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

**Part 1:
Materials and systems**

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

Partie 1: Matériaux et systèmes





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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).

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For an explanation on 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 the following URL: www.iso.org/iso/foreword.html.

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

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

Introduction

ISO 17738 comprises three parts: this document deals with the material performance of exterior insulation and finish systems (EIFS), ISO 17738-2¹⁾ provides guidance on installation and ISO 17738-3¹⁾ gives guidance on the design of an EIFS system.

1) Under preparation.

Thermal insulation products — Exterior insulation and finish systems —

Part 1: Materials and systems

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. It also outlines the requirements for water resistive barrier systems that are to be used with EIFS.

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

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

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.

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 consult the appropriate authorities and to establish health and safety practices, in conjunction with any existing applicable regulatory requirements, prior to its use.

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 1663:2007, *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 4628:2016, *Paints and varnishes — Evaluation of degradation of coatings — Designation of quantity and size of defects, and of intensity of uniform changes in appearance — Part 4: Assessment of degree of cracking*

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

ISO 17738-1:2017(E)

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

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

ISO 15148, *Hygrothermal performance of building materials and products — Determination of water absorption coefficient by partial immersion*

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*

3 Terms and definitions

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

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

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1 adhesive

product for adhering the thermal insulation board (3.21) to the *water resistive barrier system* (3.23)

3.2 base coat

polymer-based coating, either *factory-blended* (3.10) or *field-mixed* (3.11), applied directly to the *thermal insulation board* (3.21), fully embedding the *reinforcing mesh* (3.17) providing the primary barrier to water penetration

3.3 cure

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

3.4 drainage cavity

space between the WRB and *thermal insulation board* (3.21) that allows for the free drainage of water that penetrates the *EIFS* (3.9)

3.5 dry

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

3.6 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

3.7 EIFS manufacturer

producer of the materials and components forming a proprietary *EIFS* (3.9)

3.8 embed

press into and encapsulate the *reinforcing mesh* (3.17) in the wet *base coat* (3.2)

3.9**exterior insulation and finish system****EIFS**

non-load-bearing wall cladding system comprised of *LA-WRB* (3.15), an *adhesive* (3.1) for attachment of the *thermal insulation board* (3.21) to the LA-WRB, rigid thermal insulation board, a glass fibre *reinforcing mesh* (3.17) embedded in a *base coat* (3.2) on the face of the thermal insulation board and a *finish coat* (3.12)

3.10**factory-blended**

material that arrives from the manufacturer requiring no additions apart from water to produce the wet state material

3.11**field-mixed**

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

3.12**finish coat**

outermost coat applied over the *base coat* (3.2), which gives the wall its colour and texture, exclusive of sealers and paints

3.13**geometrically defined drainage cavity****GDDC**

path created between the WRB and *thermal insulation board* (3.21) through the use of thermal insulation board that has a pattern cut into its back

3.14**lamina**

composite of *base coat* (3.2), *reinforcing mesh* (3.17) and *finish coat* (3.12)

3.15**liquid applied water resistive barrier****LA-WRB**

fluid material applied by spray, roller or trowel, that dries to a membrane possessing low water absorption properties becoming a component of the *water resistive barrier system* (3.23)

3.16**manufacturer's installation instructions**

written installation instructions provided by the *EIFS manufacturer* (3.7) that include information that will assist in the correct use and installation of the materials and components that comprise their system

3.17**reinforcing mesh**

woven or non-woven glass fibre fabric component of the *EIFS* (3.9) encapsulated in the *base coat* (3.2) to strengthen the system

3.18**substrate**

structural component supporting the *EIFS* (3.9), which is resistant to deterioration caused by water or is protected by a *water resistive barrier system* (3.23)

3.19**test sample**

prepared materials or systems from which *test specimens* (3.20) are taken

3.20**test specimen**

portion of a *test sample* (3.19) taken for measurement of a given property or characteristic

3.21

thermal insulation board

component that functions to reduce heat flow through the wall and serves as the surface to receive the *base coat* (3.2)

3.22

water absorption coefficient

mass of water absorbed by a *test specimen* (3.20) under specified time and pressure, per unit area and per square root of time

3.23

water resistive barrier system

WRB

material(s) possessing low water absorption properties that are applied over *substrates* (3.18) susceptible to water absorption to create a continuous surface that prevents water penetration into the wall assembly

3.24

water retention ratio

weight of water retained in the *test specimen* (3.20) following the drainage capacity test divided by the projected area of wetted wall

3.25

wrap

protect the exposed edges of *thermal insulation board* (3.21) by back-wrapping or edge-wrapping

4 Requirements

4.1 EIFS constituent products

4.1.1 The constituent products of EIFS shall meet the technical requirements listed in [Table 1](#).

4.1.2 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

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

- a) joint durability test;
- b) nail popping resistance test.

The type of wood substrate can have an effect on the adhesion of the LA-WRB to the substrate. Given its nature of manufacture, oriented strand board (OSB) is deemed to represent a worst-case scenario in this regard. Therefore, any LA-WRB that passes the tests required in [5.4](#), when applied to OSB, shall be deemed suitable for use on plywood.

4.3 EIFS

The EIFS shall be tested as an assembly as required in [5.5](#); the associated technical requirements for the system are listed in [Table 3](#).

4.4 Special applications

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

5 Testing

5.1 Sampling

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

5.2 Preparation of sample panels

5.2.1 As a minimum, the following test sample panels shall be prepared.

5.2.1.1 One nominal 610 mm × 610 mm panel consisting of 25 mm thick thermal insulation board and base coat, including reinforcing mesh shall be prepared. The base coat and reinforcing mesh shall be applied at the thickness stipulated by the EIFS manufacturer, determined for the purpose of confirmation as a mass per unit area, as per [5.2.5](#). This test sample panel shall be used for preparation of the test specimens 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.

5.2.1.2 Five nominal 610 mm × 610 mm panels consisting of 25 mm thick thermal insulation board and base coat, including reinforcing mesh, and finish coat. The edges of four of the panels shall be wrapped with base coat, reinforcing mesh and finish coat. The base coat shall be allowed to cure for a minimum of 24 h prior to application of the finish coat. The base coat and reinforcing mesh and finish coat shall be applied at the thicknesses stipulated by the EIFS manufacturer, determined for the purpose of confirmation as a mass per unit area, as per [5.2.5](#). This test sample panel shall be used for preparation of the test specimens for the following tests:

- a) bond strength test of the finish coat;
- b) water vapour permeance of the lamina test;
- c) lamina salt spray resistance test;
- d) lamina ultraviolet resistance test;
- e) EIFS impact resistance test (the wrapped panels).

5.2.1.3 One nominal 610 mm × 1 220 mm vertical wood frame to which is attached 19 mm thick OSB sheathing meeting the requirements of ISO 16894 and having a water absorption coefficient of $(0,002 \pm 0,001) \text{ kg/m}^2 \text{ s}^{1/2}$. 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 [5.2.5](#). 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.

5.2.1.4 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 manufacturers 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 [5.2.5](#). This test sample panel shall be used for preparation of the test specimens to test the water vapour permeance of the LA-WRB.

5.2.2 The test sample panels shall be prepared in a vertical orientation to simulate installation in the field.

5.2.3 For the installation requirements of EIFS and LA-WRB, see ISO 17738-2²⁾.

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

5.2.5 The applied material thickness shall be verified as a mass per unit area, as follows. In determining the area of the test sample panel, its linear dimensions shall be measured to an accuracy of 1 mm.

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

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

The initial mass of the material including its storage container shall be measured to an accuracy of 1/1 00 of the mass.

Material shall be removed from the storage container and applied uniformly to the test sample panel until the mass of material removed is equal to the mass determined. The mass of material removed shall be determined by measuring the mass of the remaining material, including its storage container, until the difference between the initial mass and the final mass is equal to the mass determined to an accuracy of 1/1 00 of the mass.

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

5.2.7 Test specimens, unless otherwise specified in the test methods, shall be obtained from the conditioned test sample panels described in [5.2.1.1](#) through [5.2.1.4](#). 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 number of teeth per inch and other cutting variables shall be considered in test specimen preparation in order to avoid excess vibrations or heat build-up.

2) Under preparation.

5.3 EIFS constituent material tests

5.3.1 Ash content

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

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

5.3.2 Infrared analysis

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

5.3.2.2 Test specimens shall be prepared and the absorption spectrum of the organic fraction of the binder used in the formulation of the base coat and finish coat shall be determined in accordance with ISO 4650 and the results shall be recorded on a plot of percent transmittance vs. wavelength.

Test specimen preparation for infrared analysis is provided in [Annex H](#).

5.3.3 Bond strength tests

5.3.3.1 Test specimen preparation and testing of the bond strength of the adhesive, base coat and finish coat shall be according to [Annex A](#).

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

5.3.4 Water vapour permeance of the lamina

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

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

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

5.3.5 Base coat water impermeability test

5.3.5.1 Three test specimens measuring 200 mm × 200 mm shall be cut from the test sample panel described in [5.2.1.1](#). 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”, would be a suitable material to use for sealing the edges of the test specimens.

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

5.3.5.3 The test specimens, with the coatings facing downward, shall be placed in a tank of water to a depth of $(5 \pm 0,25)$ mm for at least 2 h.

5.3.5.4 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.

5.3.6 Water absorption of the base coat

5.3.6.1 Two test specimens measuring 100 mm × 100 mm shall be cut from the test sample panel described in [5.2.1.1](#) and the thermal insulation board shall be detached from each of them.

5.3.6.2 The test specimens shall be dried in a well-ventilated oven for 24 h at a temperature of (105 ± 2) °C. After cooling at room temperature for 15 min, the dry weight of the test specimens shall be measured and reported to the nearest 0,01 g.

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

5.3.6.4 After 48 h immersion, the 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.

5.3.7 Finish coat fungus resistance test

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

5.3.7.2 The fungus resistance test shall be conducted according to ISO 846. The test specimen shall be incubated for a minimum of 28 d.

5.3.7.3 At the end of the test period, the test specimen shall be examined for fungal growth on the finish coat material and the observations recorded according to the requirements of ISO 846.

5.3.8 Lamina salt resistance test

5.3.8.1 Three test specimens measuring 100 mm × 300 mm shall be cut from the test sample panel described in [5.2.1.2](#). The edges of each test specimen shall be sealed with wax.

5.3.8.2 The test specimens shall be tested according to ISO 4611 for 300 h.

5.3.8.3 The test specimens shall be visually examined without magnification.

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

5.3.9 Lamina ultraviolet resistance test

5.3.9.1 Three test specimens measuring 100 mm × 300 mm shall be cut from the test sample panel described in [5.2.1.2](#). The edges of each test specimen shall be sealed with wax.

5.3.9.2 The test specimens shall be tested according to ISO 16474-3. 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 minutes of light exposure with no water spray [black panel temperature of (63 ± 2) °C and $(50 \% \pm 5 \%)$ RH];
- b) 18 min of light exposure with water spray [water temperature at (16 ± 3) °C];
- c) the above cycle (A and B) is repeated for 18 h;
- d) 6 h of darkness, no water spray [black panel temperature of (24 ± 2) °C and $(95 \pm 5) \%$ RH];
- e) the above cycle (A through D) represents 24 h or 1 d exposure. The cycle is repeated for a total of at least 1 998 h of light exposure (2 664 h or 111 d total).

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

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

5.3.10 Reinforcing mesh strength and alkalinity resistance

5.3.10.1 A minimum of 20 test specimens, each measuring 50 mm wide and 300 mm long, shall be prepared from the lightest weight of mesh used with a proprietary system. At least 10 test specimens shall have the long dimension in the direction of the weft and 10 test specimens shall have the long dimension in the direction of the warp. At least five of each type of test specimen shall be exposed to an alkaline solution for 28 d and then allowed to dry for 7 d in accordance with ISO 4606.

5.3.10.2 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.

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

5.3.10.3 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 exposure in the weft;
- d) five test specimens after exposure in the warp.

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

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

5.3.11 Dry thickness of the base coat

5.3.11.1 Following the completion of the testing described in [5.3.3](#), [5.3.5](#) and [5.3.6](#), 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 [5.2.1.1](#).

5.3.11.2 The dry thickness of the base coat shall be measured in accordance with ISO 1463, in three places on each test specimen to an accuracy of 0,1 mm. The maximum, minimum and average of the 18 measurements shall be reported.

5.3.11.3 Following the completion of the testing described in [5.3.3](#), [5.3.4](#), [5.3.8](#) and [5.3.9](#), 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 [5.2.1.2](#)

5.3.11.4 The dry thickness of the base coat shall be measured in accordance with ISO 1463 in three places on each test specimen to an accuracy of 0,1 mm. The maximum, minimum and average of the 18 measurements shall be reported.

5.4 LA-WRB tests

5.4.1 Ash content

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

5.4.1.2 When conducted, test specimens shall be prepared and the ash content of the LA-WRB material shall be determined in accordance with ISO 3451-1 and 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 This test shall be conducted only if deemed necessary by the testing agency as a means of identification of the test sample materials submitted.

5.4.2.2 When conducted, test specimens shall be prepared and the absorption spectrum of the organic fraction of the binder used in the formulation of the LA-WRB shall be determined in accordance with ISO 4650 and the results shall be recorded on a plot of percentage transmittance vs. wavelength.

5.4.3 Bond strength test of the LA-WRB

5.4.3.1 Test specimen preparation and testing of the bond strength of the LA-WRB shall be according to [Annex A](#).

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

5.4.3.3 The bond strength of the LA-WRB shall meet the minimum requirements specified in [Table 2](#) for each state tested (initial, wet and dry).

5.4.4 Water absorption coefficient of the LA-WRB

5.4.4.1 Test specimen preparation and testing of the water absorption coefficient of the LA-WRB shall be in accordance with the requirements set forth in [Annex B](#).

