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BSI Standards Publication

Windows — Behaviour between different climates — Test method

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee B/538/1, Windows.

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

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Windows - Behaviour between different climates - Test method

Fenêtres - Comportement entre climats différents - Méthode d'essai

Fenster - Differenzklima - Prüfverfahren

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Foreword

This document (EN 13420:2011) has been prepared by Technical Committee CEN/TC 33 “Doors, windows, shutters, building hardware and curtain walling”, the secretariat of which is held by AFNOR.

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of an identical text or by endorsement, at the latest by October 2011, and conflicting national standards shall be withdrawn at the latest by October 2011.

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.

This document supersedes ENV 13420:2000.

The main modifications to ENV 13420:2000 are:

a) Status of document changed from ENV to EN;

b) The German title has been added among the titles of the standard;

c) The Contents have been updated respectively revised;

d) The description of test method 2 in Clause 1 has been rephrased;

e) The description of the annexes has been rephrased;

f) In 3.1 a reference to Annexes A and B has been integrated at the end;

g) In Clause 4 the description of the principle tests has been split into the test procedure vapour diffusion and stability;

h) In Clause 8 the reference to the values of EN 1121 has been deleted because the values given in Table 1 are completely different to those in EN 1121;

i) Tolerances have been integrated in Table 1;

j) The status of Annex B has been changed into a normative annex.

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Introduction

Through climatic loading of the windows it is possible in the case of unfavourable designs that the frames of windows manufactured of different materials may:

— decay through accumulation of moisture and may thus be damaged; this moisture may come from water vapour diffusion and condensation;

— be unable to fulfil their basic functions (serviceability, air permeability) because of unacceptable deformations.

1 Scope

This European Standard specifies the test methods for evaluating:

— the risks of decay of openable and fixed windows manufactured of different materials through increased moisture accumulation as a result of condensation or water vapour diffusion;

— the influence of deformation on basic performances of openable and fixed windows manufactured of different materials exposed to different climates between their external and internal faces.

Three test methods are to be differentiated. They take into account different cases of loadings.

— **Test method 1:** For designs with low resistance to water vapour diffusion (normally designs with water vapour equalization holes); the test procedure is to be used for cross-sections where the danger is given by the moisture accumulation as a result of the condensation of moisture between the planking and the timber (see Annex A (informative), Figure A.1).

— **Test method 2.1 and 2.2:** For designs with high resistance to water vapour diffusion (normally designs without water vapour equalization holes); the test procedure is to be used for cross-sections where the danger is given by the condensation of the moisture between the surface of the inner profile and the inner surface of the outer profile by having a different water vapour diffusion (see Annex A (informative), Figures A.2 and A.3).

— **Test method 3:** For designs being sensitive to deformation; the test procedure is to be used for cross-sections where they are sensitive to the function through deformation as a result of climatic loading.

This European Standard defines the test procedures which are to be used in dependence of the potential risk of the design.

This European Standard is relevant to initial type testing, i. e. to developments or changes in designs. It is not relevant to routine quality control or to proven designs.

NOTE Designs are included in Annex A (informative). Annex B (normative) is the survey of general design criteria where tests are not necessary.

2 Normative references

The following referenced documents are indispensable for the application 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.

EN 1026, *Windows and doors — Air permeability — Test method*

EN 1121:2000, *Doors — Behaviour between two different climates — Test method*

EN 12046-1, *Operating forces — Test method — Part 1: Windows*

EN 12207, *Windows and doors — Air permeability — Classification*

EN 12519:2004, *Windows and pedestrian doors — Terminology*

EN 13115, *Windows — Classification of mechanical properties — Racking, torsion and operating forces*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 12519:2004 and the following apply.

3.1
design with low resistance to water vapour diffusion
design which is regarded as being a design with low water vapour diffusion when moisture conditioned by water vapour diffusion can be drained in the cross-section in a controlled way under specified service conditions, e.g. through sufficient ventilation

NOTE See Annex A (informative) and B (normative).

3.2
design with high resistance to water vapour diffusion
design which is regarded as being a design with high resistance to water vapour diffusion when as a result of profile coverings a sufficient draining of the moisture conditioned by water vapour diffusion is impaired in the combined profile

3.3
design being sensitive to deformation
design which is regarded as being sensitive to deformation when under specified service conditions the relative expansion (thermal or hygrometrical) of the profile may impair the basic functions of the window (e.g. operating forces, air permeability)

3.4
window manufactured of different materials
window whose frame (or sash or both) members are manufactured of non-identical materials, operating hardware being excluded

EXAMPLES Typical examples:

- basic timber windows clad with aluminium or PVC profiles;
- basic aluminium windows clad with timber (solid profiles or veneers);
- basic plastic windows clad with aluminium profiles.

