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Thermal insulation products for building applications — Determination of the hygrothermal behaviour of external thermal insulation composite systems with renders (ETICS)

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National foreword

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English Version

Thermal insulation products for building applications - Determination of the hygrothermal behaviour of external thermal insulation composite systems with renders (ETICS)

Produits isolants thermiques destinés aux applications du bâtiment - Détermination du comportement hygrothermique des systèmes d'isolation thermique extérieure par enduit sur isolant (ETICS)

Wärmedämmstoffe für das Bauwesen - Bestimmung des hygrothermischen Verhaltens von außenseitigen Wärmedämm-Verbundsystemen mit Putzen (WDVS)

This European Standard was approved by CEN on 6 August 2016.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

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European foreword

This document (EN 16383:2016) has been prepared by Technical Committee CEN/TC 88 “Thermal insulating materials and products”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2017, and conflicting national standards shall be withdrawn at the latest by April 2017.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

NOTE It has not been possible to include a statement on the accuracy of the test method in this edition, but it is intended to include such a statement when this European Standard is next revised.

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1 Scope

This European Standard specifies the equipment and procedures for determining the hygrothermal behaviour of external thermal insulation composite systems with renders (ETICS) delivered as a kit and used as thermal insulation for buildings.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 822, *Thermal insulating products for building applications — Determination of length and width*

EN 823, *Thermal insulating products for building applications — Determination of thickness*

EN 998-1, *Specification for mortar for masonry — Part 1: Rendering and plastering mortar*

EN 1015-1, *Methods of test for mortar for masonry — Part 1: Determination of particle size distribution (by sieve analysis)*

EN 1062-1, *Paints and varnishes — Coating materials and coating systems for exterior masonry and concrete — Part 1: Classification*

EN 1607, *Thermal insulating products for building applications — Determination of tensile strength perpendicular to faces*

EN 1609, *Thermal insulating products for building applications — Determination of short term water absorption by partial immersion*

EN 13494, *Thermal insulation products for building applications — Determination of the tensile bond strength of the adhesive and of the base coat to the thermal insulation material*

EN 13496, *Thermal insulation products for building applications — Determination of the mechanical properties of glass fibre meshes as reinforcement for External Thermal Insulation Composite Systems with renders (ETICS)*

EN 13497, *Thermal insulation products for building applications — Determination of the resistance to impact of external thermal insulation composite systems (ETICS)*

EN 15824, *Specifications for external renders and internal plasters based on organic binders*

EN ISO 3251, *Paints, varnishes and plastics — Determination of non-volatile-matter content (ISO 3251)*

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

EN ISO 9229, *Thermal insulation — Vocabulary (ISO 9229)*

3 Terms and definitions

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

3.1
adhesive
component used for bonding the thermal insulation product to the substrate

3.2
base coat
component applied directly by rendering on to the thermal insulation product

3.3
design external thermal insulation composite system
design ETICS
combination of components defined by the system holder, consisting of one base coat, thermal insulation product(s) of the same material, adhesive(s), reinforcement(s) and finishing layer(s) with or without mechanical fixing device(s)

3.4
finishing layer
finishing coat with a key coat (optional) and/or a decorative coat (optional)

3.5
anchor for thermal insulation products
fixing device consisting of a plate for fixing the thermal insulation product and if appropriate also the reinforced base coat, a sleeve which passes through the thermal insulation product and a part which is embedded to the substrate

3.6
anchor for profiles or rails
fixing device for fixing the profiles or rails to the substrate

3.7
mechanical fixing device
component used for fixing a kit mechanically to the substrate

3.8
reinforced base coat
base coat with embedded reinforcement

3.9
substrate
part of the wall/test assembly to which the kit is fixed

3.10
test wall
substrate covered by a kit or set of kits to test the hygrothermal behaviour

3.11
system holder
single manufacturer who is placing kits out of a design ETICS on the market

3.12
key coat
component applied to the base coat as a preparation for the application of the finishing coat

4 Principle

Exposure of a kit to a set of hygrothermal cycles, consisting of heating, wetting, cooling and freeze/thaw cycles.