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

5.4.5 Water vapour permeance of the LA-WRB

5.4.5.1 Four test specimens, and samples of the substrate material, each measuring 305 mm × 305 mm, shall be cut from the test sample panel described in [5.2.1.4](#).

5.4.5.2 The test specimens shall be tested according to ISO 12572, Water Method, Procedure B, with the LA-WRB side face down to the tray.

5.4.5.3 The water vapour permeance of the LA-WRB and the substrate material shall be determined as per ISO 12572 in $\text{ng}/(\text{Pa} \cdot \text{s} \cdot \text{m}^2)$. The substrate material shall be tested independently from the coated sample.

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

5.4.6 Accelerated weathering resistance test of the LA-WRB

5.4.6.1 Three test specimens of a size suitable for the test apparatus, but in no case smaller than 100 mm × 150 mm, shall be cut from the test sample panel described in [5.2.1.3](#).

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

5.4.6.2 The test shall be conducted in accordance with ISO 16474-3 utilizing a UVA-340 lamp and the following cycle:

- a) 102 min of light exposure with no water spray [black panel temperature of $(63 \pm 2) \text{ }^\circ\text{C}$ 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).

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

5.4.6.4 Any deleterious effects, such as cracking, delamination or flaking, shall be recorded. Cracking is defined using ISO 4628-4:2016, Table 2, Rating 3(c) or higher.

5.4.7 LA-WRB joint durability test

5.4.7.1 The test specimens shall be constructed and tested according to the method outlined in [Annex C](#).

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

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

5.4.7.4 All test specimens undergoing the water transmission test shall meet the performance requirements specified in [Table 2](#).

5.4.8 Nail popping resistance test

5.4.8.1 The test specimens shall be constructed and tested according to the method outlined in [Annex D](#).

5.4.8.2 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.

5.4.8.3 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 EIFS tests

5.5.1 EIFS impact resistance test

5.5.1.1 The four test sample panels prepared as per [5.2.1.2](#) with their edges wrapped shall be used for this test.

5.5.1.2 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).

5.5.1.3 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).

5.5.1.4 Following each drop, the test specimen shall be visually examined without magnification for cracks and perforations, where a crack is considered an opening through the finish coat and base coat which allows the reinforcing mesh to be seen and a perforation is considered to be broken reinforcing mesh.

5.5.1.5 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.

5.5.1.6 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.

5.5.2 Durability under cyclic environmental conditions test

5.5.2.1 It is not necessary that all the EIFS manufacturer’s constituent materials be tested. Rather, 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) the EIFS manufacturer’s LA-WRB with the weakest bond strength in the Wet State and the highest water absorption;

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

5.5.2.2 Where it is not possible to construct one test specimen incorporating the "worst-case" constituent materials identified in [5.5.2.1](#), 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.

5.5.2.3 Where it is not possible to construct one test specimen incorporating the "worst-case" constituent materials identified in [5.5.2.1](#), 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.

5.5.2.4 A situation in which 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 would represent a situation in which it would be necessary to construct more than one test specimen.

5.5.2.5 The test specimens shall be constructed and tested according to [Annex E](#).

5.5.2.6 Upon completion of the Cyclic Environmental Testing, the condition of the test specimen shall be visually examined without magnification

5.5.2.7 Any signs of deterioration, which include 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.

5.5.2.8 The extent of visual deterioration following the cyclic environmental testing shall not exceed that indicated in [Table 3](#). For the purposes of evaluation in this test, crazing or microcracking is not considered to be deterioration.

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.

5.5.3 Drainage capacity test

5.5.3.1 The test specimen shall be constructed and tested according to the method outlined in [Annex F](#).

NOTE The drainage capacity test is conducted to evaluate the performance of the drainage cavity of the EIFS. The type of LA-WRB or the substrate used for the test is irrelevant to the results. However, if 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, it will be necessary to retest.

5.5.3.2 The water retention ratio shall be reported in g/m².

5.5.3.3 The maximum water retention ratio of the system shall not exceed the value provided in [Table 3](#).

5.5.4 Fire resistance testing

Depending on the building circumstances, such as occupancy, building height and limiting distances, fire testing of EIFS is typically required by authorities having jurisdiction.

5.5.5 Mechanical fasteners

Testing of EIFS that incorporate mechanical fasteners is outside the scope of this document. However, methods to evaluate the use of mechanical fasteners, if required, are provided in ISO 17738-3:—, Annex A³⁾.

5.6 Reporting requirements

All reports describing the testing of the EIFS in accordance with this document 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 (if applicable);
- c) the address of manufacturing location;
- d) the lot number;
- e) the name and address of sampling agency;
- f) the date and method of sampling and list 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 compliance 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.

6 Marking, packaging and labelling

6.1 Packaging

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

3) Under preparation.

6.2 Labelling

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

- a) manufacturer's name and address;
- b) product's 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: [4.1.1](#))

TEST	Reference	Requirement	Notes
Bond strength of adhesive to LA-WRB	5.3.3 and Annex A	≥80 kPa	Wet state
		≥250 kPa	Initial and dry state
Bond strength of adhesive to Concrete Block	5.3.3 and Annex A	≥80 kPa	Wet state
		≥250 kPa	Initial and dry state
Bond strength of base coat to thermal insulation board	5.3.3 and Annex A	≥80 kPa	All states
Bond strength of finish coat to base coat	5.3.3 and Annex A	≥80 kPa	All states
Water vapour permeance of the lamina	5.3.4	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	5.3.5	<90% of surface area damp no liquid water visible	
Base coat water absorption	5.3.6	<20 % avg. mass gain	
Finish coat fungus resistance	5.3.7	No fungal growth supported	
Lamina salt resistance	5.3.8	No deleterious effects visible	
Lamina ultraviolet resistance	5.3.9	No deleterious effects visible	
Strength of reinforcing mesh after alkaline exposure	5.3.10	Avg. residual strength ≥21 N/mm	For both weft and warp
Dry thickness of the base coat	5.3.11	There is no pass/fail criterion for the dry thickness of the base coat test.	Dry thickness of the base coat is determined for verification purposes only.

Table 2 — Technical requirements for LA-WRB (reference: [4.1.2](#))

Test	Reference	Requirement	Notes
Bond strength	5.4.3 and Annex A	≥80 kPa	Wet state
		≥250 kPa	Initial and dry state
Water absorption coefficient	5.4.4 and Annex B	<4,0 g/(m ² ·s ^{1/2})	
Water vapour permeance	5.4.5	Report value in ng/(Pa·s·m ²). There is no pass/fail criterion water vapour permeance of the LA-WRB.	Water vapour permeance of the LA-WRB is included for potential hygrothermal design purposes. Test specimen shall be the maximum recommended thickness
Accelerated weathering resistance	5.4.6	No cracking, delamination, or flaking	
Joint durability	5.4.7	No water transmission	
Nail popping resistance	5.4.8	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

Table 3 — Technical requirements for EIFS (reference: [4.1.3](#))

Test	Reference	Requirement	Notes
Impact Resistance	5.5.1	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	5.5.2 and Annex E	No visible deterioration	Crazing, or microcracking, is not considered to be deterioration
	5.5.2 and Annex F	≤20 % bond strength loss compared to test specimens tested per 5.3.3 and 5.4.3	
Drainage capacity test	5.5.3 and Annex F	Water retention ratio ≤40 g/m ² based on projected drainage area	

Table 4 — Sample compliance report (reference: [4.1.3](#))

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

Manufacturer name: _____

Address: _____

Telephone: _____ Fax: _____

Website: _____

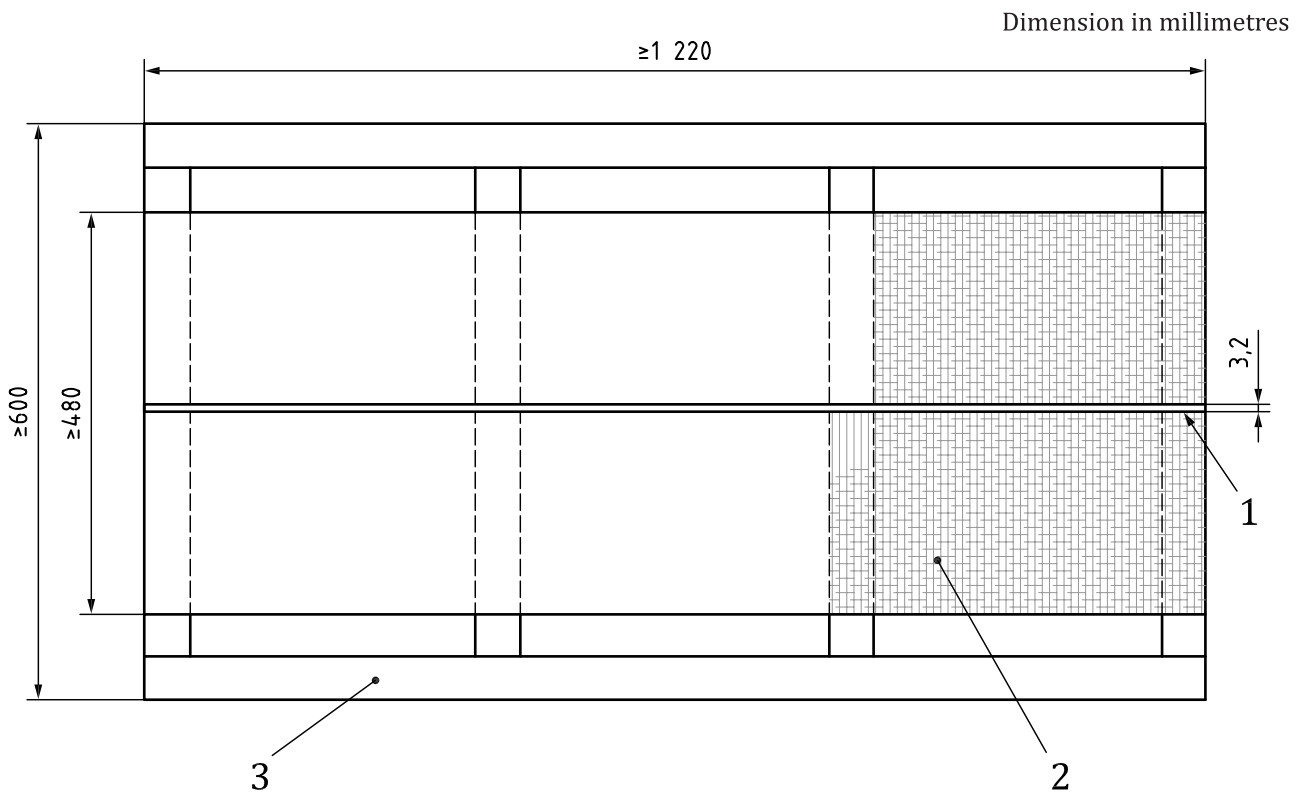
EIFS Identification: _____

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)
Reinforcing mesh strength after alkalinity exposure	≥21 N/mm (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 <i>substrate</i>)	≥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	≤20 % bond strength loss compared to LA-WRB and EIFS constituent material tests		(Pass/Fail)
Drainage capacity	≤40 g/m ²		(Pass/Fail)

Testing Agency: _____
 Address: _____
 Telephone: _____
 Fax: _____
 Name: _____ Signature: _____ Date: _____



- Key**
- 1 gap
 - 2 OSB
 - 3 wood frame

Figure 1 — Test sample panel construction (reference: [5.2.1.3](#))

Annex A (normative)

Bond strength testing (reference: [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 [5.2.1.3](#), 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 40 mm thick (minimum) non-patterned concrete block or paving stone, 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 [5.2.1.1](#);
- g) **Bond strength of the base coat to the finish coat.** Test specimens shall be cut from the test sample panels described in [5.2.1.2](#).

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 [5.2.5](#).

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 d at (23 ± 2) °C and (50 ± 5) % relative humidity (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 ± 2) °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 ± 2) °C and (50 ± 5) % relative humidity (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 ± 2) °C and (50 ± 5) % relative humidity (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 m². 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 [5.6](#), 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 (reference: [5.4.2](#))

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 100 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 100 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.

B.5 Test specimens

B.5.1 10 test specimens, each measuring 500 mm × 50 mm, shall be cut from the test sample panel described in [5.2.1.3](#). 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 with nominal dimensions of 150 mm × 88 mm × 88 mm, constructed of particle board glued with epoxy, as per [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) % relative humidity 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.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 100 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 (100 ± 2) mm above the tested surface 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 tank, dry the surfaces completely with a paper towel and weigh the test specimen to the nearest 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 .

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

$$m_t = (M_t - M_i)/A \text{ in } (g/m^2) \quad (\text{B.1})$$

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 [Formula \(B.2\)](#):

$$A_w = (m'_{tf} - m'_o)/\sqrt{tf} \text{ in } g/(m^2 \cdot s^{1/2}) \quad (\text{B.2})$$

Where (m'_{tf}) is the value of (m) on the straight line at time (tf), and (tf) is the time in seconds, of end of the test.

Type B — If the graph of m_t against \sqrt{t} does not give a straight line, but a curve of some form, the value of m_t 24 h, 48 h and 72 h after the start should be taken as m'_{tf} and A_w shall be calculated from [Formula \(B.3\)](#):

$$A_w, (24, 48, 72) = m'_{tf} / \sqrt{tf} \text{ in } g/(m^2 \cdot s^{1/2}) \quad (\text{B.3})$$

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.

