specimens may be protected as shown in Figure B.2 with a water/vapour-tight sealant or epoxy coating that does not react chemically with the product. It is important to seal the four sides of the test specimens with impermeable coating to prevent bypassing of the tested coating.

B.5.3 The test specimens shall be conditioned at (23 ± 2) °C and (50 ± 5) % RH until the mass of each test specimen has stabilized to within 0,1 % of its total weight when measured over a 24 h period.

B.5.4 Where four-sided protection is provided by a hollow column as described in B.5.2, specimens may be arranged in a supporting rig to provide the conditioning of the exposed LA-WRB through

emersion in 5 mm of water. Specimens shall otherwise be protected and conditioned as illustrated in Figures B.1 and B.2.



Key

- 1 tall nut (9 mm or greater) centred on specimen and glued in place.
- 2 19 mm OSB
- 3 specimen edge waterproofing
- 4 LA-WRB

NOTE Tall nut for attaching bolt and weights as required to submerge specimen to the required depth in the conditioning tray/reservoir. A larger nut may be used to achieve desired balance and weight. Bolt will allow placement and removal of specimens from tray with minimum disruption.

Figure B.3 — Test specimen

B.6 Test procedure

B.6.1 The test specimen shall be weighed to 0,1 % of its weight to determine the initial mass, m_i , after conditioning. The test specimens shall then be clamped in the test assembly in such a way that the surface of each test specimen is exposed to 5 mm water head. Care shall be taken to ensure that the test specimens are kept clear from the bottom of the tank and that air bubbles are not trapped below the test specimen. The water level shall be kept constant during the test at 5 mm above the highest point on the base of the test specimen (see [Figure B.1](#)).

B.6.2 After 5 min of exposure to the water head, remove the test specimen from the water, blot the surfaces with a damp sponge, ensuring that the sponge is wrung out before blotting each face, and weigh the test specimen to the nearest $\pm 0,1$ % of its mass. Repeat this at increasing time intervals such as 20 min, 1 h, 2 h, 4 h and 8 h after immersion and then at times, including 24 h, 48 h and 72 h to obtain a series of masses m_t at times t .

The operations of blotting and weighing should be carried out as quickly as possible, preferably within a minute and the specimen returned to the water immediately afterwards.

B.6.3 The method of calculating the result shall depend on the shape of the resulting curve, and the accuracy of the results depends almost entirely on the handling, drying etc. of the test specimens, thus, the calculations and plots shall be done immediately after the weighing. It will then be possible to assess whether further weighing is needed to achieve the required accuracy.

B.6.4 If the observed increase in mass is very small after 24 h, the test may be extended over further days to give a more precise result.

B.7 Assessment

B.7.1 Calculate the area (A) of the base of the test specimen in m^2 . Calculate the difference between the mass at each weighing (m_t) and the starting mass (m_i) per unit area (A),

$$\Delta m_t = (m_t - m_i)/A \quad (\text{B.1})$$

and plot this against the square root of the weighing times (\sqrt{t}).

B.7.2 The resulting graph will fall into one of two types: type A or type B (see [Figures B.3](#) and [B.4](#)). In both type of graphs, the water absorption coefficient (A_w) at 72 h shall be used in determining the water absorption coefficient.

Type A — After a short initial period of stabilization, a straight line can be drawn through the values of m_t against \sqrt{t} . Extend this line back to time zero where it cuts the vertical axis at m'_o .

The water absorption coefficient is then calculated from:

$$A_w = (m'_{tf} - m'_o)/\sqrt{t_f} \quad (\text{B.2})$$

where

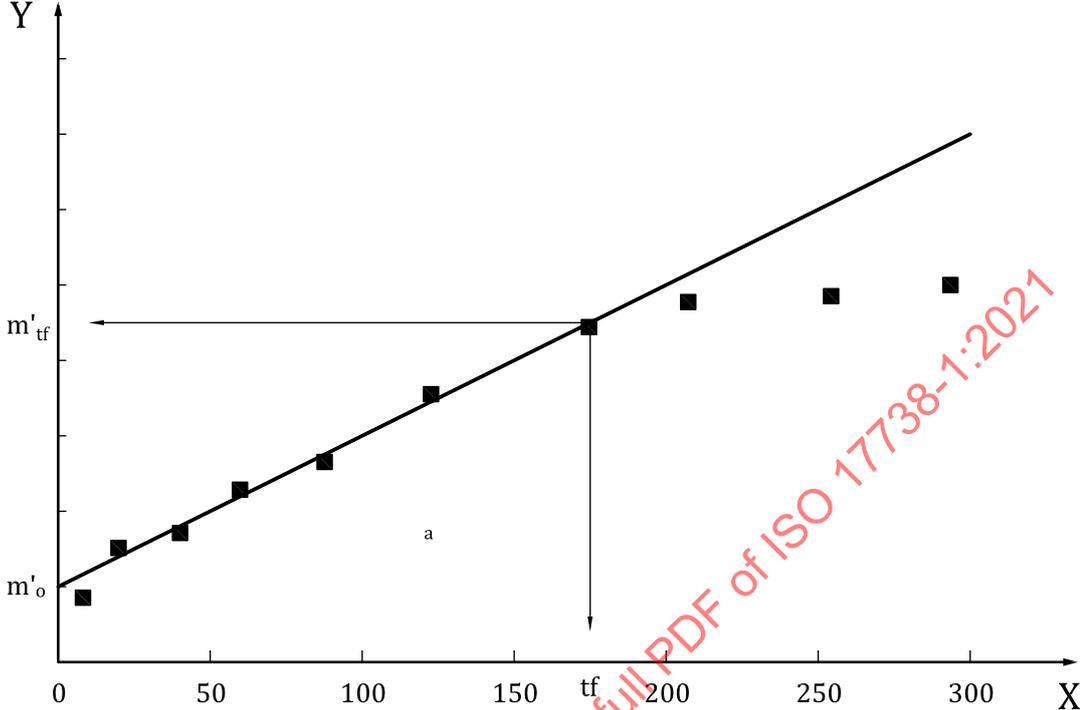
$\Delta m'_{tf}$ is the value of Δm on the straight line at time t_f , in kg/m^2 ;

t_f is the time in seconds, at the end of the test.

Type B — If the graph of Δm_t against \sqrt{t} does not give a straight line, but a curve of some form, the value of Δm_t 24 h, 48 h and 72 h after the start should be taken as Δm_{tf} and A_w shall be calculated from:

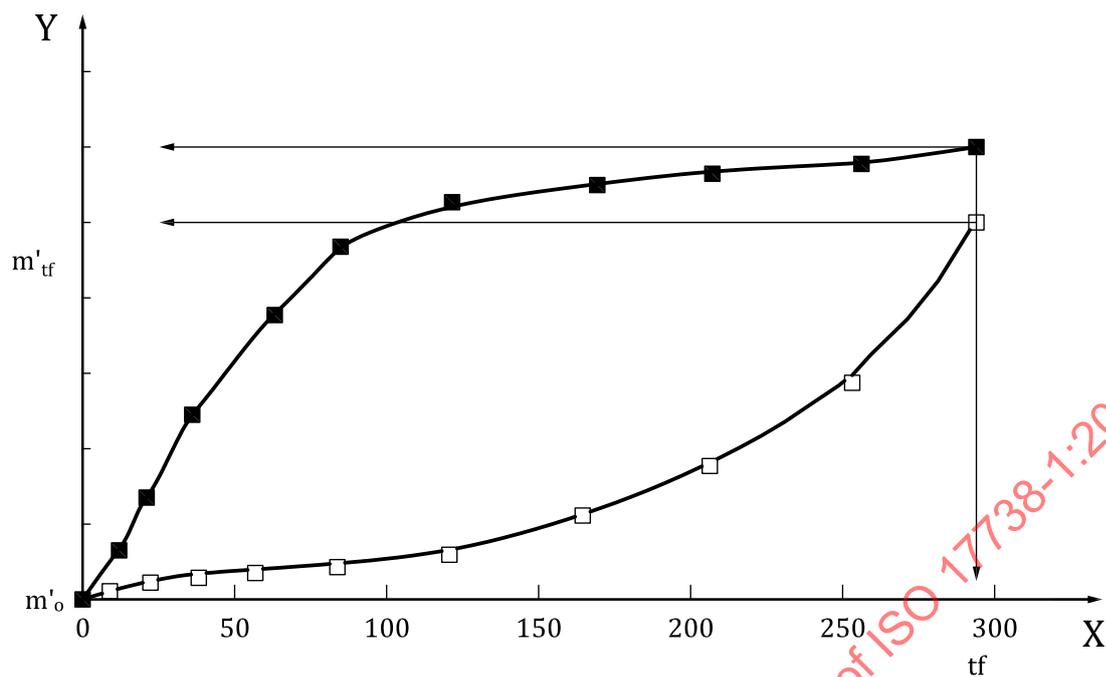
$$A_{w(24, 48, 72)} = m'_{tf} / \sqrt{t_f} \quad (\text{B.3})$$

B.7.3 If the test specimen becomes saturated before 24 h and the test cannot be repeated with a thicker test specimen, the time of saturation should be quoted in the test report and no A_w reported.



- Key**
- X time ~ 0,5
 - Y m_t
 - a slope = A_w

Figure B.4 — Type A



Key
 X time ~ 0,5
 Y m_t

Figure B.5 — Type B

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Annex C (normative)

Joint durability test ([5.5.7](#))

C.1 General

This test method evaluates the ability of the LA-WRB to span cracks and to maintain its integrity when subject to temperature extremes.

C.2 Summary of test method

C.2.1 This test method consists of temperature cycling of the LA-WRB when applied over a typical joint in the OSB substrate that is then stretched 40 %.

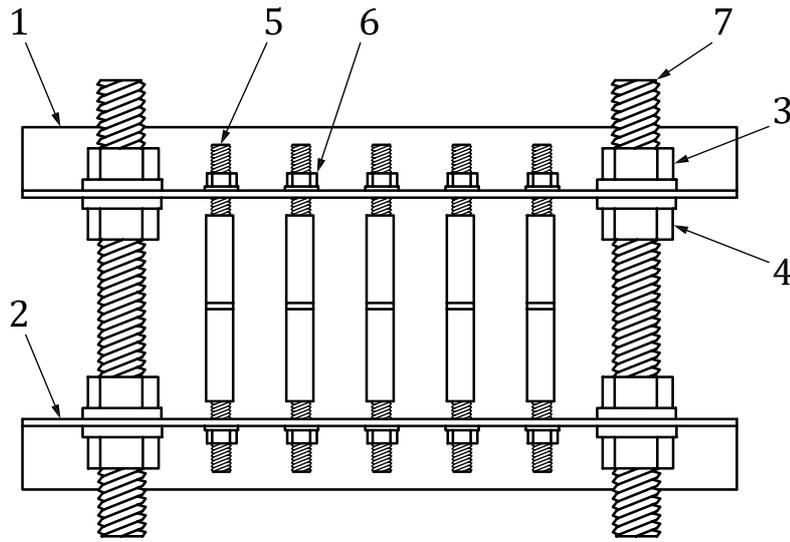
C.2.2 Five test specimens shall be tested.