5 Testing devices

The following test devices are necessary:

— device for heating the surface of the assembled kit regulated to (70 ± 5) °C and maintaining the relative humidity of the air close to the surface of the kit to less than 30 %;

— device for wetting the surface of the kit with tap or demineralized or deionized water with a temperature of (15 ± 5) °C and an amount of (1,5 ± 0,5) l/(m^2 · min) with the use of spraying nozzles to ensure uniform water distribution;

— device for cooling the surface of the kit to (−20 ± 5) °C.

These devices shall meet the required test conditions described in Clause 7.

6 Test wall

6.1 Preparation of the test wall

6.1.1 General

The kit(s) shall be applied on the substrate according to the instructions of the system holder. The configuration of the kit(s) to be tested shall be according to the worst case rules given in the relevant product standard.

The thermal insulation product shall be fixed to the substrate and covered by the reinforced base coat. The perimeter edges of the test wall shall be wrapped/covered with the reinforced base coat. The upper 2/3 of the height of the test wall shall be covered additionally with one or more finishing layers according to Figure 1 and Figure 2. Within the lower 1/3 from the bottom edge shall be at least one horizontal joint between thermal insulation products (see "*a*" in Figure 1 and Figure 2). The distance between the horizontal joint and the 1/3 of the height of the test wall (see "*b*" in Figure 1 and Figure 2) shall be at least 200 mm.

If the height of the thermal insulation product is bigger than 1/3 of the height of the test wall minus 200 mm, the thermal insulation product shall be cut properly.

The test wall shall have openings according to 6.1.2 or 6.1.3.

NOTE If given in the worst case rules of the relevant product standard, the whole test wall can be covered by finishing coat(s).

6.1.2 Test wall with one opening

The dimensions of the weathered surface of the test wall shall be as following (see Figure 1):

— width: ≥ 2,5 m;

— height: ≥ 2,0 m.

In the middle of the upper 2/3 of the total height of the test wall, one opening shall be included (see Figure 1). The opening shall have a width of (0,5 ± 0,1) m and a height of (0,5 ± 0,1) m. The opening

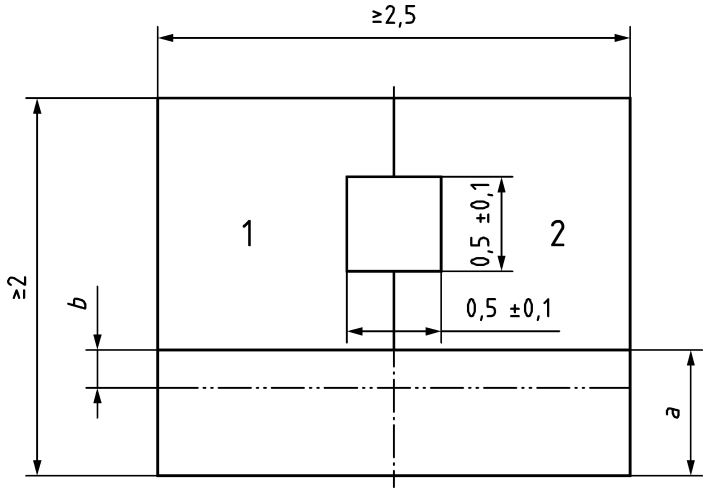
shall be obtained by a recess in the thermal insulation product. Edges and corners of the opening shall be covered with the reinforced base coat and finishing layer(s).

The lower horizontal area of the opening shall be protected against water penetration. The edges of the openings to the substrate shall be sealed.

If specified in the relevant product standard, at maximum two different configurations noted as 1 and as 2 can be tested on the test wall. In this case the test wall shall be divided vertically in the middle (see Figure 1). The two configurations shall contain the same reinforced base coat. If two different insulation products are tested, they shall have the same thickness. In any case, the nominal thickness/coverage of the reinforced base coat shall be the same.

The two different insulation products may consist of the same or different thermal insulation materials or types.

Dimensions in metres



Key

1 configuration 1

2 configuration 2

a 1/3 of the total height of the test wall

b at least 200 mm

Figure 1 — Scheme of the test wall with one opening

6.1.3 Test wall with two openings

The dimensions of the weathered surface of the test wall shall be as following (see Figure 2):

— width: ≥ 3,0 m;

— height: ≥ 2,0 m.