3.5
orientation side 1
orientation with an inward looking face

3.6
orientation side 2
orientation with an outward looking face

3.7
wet spot
visible moisture accumulation, after climatic exposure, at the interface between timber (or any other hygroscopic materials) and another material

4 Principle of tests

4.1 Vapour diffusion

In order to have a temperature below dew point in composite profiles, a gradient of water vapour diffusion and a gradient of temperature are created; the window is exposed to this double gradient for a specified time during which the water content of hygroscopic elements is checked.

4.2 Stability

A gradient of temperature between the 2 sides of window is created and the window is exposed to this gradient for a specified time and measurement of deformations and functional deformations are carried out.

5 Test facility

The test facility is defined in EN 1121. In addition the following test facilities are required:

— a measuring device for determining the moisture content;

— an electric hygrometer which is properly calibrated for determining the moisture content of the timber and which has to have an accuracy of ± 1 %; and

— a measuring device for determining the deformation with an accuracy of 0,1 mm.

6 Dimensions of the test specimens

For the test methods 1 and 2 the test results are independent of the dimensions. For that reason, the dimension can be agreed upon between the test laboratory and the applicant.

In the case of designs sensitive to deformation (test method 3) the largest overall dimension foreseen by the manufacturer is to be tested to ensure the validity of the test.

The test results obtained at the foreseen maximum dimensions of the tested profile system can be extrapolated to smaller width and height without additional testing.

7 Preparation for test

The test specimen shall be mounted taking into account the installation instructions as defined and published by the manufacturer.

The test specimen shall be fixed in the test rig plumb without any twists or bends, which may influence the test results. The specimen shall be fully operable and shall be opened and closed five times before the test.

During the test the windows shall be secured in a closed and locked position.

8 Test conditions

The test conditions subsequently listed shall be used in connection with the test methods in Clause 9.

Table 1 — Test methods for designs with low and high resistance to water vapour diffusion

Test method	Test climate	Side 1		Side 2		Cycle/ durability
		Air temperature θ_1 °C	Relative humidity (U) φ %	Air temperature θ_2 °C	Relative humidity (U) φ %	
1	A	23 ± 2	50 ± 5	-10 ± 2		See Figure 1 (12 h)
	B	23 ± 2	50 ± 5	60 ± 2	-	
2.1	C	23 ± 2	70 ± 5	3 ± 2	80 ± 5	≥ 30 days ≤ 60 days[a]
2.2	A	23 ± 2	50 ± 5	-10 ± 2	-	≥ 30 days ≤ 60 days[a]

[a] Until the constant moisture content of the hygroscopic materials or visible condensation is reached in the profile.

Table 2 — Test methods for designs sensitive to deformation

Test method	Test climate	Side 1		Side 2		Cycle/durability
		Air temperature θ_1 °C	Relative humidity (U) φ %	Air temperature θ_2 °C	Relative humidity (U) φ %	
3	A	23 ± 3	50[c] ± 5	-10 ± 3	-	24 h
	D	23 ± 3	50[c] ± 5	70[a, b ,d, e] ± 3	-	24 h

[a] The reference temperature (according to EN 1121:2000, 5.2) for heating up the surface by radiation.

[b] All test results obtained at 75°C (worst case) can be extrapolated to 70 °C without additional testing.

[c] For non hygroscopic materials the relative humidity need not be regulated.

[d] For non hygroscopic materials also a temperature difference ($\Delta\ \theta$) of 47 °C may be used, if the upper temperature remains below the softening point of the material.

