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European Assessment Document for

Gypsum plasterboards, gypsum boards with fibrous reinforcement and expanded glass boards with fibrous reinforcement for sheeting and lining of building elements

This European Assessment Document (EAD) has been developed taking into account up-to-date technical and scientific knowledge at the time of issue and is published in accordance with the relevant provisions of Regulation (EU) No 305/2011 as a basis for the preparation and issuing of European Technical Assessments (ETA).

Contents

1 SCOPE OF THE EAD

1.1 Description of the construction product

This EAD covers the following products (in the following referred to as boards):

- Gypsum plasterboards for sheathing and lining of building elements as well as for seismic applications (in the following referred to as gypsum plasterboards) are flat rectangular boards, composed of a reinforced gypsum plaster core encased in, and firmly bonded to paper liners, with:
  - controlled density according to EN 520[1], Clause 4.13
  - water vapour permeability μ ≤ 25 as for gypsum boards to be used as sheathing board, see EN 520, Clause 4.11
  - improved core adhesion at high temperature according to EN 520, Clause 4.12
  - reduced water absorption rate according to EN 520, Clause 4.10 (H1 to H3)
  - enhanced surface hardness according to EN 520, Clause 4.14
  - enhanced strength according to EN 520, Clause 4.1.2.2.

  The thickness of the gypsum plasterboards amounts from 9,0 mm to 20,0 mm.
- Gypsum boards with mat reinforcement for sheathing and lining of building elements as well as for seismic applications (in the following referred to as gypsum boards with mat reinforcement) are flat rectangular boards, composed of a reinforced gypsum plaster core firmly bonded to non-woven mats, with:
  - controlled density according to EN 520, Clause 4.13
  - water vapour permeability μ ≤ 25 as for gypsum boards to be used as sheathing board, see EN 520, Clause 4.11
  - improved core adhesion at high temperature according to EN 15283-1, Clause 4.10
  - reduced water absorption rate according to EN 15283-1, Clause 4.8 (H1 and H2)
  - enhanced surface hardness according to EN 15283-1, Clause 4.9
  - enhanced strength according to EN 15283-1, Clause 4.1.1 and Table 2 (GM-R).

  The thickness of the gypsum boards with mat reinforcement amounts from 9,0 mm to 20,0 mm.
- Gypsum fibre boards for sheathing and lining of building elements as well as for seismic applications (in the following referred to as gypsum fibre boards) are flat rectangular boards, composed of a gypsum plaster core and reinforced by cellulose fibres, with:
  - tolerances according to EN 15283-2, Clause 4.7 (C1 and C2)
  - reduced surface water absorption according to EN 15283-2, Clause 4.8 (W1 and W2)
  - enhanced surface hardness according to EN 15283-2, Clause 4.11

  The thickness of the gypsum fibre boards amounts from 10,0 mm to 30,0 mm.
- Expanded glass boards with fibrous reinforcement for sheathing and lining of building elements (in the following referred to as expanded glass boards) are flat rectangular boards composed of expanded glass (≥ 85 % by mass, part of it recycled) and (in)organic binders (< 15 % by mass) reinforced by inorganic fibres located on or just below the surfaces, with:
  - enhanced surface hardness according to EN 15283-1, Clause 4.9
  - strength according to EN 15283-1, Clause 4.1.1 and Table 2 (GM, GM-H1, GM-H2, GM-I, GM-F).

  The thickness of the expanded glass boards amounts from 8,0 mm to 30,0 mm.

The substructure is not part of the product.

The expanded glass boards with fibrous reinforcement are not covered by a harmonised European standard (hEN).

The gypsum plasterboards, gypsum boards with mat reinforcement and gypsum fibre boards are not fully covered by the following harmonised technical specification:

- hEN 520 for gypsum plasterboards because of the possible load-bearing use in building components and because of additional characteristics regarding mechanical resistance and stability used accordingly for calculation. The set of mechanical characteristics and test methodologies of EN 520 does not cover these essential characteristics.

1 All undated references to standards or to EADs in this EAD are to be understood as references to the dated versions listed in clause 4.

- hEN 15283-1 for gypsum boards with mat reinforcement because of the possible load-bearing use in building components and because of additional characteristics regarding mechanical resistance and stability used accordingly for calculation. The set of mechanical characteristics and test methodologies of EN 15283-1 does not cover these essential characteristics.
- hEN 15283-2 for gypsum fibre boards because of the possible load-bearing use in building components and because of additional characteristics regarding mechanical resistance and stability used accordingly for calculation. The set of mechanical characteristics and test methodologies of EN 15283-2 does not cover these essential characteristics.
- hEN 13964 for suspended ceilings because of deviating intended use.
- EAD 070001-01-0504 because of additional variants, intended use in service class 3 and additional essential characteristics.

Compared to the previous version of the EAD 070001-01-0504, the following changes are introduced:

- gypsum plasterboards with reduced water absorption rate H3 included
- additional variants (thickness, gypsum boards and expanded glass boards with fibrous reinforcement) added
- the following additional essential characteristics are added:
  - Head pull-through resistance of fasteners in boards
  - Static ductility of dowel-type fasteners in boards
  - Water absorption of board surface
  - Resistance to water penetration
  - Moisture absorption
  - Air permeability
  - Mould resistance
- additional intended use in service class 3 included leading to the following additional assessment methods after exposure to water:
  - Bending strength
  - Compressive strength
  - Load bearing capacity of the wall elements
  - Embedment strength of fasteners in boards
  - Head pull-through resistance of fasteners in boards
  - Dimensional stability
  - Surface hardness
- clarification and/or more details to the number of tested specimens, sizes, direction of production, standards for methods of test and assessment - clauses 2.2.1 – 2.2.12; 2.2.15; 2.2.17; Annex 1 - clause 1.2; Annex 3 - clause 3.2 added.

Concerning product packaging, transport, storage, maintenance, replacement and repair it is the responsibility of the manufacturer to undertake the appropriate measures and to advise his clients on the transport, storage, maintenance, replacement and repair of the product as he considers necessary.

It is assumed that the product will be installed according to the manufacturer's instructions or (in absence of such instructions) according to the usual practice of the building professionals.

Relevant manufacturer's stipulations having influence on the performance of the product covered by this European Assessment Document shall be considered for the determination of the performance and detailed in the ETA.

1.2 Information on the intended use(s) of the construction product

1.2.1 Intended use(s)

The boards are intended for the uses of Table 1.2.1.1.

Table 1.2.1.1 Categories of intended use

No	Category of intended use	Products	Service classes according to EN 1995-1-1
1	Load-bearing and non-load-bearing applications as system components for drywall constructions (for example on wooden based or steel-based substructures).	Gypsum plasterboards Gypsum boards with mat reinforcement Gypsum fibre boards Expanded glass boards	1 and 2
2	Non-load-bearing boards in ceilings.	Gypsum plasterboards Gypsum boards with mat reinforcement Gypsum fibre boards Expanded glass boards	1 and 2
3	Load-bearing and bracing applications under seismic action.	Gypsum plasterboards Gypsum boards with mat reinforcement Gypsum fibre boards	1 and 2
4	Load-bearing and non-load-bearing applications on the external side of external sheathing walls without protection during an erection span of maximum 3 months. Hereby, joints are sealed.	Gypsum boards with mat reinforcement with reduced water absorption type H1	3

1.2.2 Working life/Durability

The assessment methods included or referred to in this EAD have been written based on the manufacturer's request to take into account a working life of the boards for the intended use of 50 years when installed in the works. These provisions are based upon the current state of the art and the available knowledge and experience.

When assessing the product, the intended use as foreseen by the manufacturer shall be taken into account. The real working life may be, in normal use conditions, considerably longer without major degradation affecting the basic requirements for works[2].

The indications given as to the working life of the construction product cannot be interpreted as a guarantee neither given by the product manufacturer or his representative nor by EOTA when drafting this EAD nor by the Technical Assessment Body issuing an ETA based on this EAD, but are regarded only as a means for expressing the expected economically reasonable working life of the product.

1.3 Specific terms used in this EAD

1.3.1 Lining

Dry covering, always applied to the inside of any internal building surface, intended for purposes such as dry lining finishes to walls, to fixed and suspended ceilings, to partitions, or as cladding to structural columns and beams, not primarily intended to contribute to racking resistance and stiffness to a framed structure.

1.3.2 Sheathing

Dry covering usually applied to the outside of the framing and primarily used to provide racking resistance and stiffness to a framed structure.

2 The real working life of a product incorporated in a specific works depends on the environmental conditions to which that works is subject, as well as on the particular conditions of the design, execution, use and maintenance of that works. Therefore, it cannot be excluded that in certain cases the real working life of the product may also be shorter than referred to above.

2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

2.1 Essential characteristics of the product

Table 2.1.1 shows how the performance of the boards is assessed in relation to the essential characteristics.

Table 2.1.1 Essential characteristics of the product and methods and criteria for assessing the performance of the product in relation to those essential characteristics

No	Essential characteristic	Assessment method	Type of expression of product performance
Basic Works Requirement 1: Mechanical resistance and stability			
1	Bending strength	Service classes 1 and 2: 2.2.1.1 Service class 3: 2.2.1.2	Level Service classes 1 and 2: $f_{m,\perp,MD,k}$ [MPa], $E_{m,\perp,MD,mean}$ [MPa] $f_{m,\perp,CD,k}$ [MPa], $E_{m,\perp,CD,mean}$ [MPa] $f_{m,II,MD,k}$ [MPa], $E_{m,II,MD,mean}$ [MPa] $f_{m,II,CD,k}$ [MPa], $E_{m,II,CD,mean}$ [MPa] Service class 3: $k_{m,red,m,hum}$ [-], $k_{m,red,m,imm}$ [-]
2	Shear strength	2.2.2	Level $f_{v,\perp,MD,k}$ [MPa], $G_{v,\perp,MD,mean}$ [MPa] $f_{v,\perp,CD,k}$ [MPa], $G_{v,\perp,CD,mean}$ [MPa] $f_{v,II,MD,k}$ [MPa], $G_{v,II,MD,mean}$ [MPa] $f_{v,II,CD,k}$ [MPa], $G_{v,II,CD,mean}$ [MPa]
3	Compressive strength	Service classes 1 and 2: 2.2.3.1 Service class 3: 2.2.3.2	Level Service classes 1 and 2: $f_{c,\perp,MCD,k}$ [MPa], $E_{c,\perp,MCD,mean}$ [MPa] $f_{c,II,MD,k}$ [MPa], $E_{c,II,MD,mean}$ [MPa] $f_{c,II,CD,k}$ [MPa], $E_{c,II,CD,mean}$ [MPa] Service class 3: $k_{c,red,hum}$ [-], $k_{c,red,imm}$ [-]
4	Tensile strength	2.2.4	Level $f_{t,II,MD,k}$ [MPa], $E_{t,II,MD,mean}$ [MPa] $f_{t,II,CD,k}$ [MPa], $E_{t,II,CD,mean}$ [MPa] $f_{t,II,\alpha,k}$ [MPa], $E_{t,II,\alpha,mean}$ [MPa]
5	Load bearing capacity of the wall elements	Service classes 1 and 2: 2.2.5.1 Service classes 1 and 2 at increased moisture content: 2.2.5.2 Service class 3: 2.2.5.3	Level, Description Service classes 1 and 2: $F_{v,Rk}$ [N], R [N/mm] $k_{F,red}$ [-] Service class 3: $F_{v,Rk,SC3}$ [N]