In the middle of each half side of the upper 2/3 of the total height of the test wall, one opening shall be included (see Figure 2). The two openings shall have a width of (0,5 ± 0,1) m and a height of (0,5 ± 0,1) m. The openings shall be obtained by a recess in the thermal insulation product. Edges and corners of the openings shall be covered with the reinforced base coat and finishing layer(s).

The lower horizontal area of the openings shall be protected against water penetration. The edges of the openings to the substrate shall be sealed.

If specified in the relevant product standard at maximum four different configurations noted as 1, 2, 3 and 4 can be tested on the test wall, provided that:

— configurations 1 and 2 have the same thermal insulation product and different finishing coats;

— configurations 3 and 4 have the same thermal insulation product and different finishing coats;

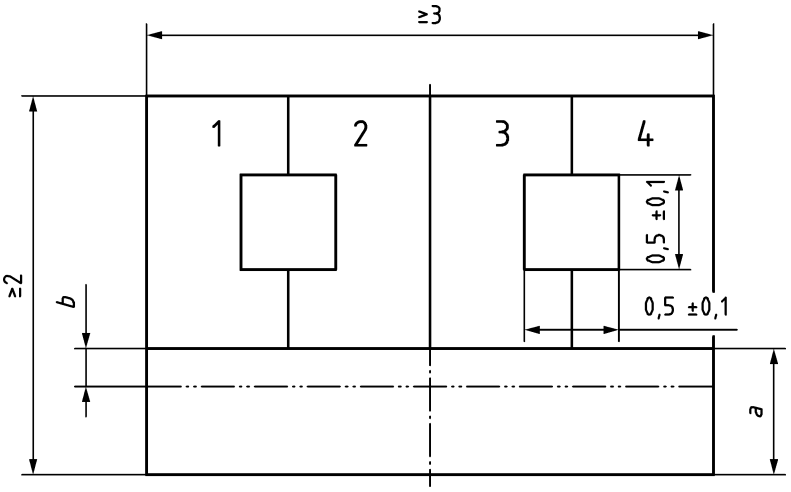
— the thermal insulation products have the same thickness;

— configurations 1, 2, 3 and 4 have the same reinforced base coat.

If two different thermal insulation products are used, the test wall shall be divided vertically in the middle (see Figure 2). The upper 2/3 of the test wall shall be divided at most in four vertical strips according to the tested finishing layers (see Figure 2).

The two different insulation products may consist of the same or different thermal insulation materials or types.

Dimensions in metres



Key

1 configuration 1
2 configuration 2
3 configuration 3
4 configuration 4

a 1/3 of the total height of the test wall
b at least 200 mm

Figure 2 — Scheme of the test wall with two openings

6.2 Conditioning of the test wall

Condition the test wall at minimum 28 days at ambient temperature of (20 ± 10) °C.

During conditioning, any defects of the kit (e.g. blistering, cracking) shall be recorded.

7 Testing the hygrothermal behaviour of the test wall

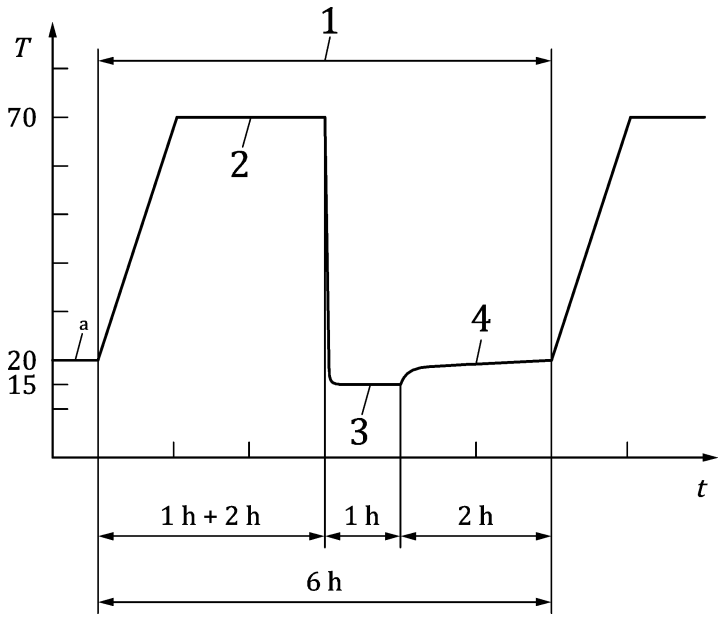
To test the hygrothermal behaviour of the test wall, the following cycles shall be carried out in the following order:

a) 80 cycles heating and wetting (see Figure 3):

   1) heat up the surface of the test wall within 1 h to (70 ± 5) °C and maintain it at a relative humidity less than 30 % for 2 h (in total 3 h);

   2) wet the test wall for 1 h with an amount (1,5 ± 0,5) l/(m^2 · min) water with a temperature of (15 ± 5) °C;

   3) condition the test wall 2 h at temperature of (20 ± 5) °C;



Key

T temperature in °C
t duration in h
1 one cycle (heating, wetting and conditioning 6 h)
2 heating
3 wetting
4 conditioning

[a] temperature at the start of the first cycle

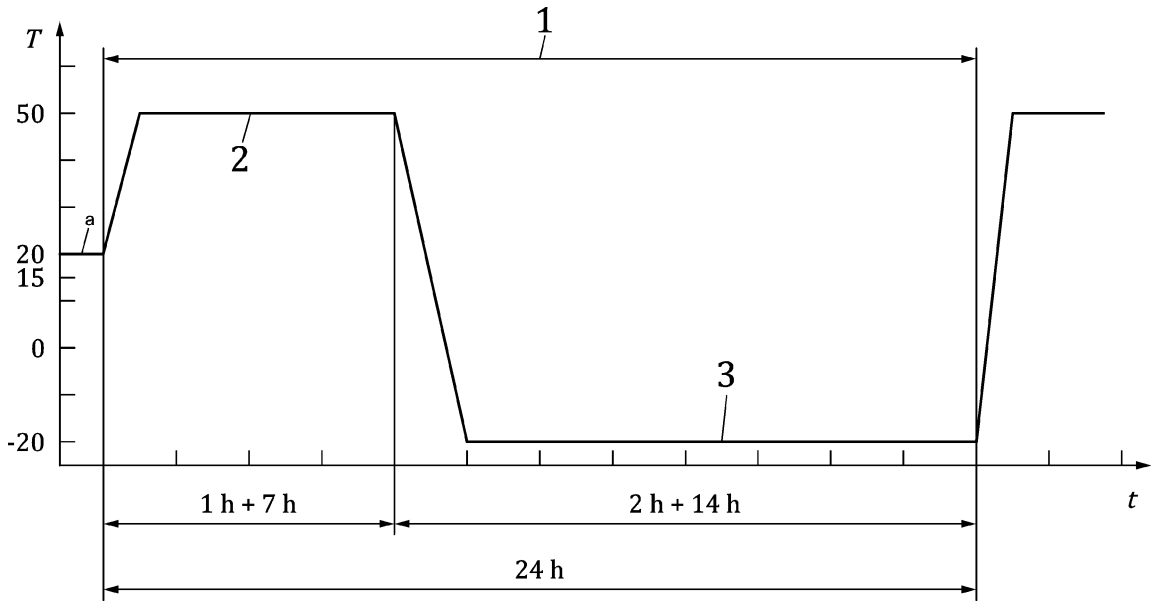
Figure 3 — Scheme of the test cycle heating and wetting

Conditioning at least 48 h at ambient temperature of (20 ± 10) °C before starting the cycles b) (heating and cooling):

b) 5 cycles heating and cooling (see Figure 4):

   1) heat up the surface of the test wall within 1 h to (50 ± 5) °C and maintain it at a relative humidity less than 30 % for 7 h (in total 8 h);

2) cool the surface of the test wall within 2 h to (−20 ± 5) °C and maintain it for 14 h (in total 16 h).