C.3 Significance and use

The building structure and, therefore, the LA-WRB, can be expected to go through thermal expansion and contraction with changes in temperature over the course of the year. The weakest spot of the LA-WRB is at the joints in the substrate. This test provides some assurance that the LA-WRB will not fail at the joints when subjected to temperature changes.

C.4 Test apparatus

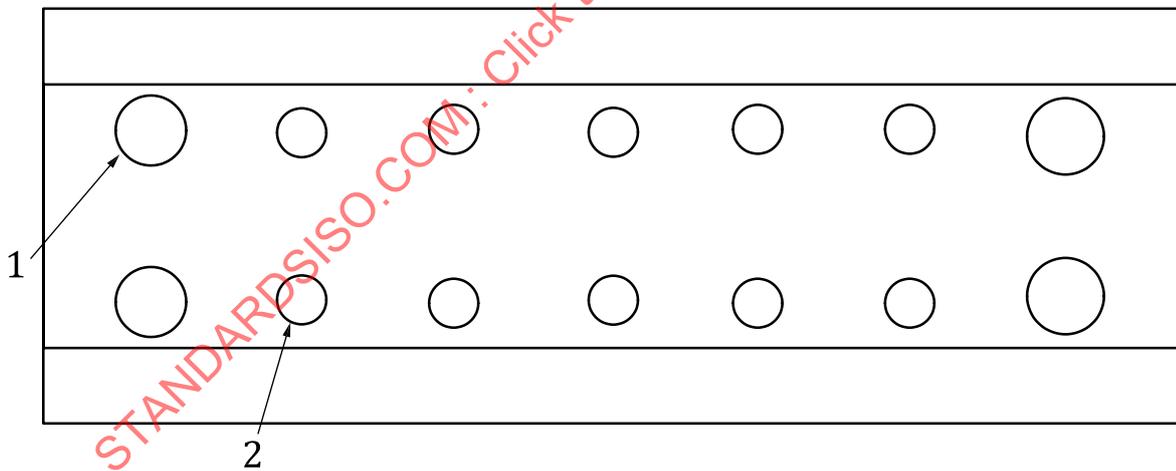
The test apparatus shall consist of two stainless steel C channels, 125 mm wide × 350 mm long, held approximately 200 mm apart using four threaded stainless-steel rod spacing bolts, two at each end of the channels, each secured with the use of compression and tension nuts, as shown in [Figures C.1 to C.3](#). Each channel shall have 10 additional holes drilled through the bottom to be used to secure the test specimens.



Key

- 1 top aluminium C channel frame
- 2 bottom aluminium C channel frame
- 3 tension nut
- 4 compression nut
- 5 tension anchors
- 6 tension nut
- 7 steel rods 19 mm

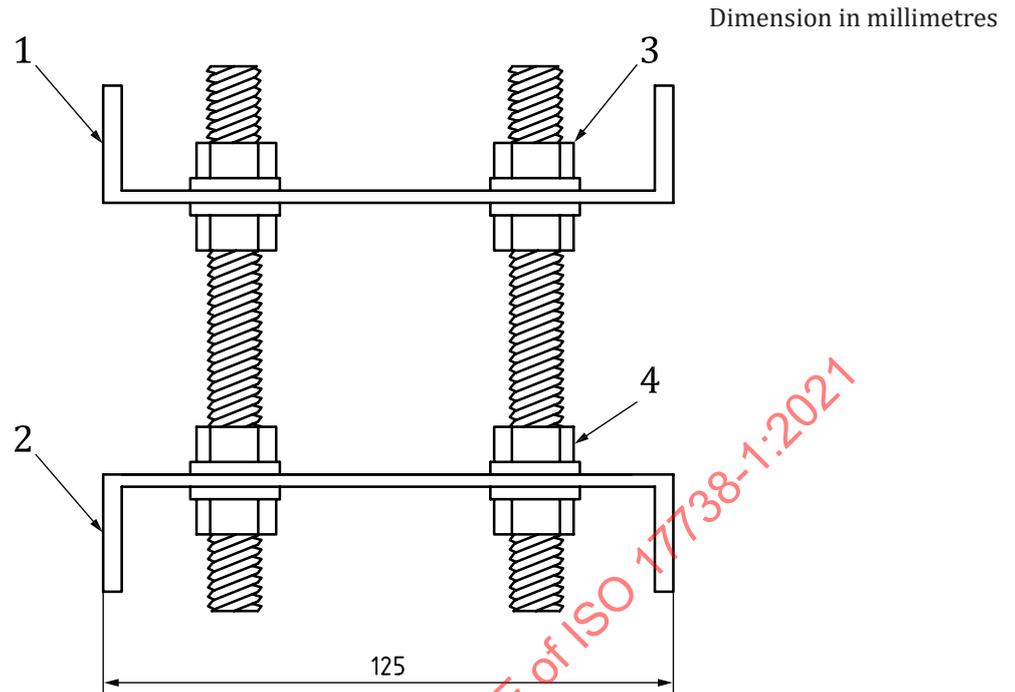
Figure C.1 — Section view of test apparatus



Key

- 1 steel rods 19 mm
- 2 tension anchors

Figure C.2 — Plan view of the top channel of the test apparatus

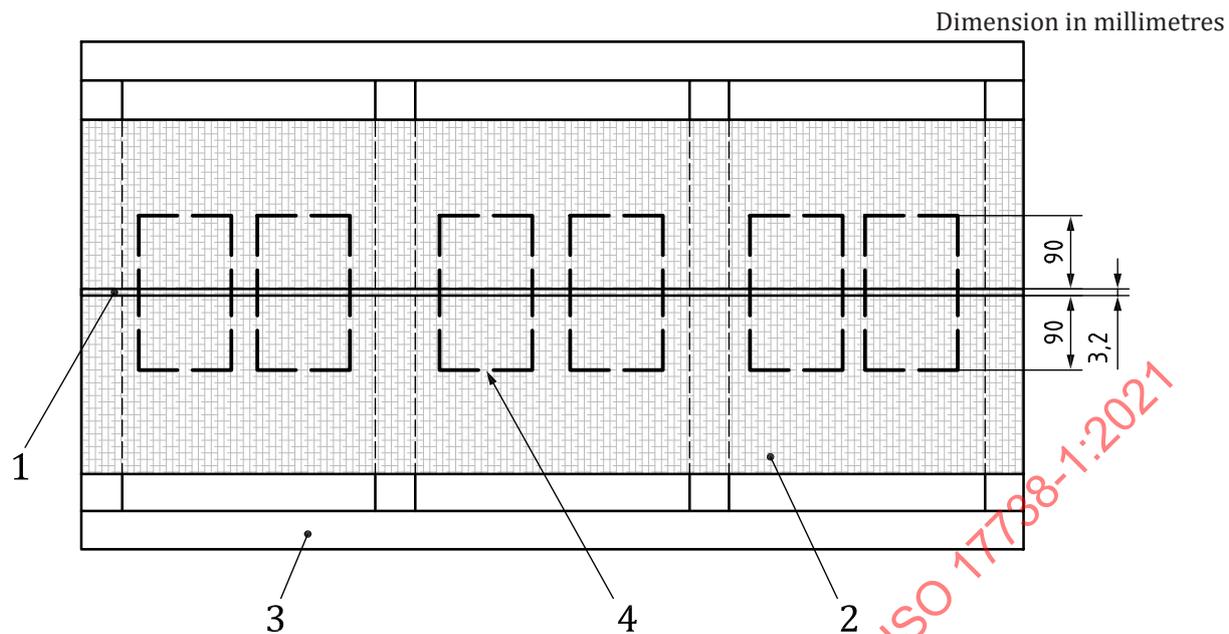
**Key**

- 1 top aluminium C channel frame
- 2 bottom aluminium C channel frame
- 3 compression nut
- 4 tension nut

Figure C.3 — End cross section of test apparatus

C.5 Test specimen

C.5.1 Test specimens 150 mm wide × 180 mm tall (nominally) shall be cut from the test sample panel described in 5.3.1.3 such that the joint in the OSB bisects each test specimen (see Figure C.4).



Key

- 1 gap
- 2 OSB
- 3 wood frame
- 4 specimens to be cut out for joint relaxation test

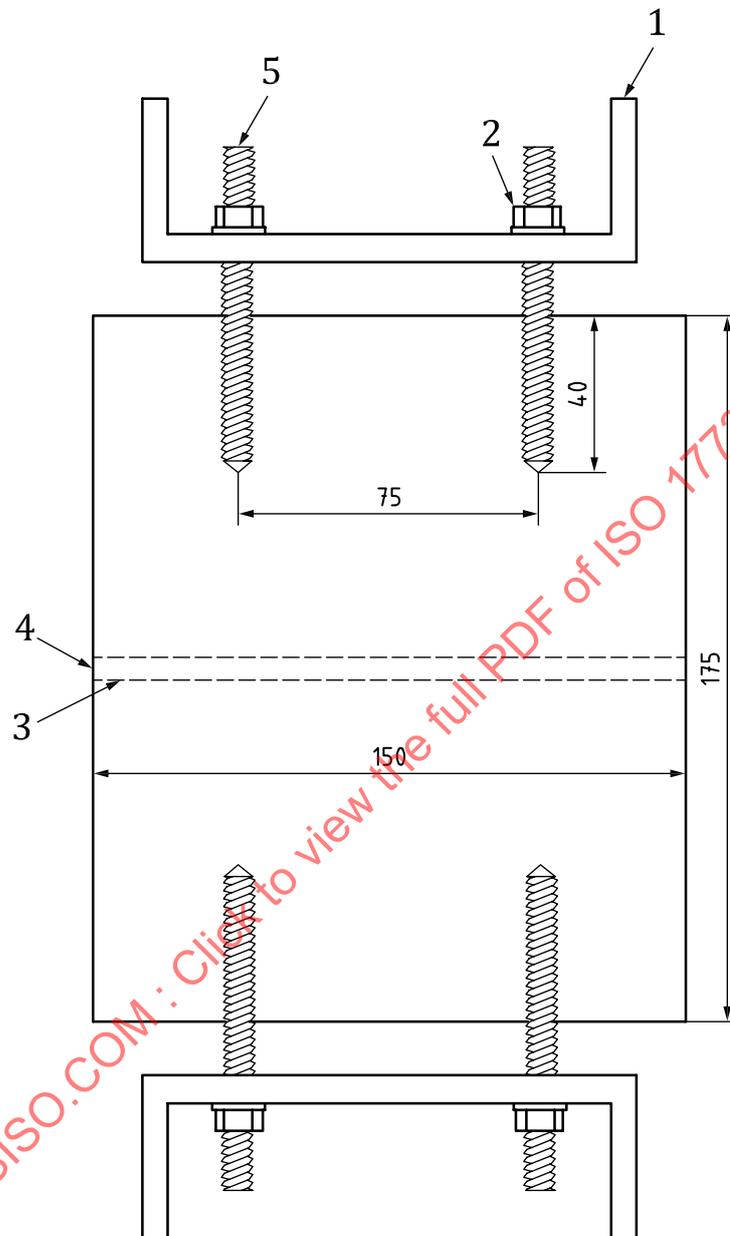
NOTE 1 The figure is not drawn to scale, the schematic is only to demonstrate configuration of panel.