No	Essential characteristic	Assessment method	Type of expression of product performance
6	Embedment strength of fasteners (staples, nails, screws) in boards	Service classes 1 and 2: 2.2.6.1 Service class 3: 2.2.6.2	Level Service classes 1 and 2: $f_{h,MD,k}$ [MPa], $f_{h,CD,k}$ [MPa] Service class 3: $f_{h,MD,SC3,k}$ [MPa], $f_{h,CD,SC3,k}$ [MPa]
7	Head pull-through resistance of fasteners (staples, nails, screws) in boards	Service classes 1 and 2: 2.2.7.1 Service class 3: 2.2.7.2	Level Service classes 1 and 2: $f_{head,k}$ [MPa] Service class 3: $f_{head,SC3,k}$ [MPa]
8	Creep and duration of the load	2.2.8	Level k_{mod} [-], k_{def} [-]
9	Structure of the cohesion of the core at high temperature	EN 520, Clause 5.10	Description
10	Dimensional stability	Service classes 1 and 2: 2.2.9.1 Service class 3: 2.2.9.2	Level Service classes 1 and 2: $\delta l_{65,85}$, $\delta l_{65,30}$ [mm/m], $\delta t_{65,85}$, $\delta t_{65,30}$ [%] Service class 3: Δl_{SC3} [mm/m], Δm_{SC3} [%]
11	Surface hardness	Service classes 1 and 2: 2.2.10.1 Service class 3: 2.2.10.2	Level Service classes 1 and 2: D [mm] Service class 3: D_{hum} [mm], D_{imm} [mm]
12	Static ductility of dowel-type fasteners (staples, screws) in boards	2.2.11	Level μ [-]
Basic Works Requirement 2: Safety in case of fire			
13	Reaction to fire	2.2.12	Class
Basic Works Requirement 3: Hygiene, health and the environment			
14	Water vapour permeability (expressed as water vapour resistance factor)	EN 520, Clause 4.4, for gypsum plasterboards EN 15283-1, Clause 4.4, for gypsum boards with mat reinforcement and expanded glass boards with fibrous reinforcement EN 15283-2, Clause 4.4, for gypsum fibre boards	Level μ [-],s_d [mm]
15	Water absorption of board surface	EN 520, Clause 5.9.1, for gypsum plasterboards EN 15283-2, Clause 5.8, for gypsum fibre boards , gypsum boards with mat reinforcement and expanded glass boards with fibrous reinforcement	Level Water absorption of board surface [g/m²]
16	Resistance to water penetration	EN 13111	Level Resistance to water penetration [g/m²]

No	Essential characteristic	Assessment method	Type of expression of product performance
17	Total water absorption	EN 520, Clause 5.9.2, for gypsum plasterboards EN 15283-1, Clause 5.8, for gypsum boards with mat reinforcement and expanded glass boards with fibrous reinforcement EN 15283-2, Clause 5.9, for gypsum fibre boards	Level Total water absorption [%]
18	Moisture absorption	2.2.13	Level Moisture absorption [%]
Basic Works Requirement 4: Safety and accessibility in use			
19	Hard body impact resistance	EN 1128	Level IR [mm/mm]
Basic Works Requirement 5: Protection against noise			
20	Airborne sound insulation	EN 520, Clause 4.6.1, for gypsum plasterboards EN 15283-1, Clause 4.3.1, for gypsum boards with mat reinforcement and expanded glass boards with fibrous reinforcement EN 15283-2, Clause 4.3.1, for gypsum fibre boards	Level $R_w(C; C_{tr})$ [dB]
21	Sound absorption	EN 520, Clause 4.6.2, for gypsum plasterboards EN 15283-1, Clause 4.3.2, for gypsum boards with mat reinforcement and expanded glass boards with fibrous reinforcement EN 15283-2, Clause 4.3.2, for gypsum fibre boards	Level α_s [-]
Basic Works Requirement 6: Energy economy and heat retention			
22	Thermal resistance (expressed as thermal conductivity)	EN 520, Clause 4.7, for gypsum plasterboards EN 15283-1, Clause 4.5, for gypsum boards with mat reinforcement and expanded glass boards with fibrous reinforcement EN 15283-2, Clause 4.5, for gypsum fibre boards	Level λ [W/(m·K)]
23	Air permeability	2.2.14	Level C [$m^3/s\ Pa^n$], n [-]
24	Coefficient of thermal expansion	2.2.15	Level T (K)
Aspects of durability			
25	Mould resistance	2.2.16	Level, description

2.2 Methods and criteria for assessing the performance of the product in relation to essential characteristics of the product

This chapter is intended to provide instructions for TABs. Therefore, the use of wordings such as “shall be stated in the ETA” or “it has to be given in the ETA” shall be understood only as such instructions for TABs on how results of assessments shall be presented in the ETA. Such wordings do not impose any obligations for the manufacturer and the TAB shall not carry out the assessment of the performance in relation to a given essential characteristic when the manufacturer does not wish to declare this performance in the Declaration of Performance.

2.2.1 Bending strength

2.2.1.1 Bending strength in dry conditions (intended use in service classes 1 and 2)

Purpose of the assessment

Determination of bending strength and stiffness of the boards.

Assessment method

Bending strength and the bending modulus of elasticity perpendicular to the plane of the boards and/or in plane of the boards shall be determined according to Annex A. Testing shall be performed after storage under climatic conditions of 20 ± 2°C and 65 ± 5% humidity.

Tests shall be performed on specimens orientated in direction of production (machine direction) as well as perpendicular to direction of production (cross direction) of the boards. When determining the bending strength perpendicular to the plane of the board, the influence of the orientation of the top side of the board (tension/compression due to bending) shall also be taken into account (face down/face up).

Mean and characteristic values shall be determined in accordance with EN 14358, Clause 3, as log-normally distributed.

Expression of results

Characteristic bending strength and mean bending modulus of elasticity shall be stated in the ETA:

- perpendicular to the plane of the boards and in machine direction $f_{m,\perp,MD,k}$ in MPa and $E_{m,\perp,MD,mean}$ in MPa
- perpendicular to the plane of the boards and in cross direction $f_{m,\perp,CD,k}$ in MPa and $Em_{,\perp,CD,mean}$ in MPa
- in plane of the boards and in machine direction $f_{m,II,MD,k}$ in MPa and $E_{m,II,MD,mean}$ in MPa
- in plane of the boards and in cross direction $f_{m,II,CD,k}$ in MPa and $E_{m,II,CD,mean}$ in MPa.

2.2.1.2 Bending strength after exposure to water (intended use in service class 3)

Purpose of the assessment

Determination of reduction factor for factory production control.

Assessment method

For gypsum boards with mat reinforcement with reduced water absorption type H1 for the intended use in service class 3 additional tests shall be performed according to EN 15283-1, Clause 5.6, with vector of momentum in direction of production and perpendicular to direction of production in humid as well as immersed conditions.

For the humid conditions, the specimens shall be stored for 7 days in a humid chamber, which shall be regulated at 30 ±2°C and 90 ±3 % humidity. After 7 days, the specimens shall be tested immediately on the loading machine as specified in EN 15283-1, Clause 5.6.2 and 5.6.3.2 and evaluated according to Clause 5.6.3.3.

For the immersed conditions, the specimens shall be placed in a water bath at 23 ±2°C, large enough to hold the specimens. The specimens shall be placed horizontally but not resting flat on the bottom of the container. They shall be covered with 25 mm of water for 2 hours ±2 minutes. After the elapsed time, the

specimens shall be removed from the bath, and the surface and edges shall be wiped in order to eliminate the excess water. The specimens shall be tested immediately on the loading machine as specified in EN 15283-1, Clause 5.6.2 and 5.6.3.2 and evaluated according to Clause 5.6.3.3.

The minimum number of specimens shall be 10 (5 in machine direction and 5 in cross direction) for each condition.

Expression of results

The reduction factor for loss of bending strength shall be determined for humid $k_{m,red,hum}$ as well as immersed $k_{m,red,imm}$ conditions by dividing the breaking load in humid/immersed conditions by the breaking load in dry conditions according to EN 15283-1, Clause 5.6. The values of $k_{m,red,hum}$ and $k_{m,red,imm}$ shall be stated in the ETA.

2.2.2 Shear strength

Purpose of the assessment and assessment method

Shear strength and shear modulus perpendicular to the plane of the boards and/or in plane of the boards shall be determined according to EN 789, clauses 10 and 11, considering Annexes B and C. Testing shall be performed after storage under climatic conditions of 20 ± 2°C and 65 ± 5% humidity.

Tests shall be performed on specimens orientated in direction of production (machine direction) as well as perpendicular to direction of production (cross direction) of the boards. The minimum number of specimens for tests in machine direction as well as in cross direction shall be 5.

Evaluation of the shear strength and the shear modulus shall be performed according to EN 789.

Mean and characteristic values shall be determined in accordance with EN 14358, Clause 3, as log-normally distributed.

Expression of results

Characteristic shear strength and mean shear modulus shall be stated in the ETA:

- perpendicular to the plane of the boards and in machine direction $f_{v,\perp,MD,k}$ in MPa and $G_{v,\perp,MD,mean}$ in MPa
- perpendicular to the plane of the boards and in cross direction $f_{v,\perp,CD,k}$ in MPa and $G_{v,\perp,CD,mean}$ in MPa
- in plane of the boards and in machine direction $f_{v,II,MD,k}$ in MPa and $G_{v,II,MD,mean}$ in MPa
- in plane of the boards and in cross direction $f_{v,II,CD,k}$ in MPa and $G_{v,II,CD,mean}$ in MPa.

2.2.3 Compressive strength

2.2.3.1 Compressive strength in dry conditions (intended use in service classes 1 and 2)

Purpose of the assessment

Determination of compressive strength and stiffness perpendicular to and in plane of the boards.

Assessment method

Compressive tests perpendicular to the plane of the boards shall be performed according to EN 789, Annex D, in direction of production (machine direction) as well as perpendicular to direction of production (cross direction) of the boards. Compressive tests in plane of the boards shall be performed according to EN 789, Clause 8, considering Annex A of EN 789, independent of direction pf production. Testing shall be performed after storage under climatic conditions of 20 ± 2°C and 65 ± 5% humidity.

The minimum number of specimens shall be 20 for gypsum plasterboards, gypsum boards with mat reinforcement and gypsum fibre boards. The minimum number of specimens shall be 10 for expanded glass boards with fibrous reinforcement.

Evaluation of the compressive strength and the compressive modulus of elasticity perpendicular to the plane of the boards shall be performed according to EN 789, Annex D.5, and in plane of the boards according to EN 789, Clause 8.5.