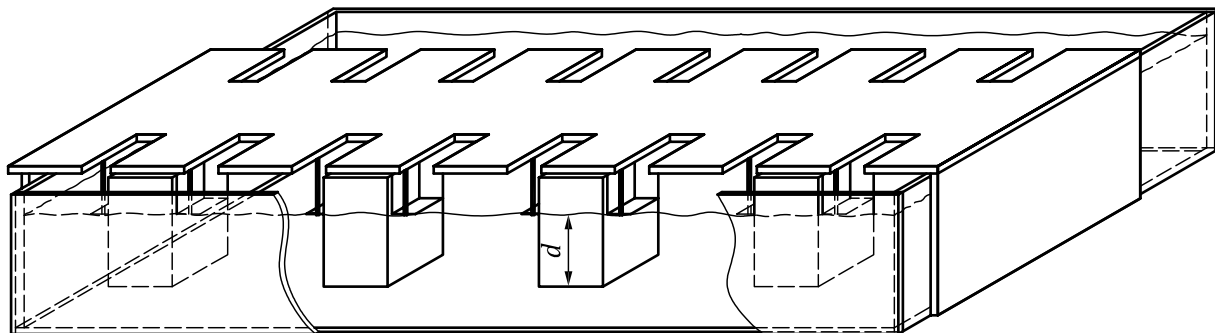
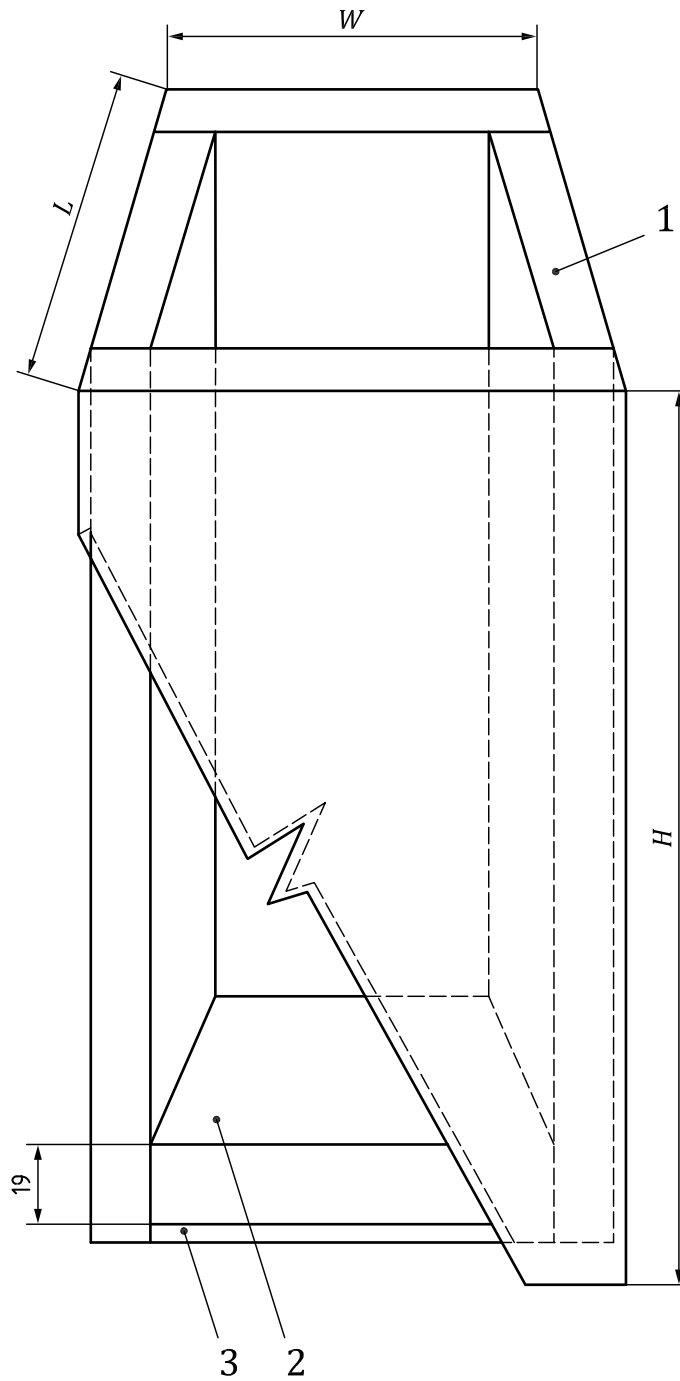


Figure B.1 — Test apparatus

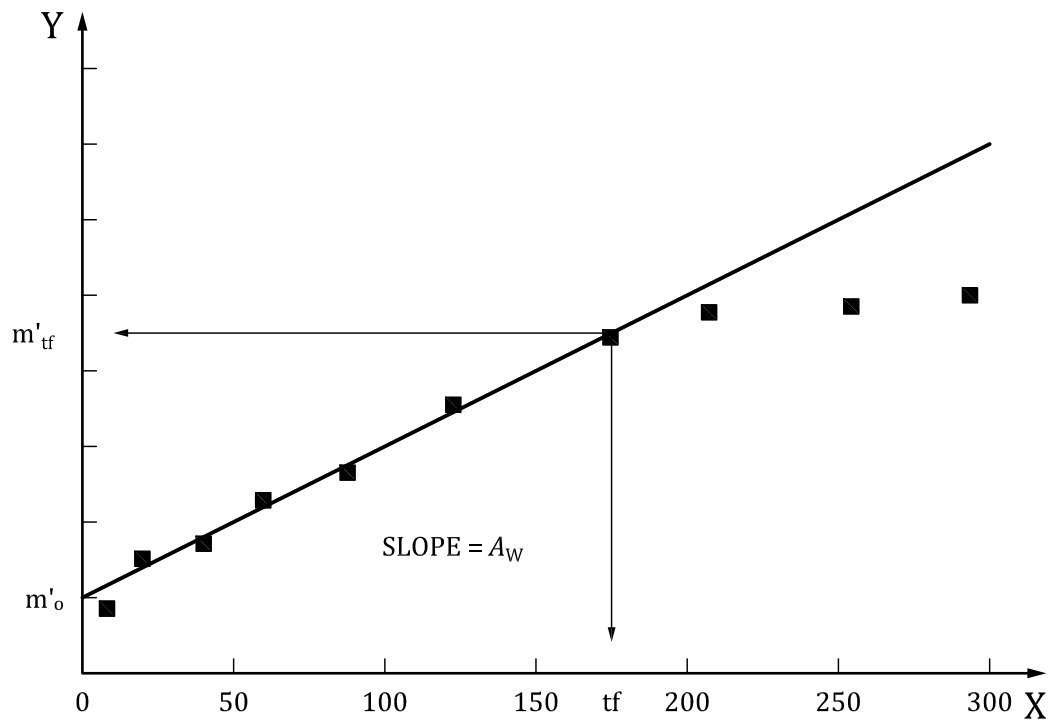
Dimension in millimetres



Key

- 1 particle board forming a square, open column
- 2 50 mm × 50 mm OSB, 19 mm thick
- 3 LA-WRB

Figure B.2 — Test specimen

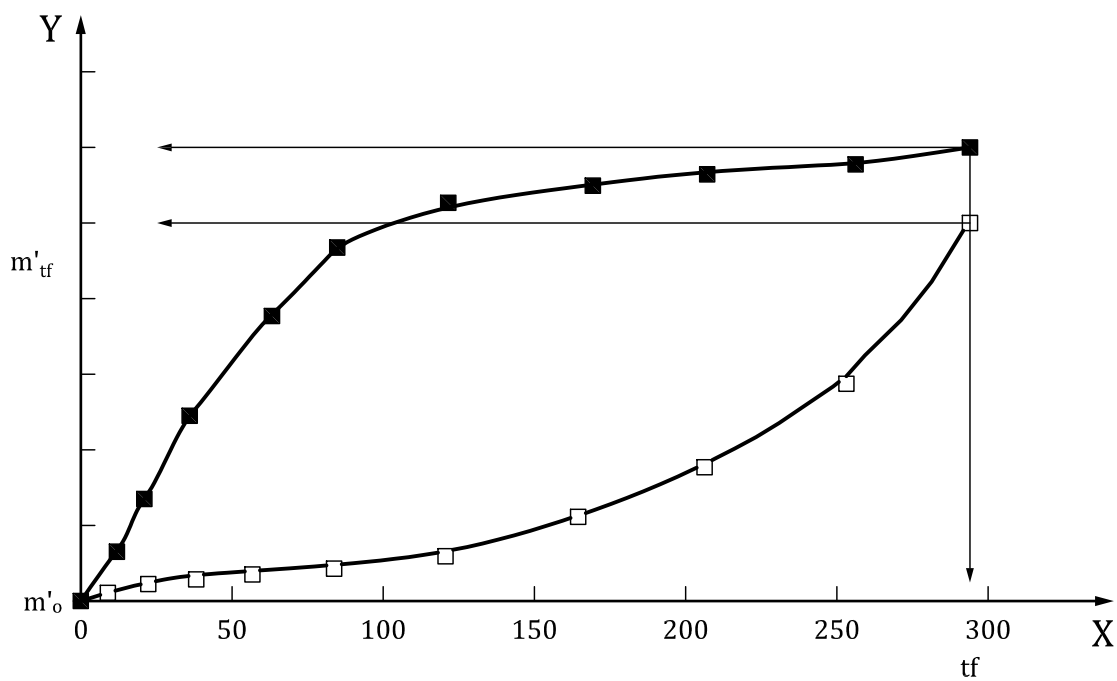


Key

X time ~ 0,5

Y m_t

Figure B.3 — Type A



Key

X time ~ 0,5

Y m_t

Figure B.4 — Type B

Annex C (normative)

Joint durability test (reference: [5.4.5](#))

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 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.

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 [5.2.1.3](#) such that the joint in the OSB bisects each test specimen (see [Figure C.4](#)).

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.

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.

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 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 — 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.

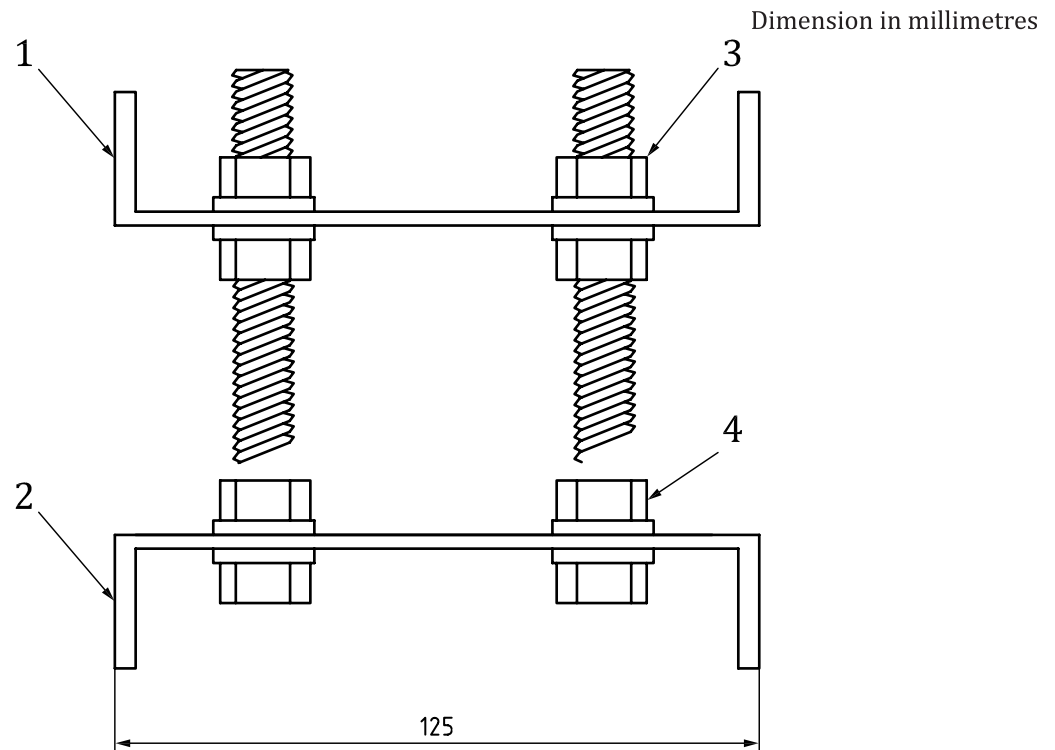
C.6.11 The membrane shall be maintained at constant conditions of temperature and relative humidity (25 ± 5) °C and (45 ± 10) % RH for a period of 2 h.

C.6.12 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 5.6, the following information shall be reported:

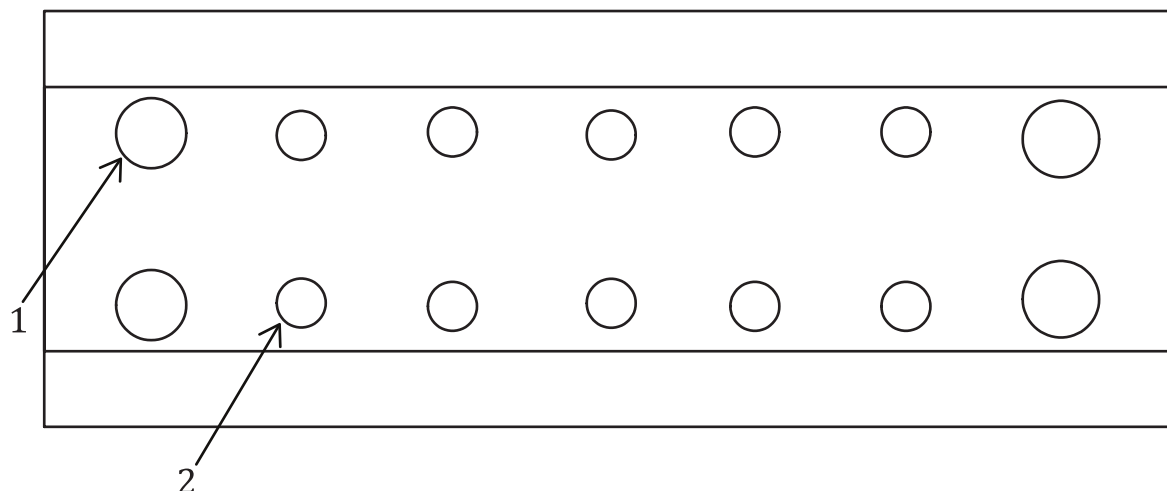
- a) a statement as to the visual condition of the test specimens after the cycling with respect to any damage to the integrity of any joint involving separation that would allow water to penetrate in the middle 100 mm of the test specimen joint length;
- b) a statement as to the indications of moisture seepage, if any, through the test specimens after the water penetration test.