NOTE 2 Additional bracing can be required to support samples when cut out of the panel, prior to placing in the test apparatus.

Figure C.4 — Cutting of test specimens from sample panel

C.5.2 Two holes shall be drilled into the top edge and two in the bottom edge of each test specimen that has been cut from the test sample panel. The holes shall be of sufficient diameter to allow the

installation of 8,0 mm threaded rods of sufficient length to penetrate 40 mm into the test specimen, as shown in [Figure C.5](#). The rods shall be anchored with epoxy and allowed to cure.



Key

- | | | | |
|---|---------------------------|---|-------------------------------------|
| 1 | aluminium C channel frame | 4 | joint |
| 2 | tension nut | 5 | tension anchors embedded with epoxy |
| 3 | specimen with a joint | | |

NOTE The environmental conditions during the installation of the threaded rods into the test specimens does not need to be controlled; typical room conditions are acceptable.

Figure C.5 — Installation of metal rods into test specimen

C.6 Test procedure

C.6.1 The five test specimens shall be installed into the test frame with the threaded rods set into the predrilled holes in the channels.

C.6.2 Once all five test specimens are in place, the spacing bolts for the test frame shall be set and the nuts tightened to provide a rigid frame.

C.6.3 The individual test specimens shall then be centered in their positions with corrosion resistant nuts and washers in a snug position until all test specimens have been so arranged.

C.6.4 Once all test specimens are secured, the nuts on the test specimen rods shall be tightened from one edge to cause the test specimens to be extended. The total extension of the test specimens shall be 1,3 mm as measured from the end of the rod to the top of the nut by means of which tension is applied. The extension shall be measured using callipers.

NOTE 1 It is assumed that the change in distance from the tip of the threaded rod to the top of the tightening bolt represents the extension at the joint, ignoring compensating strains in the test frame, in the epoxy anchored tightening anchors and in the body of the test specimens.

To achieve greater accuracy in setting this extension, the ends of the test specimen threaded rods should be shaped to present a single point of reference at that end of the rod.

Care should be taken during tightening that excessive torque is not transmitted to the anchorage of the threaded rods into the edge of the individual test specimens. Tensioning should be done evenly to each rod to achieve a uniform extension for each joint.

C.6.5 When all test specimens have been tightened, a final check on the tightening measurement shall be made before environmental cycling is begun.

C.6.6 The test specimens in the test frame shall be subjected to the following environmental cycling without interruption ([Table C.1](#)).

Table C.1 — Environmental cycling

Hot cycle		Cold cycle		Total cycles	Total time
Conditions	Time	Conditions	Time		
(65 ± 2) °C (90 ± 5) % RH	18 h	(-10 ± 3) °C	5 h	15	360 h

C.6.7 To prevent thermal shock, a transition period of 1 h shall be applied between high and low temperature exposures in which the test specimens are exposed to room conditions [(25 ± 5) °C and (45 ± 10) % RH].

C.6.8 At the conclusion of the cycling, the test specimens shall be removed from the test frame and examined.

C.6.9 Any obvious damage to the integrity of any joint involving separation that would allow water to penetrate the middle 100 mm of the test specimen joint length constitutes failure of the test and no further testing is required.

C.6.10 The test specimens shall then undergo a water penetration test. Each test specimen shall be sealed using a wax and paraffin mixture to the bottom of a hollow plastic cylinder with an interior diameter of at least 100 mm such that the joint spans the mid point of the cylinder. A 25 mm water head shall be introduced on the top surface of the test specimen, into the plastic cylinder. The cylinder shall be raised by about 250 mm above a sheet of plain kraft paper placed underneath the membrane to aid in monitoring any passage of water.

C.6.11 The 25 mm head of water in the cylinder shall be maintained for a period of 2 h.

C.6.12 The test specimen shall be maintained at constant conditions of temperature and relative humidity [(25 ± 5) °C and (45 ± 10) % RH] for the 2 h test period.

C.6.13 At the conclusion of the test, the underside of the test specimens shall be examined for indications of moisture seepage. The kraft paper shall also be examined for evidence of seepage.

C.7 Assessment

In addition to the information required in 5.7, the following information shall be reported:

- a) a statement as to the visual condition of the test specimens after the cycling with respect to 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 joint length;
- b) a statement as to the indications of moisture seepage, if any, through the test specimens after the water penetration test.

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Annex D (normative)

Nail popping resistance test (5.5.8)

D.1 General

This test method pushes a nail, counter-sunk 1,0 mm below the surface of the test specimen and coated with the LA-WRB, back out to the surface and observing the effect on the cured LA-WRB.

Six test specimens shall be tested.

D.2 Significance and use

D.2.1 Drying of the wood substrate can cause nail popping, which could affect the integrity of the LA-WRB. This test method simulates such a situation to evaluate the behaviour of the LA-WRB.

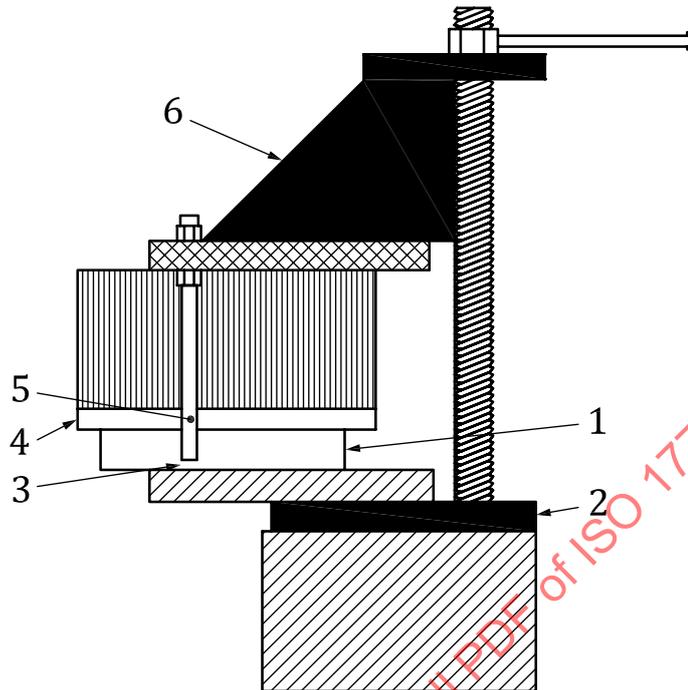
D.2.2 The type of wood substrate can have an effect on the adhesion of the LA-WRB to the substrate. Given its nature of manufacture, OSB is deemed to represent a worst-case scenario in this regard. Therefore, any LA-WRB that passes this test when applied to OSB shall be deemed suitable for use on plywood and glass mat gypsum.

D.3 Test apparatus

D.3.1 The description of the apparatus is general in nature; any equipment capable of performing the test procedure within the allowable tolerances is permitted.

D.3.2 The test apparatus shall support the perimeter of the test specimen while allowing a nail to be pushed into or back through the OSB perpendicularly to the surface of the OSB. The apparatus shall be capable of measuring the movement of the nail to an accuracy of 0,1 mm.

D.3.3 If a vise with a positive movement is used, it shall be equipped with an adjustable stop that allows for minor differences in test specimen dimensions due to nail length, sitting, etc. (see [Figure D.1](#)).



Key

- 1 metal ring
- 2 fixed stop
- 3 51 mm gap
- 4 test sample
- 5 adjustable stop
- 6 moving side of vise

Figure D.1 — Schematic of suitable test apparatus

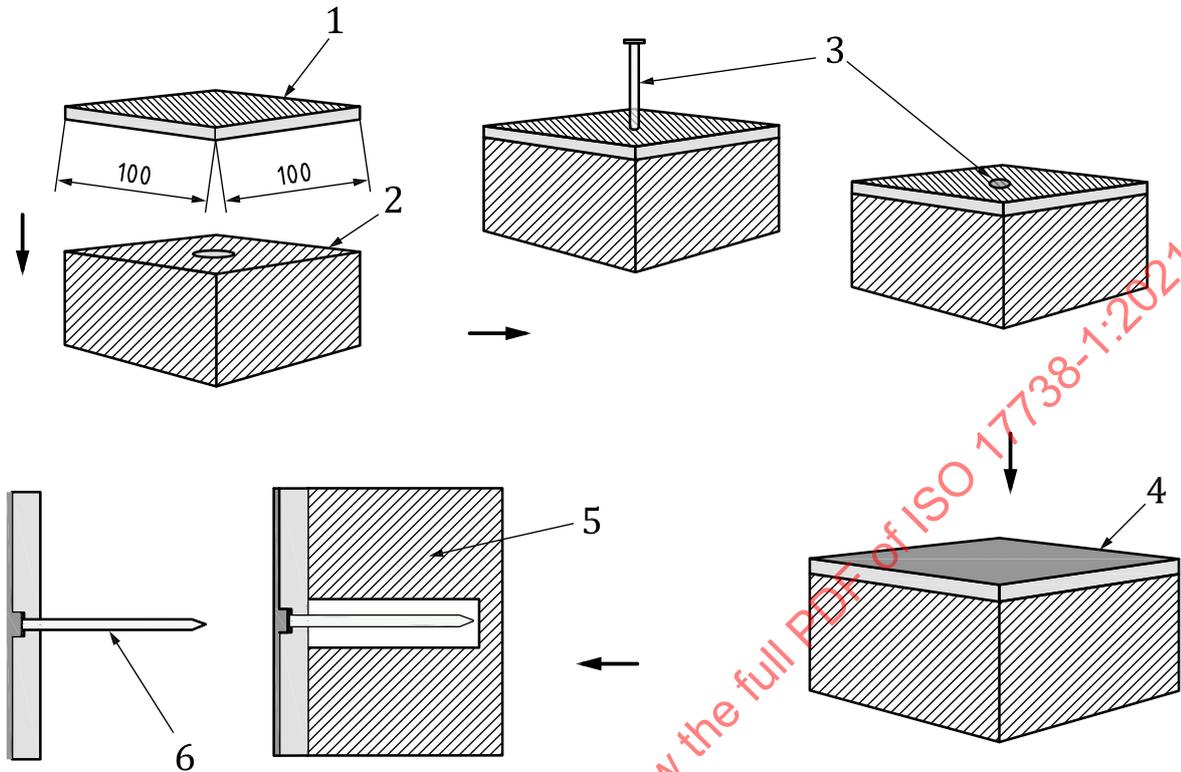
D.4 Test specimen

D.4.1 Six test specimens, each measuring 100 mm × 100 mm shall be cut from 11 mm thick OSB panels that meets the requirements of ISO 16894. The OSB shall be free of any dirt, dust or other deleterious substances that may affect the adhesion of the LA-WRB.