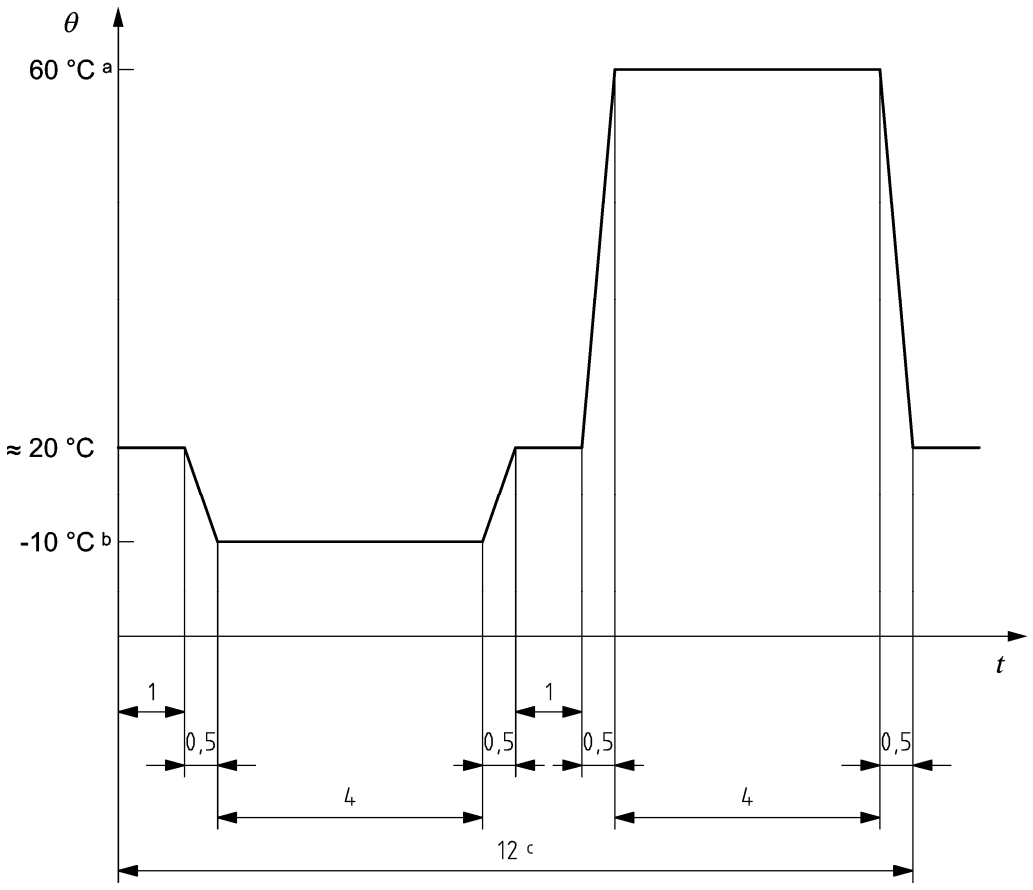
[e] Alternatively to the method given in EN 1121 (radiation), the temperature may be produced by hot air.

The surface temperature of the specimen shall not rise above the surface temperature resulting from radiation when measured at 70°C (BST), which shall be determined first.

9 Test methods

— **Test method 1**

For the test the specimen shall be exposed within a changing test climate A and B (see Table 1) according to Figure 1 with 100 cycles or until a constant weight or moisture of the hygroscopic materials of a climatic exposure has been reached. The moisture of the wood shall be continuously examined and recorded.



Key

θ	air temperature
t [h]	cycle time
a	test climate B + 60°C
b	test climate A -10°C
c	100 cycles

NOTE The moisture content shall be gauged before and after the test methods 1, 2.1 and 2.2.

Figure 1 — Loading by changing temperatures ("side 2" in accordance with the definition in 3.6)

— **Test methods 2.1 and 2.2**

For the test the specimen shall be exposed to a constant climatic loading according to the test climate C or A (Table 1) for a period of 30 days (min.) and 60 days (max.)[1)]. The moisture of the wood shall be examined and recorded continually or at least once a week.

— **Test method 3**

For the test the specimen shall be loaded with test climate A and D (Table 2) with a temperature loading on one side for a period of 24 h per climate.

1) Until the constant moisture content of the hygroscopic materials or visible condensation is reached in the profile.

10 Test sequence

For test method 3 the following test sequence is to be carried out:

— air permeability according to EN 1026;

— operating forces according to EN 12046-1;

— deformation;

— cold test - climate A (Table 2);

— deformation;

— operating forces according to EN 12046-1;

— heat test - climate D (Table 2);

— deformation[2)];

— operating forces according to EN 12046-1;

— air permeability[3)] according to EN 1026.

NOTE For analysing the test results it is reasonable to measure the deformation of the sash and the frame members before and after the climatic loading.

11 Test report

The test report shall at least contain the following information:

a) reference to this European Standard;

b) name of the test institution;

c) all references necessary for identifying the test specimen;

d) all relevant details concerning the dimensions of the test specimen, its materials, the design, the construction and the manufacture and its surface finish and fittings; also its method of delivery to the test laboratory;

e) detailed drawings of the test specimen the scale being 1:1;

f) description of the test facilities;

g) test climates used (with information concerning the test period / test cycles);

h) results of measurement of the moisture content of the hygroscopic materials before and after test methods 1, 2.1 and 2.2;

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2) Following this deformation test, the test specimen shall be visually inspected for any remaining deformations which would interfere with air permeability or water tightness test results. These shall be recorded.

3) Before this test the test specimen shall remain in indoor climate for a minimum of 12 h.

i) test results according to EN 1026 shall be expressed in accordance with EN 12207, test results according to EN 12046-1 before and after test method 3 shall be expressed in accordance with EN 13115;

j) recording of the damage and deformation (test method 3).