Key

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

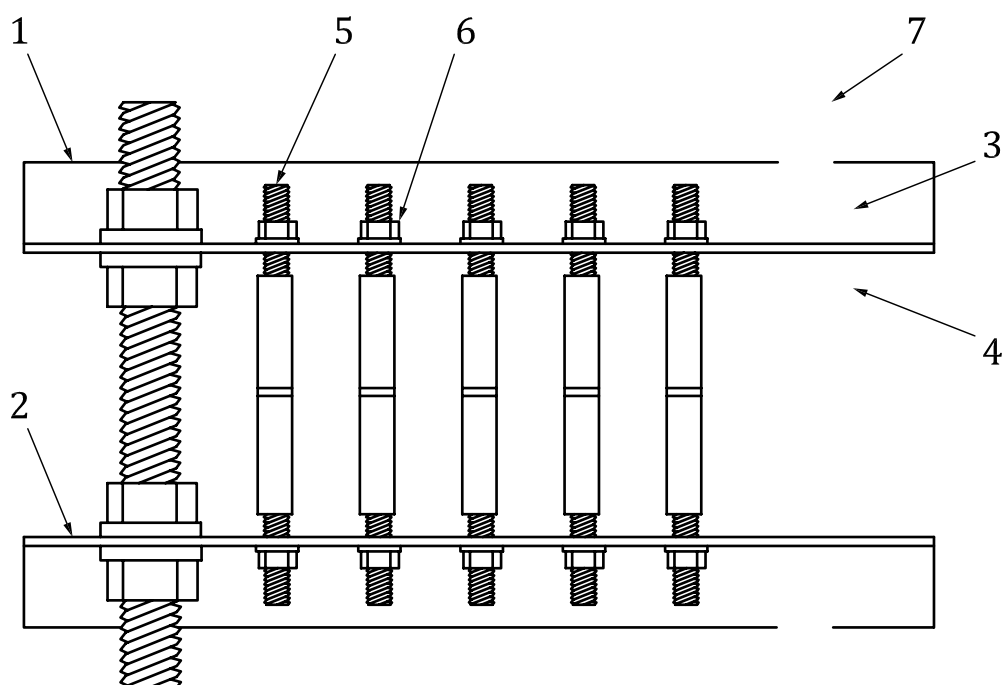
Figure C.1 — Cross section of test apparatus



Key

- 1 steel rods 19 mm
- 2 tension anchors

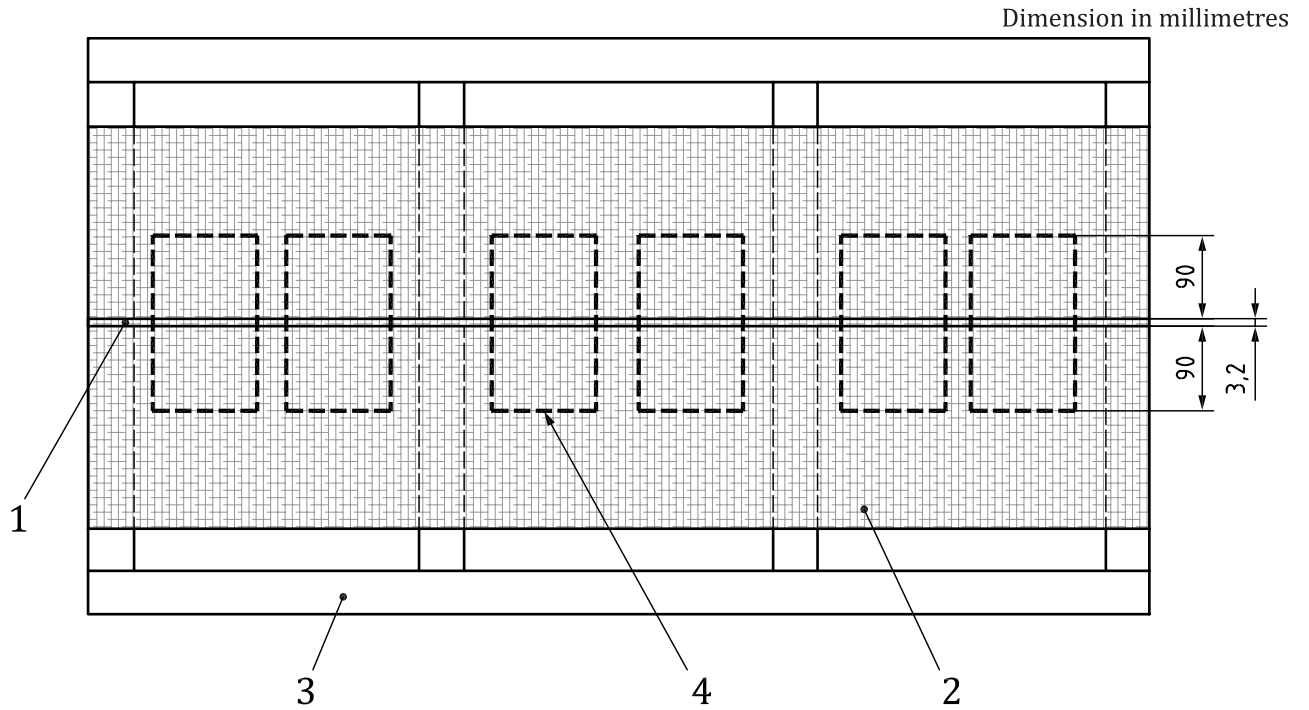
Figure C.2 — Plan view of the top channel of the test apparatus



Key

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

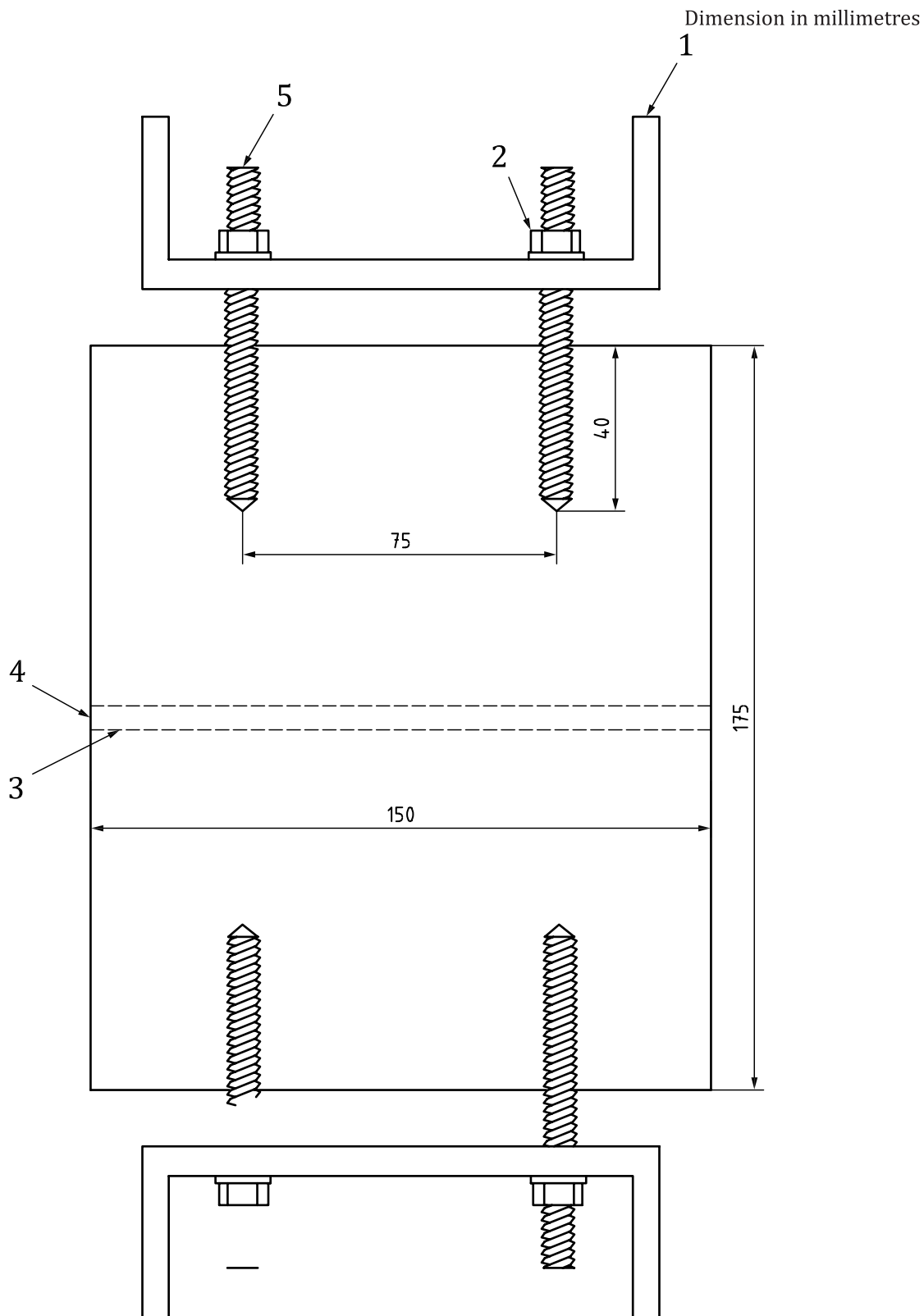
Figure C.3 — Section view of the test apparatus



Key

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

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



Key

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

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

Annex D (normative)

Nail popping resistance test (reference: [5.4.6](#))

D.1 General

D.1.1 This test method evaluates the effect of nail popping caused by drying of structural wood framing on the integrity of the LA-WRB. This test does not need to be conducted for a LA-WRB that is not intended by the EIFS manufacturer for installation on a wood substrate.

D.1.2 This test method provides information on the preparation of test specimens, describes the test apparatus to be used and the procedure used to assess the nail popping resistance of the LA-WRB.

D.2 Summary of test method

D.2.1 This test method consists of pushing a nail that has driven 1,0 mm below the surface of a test specimen of OSB that is then coated with LA-WRB back out and observing the effect on the LA-WRB.

D.2.2 Six test specimens shall be tested.

D.3 Significance and use

D.3.1 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.3.2 The type of wood substrate may 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.4 Test apparatus

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

D.4.2 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.4.3 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](#)).

D.5 Test specimen

D.5.1 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.5.2 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.5.3 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.5.4 A 64 mm (2 ½ in.) long common round wire nail with a head diameter of 6,75 mm (17/64 in.), 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](#)).

D.5.5 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 [5.2.5](#).

D.5.6 The test specimens shall be allowed to cure at (23 ± 2) °C and (50 ± 5) % RH for a minimum of 14 d prior to testing.

D.6 Test procedure

D.6.1 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.6.2 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.

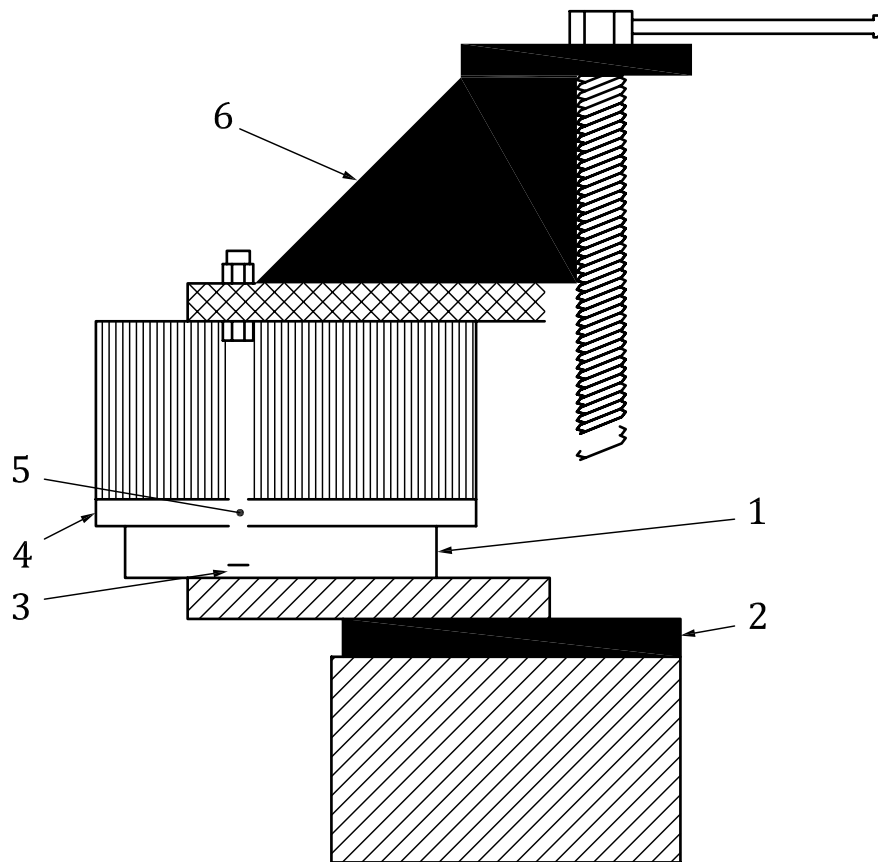
D.6.3 The nail shall be pushed a distance of 1,0 mm back through the OSB in a direction perpendicular to the surface of the OSB (see [Figure D.3](#)).