D.4.2 Each test specimen shall have a 3 mm diameter hole drilled through it using a drill press to ensure that the axis of the hole is perpendicular to the surface plane of the test specimen.

D.4.3 Each test specimen shall be set on top of a 100 mm × 100 mm × 100 mm wood block nailing base having a 25 mm diameter hole drilled in its centre to a depth exceeding 65 mm (see [Figure D.2](#)).

D.4.4 A 64 mm long common round wire nail shall be pushed into each test specimen using the test apparatus that will be used to push the nail back out through the test specimen such that the nail is embedded 1,0 mm into the test specimen (see [Figure D.2](#)).



Key

- 1 five OSB samples cut into 100 mm
- 2 nailing bases: 100 mm × 100 mm wood block with 25 mm drilled in center
- 3 54 mm nail driven into center
- 4 coated sample
- 5 protective material
- 6 nail head embedded 1 mm into face of OSB (should be right angle all sides to sheatings)

NOTE In Key 3, nail is embedded 1 mm in OSB surface.

Figure D.2 — Specimen preparation

D.4.5 The LA-WRB shall be applied over the OSB test specimens at the minimum thickness recommended by the manufacturer and in strict accordance with the manufacturer's installation instructions. The thickness of the LA-WRB shall be confirmed for each test specimen as per [5.3.5](#).

D.4.6 The test specimens shall be cured at $(23 \pm 2) ^\circ\text{C}$ and $(50 \pm 5) \% \text{RH}$ for a minimum of 14 d prior to testing.

D.5 Test procedure

D.5.1 The test specimen shall be installed securely in the apparatus such that the test specimen does not move while pressure is applied to the tip of the nail.

D.5.2 If a vise is used, the stop shall be adjusted to provide a 1,0 mm compression gap between the test specimen and the vise; the gapping of the adjustable stop shall be achieved using calibration keys accurate to 0,1 mm.

D.5.3 The nail shall be pushed a distance of 1,0 mm back through the OSB in a direction perpendicular to the surface of the OSB (see [Figure D.3](#)).

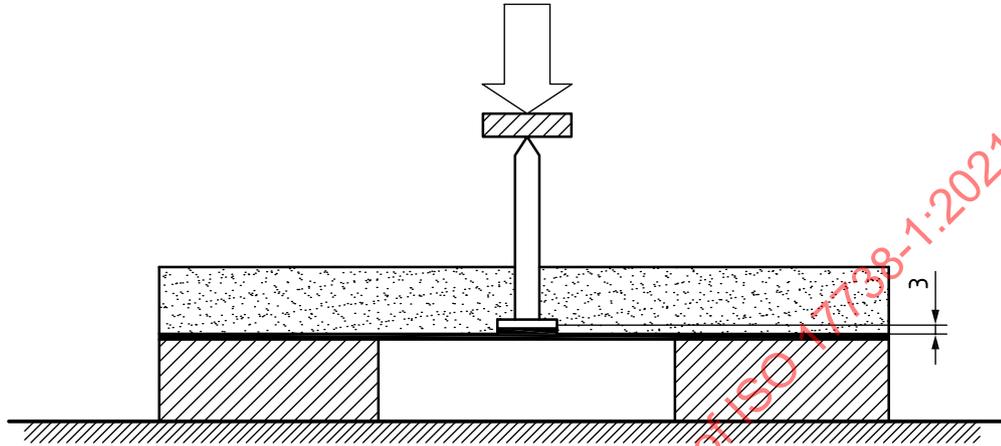


Figure D.3 — Test method

D.5.4 If a vise is used, the vise shall be closed until the adjustable stop presses the fixed end of the vise and further advance is stopped.

D.5.5 Following the test, the test specimen shall be removed from the test apparatus and the condition of the LA-WRB shall be visually observed.

D.6 Assessment

In addition to the information required in [5.7](#), a statement as to the visual condition of the test specimens after the testing, with respect to the appearance of cracking or delamination of the LA-WRB around the nail head, shall be reported.

Annex E (normative)

Assessing durability of EIFS under cyclic environmental conditions (5.6.2)

E.1 General

E.1.1 This test method provides a procedure, which can be done in a standard laboratory, for assessing the durability of EIFS cladding under specified cyclic environmental conditions.

E.1.2 The effects of design/construction details are assessed by building into the test specimen design and construction details that can affect the long-term performance of the cladding.

E.1.3 The effect of incidental water in the cladding is assessed by introducing a quantity of water into the cladding in a preconditioning stage.

E.1.4 The effect of hygrothermal stresses are assessed by subjecting the test specimen to cyclic temperature, air pressure difference and water spray that are applied for a representative number of cycles.

E.1.5 The effect of mechanical stress is assessed by constructing a flexible test specimen that will deflect under the imposed air pressure difference.

E.1.6 This procedure gives an indication of the expected performance of the cladding over time, but does not produce an estimate of the service life of the cladding.

E.2 Summary of test method

The test method consists of three stages:

- a) in the preconditioning stage, the full-scale test specimen is preconditioned by adding water behind the cladding;
- b) in the environmental cycling stage, the exterior of the test specimen is subjected to cyclic environmental conditions (temperature, pressure and water spray) for 15 d while constant conditions are maintained on the interior (i.e. unexposed side of the specimen);
- c) in the assessment stage, the durability of the cladding is assessed by observing changes in appearance (e.g. cracking, delaminating) and measuring cohesive/adhesive strength.

E.3 Significance and use

E.3.1 This test procedure sets a standard approach for assessing the durability of EIFS cladding under laboratory conditions. Deterioration can be accelerated by design details, construction practices and aging of materials, all of which can expose the building envelope materials to a microclimate that accelerates deterioration.

NOTE Durability is not an intrinsic property of a material, but rather a function of the material and its environment. To this end, the procedure accelerates aging of the materials in the assembly by subjecting a specially designed test specimen to extreme simulated cyclic environmental conditions.

E.3.2 The full-scale test specimen, representing an EIFS clad wall assembly, is constructed according to the manufacturer's installation instructions on a steel framing assembly that is designed to be flexible under the applied test pressure difference. Design/construction elements that are deemed critical to long term performance, namely expansion joints, a window opening and typical service penetrations, are included in the test specimen in order to assess the effect of these details.

E.3.3 Provision is made in the design of the assembly to manage water that might migrate into the cladding during the service life of the assembly. Since water retained in the cladding can have an adverse effect on long-term performance, this procedure includes a preconditioning stage in which a quantity of water is introduced into the cladding. The water is allowed to drain at designed drainage locations, such as at the base of the test specimen (or at any other specific location specified by the manufacturer), but any water that is retained within the assembly is left in place for the environmental cycling stage.

E.3.4 After preconditioning, the test specimen is subjected to cyclic environmental conditions. The conditions are selected based on experience with European ETICS evaluation, durability of building envelope sub-systems (e.g. fenestration systems), the physical limits of test facilities and a range of extreme climatic conditions. The environmental loads (e.g. range of air temperature, intensity of water spray) may be too severe for some applications and not severe enough for others. Nevertheless, this procedure provides standardized test conditions and evaluation criteria for an assessment of the durability of EIFS cladding.

E.4 Test apparatus

E.4.1 The description of the test apparatus is general in nature and any arrangement of equipment capable of performing the test procedure within the allowable tolerances is permitted.

E.4.2 The test apparatus for the environmental cycling stage shall consist of a room environmental chamber and a weather environmental chamber.

E.4.3 The room chamber shall be capable of maintaining static environmental conditions with an air temperature of (23 ± 2) °C and a relative humidity of (50 ± 5) %.

E.4.4 The weather chamber shall conform to the apparatus requirements of ISO 15821, except that it shall be capable of maintaining a static air pressure difference of $\pm 1\ 200$ Pa across the test specimen. The weather chamber shall also be capable of maintaining the air temperature between (-20 ± 1) °C and (66 ± 1) °C, and changing the temperature between these extremes at a rate of (60 ± 2) °C/h. Water shall be supplied and maintained at a temperature of (20 ± 3) °C.

WARNING — Ensure that the weather chamber is structurally sufficient since it will be operated at a pressure difference that is higher than normally required by ISO 15821.

E.4.5 For the environmental cycling stage, the test specimen shall be mounted in such a manner that the exterior face is exposed to the weather chamber and the base of the test specimen will not be exposed to standing water. This shall be achieved by mounting the test specimen in a separate frame to be inserted between the chambers or by mounting the test specimen directly into the opening of one of the chambers. In either case, the test specimen shall be fastened on all four sides against the load that will be imposed by the applied air pressure difference.

E.4.6 Temperatures shall be controlled to within 1 °C, and measured within 0,5 °C. Pressure difference shall be controlled to within 10 Pa, and measured within 5 Pa. Water spray shall be capable of delivering 3,4 L/m² min.