Mean and characteristic values shall be determined in accordance with EN 14358, Clause 3, as log-normally distributed.

Expression of results

Characteristic compressive strength and mean compressive modulus of elasticity shall be stated in the ETA:

- perpendicular to the plane of the boards and independent of direction of production $f_{c,\perp,MCD,k}$ in MPa and $E_{c,\perp,MCD,mean}$ in MPa
- in plane of the boards and in machine direction $f_{c,II,MD,k}$ in MPa and $E_{c,II,MD,mean}$ in MPa
- in plane of the boards and in cross direction $f_{c,II,CD,k}$ in MPa and $E_{c,II,CD,mean}$ in MPa.

2.2.3.2 Compressive strength after exposure to water (intended use in service class 3)

Purpose of the assessment

Determination of reduction factor perpendicular to the plane of the boards.

Assessment method

For gypsum boards with mat reinforcement with reduced water absorption type H1 for the intended use in service class 3 tests perpendicular to the plane of the board shall be performed according to Annex F.

Mean and characteristic values shall be determined in accordance with EN 14358, Clause 3, as log-normally distributed.

The reduction factor for loss of compressive strength shall be determined for humid $k_{c,red,hum}$ as well as immersed $k_{c,red,imm}$ conditions by dividing the characteristic compressive strength perpendicular to the plane of the board in humid/immersed conditions by the characteristic compressive strength perpendicular to the plane of the board in dry conditions.

Expression of results

The values of $k_{c,red,hum}$ and $k_{c,red,imm}$ shall be stated in the ETA.

2.2.4 Tensile strength

Purpose of the assessment

Determination of tensile strength and stiffness in plane of the boards.

Assessment method

Tensile tests in plane of the boards shall be performed according to EN 789, Clause 9. The dimensions of the specimen shall be reduced to w x L x t = 50 mm x (20 x t or 350 mm) x t mm with a specimen reduction to 30 mm width in the middle. The length of the reduced part shall be twice as long as the gauge length. The reduction shall be achieved by a radius as large as possible, to suite the self-aligning grips. The length of the specimen may be extended up to 600 mm for determination of the tensile modulus.

Tests shall be performed on specimens orientated in direction of production (machine direction) as well as perpendicular to direction of production (cross direction) of the boards. The minimum number of specimens for tests in machine direction shall be 5. The minimum number of specimens for tests in cross direction shall be 20 for gypsum plasterboards, gypsum boards with mat reinforcement and gypsum fibre boards and 5 for expanded glass boards with fibrous reinforcement.

In addition, tests can be performed on specimens orientated under a defined angle to the direction of production of the boards. Hereby, at least the following angles shall be tested: 15°, 30°, 45°, 60°, and 75°. The minimum number of specimens per angle shall be 10.

Evaluation of the tensile strength and the tensile modulus of elasticity in plane of the boards shall be performed according to EN 789, Clause 9.5.

Mean and characteristic values shall be determined in accordance with EN 14358, Clause 3, as log-normally distributed.

Expression of results

Characteristic tensile strength and mean tensile modulus of elasticity in plane of the boards for each of relevant directions shall be stated in the ETA:

- in plane of the boards and in machine direction $f_{t,II,MD,k}$ in MPa and $E_{t,II,MD,mean}$ in MPa
- in plane of the boards and in cross direction $f_{t,II,CD,k}$ in MPa and $E_{t,II,CD,mean}$ in MPa
- in plane of the boards and with and angle to the direction of production $f_{t,II,\alpha,k}$ in MPa and $E_{t,II,\alpha,mean}$ in MPa.

2.2.5 Load bearing capacity of the wall elements

2.2.5.1 Load bearing capacity of the wall elements in dry conditions (intended use in service classes 1 and 2)

Purpose of the assessment

Determination of load bearing capacity of the wall elements.

Assessment method

Shear tests shall be performed according to EN 594 with additional vertical loads F_v and with bracket at junction of timber studs with horizontal timber channels. At least three configurations with the minimum number of fasteners shall be tested. The load deflection curve shall be recorded. Afterwards the racking strength F_{max} and stiffness R shall be determined according to EN 594. The tests shall be carried out under normal conditions of regular application (installation and mounting according to the intended use) in accordance with EN 594 clause 6.3.2.

Mean and characteristic values shall be determined in accordance with EN 14358, Clause 3, as log-normally distributed.

Extended application shall be assessed for the boards by calculation assisted by testing. The calculation method of the racking strength and stiffness shall be based on EN 1995-1-1, clause 9.2.4. Hereby, the calculation method shall be applied to a comparable calculated load case and compared with the shear tests performed.

Expression of results

The characteristic racking strength $F_{v,Rk}$ in N and mean stiffness R in N/mm shall be stated in the ETA together with the boundary conditions:

- vertical loads F_v and total vertical load during testing,
- distance of timber studs,
- connections to the ground,
- thickness, characteristic and mean density of the covering,
- specification of fasteners, and
- spacing of fasteners.

In case of extended application the racking strength and stiffness shall be stated in the ETA together with the calculation method and the boundary conditions given above.

2.2.5.2 Load bearing capacity of the wall elements at increased moisture content (intended use in service classes 1 and 2)

Purpose of the assessment

Determination of load bearing capacity of the wall elements at increased moisture content.

Assessment method

Shear tests shall be performed according to Clause 2.2.5.1 with increased moisture content. Therefore, the bottom of the wall shall be stored in a 1 m high water bath for 24 hours prior to testing. The water temperature shall be more than 5 °C. The tests shall be performed immediately after release from the water bath.

The racking strength and stiffness assessed by tests according to Clause 2.2.5 shall be compared with the determined racking strength and stiffness at increased moisture content and the percentage of loss of racking strength and stiffness shall be calculated.

The reduction factor for loss of load bearing capacity of the wall elements $k_{F,red}$ shall be determined by dividing the load bearing capacity of the wall element at increased moisture content by the load bearing capacity of the wall element in dry conditions.

Expression of results

The values of $k_{F,red}$ shall be stated in the ETA.

2.2.5.3 Load bearing capacity of the wall elements after exposure to water (intended use in service class 3)

Purpose of the assessment

Determination of load bearing capacity of the wall elements of the gypsum boards with mat reinforcement with reduced water absorption type H1 for the intended use in service class 3 for a maximum erection span of 3 months (see Clause 1.2.1).

Assessment method

Tests reflecting the intended use in service class 3 with humid climatic conditions of 20 ± 2°C and 85 ± 5% relative humidity plus exposure to sprinkled water in a controlled and comparable manner are particularly expensive for large scale tests.

Calculation of wall elements according to EN 1995-1-1, Clause 9.2.4.2 “Simplified verification of wall elements – Method A” is the least onerous method for the assessment of the load bearing capacity of the wall elements and leads to conservative results. The main input value for calculation of the characteristic value of load bearing capacity of the wall elements is the embedment strength of the fasteners. Hence, calculation together with the most unfavourable input values (embedment strength after exposure to water $f_{h,MD/CD,SC3,k}$ determined according to Clause 2.2.6) shall be performed:

$$F_{v,Rk} = \sum F_{i,v,Rk}$$

$F_{i,v,Rk}$ … characteristic value of load bearing capacity of the wall elements

$$F_{i,v,Rk} = \frac{F_{f,Rk} \cdot b_i \cdot c_i}{s}$$

$F_{f,Rk}$ … characteristic value of the load bearing capacity for shearing off the single fastener according to EN 1995-1-1, Equation (8.6), with lowest value of embedment strength after exposure to water according to Clause 2.2.6 (NOTE: k_{mod} = 1 applies) and $F_{ax,Rk}$ = 0

b_i … width of the wall element

s … spacing of the fasteners

c_i … according to EN 1995-1-1, Equation (9.22).

Expression of results

The calculated characteristic value of load bearing capacity of the wall elements $F_{v,Rk,SC3}$ in N shall be stated in the ETA together with the boundary conditions:

- width of the wall element,
- thickness of the covering,
- input values for calculation as diameter of fasteners,
- specification of fasteners (diameter, characteristic yield moment),
- diameter of fasteners,
- spacing of fasteners, and
- embedment strength in immersed conditions and embedment strength of the fasteners in the substructure.

2.2.6 Embedment strength of fasteners (staples, nails, screws) in boards

2.2.6.1 Embedment strength in dry conditions (intended use in service classes 1 and 2)

Purpose of the assessment

Determination of embedment strength of fasteners in boards.

Assessment method

The embedment strength shall be evaluated according to EN 383, Clause 6. Tests shall be performed on at least 5 specimens orientated in direction of production (machine direction) as well as on at least 5 specimens perpendicular to direction of production (cross direction) of the boards under climatic conditions of 20 ± 2°C and 65 ± 5% humidity.

Designated fastener for intended use of the product shall be tested for each board thickness, diameter of fastener and orientation (0° and 90°).

The embedment strength for both directions of production shall be determined in accordance with EN 14358, Clause 3, as log-normally distributed.

Expression of results

The embedment strength for both directions of production $f_{h,MD,k}$ and $f_{h,CD,k}$ in MPa shall be stated in the ETA together with the technical specification of the respective fastener including the nominal thickness and characteristic and mean density of the boards related to the embedment strength.

2.2.6.2 Embedment strength after exposure to water (intended use in service class 3)

Purpose of the assessment

Determination of embedment strength of fasteners in boards.

Assessment method

The embedment strength shall be evaluated according to EN 383, Clause 6. Tests shall be performed on at least 5 specimens orientated in direction of production as well as on at least 5 specimens perpendicular to direction of production of the boards.

For gypsum boards with mat reinforcement with reduced water absorption type H1 for the intended use in service class 3 tests shall be performed on boards after 2 hours immersion in water. Hereby, the specimens shall be cut at 100 x 150 mm according to EN 383 both in direction as well as perpendicular to the direction of production. The specimens shall be placed in a water bath at 23 ± 2 °C, large enough to hold the specimens. The specimens shall be placed horizontally but not resting flat on the bottom of the container. They shall be covered with 25 mm of water for 2 hours ± 2 minutes. After the elapsed time, the specimens shall be removed from the bath, and the surface and edges shall be wiped in order to eliminate the excess water. The specimens shall be then drilled with a hole of a diameter equal to the pin diameter to be assessed. They shall be immediately tested on the mechanical press.

Designated fastener for intended use of the product shall be tested for each board thickness, diameter of fastener and orientation (0° and 90°).

The embedment strength for both directions of production shall be determined in accordance with EN 14358, Clause 3, as log-normally distributed.

Expression of results

The embedment strength for both directions of production $f_{h,MD,SC3,k}$ and $f_{h,CD,SC3,k}$ in MPa shall be stated in the ETA together with the technical specification of the respective fastener including the nominal thickness and characteristic and mean density of the boards related to the embedment strength.

2.2.7 Head pull-through resistance of fasteners (staples, nails, screws) in boards

2.2.7.1 Head pull-through resistance in dry conditions (intended use in service classes 1 and 2)

Purpose of the assessment

Determination of head pull-through resistance of fasteners in boards.