D.6.4 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.6.5 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.7 Assessment

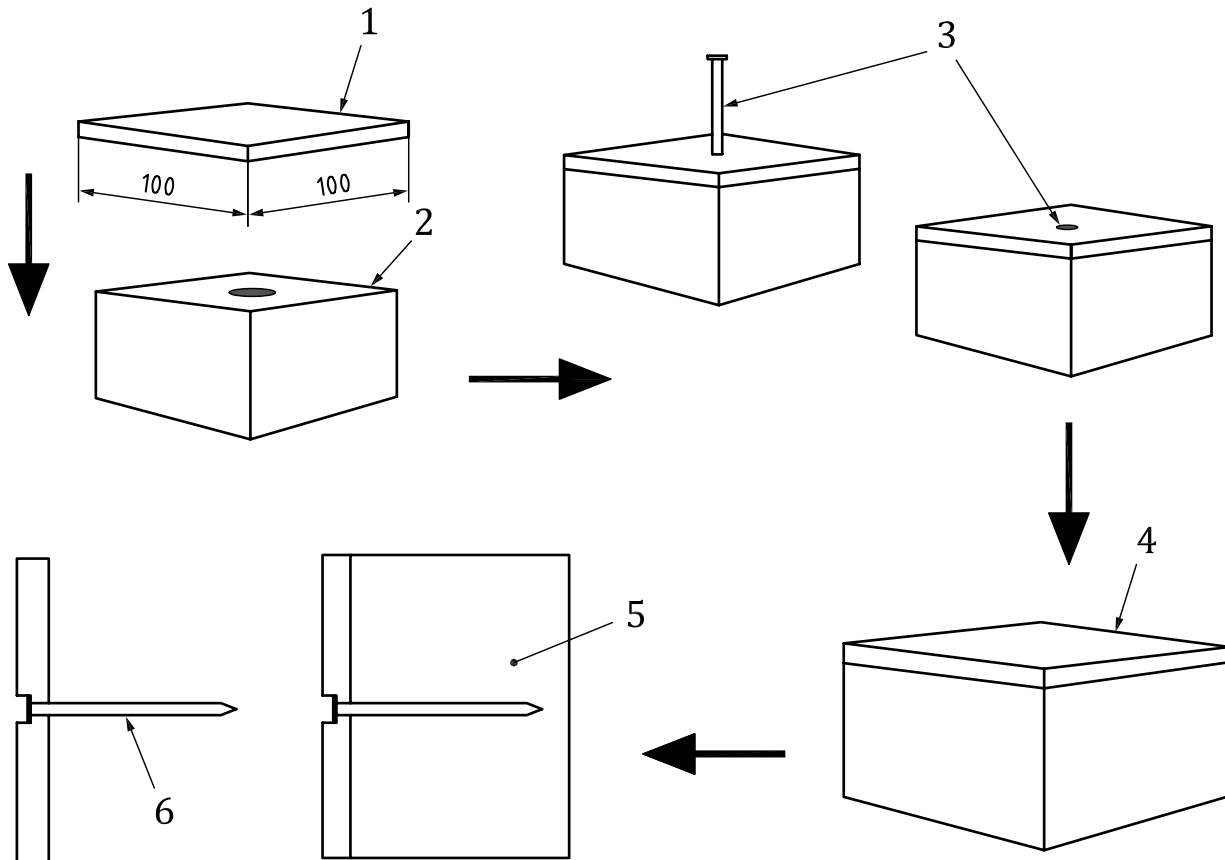
In addition to the information required in [5.6](#), a statement as to the visual condition of the test specimens after the testing, with respect to the appearance of cracking or delamination of the LA-WRB around the nail head, shall be reported.



Key

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

Figure D.1 — Schematic of suitable test apparatus



Key

- 1 five OSB samples cut into 100 mm square
- 2 nailing bases: 100 mm × 100 mm (4 inch × 4 inch) wood block with 25 mm (1 inch) drilled in center
- 3 54 mm (2,5 inch) 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 1 In key 2, hole needs to be deep enough to allow for 64 mm (2,5 inch).

NOTE 2 In key 3, nail is embedded 1 mm in OSB surface.

Figure D.2 — Specimen preparation

Dimension in millimetres

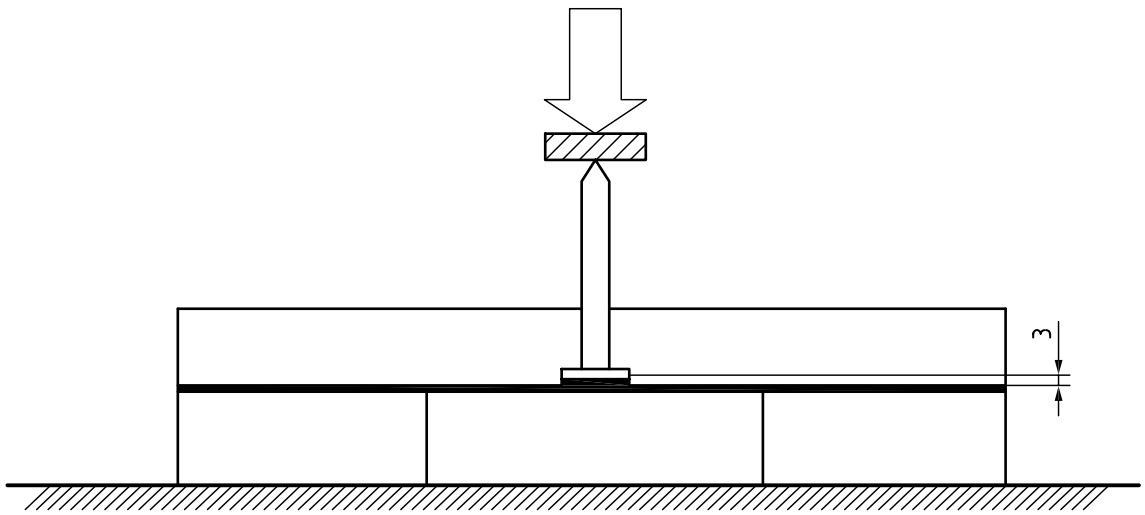


Figure D.3 — Test method

Annex E (normative)

Assessing durability of EIFS under cyclic environmental conditions (reference: [5.5.2](#))

E.1 General

E.1.1 This test method provides a standard laboratory procedure 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, a 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;
- c) in the assessment stage, the durability of the cladding is assessed by observing changes in appearance (cracking, delaminating, etc.) 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 A 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) as per ASTM test methods, the physical limits of test facilities and the range of Canadian 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.4.3 The test apparatus for the environmental cycling stage shall consist of a room environmental chamber and a weather environmental chamber.

E.4.4 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.4.5 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.

CAUTION — 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.4.6 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.4.7 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 used.

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 hexagonal electrical junction box.

The 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 × 1,2 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. A lintel shall not be installed above the window opening. Horizontal flat strap bridging shall be installed at the tertiary points on the interior and exterior faces of the frame, and the bridging at each side shall be terminated with blocking installed between the two end studs (see [Figure E.1](#)).

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 could be caused by other factors such as too few fasteners, inappropriate fasteners, etc.

E.5.3 A 50 mm diameter tube, 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. 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 to drain to the weather chamber. A gutter shall be installed at the base of each designed drainage outlet to collect the water draining from each outlet.

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 so as 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 eliminate 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 against air and water passage through them.

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 eliminate it.

E.5.6 The sheathing installation shall be 12,7 mm (1/2 inch) thick glass-fibre faced gypsum sheathing as shown in [Figure E.2](#).

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.

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

E.5.8 The EIFS cladding shall be installed according to the manufacturer's installation instructions and in conformance with the requirements of ISO 17738-2⁴⁾ using the thinnest thermal insulation board acceptable to the manufacturer. 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](#).

E.5.10 The lamina shall be rendered onto the test specimen according the manufacturer's installation instructions, except 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 prepared as per the manufacturer's installation instructions.

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

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

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 all 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.

NOTE Drainage at the bottom of the test specimen need 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

4) Under preparation.

supply tank shall be located such that the water can drain to a supply header 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.6.2.3 The environmental conditions in the room chamber shall be controlled at (24 ± 2) °C and (50 ± 5) % relative humidity. 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.

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 extensive 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.

E.6.3.2 After the environmental cycling is terminated, 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.

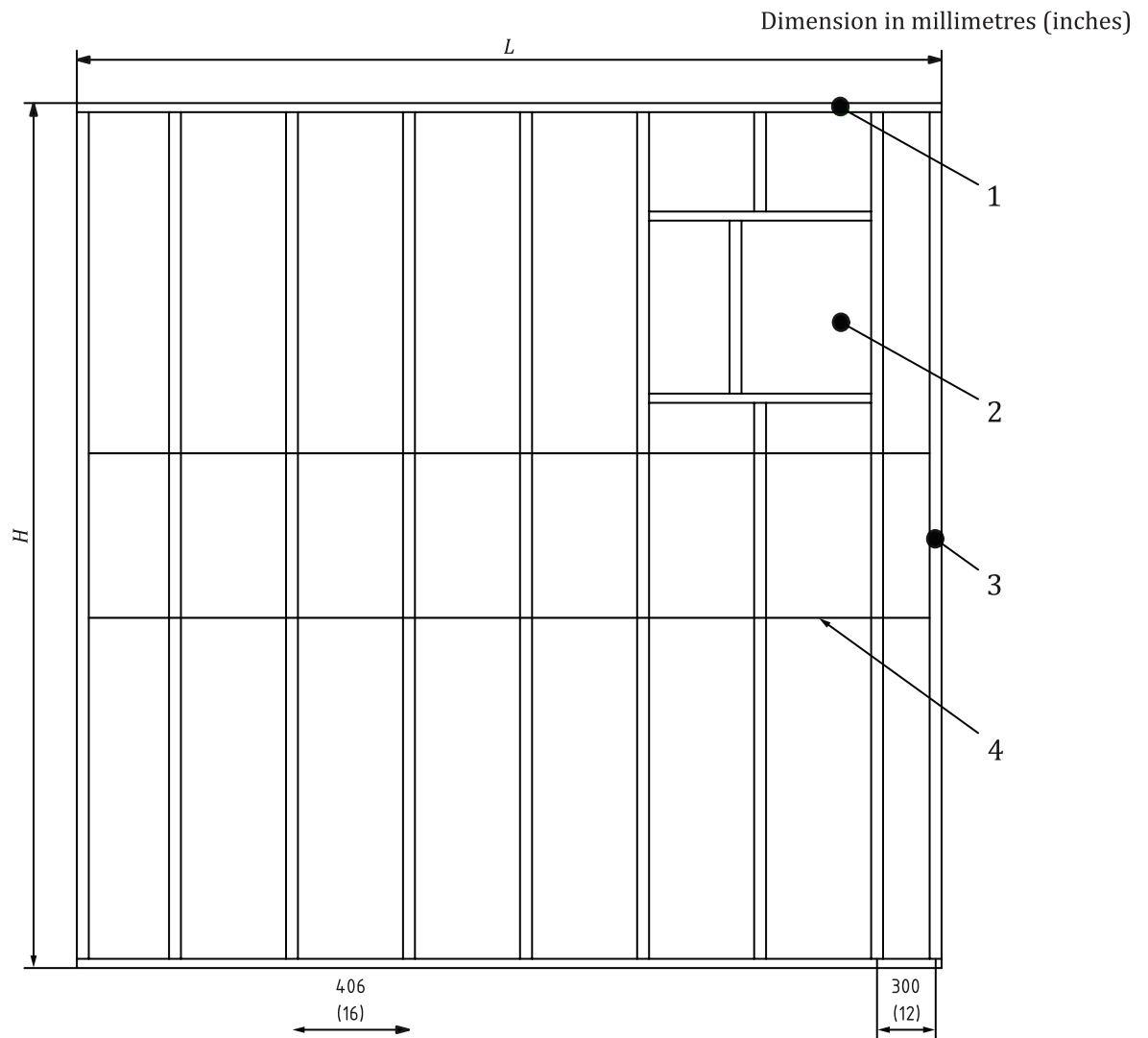
E.6.3.5 The cores shall not be subjected to the water immersion step of the bond strength test.

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.

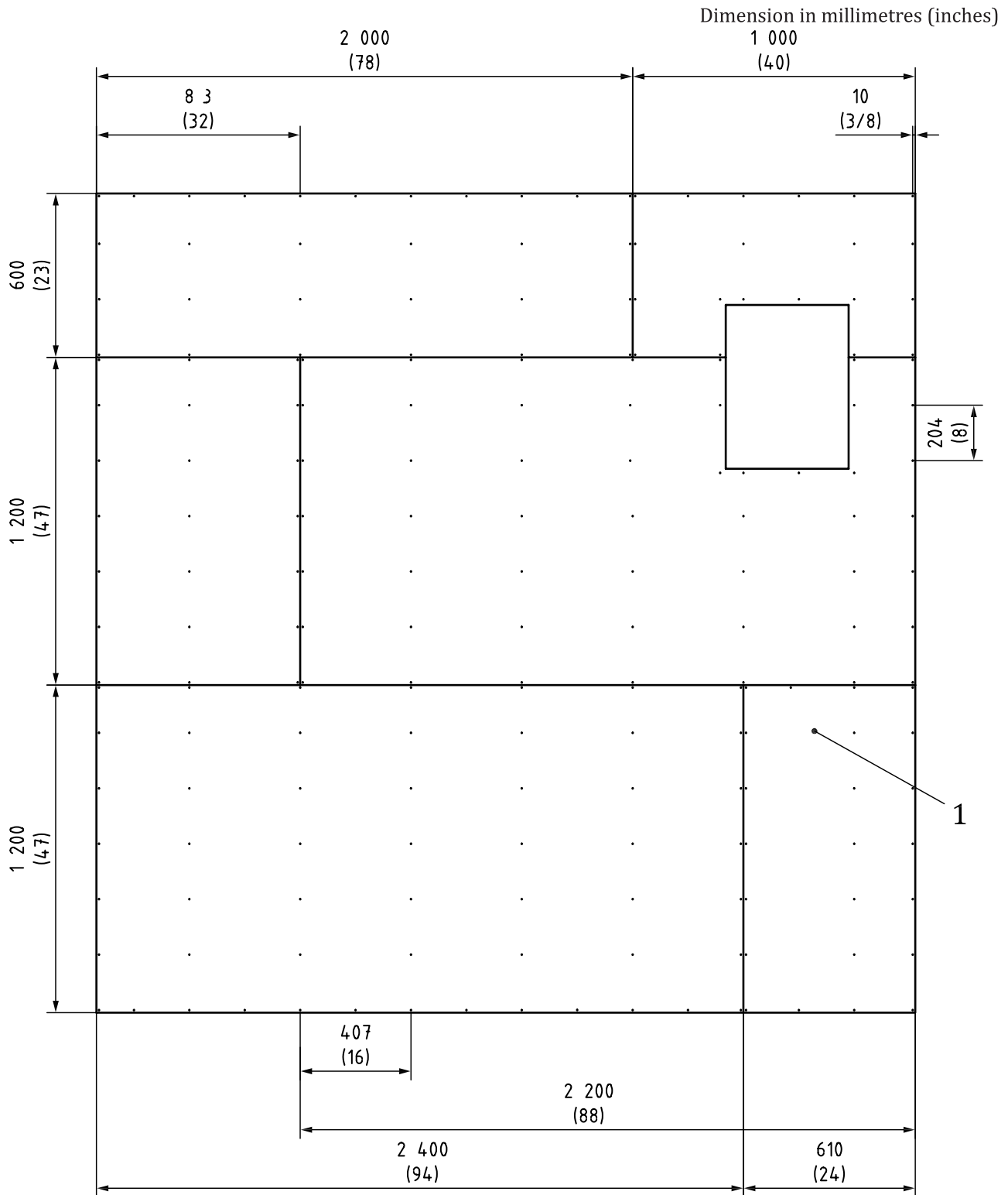


Key

- 1 steel track, 92 mm × 32 mm (3-5/8 inch × 1-1/4 inch)
- 2 window opening
- 3 18 gauge steel studs 92 mm × 41 mm (3-5/8 inch × 1-5/8 inch)
- 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 (7/16 inch) long, metal pan-head screw on each side of the track/stud.