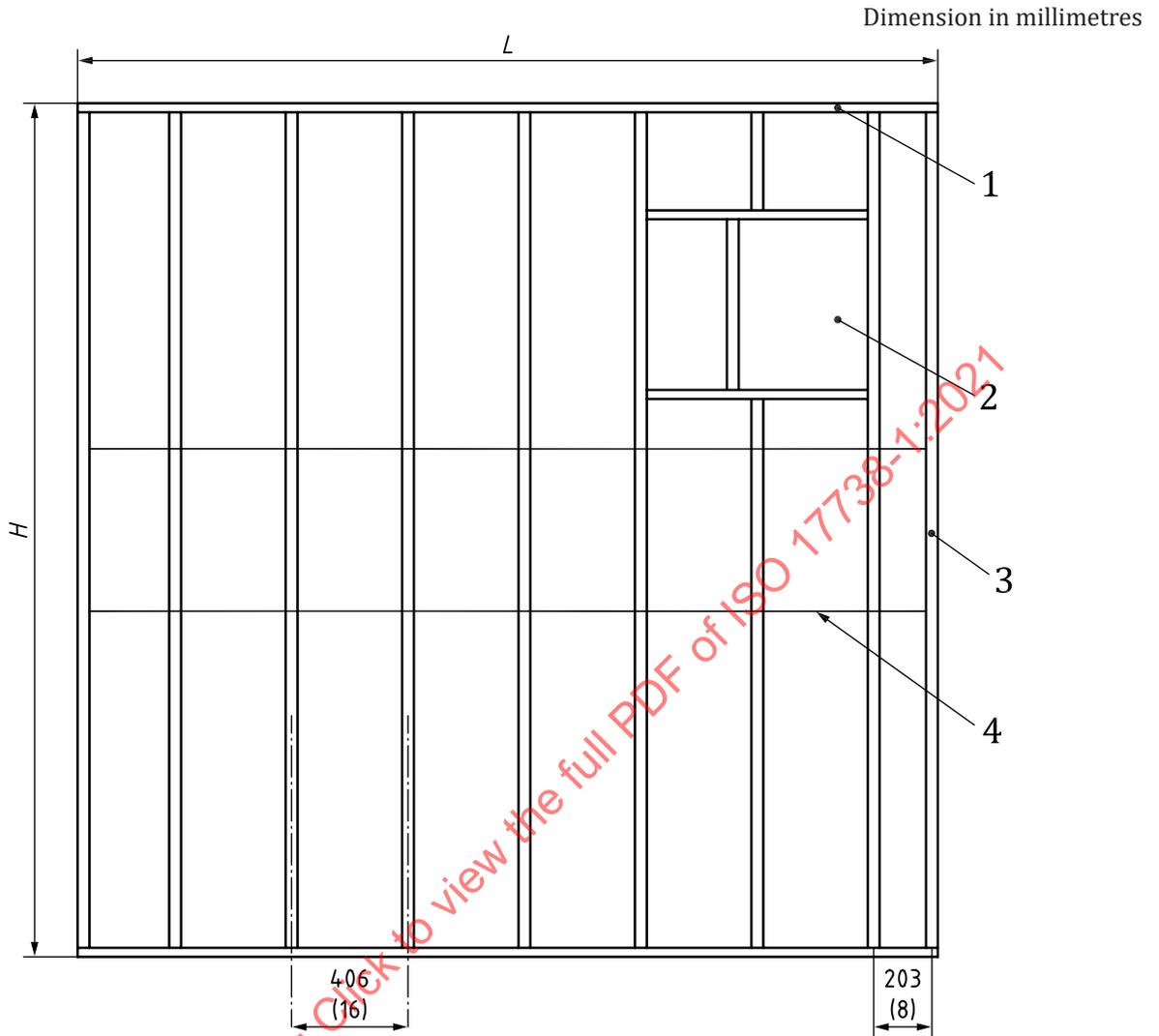
E.5 Test specimen

E.5.1 The test specimen shall be an EIFS clad wall assembly with minimum overall dimensions of 3 m × 3 m. It shall be constructed using lightweight steel framing and incorporating the following:

- a) one vertical and one horizontal expansion joint;
- b) a 450 mm × 600 mm window frame;
- c) representative service penetrations, namely 100 mm square or round galvanized duct, 38 mm diameter PVC pipe and an exterior electrical junction box.

The exposed dimensions of the test specimen may be up to 100 mm less than those stated to accommodate a space for adding preconditioning water at the top, drainage at the bottom and at junctions designed to maintain moisture and structural integrity at the sides.

E.5.2 A lightweight steel frame shall be using 41 mm × 92 mm × 1,12 mm (18 gauge). The frame shall be finished at the top and bottom with steel tracks. A rough opening for the window frame shall be located 300 mm from the top and side. If the test chamber overlaps the EIFS clad wall assembly so the chamber seal is to the face of the EIFS, no less than 200 mm of EIFS shall be exposed between the window and the edge of the chamber. A lintel shall not be installed above the window opening. Two cold-rolled steel channels shall be installed through the stud punch outs and secured to the studs. (see [Figure E.1](#)).



Key

- 1 steel track, 92 mm × 32 mm
- 2 window opening
- 3 18 gauge steel studs 92 mm × 41 mm
- 4 cold-rolled steel channel installed through punch-outs

NOTE Each stud-end is fastened to a track with a single no. 8 Phillips drive, 11 mm long, metal pan-head screw on each side of the track/stud.

Figure E.1 — Lightweight steel frame assembly

NOTE 1 The structural frame is designed to an acceptable standard for wind loading. The frame includes wall bracing and appropriate details around window openings and service penetrations. For wind load testing, see [Annex G](#).

NOTE 2 18 gauge steel stud is not expected to cause fastening failure (“unzipping” of fasteners) of sheathing during the repeated pressure cycling. Unzipping can be caused by other factors, e.g. too few fasteners, inappropriate fasteners.

E.5.3 A 50 mm diameter clear tube, the supply header, fitted with six evenly spaced 6 mm holes (one 6 mm diameter hole per stud bay) shall be placed near the top end of the interior side of the panel. Each hole shall be connected to a corresponding port in the sheathing and be sealed to be airtight. The setup

shall be designed to allow the uniform delivery of water to the drainage cavity onto the exterior of the LA-WRB at the controlled rate with no more than 10 mm head.

The drainage outlet at the bottom of the test specimen shall be configured as per EIFS manufacturer's installation instructions to drain into the weather chamber.

The supplier header will be required to maintain a 10 mm head of water during the testing. It should be marked at the 10 mm point so it can be accurately monitored.

Care is required when placing the water delivery tubes so that they terminate within the cladding drainage cavity. The drainage cavity may be small (2 mm) and will contain adhesive supporting the insulation.

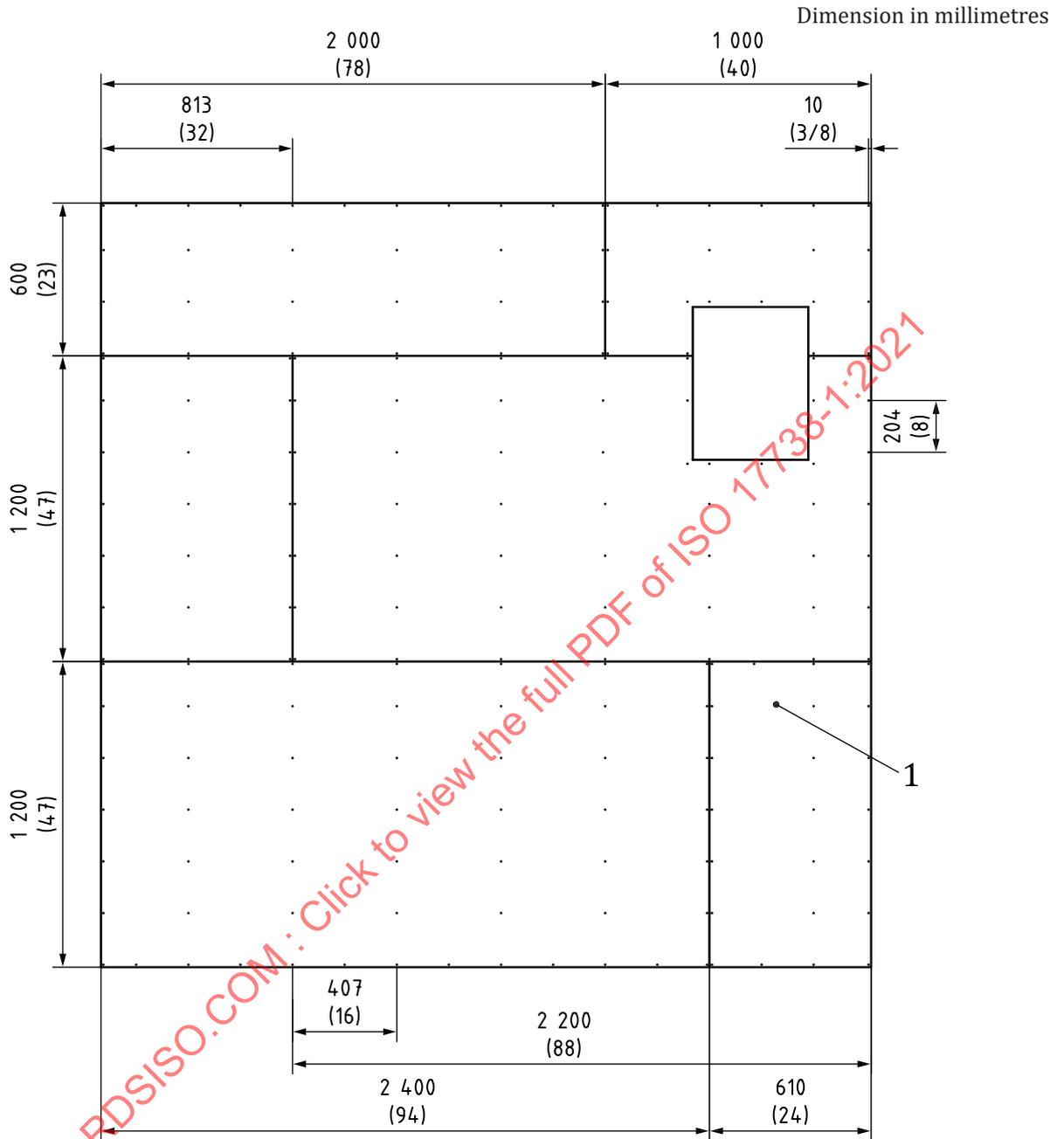
E.5.4 The rough window opening shall be constructed in accordance with general construction practices. The rough window opening shall be finished according to the manufacturer's installation instructions. An aluminium fixed window frame shall be installed in the opening and the details of the window installation shall be executed according to the manufacturer's installation instructions. The window shall be sealed to ensure that no air and water pass through it.

The window frame serves to include a representation of a standard wall-window interface in the test specimen. However, air and water passage through the window should not be a factor in the durability test, and the window should be sealed appropriately to prevent it.

E.5.5 The service penetrations shall be located on a horizontal line 500 mm from the top of the test specimen. The first penetration shall be positioned 300 mm from the edge of the test specimen and the spacing between penetrations shall be at least 300 mm (refer to [Figure E.3](#)). The service penetrations shall be installed according to the requirements of each penetration, including structural integrity, and shall be sealed to prevent passage of air and water.

The service penetrations serve to include standard penetrations in the test specimen. However, air and water passage through the service penetrations should not be a factor in the durability test, and the service penetrations should be sealed appropriately to prevent it.

E.5.6 12,7 mm thick glass-fibre faced gypsum sheathing shall be installed as shown in [Figure E.2](#).