Assessment method

The head pull-through resistance shall be evaluated according to EN 1383. A minimum of 10 fasteners (for example staples, nails, screws) shall be tested for all parameters influencing the head pull-through resistance under climatic conditions of 20 ± 2°C and 65 ± 5 % humidity.

Designated fastener for intended use of the product shall be tested.

The head pull-through resistance shall be determined in accordance with EN 14358, Clause 3, as log-normally distributed.

Expression of results

The head pull-through resistance $f_{head,k}$ in MPa shall be stated in the ETA together with the technical specification of the respective fastener including the nominal thickness and characteristic and mean density of the boards related to the head pull-through resistance.

2.2.7.2 Head pull-through resistance after exposure to water (intended use in service class 3)

Purpose of the assessment

Determination of head pull-through resistance of fasteners in gypsum boards with mat reinforcement with reduced water absorption type H1 for the intended use in service class 3.

Assessment method

The head pull-through resistance shall be evaluated according to EN 1383. A minimum of 10 fasteners (for example staples, nails, screws) shall be tested for all parameters influencing the head pull-through resistance.

The tests shall be performed on boards after 2 hours immersion in water. Hereby, the specimens shall be cut according to EN 1383. The specimens shall be placed in a water bath at 23 ± 2°C, large enough to hold the specimens. The specimens shall be placed horizontally but not resting flat on the bottom of the container. They shall be covered with 25 mm of water for 2 hours ± 2 minutes. After the elapsed time, the specimens shall be removed from the bath, and the surface and edges shall be wiped in order to eliminate the excess water. The specimens shall be then drilled with a hole of a diameter equal to the pin diameter to be assessed. They shall be immediately tested on the mechanical press.

Designated fastener for intended use of the product shall be tested.

The head pull-through resistance shall be determined in accordance with EN 14358, Clause 3, as log-normally distributed.

Expression of results

The head pull-through resistance $f_{head,SC3,k}$ in MPa shall be stated in the ETA together with the technical specification of the respective fastener including the nominal thickness and characteristic and mean density of the boards related to the head pull-through resistance.

2.2.8 Creep and duration of the load

Purpose of the assessment

Determination of deformation and modification factors of boards.

Assessment method

The deformation and modification values shall be determined according to EN 1156, Clauses 6 and 7 and Annex B of this EAD (reference method). The specimens shall be loaded under the conditions of the respective service class (service class 1, 2 or 3 according to EN 1995-1-1) by a constant load according to Annex B of this EAD.

As simplified method for gypsum plasterboards, gypsum fibre boards and gypsum boards with mat reinforcement and for the intended use in service classes 1 and 2 only, creep and duration of the load factors shall be taken as the following values (see Table 2.2.8.1):

Table 2.2.8.1: k_{mod} and k_{def} in service class 1 and 2

	k_{mod}					
	Service class	**Load duration class**				
		Permanent action	**Long action**	**Medium action**	**Short action**	**Very short action**
Gypsum plasterboards, gypsum fibre boards and gypsum boards with mat reinforcement	1	0,2	0,4	0,6	0,8	1,1
	2	0,15	0,3	0,45	0,6	0,8

	k_{def}	
	Service class	
	1	**2**
Gypsum plasterboards, gypsum fibre boards and gypsum boards with mat reinforcement	3,0	4,0

Expression of results

The numeric values for k_{mod} and k_{def} shall be stated in the ETA as the pre-given values or for the tested service classes and duration of load together with the respective assessment method.

2.2.9 Dimensional stability

2.2.9.1 Dimensional stability for intended use in service classes 1 and 2

Purpose of the assessment

Evaluation of dimensional variations of boards for intended use in service classes 1 and 2.

Assessment method

Determination of dimensional changes associated with changes in relative humidity in service classes 1 and 2 shall be done in accordance with EN 318.

Expression of results

Determination of dimensional changes associated with changes in relative humidity of the boards shall be stated in the ETA according to EN 318:

- Change in length $\delta l_{65,85}$ and $\delta l_{65,30}$ in mm/m
- Change in thickness $\delta t_{65,85}$ and $\delta t_{65,30}$ in %.

2.2.9.2 Dimensional stability for intended use in service class 3

Purpose of the assessment

Evaluation of dimensional variations of boards for intended use in service class 3.

Assessment method

For the intended use in service class 3 determination of dimensional variations associated with changes in relative humidity shall be assessed according to Annex D.

Expression of results

The dimensional stability measured as total amplitude of size and mass between the minimum and maximum value after the 3 cycles shall be stated in the ETA:

- Size variations Δl_{SC3} (maximum-minimum) (mm/m)
- Mass Variations Δm_{SC3} (maximum-minimum) (%).

2.2.10 Surface hardness

2.2.10.1 Surface hardness in dry conditions (intended use in service classes 1 and 2)

Purpose of the assessment and assessment method

The surface hardness of the boards shall be determined according to

- EN 520, Clause 5.12, for gypsum plasterboards, gypsum boards with mat reinforcement and expanded glass boards with fibrous reinforcement, and
- EN 15283-2, Clause 5.11, for gypsum fibre boards.

NOTE: The EAD applies to boards with enhanced surface hardness

- for gypsum plasterboards according to EN 520, Clause 4.14,
- for gypsum boards with mat reinforcement and expanded glass boards with fibrous reinforcement according to EN 15283-1, Clause 4.9, and
- for gypsum fibre boards according to EN 15283-2, Clause 4.11.

Expression of results

The mean diameter of indentation D in mm shall be stated in the ETA.

2.2.10.2 Surface hardness after exposure to water (intended use in service class 3)

Purpose of the assessment and assessment method

For gypsum boards with mat reinforcement with reduced water absorption type H1 for the intended use in service class 3, the surface hardness shall be determined on a specimen of 300 x 400 mm in humid as well as immersed conditions. The impact test shall be carried out according to EN 520, Clause 5.12.

For the humid conditions, the specimens shall be stored for 7 days in a humid chamber, which shall be regulated at 30 ± 2°C and 90 ± 3 % humidity. After 7 days, the specimens shall be tested immediately.

For the immersed conditions, the specimens shall be placed in a water bath at 23 ± 2°C, large enough to hold the specimens. The specimens shall be placed horizontally but not resting flat on the bottom of the container. They shall be covered with 25 mm of water for 2 hours ± 2 minutes. After the elapsed time, the specimens shall be removed from the bath, and the surface and edges shall be wiped in order to eliminate the excess water. The specimens shall be tested immediately.

Expression of results

The mean diameter of indentation in mm for the respective condition (humid, immersed) D_{hum} and D_{imm} shall be stated in the ETA.

2.2.11 Static ductility of fasteners (staples, screws) in boards

Purpose of the assessment

Determination of static ductility of fasteners (staples, screws) in boards.

Assessment method

Test specimens

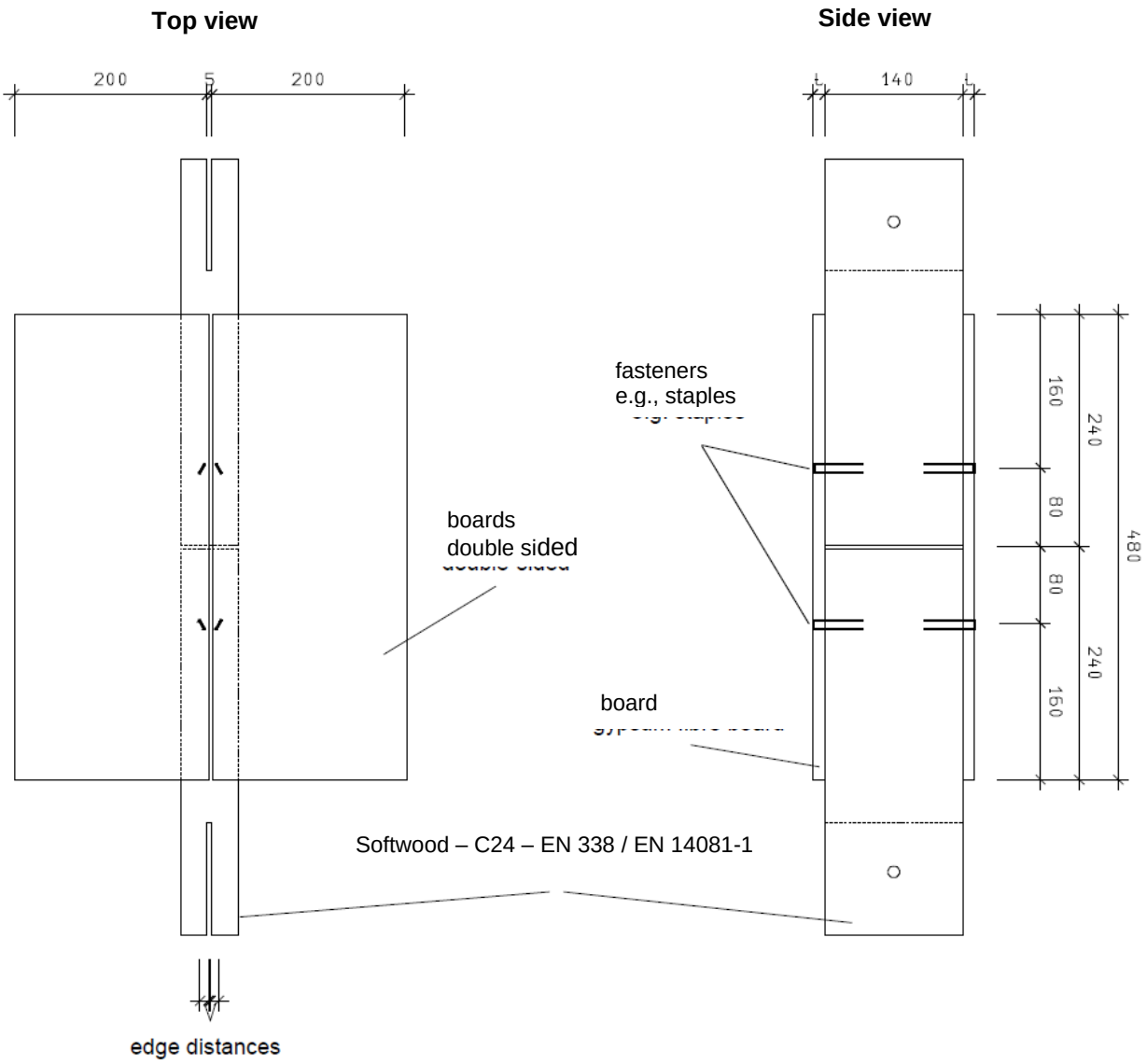
The minimum edge distances of different fasteners (staples, screws) shall be assessed on specimens given in Figure 2.2.11.1 and Figure 2.2.11.2, in a test device given in Figure 2.2.11.3.

Test specimens for each type of fastener in combination with different edge distances (for example minimum edge distance in accordance with EN 1995-1-1) shall be performed.
Specimens with double-sided panelling for each board thickness shall be tested.

At least three specimens of each combination of fastener diameter, edge distance and board thickness shall be tested.