Figure E.1 — Lightweight steel frame assembly

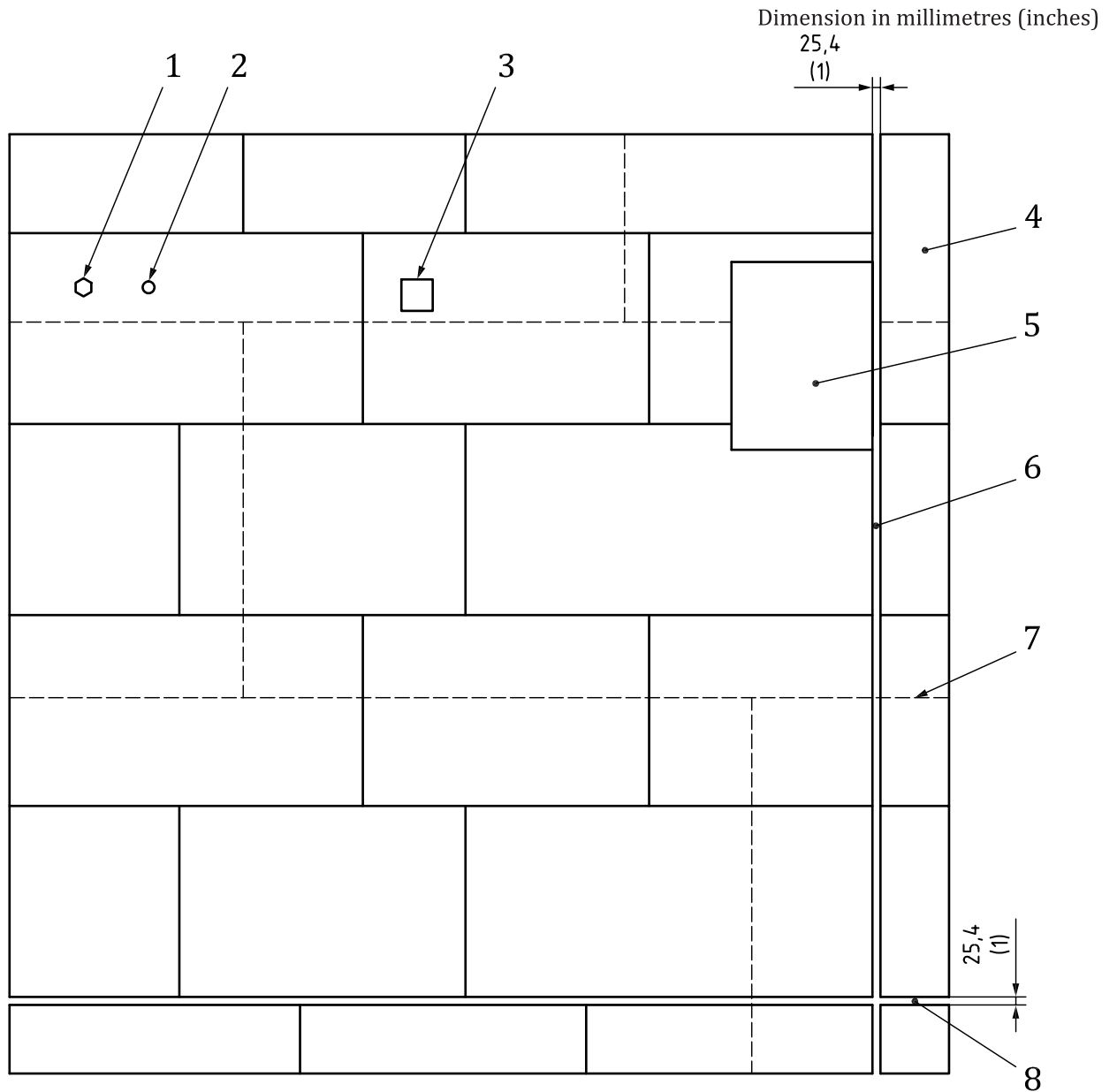


Key

1 12,7 mm (1/2 inch) thick glass-fibre faced gypsum sheathing

NOTE The sheathing is fastened to the framing with no. 6 Type S self-drilling, 32 mm (1-1/4 inch) long, bugle-head screws on 203 mm (8 inch) spacing, at least 10 mm (3/8 inch) from any edge.

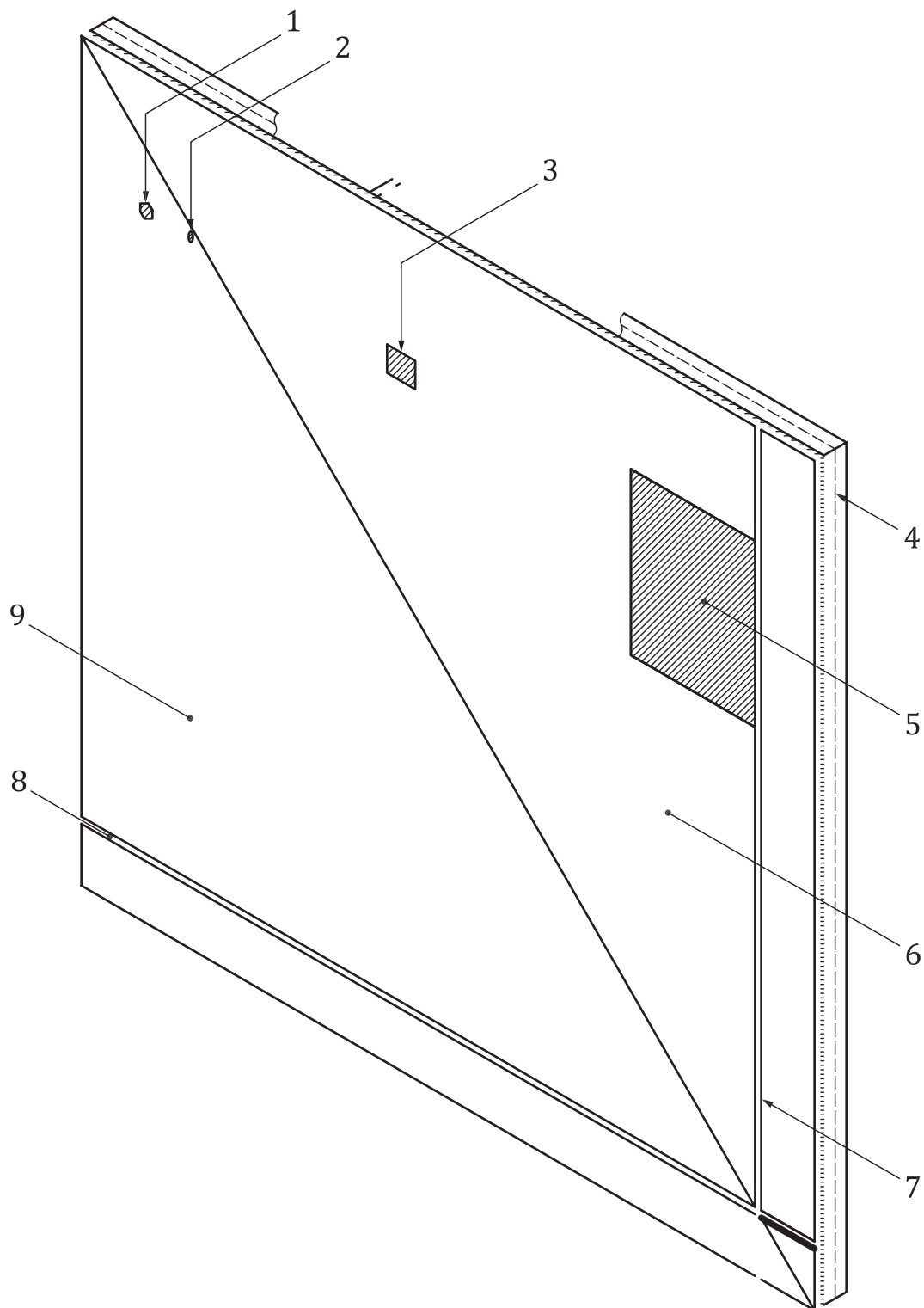
Figure E.2 — Details of sheathing installation



Key

- 1 hexagonal
- 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

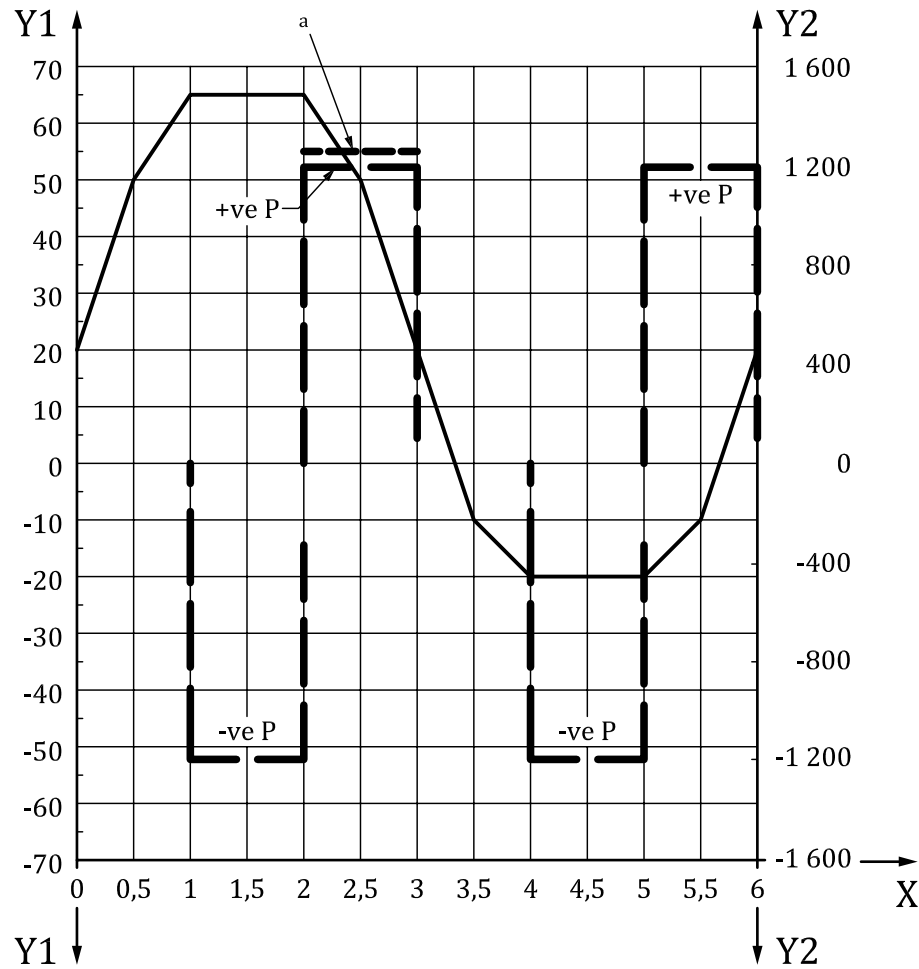
Figure E.3 — Details of installation of thermal insulation boards



Key

- | | | | | | |
|---|--------------------------|---|-------------------------|---|--------------------------|
| 1 | hexagonal | 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 without finish |

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



Key

- X time (hr)
- Y1 temperature (°C)
- Y2 pressure (Pa)
- temperature
- - - - - pressure [+/- ve P]
- · · · · 60 min. water spray (a)

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

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

Item	Type/Materials/ Description	Quantity	Size (W × H × 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					

Annex F (normative)

Assessing drainage performance of EIFS (reference: [5.5.3](#))

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, a large amount of water is drained through the test specimen and a 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.

F.2 Summary of test method

F.2.1 This test method consists of directing a known rate and amount of water into an opening at the top of a drainage cavity that forms part of an EIFS wall test specimen and determining the amount of water retained by the assembly after directing water to the drainage cavity 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.