Key

T temperature in °C

t duration in h

1 one cycle (heating, cooling 24 h)

2 heating

3 cooling

[a] temperature at the start of the first cycle

Figure 4 — Schema of the test cycle heating and cooling

Conditioning at least 48 h at ambient temperature of (20 ± 10) °C before starting the cycle c) (wetting, freezing and thawing):

c) 30 cycles, wetting, freezing and thawing (see Figure 5):

1) Condition the test wall initially by wetting for 8 h with an amount of (1,5 ± 0,5) l/(m^2 · min) water with a temperature of (15 ± 5) °C;

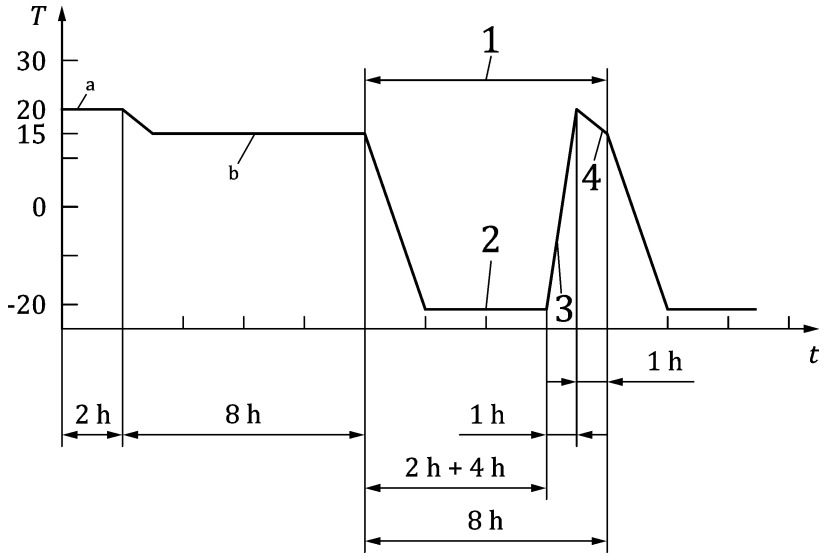
Then start the cycles consisting of the following:

2) freeze the surface of the test wall within 2 h to (−20 ± 5) °C and maintain it for 4 h (in total 6 h);

3) thaw the test wall for 1 h at temperature of (20 ± 5) °C;

4) wet the test wall for 1 h with an amount of (1,5 ± 0,5) l/(m^2 · min) water with a temperature of (15 ± 5) °C.

After the 30 cycles condition the test wall at ambient temperature (20 ± 10) °C.



Key

T temperature in °C

t time in h

1 one cycle (freezing, thawing, wetting; 8 h)

2 freezing

3 thawing at ambient temperature (20 ± 5) °C

4 wetting

[a] temperature at the start of the conditioning

[b] conditioning by wetting at (15 ± 5) °C

Figure 5 — Schema of the test cycle wetting, freezing and thawing

8 Assessment of the test wall after the hygrothermal cycles

Observe the surface to defects, blisters, flaking, delamination, cracks and other visible changes after the end of the cycles heating and wetting (Clause 7, a)), heating and cooling (Clause 7, b)), wetting, freezing and thawing (Clause 7, c)).

The upper 2/3 with the finishing layer(s) and lower 1/3 of the test wall with only the reinforced base coat shall be assessed separately if appropriate.

After finishing the test of the hygrothermal behaviour and conditioning of the test wall at minimum for 7 d at ambient temperature (20 ± 10) °C the resistance to impact according to EN 13497, the tensile bond strength of reinforced base coat to the thermal insulation product and of the finishing layer to the base coat according to EN 13494 may be tested.