Annex A
(informative)

Design principles

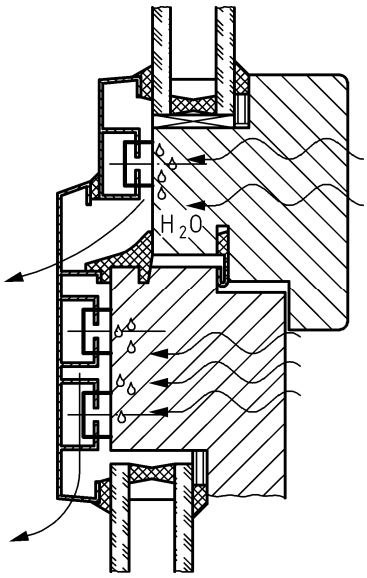

Figure A.1 — Design with low resistance to water vapour diffusion

Design principle for test method 1

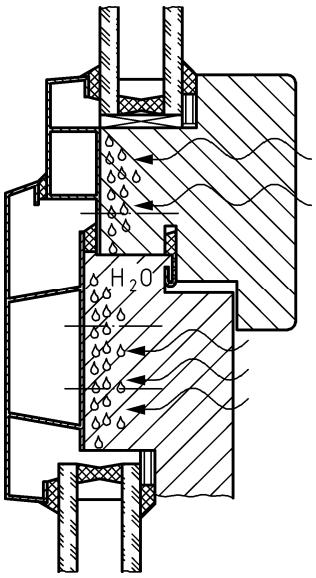

Figure A.2 — Design with high resistance to water vapour diffusion

Design principle for test methods 2.1 and 2.2

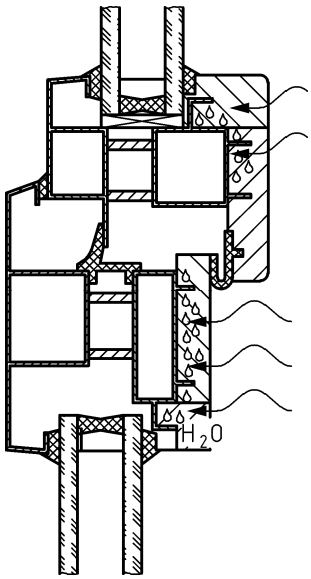

Figure A.3 — Design with high resistance to water vapour diffusion

Design principle for test methods 2.1 and 2.2

Annex B
(normative)

Survey of general design criteria where tests are not necessary

In the case of newly developed or non well-established windows manufactured of different materials with low resistance to water vapour diffusion the following criteria are to be evaluated:

— The distance between the external timber surface and the internal surface of the aluminium profile (the back side of the external surface) shall be 5 mm at a mimimum with the exception of the contact surfaces relevant for certain designs.

— Every contact surface of the aluminium profile shall be ≤ 20 mm in width on the timber surface. The same applies to connecting profiles, the contact area of sheet metal and the connections of the foils.

— All the cavities between the aluminium and the timber have to be connected with the outside climate via openings.

— There have to be at least 2 openings on the bottom in all transverse profiles. They have to have a minimum cross-section of 5 mm x 20 mm or drillings with a diameter of 8 mm. The distance between the openings may not exceed 600 mm.

— The openings have to be constructed in such a way that rain water may not penetrate into the design.

— When the wood surface partly overlaps through the fixing elements of wood-metal designs, e.g. the following condition shall apply (Figure B.1):

$$\frac{\Sigma b_j}{\Sigma a_j} \geq 2{,}5$$

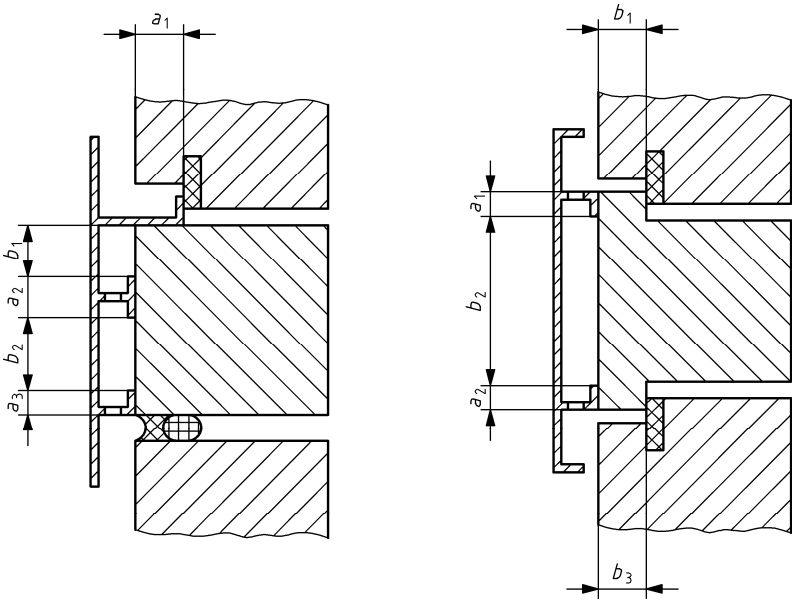

Figure B.1 — Schematic description of area fractions which are important for water vapour equalization

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