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 The water dispensing system shall uniformly dispense water across the width of the opening at the top of the test specimen and into the drainage cavity using a perforated metal tube at a rate of 8,0 L/hr. Water shall be transferred to the tube by action of a rotating fluid metering pump. The pump shall extract water from a holding tank located adjacent to the test apparatus in which water is maintained at a constant temperature of (23 ± 2) °C. 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 a metal tube (16 holes of 0,2 mm diameter spaced 38 mm apart) (0.008 in. diameter spaced at 1.5 in. apart) onto a serrated fibreglass mesh fabric 572 mm wide that directs water onto the surface of the LA-WRB. The water dispensing system shall be independent of the wall to avoid imposing any force to the free-hanging test specimen.

F.4.6 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.4.7 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 specimen shall be a minimum of 1 220 mm wide by 2 134 mm high.

F.5.2 The test specimen shall consist of the same materials and details, and be prepared by the same methods as used in actual 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 specimen shall be fabricated of steel or wood stud framing consisting of (38 × 89) mm studs placed at 400 mm spacing, thus, making three 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.2](#).

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

F.5.5 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 LA-WRB being used.

F.5.6 The LA-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.5.7 The drainage cavity shall be created using vertical ribbons of adhesive or shall be a GDDC or both, according to the manufacturer's installation instructions.

F.5.8 The top of the test specimen shall be constructed to omit a 153 mm high by 1 220 mm wide portion of the exterior cladding system to permit installation of the water delivery system and delivery of water to the drainage cavity. Water shall be delivered to the drainage cavity on the surface of the LA-WRB.

F.5.9 The sides of the test specimen shall be made water tight to prevent water exiting the test specimen over the course of the test sequence.

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.5.10 The test specimen shall be cured for a minimum of 14 d or according to the manufacturer's installation instructions, whichever is longer, prior to testing at $(23 \pm 2) ^\circ\text{C}$ and $(50 \pm 5) \% \text{RH}$.

F.5.11 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.6 Test procedure

F.6.1 The tests shall be conducted in stable laboratory conditions $(23 \pm 2) ^\circ\text{C}$ and $(50 \pm 5) \% \text{RH}$ 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 laboratory conditions for a period of at least 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.

F.6.4 The calibrated load cell shall be functional.

F.6.5 The pre-test sequence shall be initiated by ensuring data acquisition for continuous measurement of weigh, temperature and humidity is functional and by ensuring the pump is functional and openings in the metal tube used to deliver water to the drainage space are cleared of any blockage.

F.6.6 The test sequence shall be initiated by recording the time, starting the pump and, thereafter, recording the weight of the test specimen.

F.6.7 The weight increases of the wall shall be recorded continuously every 30 s using a data acquisition system or at 2 min intervals (30 times during the test period) to the nearest 1,0 g for the first 60 min.

F.6.8 The test shall be terminated after 60 min by stopping the water delivery pump.

F.6.9 The weight of the wall shall be recorded to the nearest 1,0 g 60 min after water has stopped.

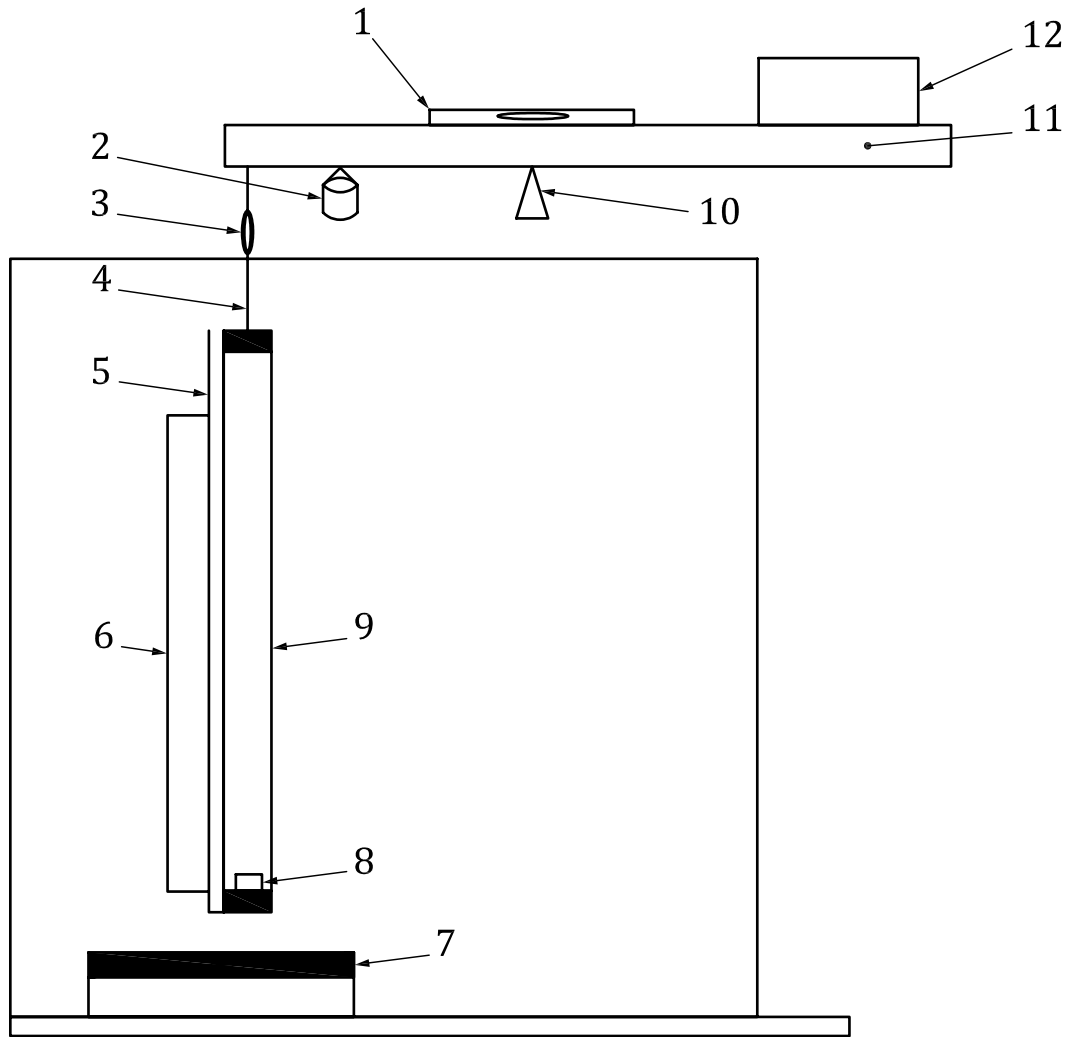
F.6.10 The water retention ratio shall be calculated as the total weight of water retained divided by the projected area of wetted wall. The projected area of wall shall be calculated as the full height of the wall below the serrated fibreglass mesh fabric multiplied by 572 mm, the width of the serrated fibreglass mesh fabric. Each distance shall be measured to an accuracy of 1 mm.

F.6.11 The water retention ratio of the wall shall be reported in g/m².

F.7 Assessment

In addition to the information required in [5.6](#), the following information shall be reported:

- a) detailed drawings of the test specimen that includes elevation and sectional drawings with dimensions and any other pertinent details of the fabrication and assembly of the test specimen;
- b) results of the calibration of the water flow rate;
- c) a graph showing the weight of the wall at each 2 min interval for the first 2 h; if continuous monitoring using a data acquisition system was used, provide the information according to the prescribed rate of data acquisition;
- d) calculate the total weight of water retained in the wall after 120 min, determined by the difference in weight of the test specimen prior to introduction of water, and in the nominally dry condition, and that after completion of the test procedure.



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

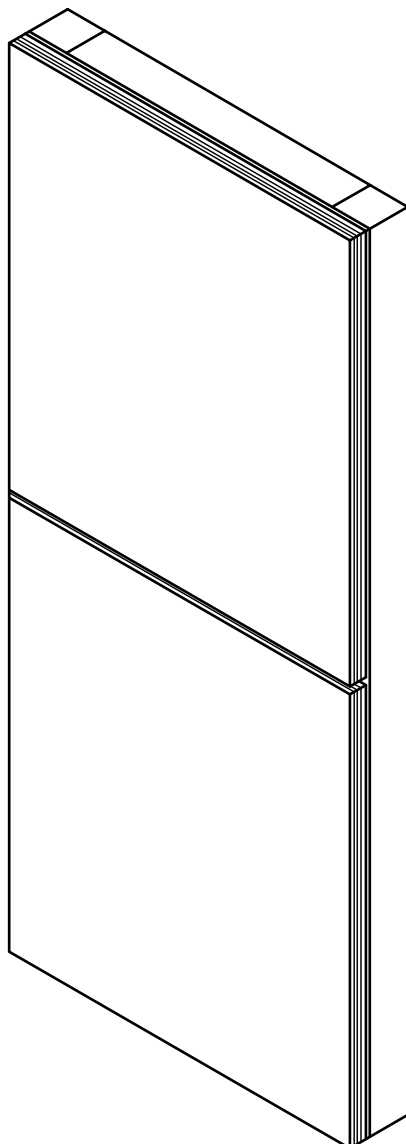


Figure F.2 — Frame

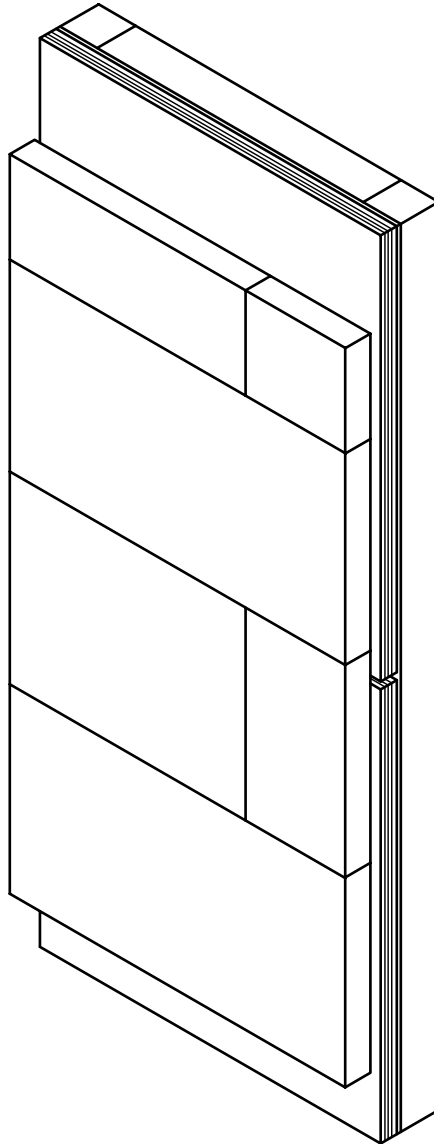


Figure F.3 — LA-WRB with thermal insulation

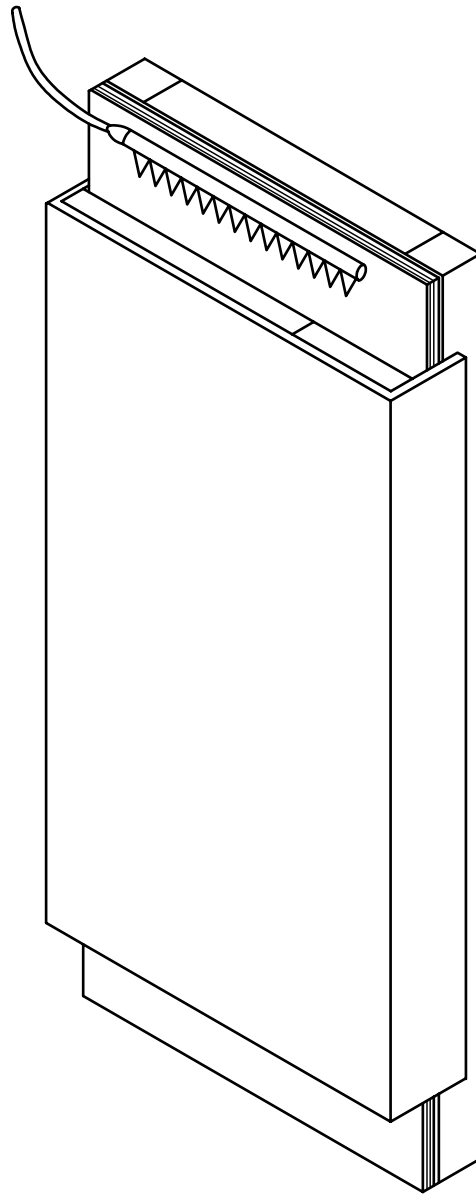


Figure F.4 — Test specimen with base coat, water delivery wand with 572 mm serrated fibreglass mesh fabric

Annex G (informative)

Wind load testing (reference: [5.2.5](#) and [Annex D](#))

G.1 Wind load resistance test

G.1.1 General

All EIFS shall have sufficient strength and stiffness to resist safely and effectively the wind load requirements. The wind load resistance test shall be conducted according to ISO 6612.

The height of the wall test specimen shall not be less than one storey height or 2,44 m, whichever is less. The width of the wall test specimen shall not be less than 2,44 m.

The test specimen shall comprise the number of components necessary to accurately represent the supporting structure, the anchorage and all the devices in current use for fixing the elements on the cladding onto the structure and onto adjacent components. The test specimen shall be constructed following the manufacturer's installation procedures, and using materials representative of those on site.

The size and spacing of the studs should represent the worst-case scenario of the minimum requirements of the building code. The sheathing board shall have the minimum thickness specified in ISO 17738-2, ISO 17738-3, the manufacturer's installation instructions or by the authority having jurisdiction, whichever is greater. The sheathing board shall be installed in accordance with [Figure G.2](#). The supporting structure may be wood or steel studs or other suitable structural materials.

It is recommended to measure the deflections, along the horizontal and vertical centre-line at the different location points indicated in [Figure G.2](#). However, as a minimum, the deflection at the location points [1, 2, 3 and 5 (framing system)], and [4 (unsupported sheathing edge)] shall be reported.