The board materials are fixed centrally and parallel to the edges of the wooden support.

The test specimens shall be stored in the climatic chamber at 20 ± 2°C and 65 ± 5 % relative humidity until they reach constant mass[3].



Dimensions in mm

Figure 2.2.11.1: Test specimen of the fastener tests under stress of the fasteners parallel to the edge in top view and side view

3 The constant mass is considered to be reached when two consecutive weighings 24 hours apart differ by less than 0,1%.

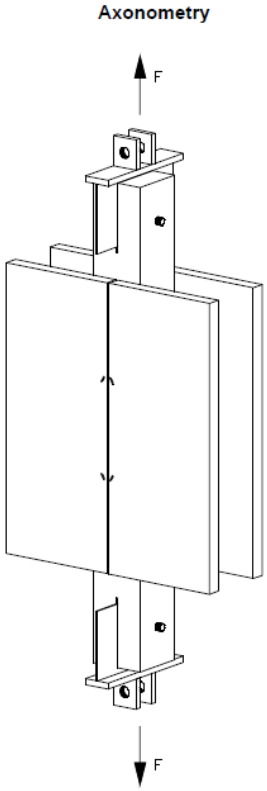


Figure 2.2.11.2: Test specimen of the fastener tests under stress of the fasteners parallel to the edge in axonometry

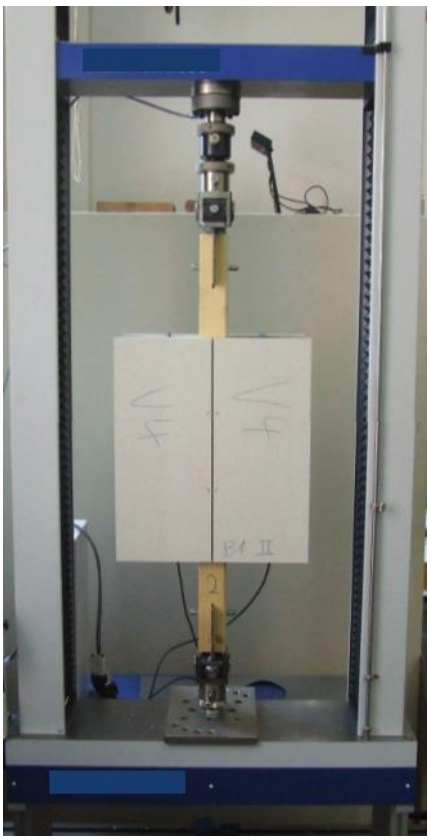


Figure 2.2.11.3: Device for testing the static ductility of fasteners in boards under stress of the fasteners parallel to the edge of the panel

Test procedure

The tests shall be carried out with the direction of force parallel to machine direction, taking into account the minimum edge distances.

The load-deformation behaviour shall be evaluated for all specimens under cyclic load. The load schedule and the load report of vertical loads shall follow the requirements of EN 12512 (Figure 2.2.11.4).

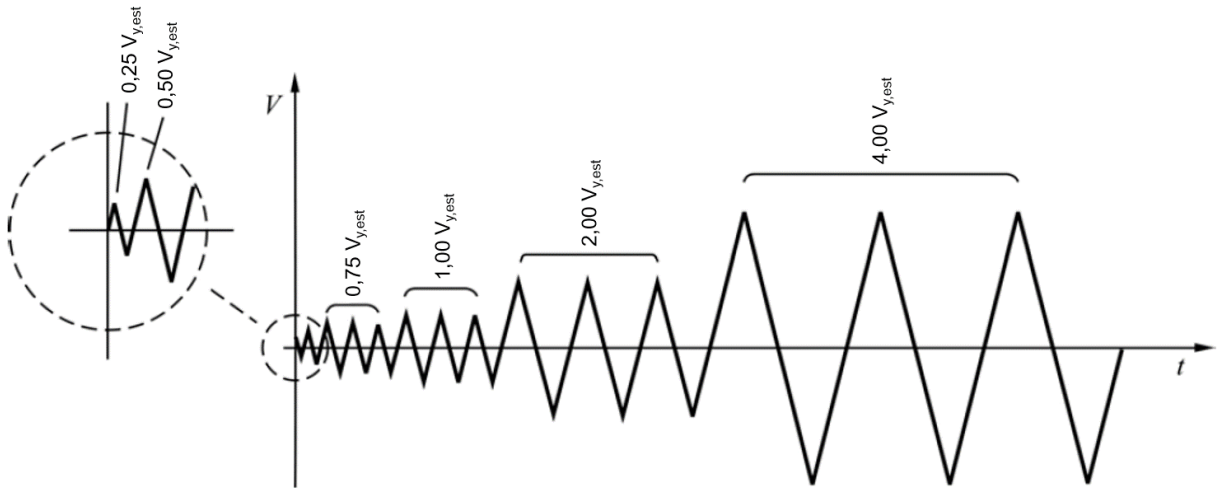


Figure 2.2.11.4: Method for cyclic testing (complete method) of EN 12512 with $V_{y,est}$ as estimated yield deformation.

Evaluation of test results

The 1st, 2nd and 3rd envelope curves (Figure 2.2.11.5) shall be derived from the method for cyclic testing of EN 12512 (Figure 2.2.11.4). The ultimate deformation V_u has been reached if one of the following criteria shown in Figure 2.2.11.6 applies:

1. Deformation cannot be increased due to sudden failure ($V_{u,a}$)
2. Load declines to 80 % of maximum load F_{max} of envelope curve 1 ($V_{u,b}$)
3. Degradation between the first and third cycle of one deformation level reaches 30 % ($V_{u,c}$)

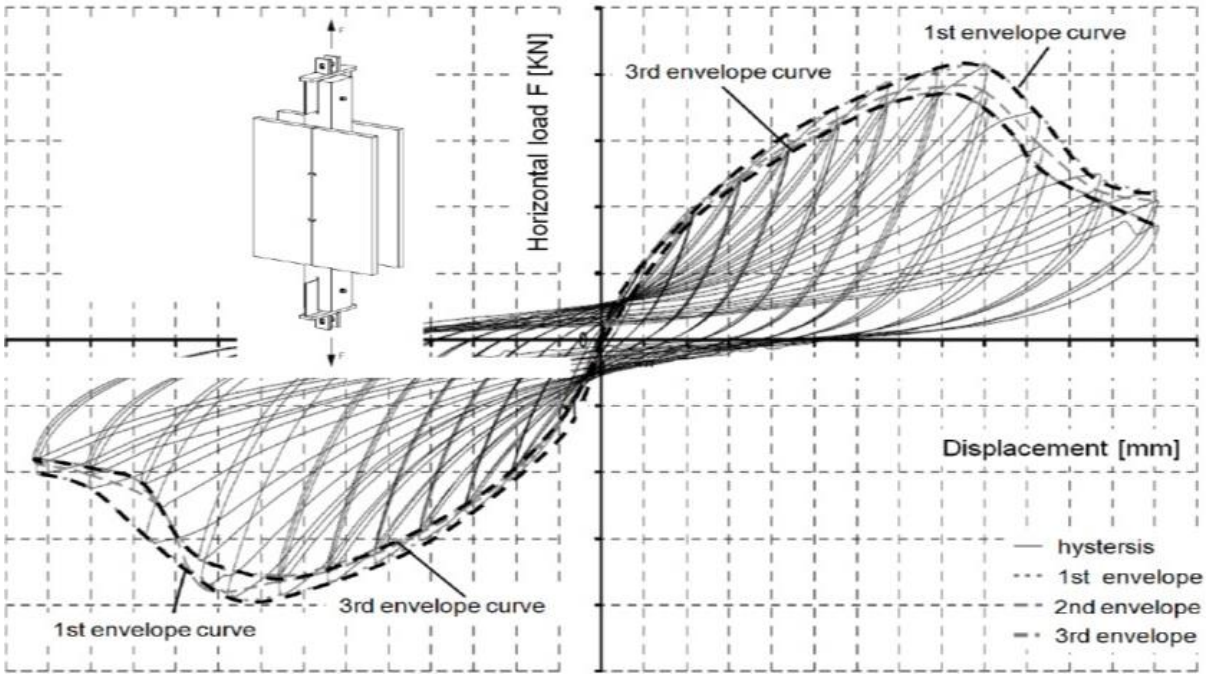


Figure 2.2.11.5: Envelope curves 1, 2 and 3 derived from cyclic loading schedule in Figure 2.2.11.4.

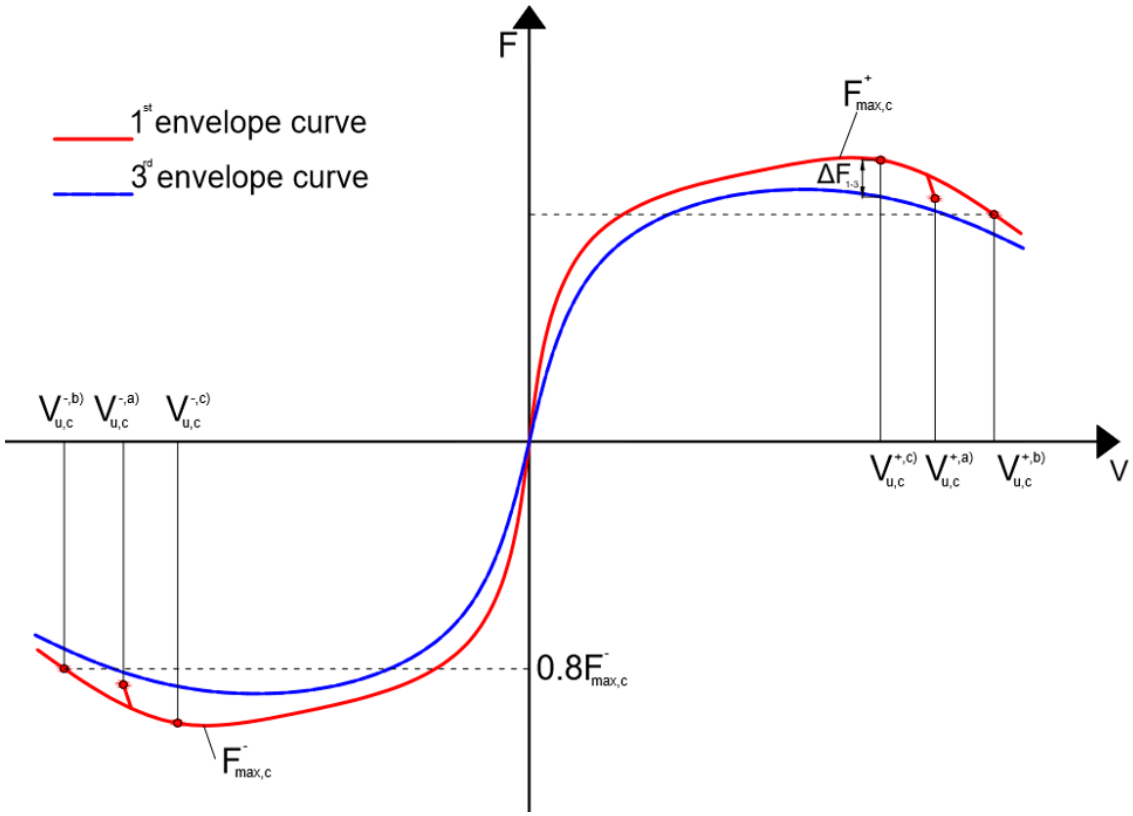


Figure 2.2.11.6: Definition of ultimate deformation V_u due to degradation (case 3), sudden failure (case 1) and load level reaches 80 % of F_{max} (case 2) of the 1st envelope curve

The displacements of the test specimen (see Figure 2.2.11.4) shall be monitored. Individual values with their relating deformation shall be stated.