Key

1 12,7 mm thick glass-fibre faced gypsum sheathing
long, bugle-head screws on 203 mm spacing, at least 10 mm from any edge

NOTE The durability under cyclic environmental conditions test is conducted solely to evaluate the performance of the EIFS. The substrate framing and sheathing is specified simply to provide a standard backing for the EIFS and is not evaluated in this test.

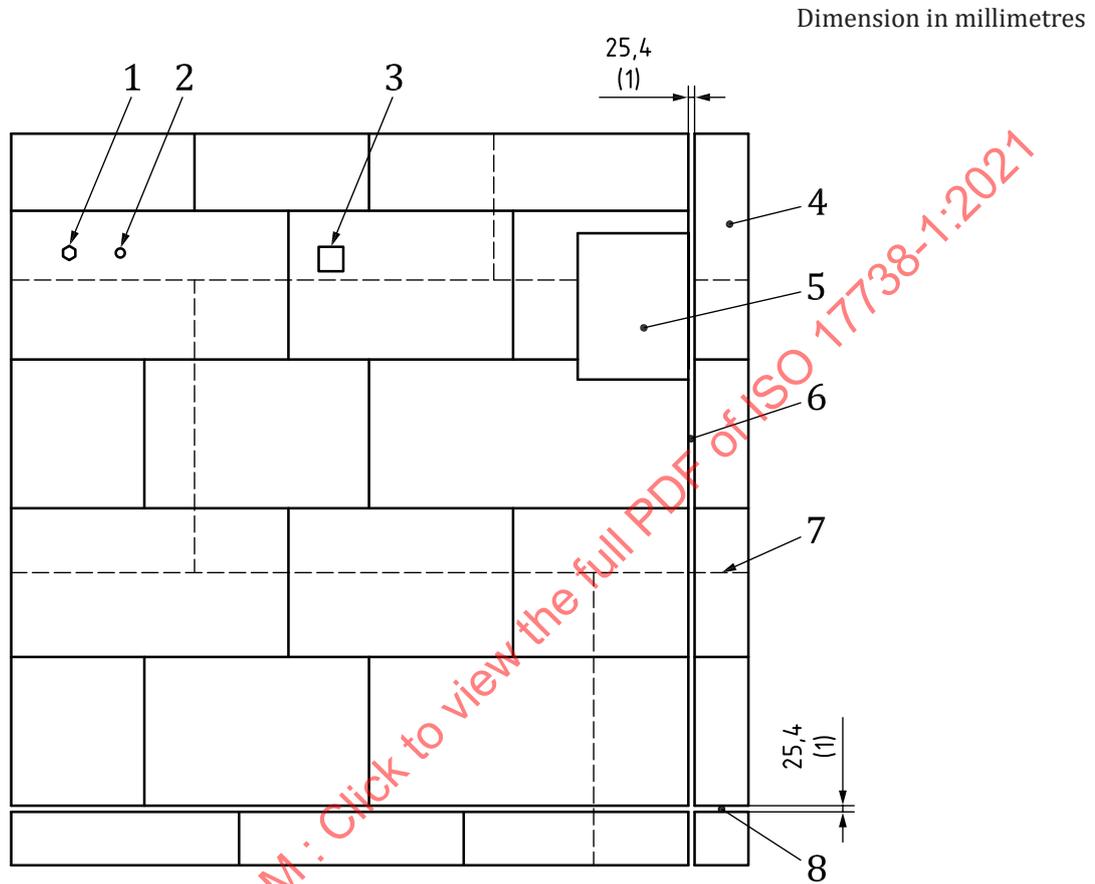
Figure E.2 — Details of sheathing installation

E.5.7 The WRB shall be installed according to the ISO 17738-2 and the manufacturer's installation instructions.

E.5.8 The EIFS cladding shall be installed in conformance with the requirements of ISO 17738-2 and according to the manufacturer's installation instructions using the thinnest thermal insulation board

acceptable. The horizontal expansion joint shall be located 300 mm from the bottom edge of the test specimen and the vertical expansion joint at the side of the window opening nearest the edge of the test specimen. The sides of the test specimen shall be wrapped and the top and bottom of the test specimen shall be finished according to the manufacturer’s installation instructions.

E.5.9 The thermal insulation board installation shall be as shown in [Figure E.3](#).



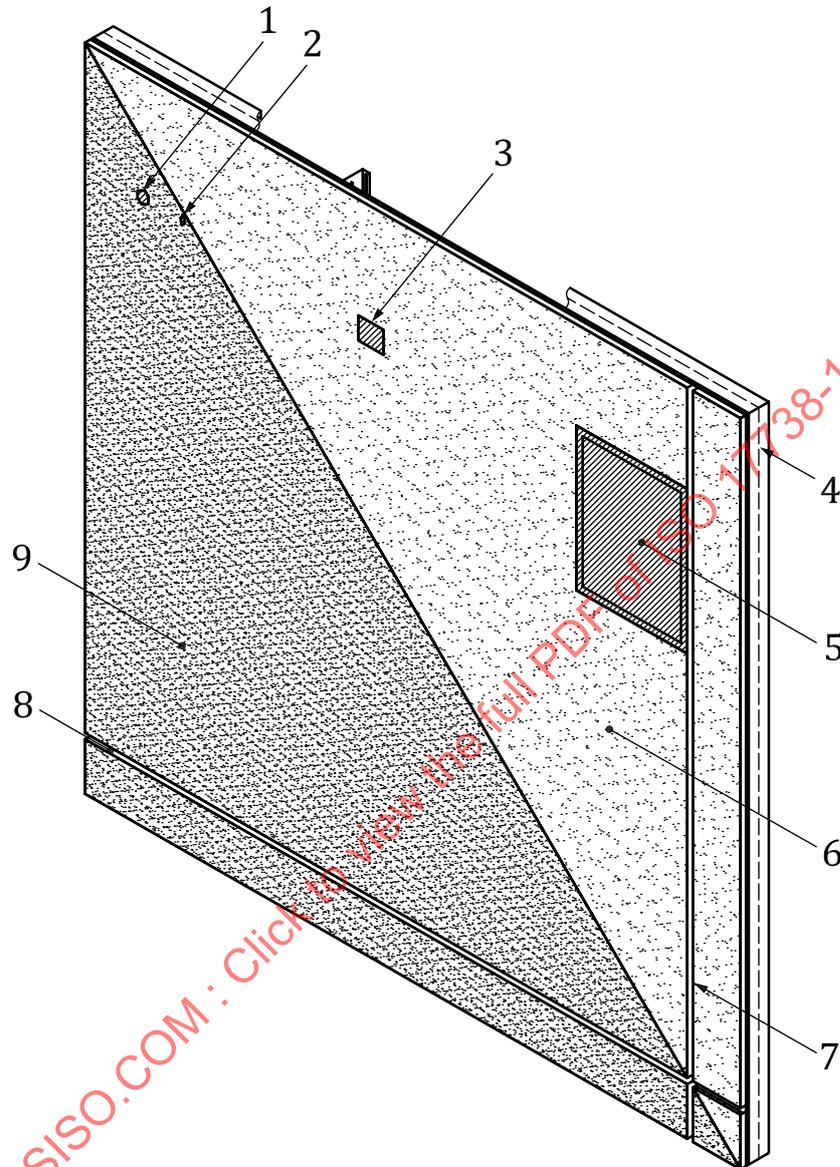
Key

- 1 exterior electrical outlet
- 2 circular, 38 mm diameter
- 3 square, 100 mm × 100 mm
- 4 thermal insulation board
- 5 window
- 6 vertical joint
- 7 sheathing board joints
- 8 horizontal joint

Figure E.3 — Details of installation of thermal insulation boards

E.5.10 The lamina shall be rendered onto the test specimen according to ISO 17738-2 and the system manufacturer’s installation instructions. The finish coat shall be applied to only 50 % of the face of

the test specimen as shown in [Figure E.4](#). The interfaces and joints shall be terminated according to ISO 17738-2 and the system manufacturer's installation instructions.



Key

1	exterior electrical outlet	4	steel studs	7	vertical joint
2	circular, 38 mm diameter	5	window, 450 mm × 600 mm	8	horizontal joint
3	square, 100 mm × 100 mm	6	base and finish coats	9	base coat only

NOTE The performance of the base coat is examined directly by leaving half of the test specimen unfinished.

Figure E.4 — Test specimen for assessing durability of EIFS cladding under cyclic environmental conditions

E.5.11 Details of test specimen components and construction shall be presented in a tabular form as suggested in [Table E.1](#).

Table E.1 — Suggested table for reporting test panel configuration

Item	Type/Materials/ Description	Quantity	Size ($W \times H \times D$)	Application/ location	Product identification
General					
Anchorage					
Fastening		# of fasteners	Length of fasteners		
Seal					
Lamina					
Base coat		# of coats	Thickness		
Reinforcing mesh		Grade of mesh	Thickness		
Finish coat		# of coat			
Thermal insulation board			Thickness of thermal insulation board		
Adhesive		# of coats	Thickness		
LA-WRB		# of coats	Thickness		
Structural support					
Framing	Type of studs	Gauge	Size		
Sheathing	Type of sheathing			Product ID	
Joint tape	Type of mesh/grade (if any)				
Expansion joint					
Horizontal	Details of joints		Width	Product ID	
Vertical	Details of joints		Width	Product ID	
Drainage	Location				
Penetrations					
Window	Fixed aluminium window				
Anchorage					
Seals					
Duct					
Seal					
Water pipe					
Seal					
Junction					
Seals					

E.6 Test procedure

E.6.1 Preconditioning stage

E.6.1.1 Preconditioning shall be carried out following installation and sealing of the test specimen and immediately prior to environmental cycling.

E.6.1.2 The test specimen shall be mounted vertically between the room and weather chambers with the EIFS cladding facing the weather chamber in such a manner that the test specimen can be observed on both sides.

Preconditioning and cycling shall be performed in the same apparatus in order to avoid manipulating the wall after preconditioning and in order to commence cycling immediately following preconditioning. Normally, a one-day period is allowed for installation and anchoring in the apparatus and one week for the installation sealant to cure.

E.6.1.3 The test specimen shall be fastened in place through the lightweight steel frame with fasteners at 600 mm on center and sealed the test specimen perimeter. Weather seals shall be watertight and shall be capable of maintaining their integrity under the imposed loads and deflection of the test specimen.

Drainage at the bottom of the test specimen shall not be sealed prior to cycling.