9 Test report

The test report shall include the following information:

a) reference to this European Standard (EN 16383);

b) trade name of the design ETICS and name of the system holder;

c) tested assembled kits;

d) tested products:

1) adhesive:

i) trade name(s);

ii) batch number, production date or other product identification;

iii) packaging and its condition when the product arrived at the laboratory;

iv) product according to EN 998-1 (powder) or EN 15824 (paste) or other;

v) type of the main binders of the product (lime, cement, organic binder);

vi) preparation of the product (with adding cement, water or other products, time and procedure for mixing the products before application);

vii) applying method (e.g. with trowel, spraying);

viii) measured consumption per square meter;

ix) identification: powder adhesives shall be identified by sieve line according to EN 1015-1; paste adhesives shall be identified by determination of non-volatile matter content in accordance with EN ISO 3251 test conditions 3 h at 105 °C, ash content in accordance with EN ISO 3451-1, test conditions 2 h at 450 °C;

2) thermal insulation product:

i) trade name(s);

ii) identification by the designation code according to the relevant product standard;

iii) batch number, production date or other product identification;

iv) packaging and its condition when the product arrived at the laboratory;

v) declared thickness according to EN 823 declared length and width according EN 822;

vi) declared tensile strength perpendicular to faces according to EN 1607;

vii) declared thermal conductivity according to the relevant product standard;

viii) declared water absorption according to EN 1609;

3) base coat:

i) trade name;

ii) batch number, production date or other product identification;

iii) packaging and its condition when the product arrived at the laboratory;

iv) product according to EN 998-1 (powder) or EN 15824 (paste);

v) type of the main binders of the product (lime, cement, organic binder);

vi) preparation of the product (with adding cement, water or other products, time and procedure for mixing the products before application);

vii) applying method (e.g. with trowel, spraying);

viii) measured consumption per square meter and measured thickness of the base coat;

ix) number of layers of the base coat;

x) identification: powder base coat shall be identified by sieve line according to EN 1015-1; paste base coat shall be identified by determination of non-volatile matter content in accordance with EN ISO 3251 test conditions 3 h at 105 °C, ash content in accordance with EN ISO 3451-1, test conditions 2 h at 450 °C;

4) glass fibre or metal mesh as reinforcement:

i) trade name;

ii) batch number, production date or other product identification;

iii) packaging and its condition when the product arrived at the laboratory;

iv) mass per m^2 of the reinforcement in g/m^2;

v) for glass fibre meshes: declared tensile strength of warp and weft directions according to EN 13496;

vi) number of thread in warp and weft per 100 mm or mesh dimensions of the reinforcement;

5) finishing coat(s) (if used also key coat and decorative coat):

i) trade name;

ii) batch number, production date or other product identification;

iii) packaging and its condition when the product arrived at the laboratory;

iv) according to EN 998-1 (powder), EN 15824 (paste) or EN 1062-1;

v) declared value of maximum grain size or thickness measured according to EN 1062-1;

vi) preparation of the product (with adding cement, water or other products, time and procedure for mixing the products before application);

vii) type of the main binders of the product (lime, cement, organic binder);

viii) applying method (e.g. with trowel, spraying);

ix) measured consumption per square meter and measured thickness;

x) declared grain size, if applicable;

xi) identification: powder finishing coats shall be identified by sieve line according to EN 1015-1; paste finishing coats shall be identified by determination of non-volatile matter

content in accordance with EN ISO 3251 test conditions 3 h at 105 °C, ash content in accordance with EN ISO 3451-1, test conditions 2 h at 450 °C;

6) mechanical fixing devices (if used):

   i) trade name;

   ii) batch number, production date or other product identification;

   iii) packaging and its condition when the product arrived at the laboratory;

   iv) technical specifications;

e) information about the assembly of the test wall:

   1) type of substrate, size and thickness of the wall;

   2) mapping of the position of the insulation boards;

   3) if used mapping of the position of the anchors or other mechanical fixing devices;

   4) mapping of the application of the adhesive (e.g. point – framing);

   5) mapping of the thermal insulation product(s);

   6) mapping of the base coat;

   7) mapping of the finishing coat(s);

f) test procedure:

   1) dates of several steps of application, applicator, date of finishing of the preparation of the test wall;

   2) number and type of cycles which are used and the end of total exposure;

   3) events which may have affected the results;

g) any deviation from this European Standard;

h) results:

   1) mapping of the blisters, flaking, delamination;

   2) mapping of the cracks, including their dimensions and water accumulation in the area of cracks.

Information about the apparatus and identification of the technician should be available in the laboratory, but it does not need to be recorded in the report.

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