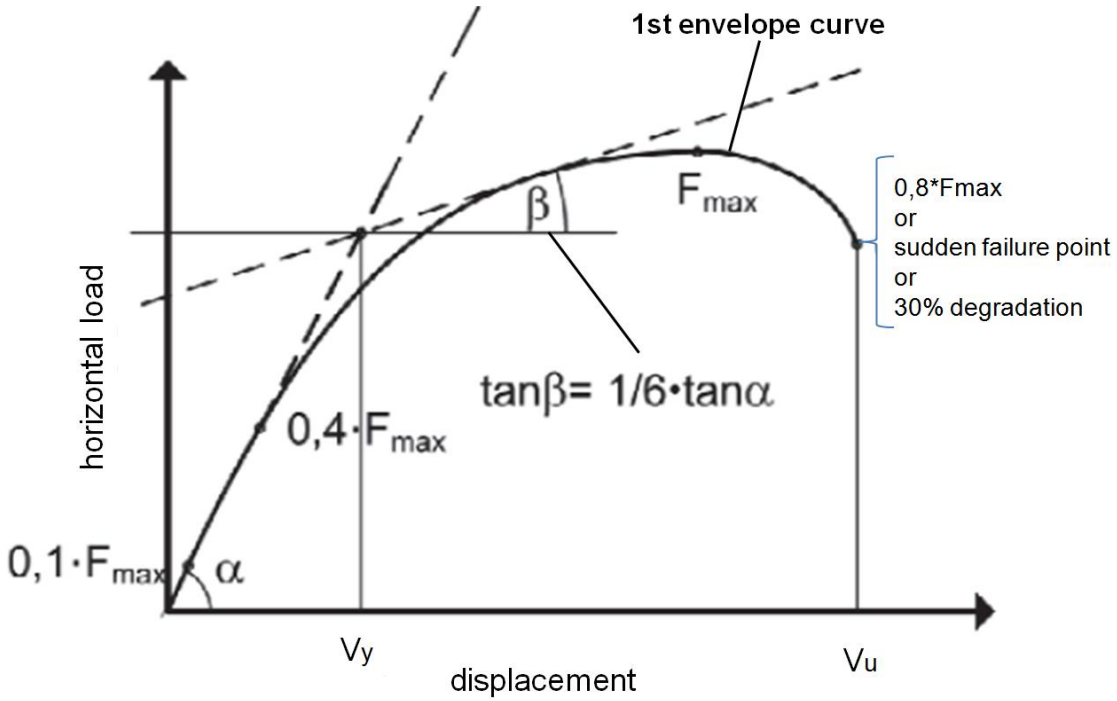


Figure 2.2.11.7: Determination of yield point F_{max} and V_u and V_y in accordance with EN 12512

In order to calculate the ductility factor μ, the lower value V_y shall be determined. EN 12512 defines this value as the intersection of a straight line between $0{,}1 \cdot F_{max}$ and $0{,}4 \cdot F_{max}$ and the secant which is a straight line with an ascend of 1/6 of the angle α (Figure 2.2.11.7).

The ductility factor μ shall be calculated by

$$\mu = V_u / V_y$$

The ductility factor μ shall be calculated as arithmetic average of individual values (separately) for each construction type.

Expression of results

The ductility factor μ [-] shall be stated in the ETA for each tested combination of fastener diameter, edge distance and board thickness together with the boundary conditions:

- thickness of the boards,
- characteristic and mean density of the boards,
- diameter of fasteners, and
- edge distance of fasteners.

2.2.12 Reaction to fire

The gypsum plasterboards are considered to satisfy the requirements for performance classes indicated in Table 2.2.11.1 of the characteristic reaction to fire in accordance with the Decision 2006/673/EC without the need for testing on the basis of it fulfilling the conditions set out in that Decision and its intended use being covered by that Decision.

Therefore, the performance of the product is indicated in Table 2.2.12.1.

Table 2.2.12.1 Classes of reaction to fire performance of gypsum plasterboards

Nominal board thickness (mm)	Gypsum core		Paper grammage (1) (g/m²)	Substrate	Class
	Density (kg/m³)	Reaction to fire class			
≥ 6,5 < 9,5	≥ 800	A1	≤ 220	Any wood-based product with density ≥ 400 kg/m³ or any product of at least class A2-s1, d0	A2-s1, d0
			> 220 ≤ 320		B-s1, d0
≥ 9,5	≥ 600		≤ 220	Any wood-based product with density ≥ 400 kg/m3 or any product of at least class A2-s1, d0 or any insulating product of at least class E-d2 mounted according to method 1 (see EN 520, Clause B.1.2)	A2-s1, d0
			> 220 ≤ 320		B-s1, d0
(1) Determined according to EN ISO 536 and with no more than 5 % organic additive content.					

When the gypsum plasterboards do not meet the provisions of the above-mentioned EC Decision, or when the product claims for a better performance, the gypsum plasterboards shall be tested, using the method(s) relevant for the corresponding reaction to fire class according to EN 13501-1, taking into account the provisions of EN 520, Clause 4.2.1. The gypsum plasterboards shall be classified according to the Commission Delegated Regulation (EU) No 2016/364 in connection with EN 13501-1.

The gypsum boards with mat reinforcement, expanded glass boards with fibrous reinforcement and gypsum fibre boards shall be tested, using the method(s) relevant for the corresponding reaction to fire class according to EN 13501-1. The boards shall be classified according to the Commission Delegated Regulation (EU) No 2016/364 in connection with EN 13501-1.

For the testing in accordance with EN 13501-1 the mounting and fixing of the specimens shall be done in accordance with EN 15283-2, Clause 4.2.1 and Annex B, for the gypsum fibre boards, and EN 15283-1, Clause 4.2.1 and Annex B, for the gypsum boards with mat reinforcement and expanded glass boards with fibrous reinforcement.

The reaction to fire class shall be given in the ETA together with those conditions for which the classification is valid.

2.2.13 Moisture absorption

Purpose of the assessment and assessment method

For determination of the moisture absorption of the gypsum boards with mat reinforcement, at least 10 specimens used for determination of bending strength in humid conditions shall be used. Specimens shall be weighted at initial stage m_{init} (climatic conditions of 23 ± 2°C and 50 ± 5% humidity) and after 7 days storage in a humid chamber m_{hum}, which is regulated at 30 ± 2°C and 90 ± 3% humidity.

The moisture absorption shall be calculated as: $\frac{m_{hum}-m_{init}}{m_{init}} \cdot 100$ in %.

Expression of results

Moisture absorption of the boards shall be stated in the ETA in %.

2.2.14 Air permeability

Purpose of the assessment and assessment method

Determination of air permeability of the boards shall be performed by testing according to EN 12114, Clause 7.2.2. The test pressure shall be chosen from the default values in EN 12114, Annex A.

The test set-up shall consist of a board with a test-surface of 1 m². The board shall not contain joints or other paths for possible air passage. This board shall be fixed with wooden battens and fasteners to a covering frame made from 3 layers of plywood with a thickness greater than 27 mm. Air sealing around the edges shall be done with a special sealing tape. For determination of the reference measurement a test set-up of 3 layers of plywood shall be mounted in identical way.

The air volume flow $\dot{V}$ [m³/s] shall be determined from the difference between the reference measurement without board and the measurement with board.

The flow coefficient C and flow exponent n [-] shall be assessed from the air volume flow according to EN 12114, Clause 8.4 and Annex B.

Expression of results

Air permeability shall be stated in the ETA as flow coefficient C [$m^3/s\ Pa^n$] and flow exponent n [-].

2.2.15 Coefficient of thermal expansion

Purpose of the assessment and assessment method

Determination of coefficient of thermal expansion of the expanded glass boards with fibrous reinforcement shall be performed by testing according to EN ISO 18099 under climatic conditions of 23 ± 2°C and 50 ±

5 % humidity at the beginning of the test. The temperature range depends on the application. In the case of anisotropic materials, the assessment shall be performed in direction of production (machine direction) as well as perpendicular to direction of production (cross direction). The dimensions of the specimens shall be l x w x h = (50 ± 1) mm x (10 ± 1) mm x (10 ± 1) mm. Two specimens shall be tested.

The coefficient of thermal expansion T shall be calculated as arithmetic average of the results of both tests.

Expression of results

Coefficient of thermal expansion T [K] shall be stated in the ETA together with the temperature range, for which the coefficient of thermal expansion has been determined.

2.2.16 Mould resistance

Purpose of the assessment and assessment method

The mould resistance of the boards shall be assessed according to Annex E (reference method), or alternatively according to Annex C.

Expression of results

The growth of fungus as well as mould growth after 28 days shall be stated in the ETA together with the chosen assessment method according to:

- Annex E.8 as identified rating 0 (≥ 50 % fungal surface coverage) to 10 (no fungal growth) or
- Annex C.8 as identified scale 0 (no apparent growth) to 3 (covering more than 25 % of the tested surface).

3 ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCE

3.1 System(s) of assessment and verification of constancy of performance to be applied

For the products covered by this EAD the applicable European legal act is Commission [Delegated] Decision 95/467/EC, as amended by Commission Decisions 2001/596/EC, 2002/592/EC and 2010/679/EU.

The applicable AVCP system is 3 for any use except for uses subject to regulations on reaction to fire.

For uses subject to regulations on reaction to fire the applicable AVCP systems regarding reaction to fire are 1, or 3, or 4 depending on the conditions defined in the said Decision.

3.2 Tasks of the manufacturer

The cornerstones of the actions to be undertaken by the manufacturer of the product in the procedure of assessment and verification of constancy of performance are laid down in Table 3.2.1.