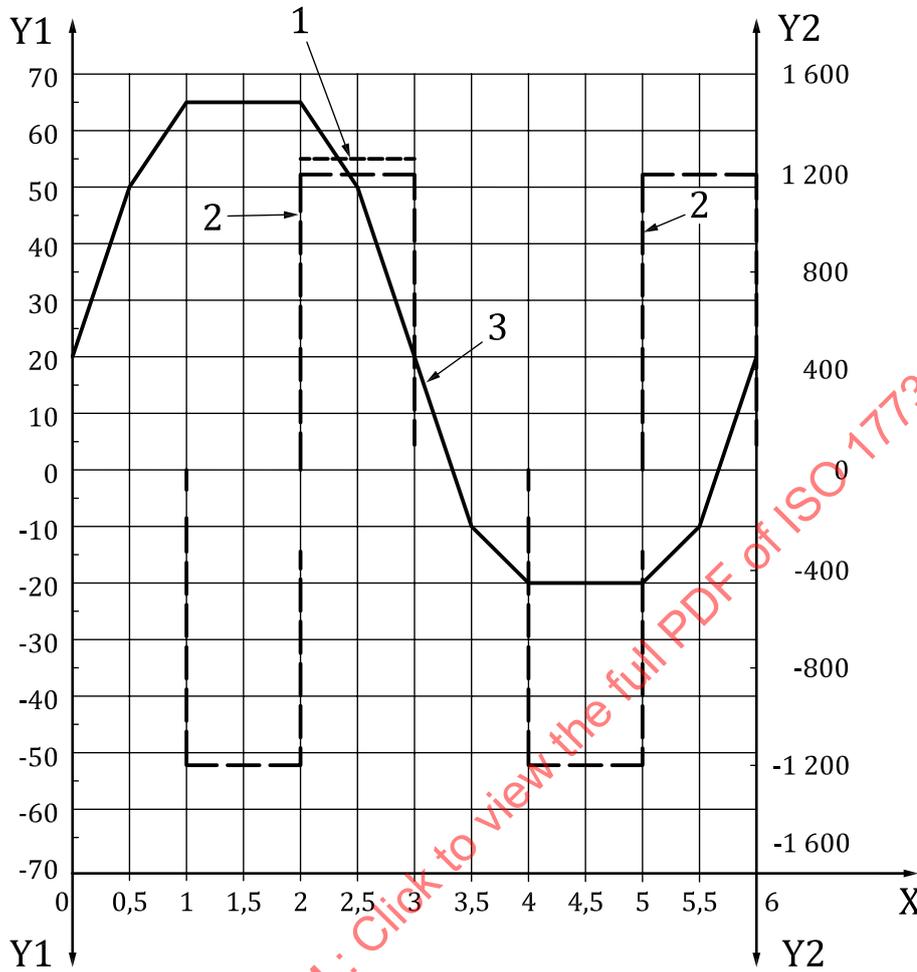
E.6.1.4 A water supply tank shall be installed above the test specimen and filled with a quantity of water that represents at least 1,5 L for each square metre of test specimen area, i.e. 13,5 L for a 3 m × 3 m test specimen. The full area of the test specimen shall be used to determine the quantity of water. The supply tank shall be located such that the water can drain to the supply header (see [E.5.3](#)) that will distribute the water uniformly over the entire width of the test specimen.

E.6.1.5 Water shall be distributed uniformly at the top of the test specimen from the supply header at a rate such that no more than a 10 mm head builds up at the top of the supply holes, but no faster than 15 l/h per metre of test specimen width. The supply of water shall be stopped after 120 min.

E.6.2 Environmental cycling stage

E.6.2.1 The environmental cycling stage of the test shall proceed with any remaining water that did not drain during the conditioning stage.

E.6.2.2 The environmental conditions in the room chamber shall be controlled at (24 ± 2) °C and (50 ± 5) % RH. The environmental conditions in the weather chamber (temperature, pressure difference and water spray) shall be controlled according to the cycles shown in [Figure E.5](#) for 60 cycles.



- Key**
- X time (h)
 - Y1 temperature (°C)
 - Y2 pressure (Pa)
 - 1 water spray
 - 2 pressure
 - 3 temperature

Figure E.5 — Details of one wet cycle of the environmental conditions to be imposed in the weather chamber

NOTE 1 Manufacturers who are not sure of the performance of their product relative to the full scale test, are encouraged to conduct unidirectional freeze-thaw screening test on smaller test specimens of their product prior to conducting the present full scale test (guidance on the size of the small panels and/or the conditions of testing could be provided by testing organization having experience with the present test).

NOTE 2 The environmental cycling has a period of 6 h and four cycles are applied per day. The total elapsed time for the cycling is 15 d.

E.6.3 Assessment stage

E.6.3.1 The test shall be terminated after 60 environmental cycles, or earlier if the test specimen is observed to have failed, where failure is defined as the following:

- a) the finish coat does not remain adhered to the base coat;
- b) there is blistering of the finish coat;
- c) there is cracking, blistering or sagging of the base coat;
- d) the base coat separates from the thermal insulation board.

NOTE A crack is considered an opening in the application where the fracture is greater than 0,2 mm, visible without magnification and penetrating the depth of the application.

E.6.3.2 After the environmental cycling is terminated and the panel is dry, the test specimen shall be examined for deterioration as noted in [E.6.3.1](#).

E.6.3.3 If water is observed to penetrate beyond the elements forming the cladding strategy or to drain from locations other than designed drainage outlets, it shall be documented.

E.6.3.4 After the visual examination of the test panel, six test specimens (cores) shall be cut to a depth and in sufficient dimensions to undergo the bond strength test (see [Annex A](#)). Three test specimens shall be cut from the base coat only area and three test specimens shall be cut from the finish coat area. The test specimens shall be separated by at least 600 mm and be at least 600 mm from the edge of the test specimen or any penetration.

E.6.3.5 The cores shall not be subjected to the water immersion step of the bond strength test.

E.6.3.6 The bond strength of each core shall be measured and the average of the measurements shall be reported.

E.7 Assessment

E.7.1 Failure of the test specimen following the environmental cycling (if any) shall be reported.

E.7.2 The average bond strength of the cores shall be reported.

Annex F (normative)

Assessing drainage performance of EIFS (5.6.3)

F.1 General

F.1.1 This test method provides information on determining the water retention ratio within a drained EIFS wall when subjected to controlled and metered water intrusion at the interface between the EIFS and the water resistive barrier system.

F.1.2 The test method provides information on the preparation of test specimens and describes the test apparatus and procedure to be used to assess the water retention ratio of the drained EIFS wall.

F.1.3 The test procedure is designed to simulate a leak in an EIFS clad wall assembly. To this end, water is drained through the test specimen and performance reported. The performance of the assembly does not replace the requirement of good building practices such as the deflection of water away from the drainage cavity and proper flashing to separate different building components.

NOTE ISO 17738-3 provides further background on detailing, durability and resilience.

F.2 Summary of test method

F.2.1 This test method consists of directing water at a known rate and amount into an opening at the top of a drainage cavity that forms part of an EIFS wall test specimen. The amount of water retained by the assembly after directing water to the drainage cavity is determined over a 60-min period.

F.2.3 Three test specimens shall be tested.

F.3 Significance and use

F.3.1 This test method provides a standard procedure for determining the water retention ratio of a drainage cavity incorporated in an EIFS cladding.

F.3.2 The effectiveness of a drainage cavity behind any cladding directly affects moisture migration and retention in the wall assembly and, as such, affects the long-term performance of the wall assembly. Water that intrudes behind any cladding and remains in interstitial spaces within the drainage system may induce problems with moisture sensitive components in the wall assembly if sufficient water is present for extended periods of time.

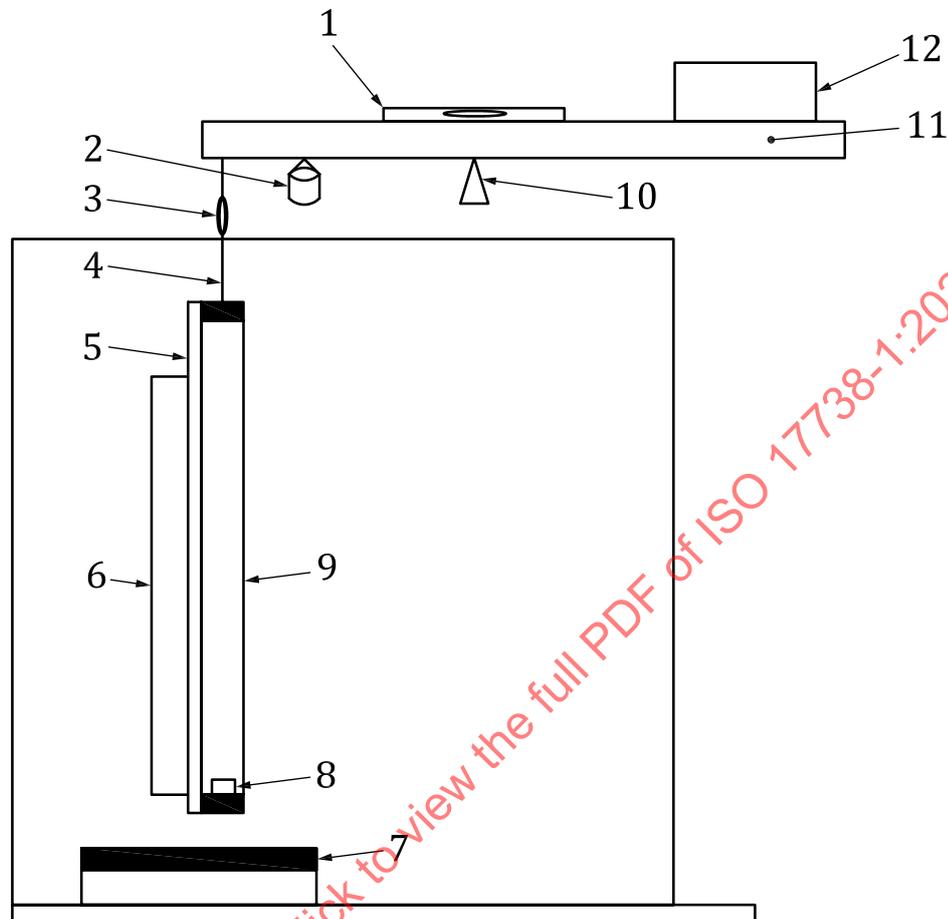
F.3.3 The information provided from these tests allows determining the degree to which water is retained in the test specimen.

F.4 Test apparatus

F.4.1 The apparatus (see [Figure F.1](#)) shall consist of the following:

- a) test specimen support and weighing system;

- b) water dispensing system;
- c) water collection system.