The deflection shall be measured at mid span of intermediate studs relative to their ends and at mid span of the sheathing relative to the intermediate studs. Measurements for the displacement of the studs and the sheathing shall be taken at all measuring points.

The test specimen shall be subjected to full-scale positive and negative test loads.

If the LA-WRB installed over the sheathing is not reported to be air tight, the testing organization shall take the necessary measures to ensure that the pressure loads are transferred to the cladding. Proper sealing of the test specimen is very important as some cladding may allow air flow through the test specimen that is in excess of the blower equipment capacity. A single membrane may be installed behind the cladding to prevent air leakage. However, means to stop air leakage shall not restrict any relative movement between test specimen components.

The test protocol specifies three maximum pressure levels for three different modes of wind pressure application: sustained, cyclic and gust loads.

G.1.2 Deformation test (sustained pressure)

The facade is submitted to increasing pressure in increasing stages for a minimum period of 10 s at each stage, up to the maximum pressure (P_1) required for the test. P_1 shall be taken as the reference velocity pressure for the design of the cladding in accordance with applicable National Building Codes having jurisdiction. This reference velocity pressure is based on a probability of being exceeded in any one year of 1 in 10, and is based on climatic data in accordance with applicable National Building Codes having jurisdiction. The reference pressure (P_1) and the cyclic (P_2) and gust pressures (P_3) indicated in [Table G.1](#) cover applications on buildings that are three storeys high or less.

G.1.3 Cyclic positive and negative pressure

The facade shall be submitted to the required number of positive pressure impulses between 0 and the value of P_2 indicated in [Table G.1](#).

G.1.4 Safety test (gust wind)

The facade shall be submitted to the maximum required gust pressure (P_3) indicated in [Table G.1](#). P_3 shall be reached as quickly as possible, but not in less than 1 s, and held for 3 s. The value of P_3 shall be at least 2,0 times the design value of P_1 .

The test specimen shall be subjected to the maximum positive and negative test loads contained in [Table G.1](#) and according to the loading schedule outlined in [Figure G.1](#).

G.1.5 Deflection measurements

At the end of the wind loading, deflection measurements shall be taken according to the following criteria:

The measurements shall be taken subsequent to the sustained, cyclic and gust wind pressure loading programme in [Figure G.1](#).

Maximum deflections shall be recorded at 3,3 times the 1 in 50 hourly wind pressure (Q_{10}), as outlined in [Table G.2](#), for both positive and negative pressures.

The design wind load value is based on the Q_{10} value and three factors, namely (C_p) the exposure factor, (C_e) the gust factor and (C_g) the external pressure coefficient. The 3,3 amplification factor is derived assuming $C_e = 1,0$, $C_g = 2,5$ and $C_p = 1,3$. Thus, $1,0 \times 2,5 \times 1,3 = 3,25$ rounded to 3,3. It should be noted that this generalized case for low-rise buildings is applicable to buildings within urban and suburban areas and does not apply to peripheral buildings adjacent to open and exposed areas.

The proponent of the system may request that the testing agency measure the deflection of the system at various stages during the wind loading. This additional information can assist the proponent in understanding the system performance during the sustained, cyclic and gust loadings.

Table G.1 — Maximum positive and negative pressures for sustained, cyclic and gust loads

For geographical areas where wind design value is	$P_1, P_1'^a$ sustained for 1 hr (Pa)	$P_2, P_2'^a$ 2 000 cycles ^b (Pa)	$P_3, P_3'^a$ gust wind (Pa)
$Q_{10} < 0,40$ kPa	400	530	800
$Q_{10} < 0,60$ kPa	600	800	1 200
$Q_{10} < 0,80$ kPa	800	1 060	1 600
^a See Figure G.1 for references to $P_1, P_1', P_2, P_2', P_3, P_3'$. ^b The 2 000 cyclic loads can be applied in four stages of 500 cycles or two stages of 1 000 cycles reversing from positive to negative pressures.			

Table G.2 — Maximum wind pressures for deflection measurements

For geographical areas where wind design value is	Record maximum deflection(s) after completion of wind pressure loading at following load ^a
$Q_{10} < 0,40$ kPa	$D_{0,40}$ at 1 320 Pa
$Q_{10} < 0,60$ kPa	$D_{0,60}$ at 1 980 Pa
$Q_{10} < 0,80$ kPa	$D_{0,80}$ at 2 640 Pa

^a The wind pressure loading shall be maintained for a minimum of 10 s and the maximum deflection, at any point on the test specimen, from the supporting member of the cladding system shall be determined for both positive and negative pressures.

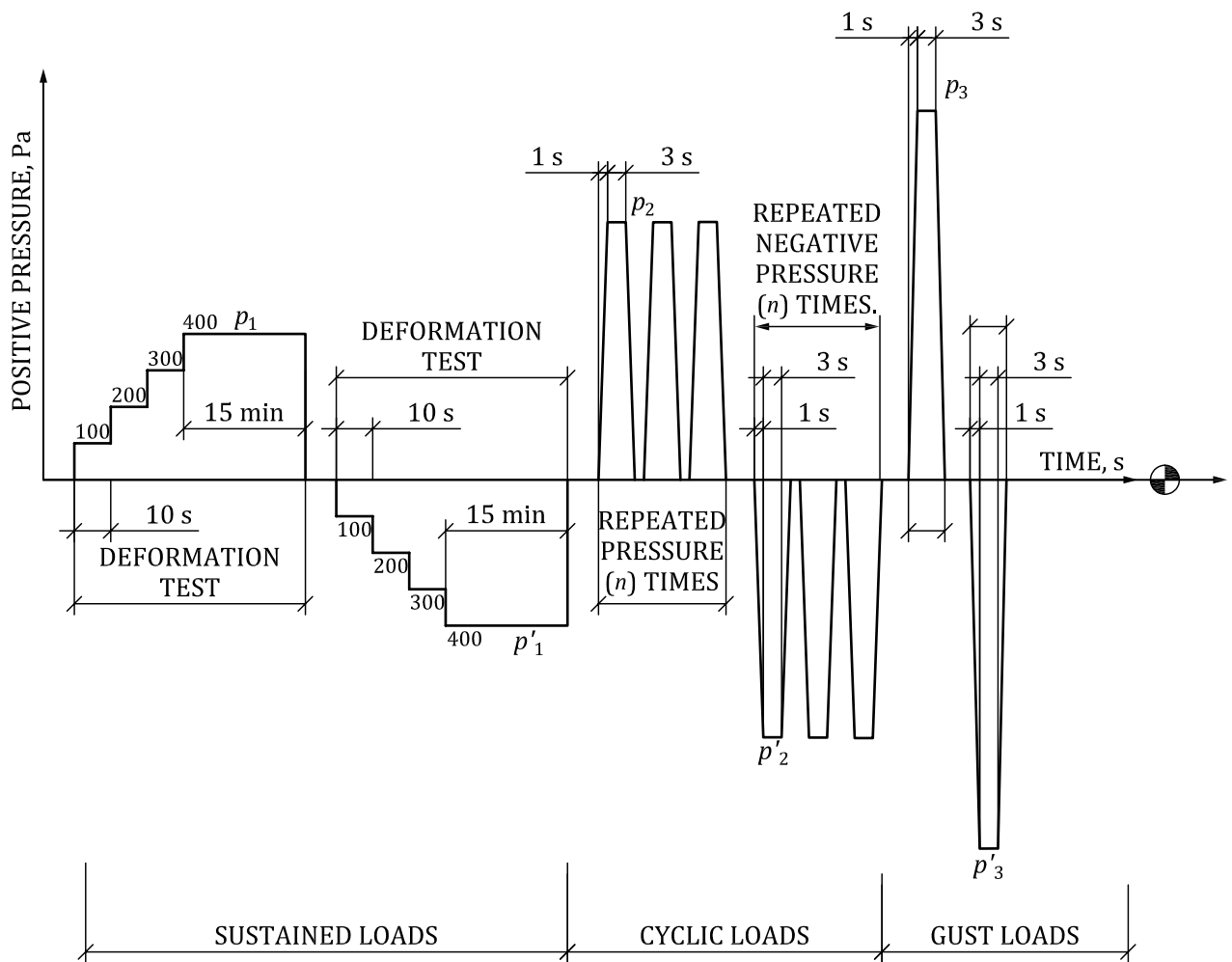
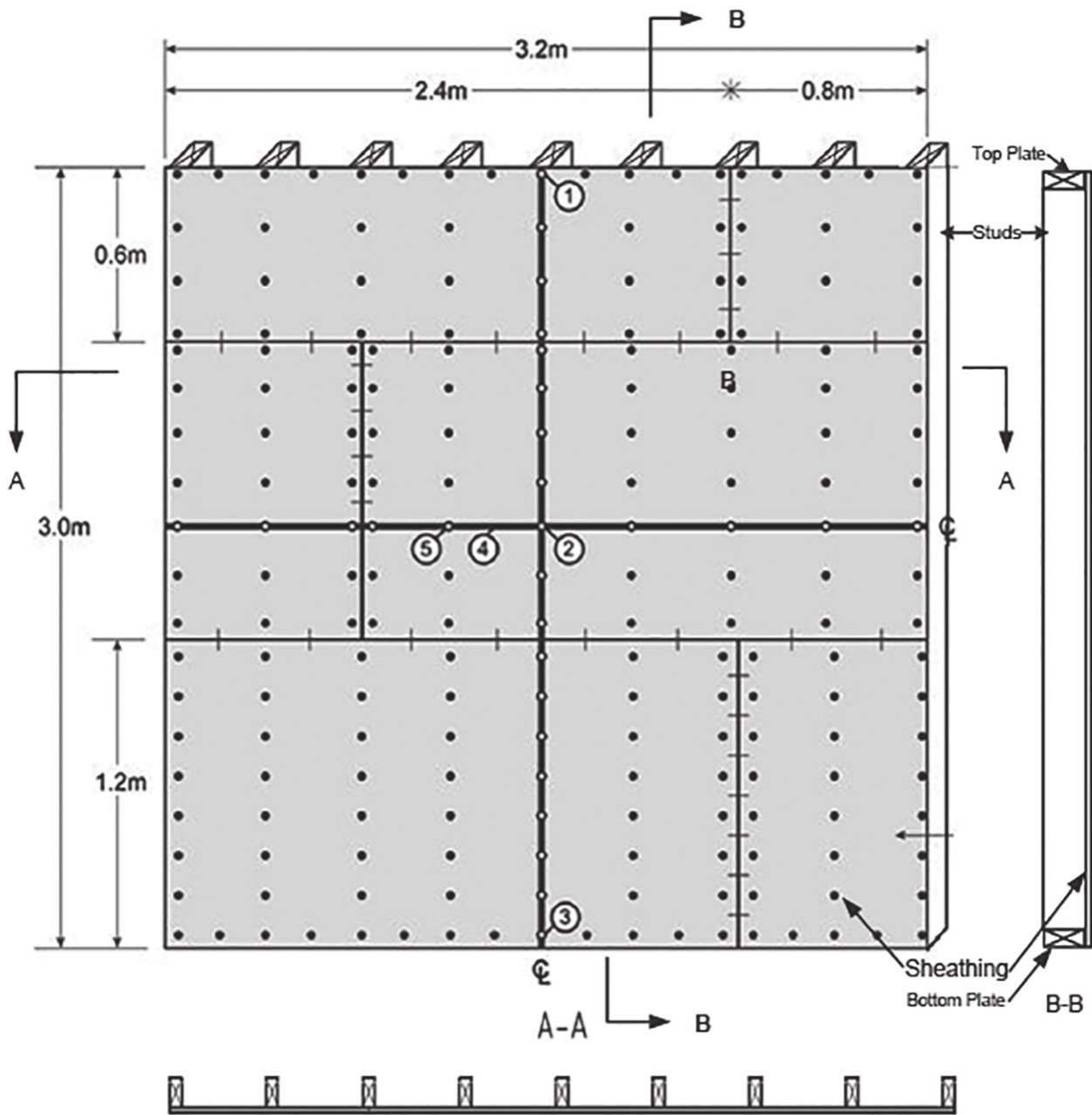


Figure G.1 — Structural (wind) loading schedule

Dimension in millimetres



Key

1-5 location of gauges on the interior side of the panel

NOTE Gauges 1, 2, 3 and 5 are mounted on the studs, whereas gauge 4 is mounted on the sheathing.

Figure G.2 — Wind load test panel (sheathing pattern and deflection location points)

Annex H

(informative)

Test specimen preparation for infrared analysis

The infrared analysis test is intended to determine the nature of the organic fraction of the binder used in the aggregate coating (rendering). To this end, the infrared spectroscopic analysis is obtained from the extracted organic fraction of the binder.

For solvent-based base coat and finish coat, the binder is extracted from the wet paste using a suitable organic solvent such as trichloroethane, and centrifuging (the testing organization shall specify the solvent composition used in the analysis)

For emulsion-type base coat and finish coat, the binder is extracted from the dry paste with an organic solvent in a Soxhlet apparatus (the testing organization shall specify the solvent composition used in the analysis).

For aggregate coatings (renderings) using catalyst in the formulation of the organic fraction of the binder, the infrared spectroscopic analysis is conducted on a test specimen of the organic fraction of the binder as provided by the manufacturer.

Bibliography

- [1] ISO 6612, *Windows and door height windows — Wind resistive tests*
- [2] ISO 7345, *Thermal insulation — Physical quantities and definitions*
- [3] ISO 9229, *Thermal insulation — Vocabulary*
- [4] ISO 16474-2,⁵⁾*Paints and varnishes — Methods of exposure to laboratory light sources — Part 2: Xenon arc lamps*
- [5] ISO 17738-2,⁴⁾*Thermal insulation materials — Exterior insulation and finish systems (EIFS) — Installation*
- [6] ISO 17738-3:—,⁴⁾*Thermal insulation materials — Exterior insulation and finish systems (EIFS) — Design*

5) Under preparation.