Table 3.2.1 Control plan for the manufacturer; cornerstones

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Factory production control (FPC) [including testing of samples taken at the factory in accordance with a prescribed test plan]					
1	Visual inspection of boards	According to Control plan	According to Control plan	100 %	continuous
2	Thickness of boards - gypsum plasterboards - gypsum boards with mat reinforcement - expanded glass boards with fibrous reinforcement - gypsum fibre boards	 EN 520, 5.4 EN 15283-1, 5.4 EN 15283-1, 5.4 EN 15283-2, 5.4	 EN 520, 4.9.2.3 EN 15283-1, 4.7.3 EN 15283-1, 4.7.3 EN 15283-2, 4.7.3	 EN 520, 5.4 EN 15283-1, 5.4 EN 15283-1, 5.4 EN 15283-2, 5.4	for every type of board after onset of production
3	Density of boards - gypsum plasterboards - gypsum boards with mat reinforcement - expanded glass boards with fibrous reinforcement - gypsum fibre boards	 EN 520, 5.11 EN 520, 5.11 EN 15283-2, 5.10 EN 15283-2, 5.10	 EN 520, 4.13 EN 520, 4.13 According to Control plan According to Control plan	 EN 520, 5.11 EN 520, 5.11 EN 15283-1, 5.10 EN 15283-2, 5.10	for every type of board after onset of production
4	Water vapour permeability of boards - gypsum plasterboards - gypsum boards with mat reinforcement	 EN ISO 12572 EN ISO 12572	 EN 520, 4.11 EN 520, 4.11	 3 3	1/year

5	Bending strength and E-modulus of boards regarding mechanical actions perpendicular to the board - gypsum plasterboards - gypsum boards with mat reinforcement (service classes 1 and 2) - gypsum boards with mat reinforcement - type H1 (service class 3) - expanded glass boards with fibrous reinforcement - gypsum fibre boards	 EN 520, 5.7 EN 15283-1, 5.6 In addition: Clause 2.2.1.2 EN 15283-1, 5.6 EN 15283-2, 5.10	 According to Control plan According to Control plan According to Control plan According to Control plan According to Control plan	 3 3 3 3 3	 for every type of board after onset of production and for every condition
6	Content of organic additives (paper liners, core, mat, board)	According to Control plan	According to Control plan	According to Control plan	1/year
7	Reaction to fire	Reaction to fire is ensured by control of - Thickness of boards; - Density of boards; - Content of organic additives in the paper liners, core, mat, board; - Mass per unit area of paper liners, mat; - Thickness of mat.	According to Control plan	According to Control plan	According to Control plan

3.3 Tasks of the notified body

The cornerstones of the actions to be undertaken by the notified body in the procedure of assessment and verification of constancy of performance for the boards are laid down in Table 3.3.1.

The intervention of the notified body under AVCP system 1 is only necessary for reaction to fire for products/materials for which a clearly identifiable stage in the production process results in an improvement of the reaction to fire classification (for example an addition of fire retardants or a limiting of organic material).

Table 3.3.1 Control plan for the notified body; cornerstones

No	Subject/type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Initial inspection of the manufacturing plant and of factory production control *(for system 1 only)*					
1	Notified Body will ascertain that the factory production control with the staff and equipment are suitable to ensure a continuous and orderly manufacturing of the "***boards***".	Verification of the complete FPC as described in the control plan agreed between the TAB and the manufacturer	According to Control plan	According to Control plan	When starting the production or a new line
Continuous surveillance, assessment and evaluation of factory production control *(for system 1 only)*					
2	The Notified Body will ascertain that the system of factory production control and the specified manufacturing process are maintained taking account of the control plan.	Verification of the controls carried out by the manufacturer as described in the control plan agreed between the TAB and the manufacturer with reference to the raw materials, to the process and to the product as indicated in Table 3.2.1	According to Control plan	According to Control plan	1/year

4 REFERENCE DOCUMENTS

EAD 070001-01-0504	Gypsum plasterboards for load-bearing applications
EN 318:2002	Wood based panels – Determination of dimensional changes associated with changes in relative humidity
EN 338:2016	Structural timber – Strength classes
EN 383:2007	Timber structures – Test methods – Determination of embedment strength and foundation values for dowel type fasteners
EN 520:2004+A1:2009	Gypsum plasterboards – Definitions, requirements and test methods
EN 594:2011	Timber structures – Test methods – Racking strength and stiffness of timber frame wall panels
EN 789:2004	Timber structures – Test methods – Determination of mechanical properties of wood-based panels
EN 1128:1995	Cement-bonded particleboards – Determination of hard body impact resistance
EN 1156:2013	Wood based panels – Determination of duration of load and creep factors
EN 1383:2016	Timber structures – Test methods – Pull through resistance of timber fasteners
EN 1995-1-1:2004+A1:2006+A2:2014	Eurocode 5 – Design of timber structures – Part 1 1: General – Common rules and rules for buildings
EN 12114:2000	Thermal performance of buildings – Air permeability of building components and building elements – Laboratory test method
EN 12512:2001+A1:2005	Timber structures – Test methods – Cyclic testing of joints made with mechanical fasteners
EN 13111:2010	Flexible sheets for waterproofing – Underlays for discontinuous roofing and walls – Determination of resistance to water penetration
EN ISO 18099:2022	Thermal insulating products for building equipment and industrial installations – Determination of the coefficient of thermal expansion (ISO 18099:2022)
EN 13501-1:2018	Fire classification of construction products and building elements – Part 1: Classification using data from reaction to fire tests
EN 13964:2014	Suspended ceilings – Requirements and test methods
EN 14081-1:2016+A1:2019	Timber structures – Strength graded structural timber with rectangular cross section – Part 1: General requirements
EN 14358:2016	Timber structures – Calculation of characteristic 5-percentile values and acceptance criteria for a sample
EN 15283-1:2008+A1:2009	Gypsum boards with fibrous reinforcement - Definitions, requirements and test methods - Part 1: Gypsum boards with mat reinforcement
EN 15283-2:2008+A1:2009	Gypsum boards with fibrous reinforcement - Definitions, requirements and test methods - Part 2: Gypsum fibre boards
EN ISO 536:2020	Paper and board – Determination of grammage
EN ISO 12572:2016	Hygrothermal performance of building materials and products - Determination of water vapour transmission properties - Cup method (ISO 12572:2016)

ANNEX A – DETERMINATION OF BENDING STRENGTH AND BENDING MODULUS OF ELASTICITY

A.1 General

The bending strength and the bending modulus of elasticity perpendicular to the plane of the board and in plane of the board shall be determined parallel and perpendicular to the production direction under climatic conditions of 20 ± 2°C and 65 ± 5% humidity.

A.2 Specimen preparation

From the boards the below given number of perpendicular board strips per production direction shall be cut off having the dimensions listed below. The cutting edges shall be placed perpendicular to the plane of the board. When cutting the specimens, a minimum distance of 100 mm off the edge and 100 mm away from the next specimen shall be kept. The specimens shall be marked.

Number of specimens:

- 30 pieces / production direction for gypsum plasterboards, gypsum boards with mat reinforcement, and gypsum fibre boards, or
- minimum 5 pieces / production direction for expanded glass boards with fibrous reinforcement.

Dimensions: w x L x H.

Table A.2.1: Dimensions for specimen preparation

	Width w	Span l_A	Length L	Height H
	mm	mm	mm	mm
Bending perpendicular to the plane of the board	400	40 x t	l_A + 100	t
Bending in plane of the board	t	20 x t	l_A + 100	3 x t
t … nominal thickness of the boards				

A.3 Assembly of the tester

For bending tests perpendicular to the plane as well as in plane of the board, strips according to Clause A.2 shall be placed in a bending test machine. The test load is applied in the middle of the span via a rounded loading equipment (radius between 3 mm and 15 mm) and depending on the production direction placed parallel or perpendicular to the direction of production.

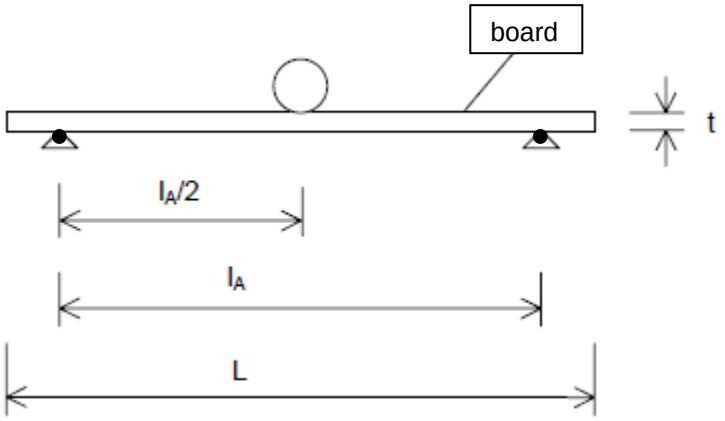


Figure A.3.1: Assembly of the tester

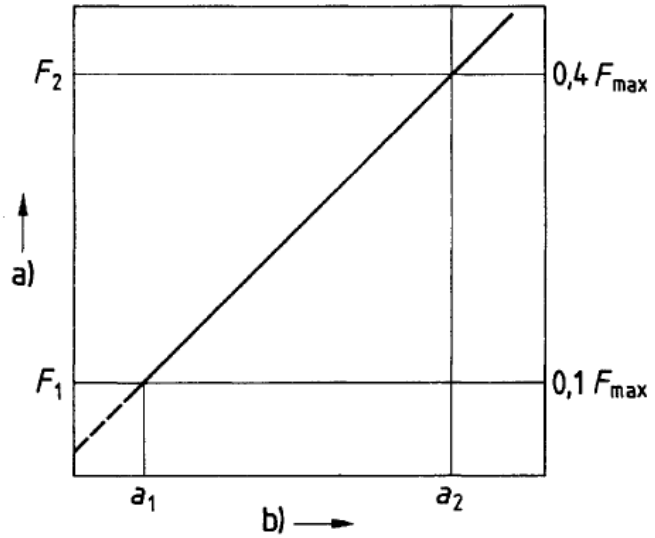
A.4 Bending test

The load F is applied at a constant rate of loading so that the maximum load is achieved within (300 ± 120) s. Hereby, the mean value is about 300 s for one specimen. The load-displacement curve shall be recorded continuously until the ultimate load F_{max} is reached.

The bending strength and the bending modulus of elasticity perpendicular to the plane of the board and in plane of the board shall be determined from:

$$f_m = \frac{3F_{\max} l_A}{2wH^2}$$

$$E_m = \frac{l_A^3 (F_2 - F_1)}{4wH^3 (a_2 - a_1)}$$



a) load F
b) displacement a

Figure A.4.1: Bending test

ANNEX B – DETERMINATION OF DEFORMATION AND MODIFICATION VALUES

B.1 Specimen preparation

From the boards 6 board strips per load level shall be cut off having the dimensions listed below. The cutting edges shall be placed perpendicular to the plane of the board. When cutting the specimens, a minimum distance of 100 mm off the edge and 100 mm away from the next specimen shall be kept. The specimens shall be marked.

Number of specimens: 6 pieces / per load level and climatic conditions.
Dimensions: w x L x H.

Table B.1.1: Dimensions for the specimen preparation for determination of deformation and modification values

	Width w mm	Span l_A mm	Length L mm	Height H mm
4 point bending with dead load	50	570	l_A + 50	t
t … nominal thickness of the boards				

B.2 Assembly of the tester

The board strips shall be placed in an assembly on which the dead load g is set up in a 4-point bending test.