Key

1	carpenter's level	7	collecting tray
2	load cell	8	calibration weights
3	turnbuckle	9	framing
4	tie bar	10	pivot
5	sheathing	11	balance beam
6	EIFS	12	counterweights

Figure F.1 — Diagrammatic representation of the weight balancing system

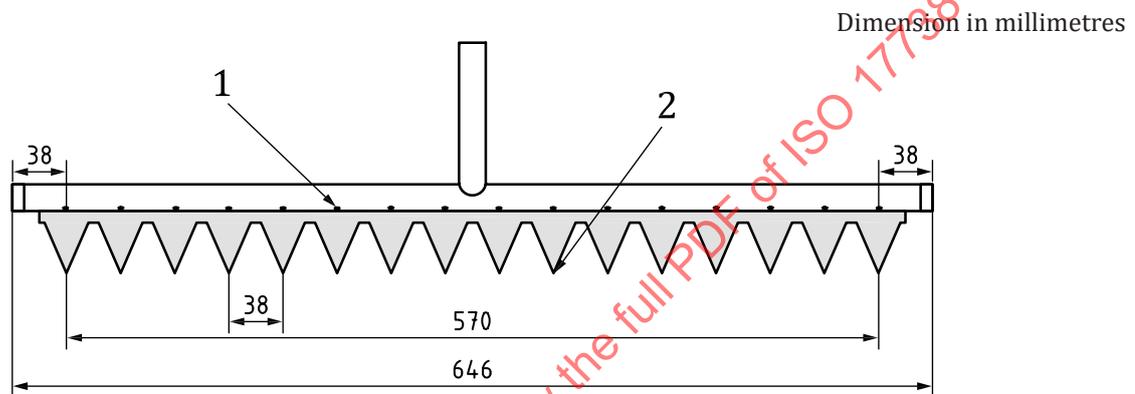
F.4.2 A validation check of the load cell calibration shall be conducted using calibrated weights over the weight range expected to be measured. These can be placed from the back of the wall on top of the bottom plate in increments of approximately 50 g for a minimum of five readings. The slope of the load/load cell reading shall represent the calibration factor.

F.4.3 Test specimen support and weighing system shall consist of a beam attached to the test specimen and to a set of counterweights. The counterweights shall be placed on a plate attached to one end of the beam whereas the test specimen shall be attached at the other end of the beam through a series of adjustable metal ties (turnbuckles) that help ensure that the test specimen is nominally plumb. The beam shall be maintained in a level position, which can be ascertained by the use of a carpenter's level placed on the beam above the pivot. A restraint shall be installed at the bottom of the wall to prevent the test specimen from swaying. The restraint shall be constructed of a lightweight material that is not affected by humidity.

F.4.4 The calibrated load cell shall have a minimum accuracy of 1 g. The load cell can be mounted either directly above the attachment point of the test wall or offset from the attachment point. For the latter, the force recorded by the load cell shall be recalculated using the principles for a lever.

F.4.5 A water delivery wand (See [Figure F.2](#)) shall be installed to uniformly dispense water at the top of the test specimen. The water delivery wand shall consist of:

- a tube with 16 weep holes of 0,2 mm diameter spaced 38 mm apart;
- a serrated fibreglass mesh fabric fastened to the tube to direct water to the surface of the water resistive barrier;
- the serrated mesh shall be secured within 2 mm of the weep holes;
- the tips of the serrated mesh shall align with the weep holes as illustrated in [Figure F.2](#).



Key

- 1 weep holes located within 2 mm of serrated mesh connection to delivery wand
- 2 tips of serrated mesh align with weep holes and are spaced 38 mm apart

Figure F.2 — Water delivery wand

F.4.6 A holding tank shall be located adjacent to the test apparatus in which the water shall be maintained at a temperature of (23 ± 2) °C.

F.4.7 Water shall be transferred from the holding tank to the delivery wand by action of a fluid metering pump at the rate of 8,0 l/h. The pump rotation rate shall be adjustable to permit varying the rate of water delivery to the drainage cavity. Water shall trickle from evenly spaced openings in the water delivery wand onto the serrated fibreglass mesh fabric that directs water onto the surface of the LA-WRB of the test specimen (See [Figure F.5](#)).

F.4.8 The flow rate shall be calibrated by activating the pump for a period of 15 min and dispensing water into a container whose weight can be monitored continuously. Following this period, the time and weight shall be recorded and the rate calculated in terms of the weight of water dispensed over the calibration period. The procedure shall be repeated at least three times and the average rate of flow shall be determined on the basis of the three test results. If the range in variation amongst any of the individual results exceeds 2 %, the tests shall be repeated to ensure repeatability in the flow rate of less than 2 %.

F.4.9 The water collection system shall consist of an inclined gutter (minimum slope 2 % along the length of the test specimen) located at the base of the test specimen and a container located adjacent to the gutter. Water drainage from the drainage cavity and exiting at the base of the test specimen shall be directed to the gutter and then away from the test specimen.

F.5 Test specimen

F.5.1 The EIFS wall test frame shall be 1 220 mm wide by a minimum 2 440 mm high.

NOTE The frame can be greater than 2 440 mm in height to accommodate connections for the balance beam.

F.5.2 The test frame shall consist of the same materials and details, and be prepared by the same methods as used in typical steel stud or wood frame construction; unless otherwise noted, installation of any of the components of the wall should follow accepted construction practice.

F.5.3 The test frame (See [Figure F.3](#)) shall be fabricated of steel or wood stud framing consisting of (38 × 89) mm making three equal stud spaces. Wood framing and sheathing shall be dried and equilibrated to the test environment. A schematic representation of the test specimen is given in [Figure F.4](#).

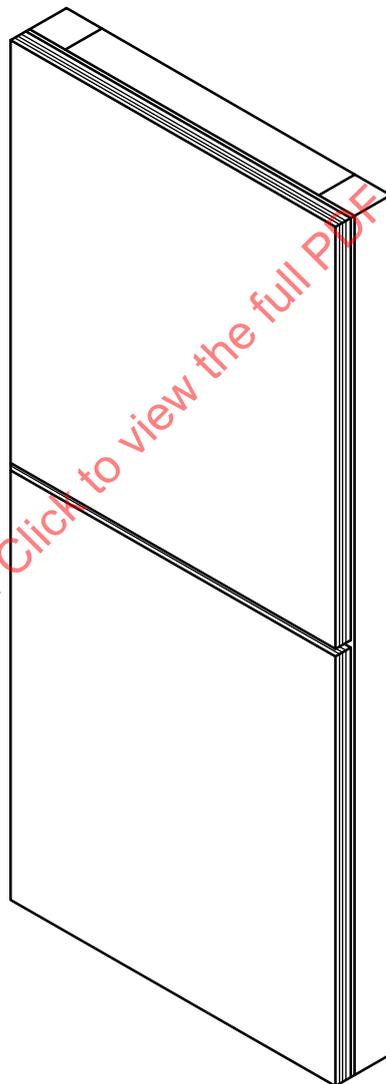


Figure F.3 — Frame

F.5.4 The test frame shall have a single bottom sill plate and double top plates.

F.5.5 A pair of fixtures shall be installed at the top plate of the test specimen to permit securely fastening it to the test assembly.

F.5.6 The sheathing panels shall consist of any material typically specified for use in fabricating EIFS walls (e.g. plywood, OSB, cement board, glass mat gypsum) and according to that prescribed in the manufacturer's installation instructions for the WRB being used. The sheathing shall have a 3,2 mm horizontal gap at the midpoint of the panel.

F.5.7 The WRB used to protect the sheathing shall meet the requirements of 5.4 and shall be installed in accordance with the manufacturer's installation instructions.

NOTE As this test evaluates the effectiveness of the drainage cavity, any LA-WRB that meets the requirements of this document can be used for this test. However, if changes are made to the EIFS that can make the drainage path more restrictive, such as changes to the pattern of ribbons or the GDDC, the test results will not be applicable.

F.5.8 All materials shall be installed according to the manufacturer's installation instructions.

F.5.9 The WRB shall be installed over the surface of the sheathing on the test frame and wrapped onto the frame perimeter covering the edge of the sheathing.

F.5.10 The EIFS test sample, 1 220 mm wide and a minimum of 2 135 mm high, shall be installed on the WRB so that:

- the top and the bottom edges of the sample are open, i.e. not wrapped, to allow the free entry and exit of water;
- a minimum space of 25 mm is open at the bottom to affix a flashing;
- a minimum space of 155 mm is open at the top of the panel to permit the positioning of the water delivery wand;
- the edges of the panel are made watertight.

NOTE Edge wrapping the panel with base coat and mesh is an acceptable method of making the edges of the panel watertight.

A self-adhered waterproofing membrane may be applied to the interior surface of the exterior vertical framing studs to render the test specimen watertight.

F.5.11 The test specimen (See [Figure F.5](#)) shall be cured for a minimum of 14 d or according to the manufacturer's installation instructions, whichever is longer, prior to testing at (23 ± 2) °C and (50 ± 5) % RH.

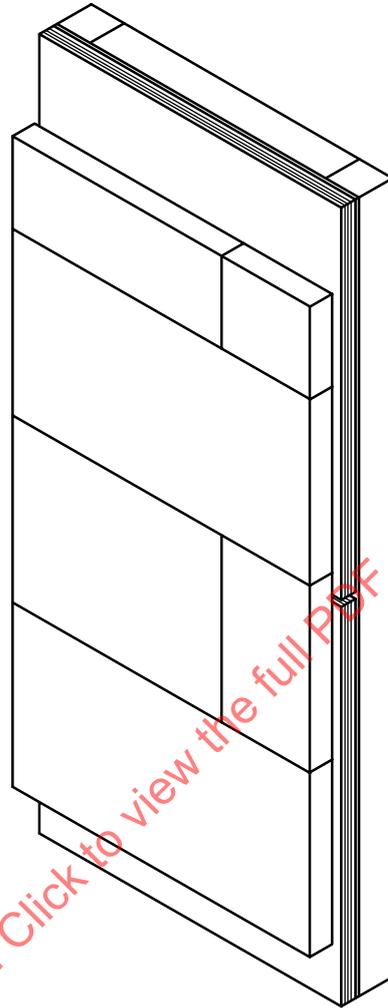


Figure F.4 — LA-WRB with thermal insulation

F.6 Test procedure

F.6.1 The tests shall be conducted in stable conditions (23 ± 2) °C and (50 ± 5) % RH and the temperature and relative humidity shall be continuously monitored prior to and during the test sequences. The test specimen shall be allowed to acclimatize to the conditions for a minimum period of 24 h before conducting the test.

F.6.2 The test specimen shall be mounted in the test apparatus and the vertical turnbuckles and other attachment fixtures shall be adjusted to ensure that the test specimen is plumb across the length, width and depth of the test specimen.

F.6.3 The weights used to counterbalance the wall shall be adjusted so that sufficient preload is applied to the load cell and, thereafter, to tare the weight of the test specimen.

NOTE This keeps the test specimen in contact with the load cell during the test and steadies it against any disturbances.