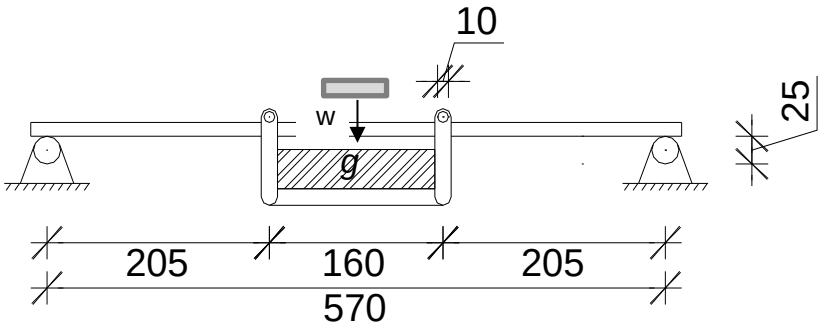
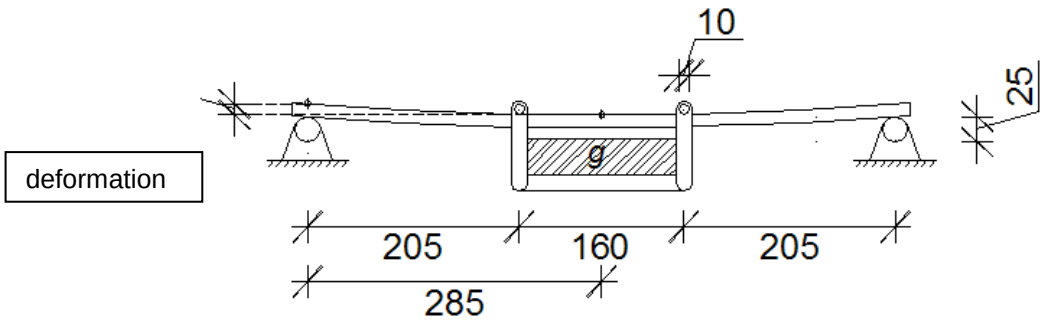


Figure B.2.1: Measurement of global deformations (deflection w) in the middle of the specimens



All dimensions in the figures are in mm.

Figure B.2.1: 4-point bending test assembly with dead load g

B.3 Service class 1 and service class 2 according to EN 1995-1-1

Step 1 (short-term load-duration)

The load-bearing capacity of the boards under normal climatic conditions of 20 ± 2°C and 65 ± 5% relative humidity and humid climatic conditions of 20 ± 2°C and 85 ± 5% relative humidity shall be determined according to EN 1156, Clause 6.3.

The results are short-term strength values, arranged according to increasing strength within each service class. From these values, ratios are calculated for different climate conditions related to different service classes:

$$R_{SC1} = \frac{1}{n}\sum_{i=1}^{n}\frac{f_{vr,SC1}}{f_{vr,SC1}} = 1 \qquad R_{SC2} = \frac{1}{n}\sum_{i=1}^{n}\frac{f_{vr,SC2}}{f_{vr,SC1}} = 1$$

with

SCX environmental conditions related to service class X
i index of specimen
f_{vr} bond shear strength
n number of samples.

Step 2 (long-term load-duration)

The influence of the duration of load under normal climatic conditions of 20 ± 2°C and 65 ± 5% relative humidity and humid climatic conditions of 20 ± 2°C and 85 ± 5% relative humidity shall be evaluated according to EN 1156, Clause 6.4.

For evaluation of k_{mod} testing of at least 5 different load levels (for example 90, 80, 70, 50, 30 %) below the maximum load is required according to EN 1156, Clause 6.4. The time-deformation plot till rupture shall be recorded.

Calculation of modification values shall be performed starting from an approximation of the time till rupture in $\log_{10}$–load level plot, see Clause 7.1 in EN 1156 for each tested service class. This approximation is the basis for calculation of the k_{mod} value each service class and the load duration classes according to Table 2.1 of EN 1995-1-1. Hereby, the following time shall be used for the respective load duration classes: permanent = 50 years, long-term = 10 years, medium-term = 6 months, short term = 1 week, instantaneous = 1 minute.

The k_{mod} values are determined as

$$k_{mod,SCX} = R_{SCX} \cdot k_{d,SCX,LDY}$$

with

SCX environmental conditions related to service class X
LDY load duration, Y = 50 years, 10 years, 6 months, 1 week or 1 minute, respectively.

Evaluation of k_{def} is performed using the approximation of the time-deformation plots at a load level of 30 % after 50 years according to Clause 7.2 Formula (4) of EN 1156 by $k_{c,50y} = (a_{50y}-a_1)/(a_1-a_0)$. Determination of k_{def} shall follow Equation (2.3) of EN 1995-1-1 with $k_{c,50y} = u_{fin}/u_{inst}$ as $k_{def} = k_{c,50y} - 1$.

The numeric values for k_{mod} and k_{def} shall be stated in the ETA for the tested service classes and duration of load.

B.4 Service class 3 according to EN 1995-1-1

Step 1 (short-term load-duration)

The load-bearing capacity of the boards under normal climatic conditions of 20 ± 2°C and 65 ± 5% relative humidity and humid climatic conditions of 20 ± 2°C and 85 ± 5% relative humidity plus exposure to sprinkled water for outdoor exposure without permanent contact to water shall be determined. The exposure to sprinkled water shall happen every 6 hours for 15 minutes with a water quantity of 2,4 l/min until constant mass is reached. The surface of the specimen shall be completely covered with a water layer.

Step 2 (long-term load-duration)

The influence of the duration of load under normal climatic conditions of 20 ± 2°C and 65 ± 5% relative humidity and humid climatic conditions of 20 ± 2°C and 85 ± 5% relative humidity plus exposure to sprinkled water for outdoor exposure without permanent contact to water shall be evaluated. The exposure to sprinkled water shall happen every 6 hours for 15 minutes with a water quantity of 2,4 l/min. The surface of the specimen shall be completely covered with a water layer.

Evaluation of k_{mod} and k_{def} according to Clause B.3, Step 2.

ANNEX C – DETERMINATION OF MOULD RESISTANCE OF THE BOARDS

C.1 Testing principle

The specimens of boards shall be inoculated with 7 species of mould spores and exposed for 28 days in a climatic chamber set at 28 ± 2 °C and 95 ± 5 % relative humidity. The preparation of the medium with spores is performed in 2 configurations:

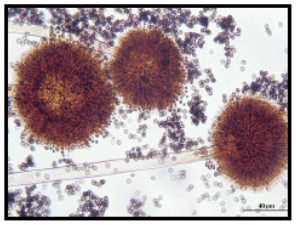
- Biodegradability test: This minimal medium solution without carbon does not allow mould growth. Only moulds able of degrading the material can grow.
- Fungicidity test: This complete medium solution contains additional carbon, which allows the growth of mould excepted if an efficient fungicide is present in the material.

After inoculation operation (D0), the specimens shall be observed and photographed at D+5, D+10, D+14, D+21 and D0+28 (days).

C.2 Moulds reference

The mould spores shall be identified hereafter. A description of each strain is made below:

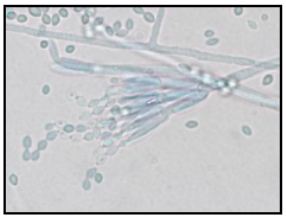
Aspergillus niger CBS 13152



Minimum temperature for growth: 6-8ºC; Optimum temperature for growth: 35-37ºC; Maximum temperature for growth: 45-47ºC; Minimum a_w (activity water): 0.77 at 35ºC

Aspergillus niger is a common contaminant of many substrates. Its preferred habitat is food and building interiors. Several types of diseases are caused by *Aspergillus niger*: mycoses of the external ear, lung aspergillosis, etc.

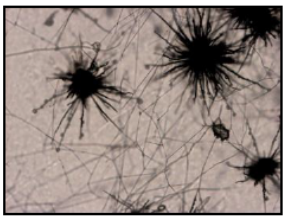
Penicillium funiculosum IP12792



Minimum temperature for growth: 8ºC; Optimum temperature for growth: 30ºC; Maximum temperature for growth: 42ºC; Minimum a_w (activity water): 0.90 at 25ºC and 30ºC

This species can sometimes be found in indoor environments..

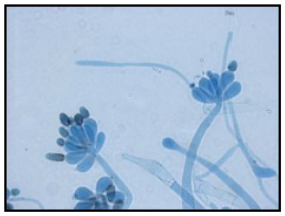
Chaetomium globosum CBS 14851



Minimum temperature for growth: 4ºC; Optimum temperature for growth: 28ºC; Maximum temperature for growth: 38ºC,Minimum A_w (activity water): 0.94 at 25ºC

This species is isolated of agricultural products than cereal, rice... It can develop on several products with cellulose like paper.

Stachybotrys chartarum IP 142082



Minimum temperature for growth: 2-7°C; Optimum temperature for growth: 23-27°C; Maximum temperature for growth: 36°C; Minimum a_w (activity water): 0.90- 0.95 at 25°C

Stachybotrys chartarum is present in many regions of the world. This species is found in wallpapers, gypsum, soil, dead plants, etc. These conidia produce many toxic metabolites and can be responsible for serious lung impairments.

Cladosporium sphaerospermum CBS 833344

Minimum temperature for growth: germination is possible at 5°C; Optimum temperature for growth: no information; Maximum temperature for growth: no growth at 37°C; Minimum a_w (activity water): 0.97 at 25°C but could develop slowly, up to a_w 0.815.

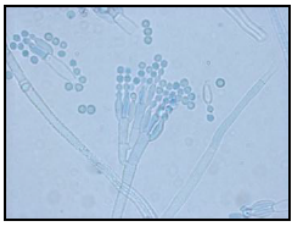
This common species is present in all the regions of the world. It can be found in air, soil, grains, paint, textiles…

Alternaria alternata CBS 119115

Minimum temperature for growth: -5°C; Optimum temperature for growth: 25°C; Maximum temperature for growth: 36°C; Minimum a_w (activity water): 0.88 - 25°C

Alternaria alternata conidia are pluri-cellular. This is a common saprophyte species found in many types of plants (with a preference for dead vegetal matter), soils and ground surfaces (often humid). This species can be responsible for skin lesions from wounds in immuno-deficient patients. Cases of invasive mycoses have been found in certain Aids patients.

Penicillium viridicatum CBS 753044



Minimum temperature for growth: -2°C; Optimum temperature for growth: 30°C; Maximum temperature for growth: 36°C; Minimum a_w (activity water): 0.80 at 23 and 25°C.

The preferred habitat of this species is cereals.

C.3 Media used for strains culture

The following media shall be used for the strains culture:

- Medium MEAc for all strains excepting *Alternaria alternata* and *Chaetomium globosum*
- Medium Oac for *Chaetomium globosum*
- Medium SNA for *Alternaria alternate.*

The media shall be sterilized at 120 ± 1°C for 20 ± 1 minute in an autoclave. Moulds shall be growing at 25 ± 1°C for a maximum period of 4 weeks.

C.4 Media used for testing

The media used for the tests may be mineral

- minimal medium without carbon source
- complete medium.

These media shall be either liquid for the preparation of the suspension or solid. In this case, they shall be solidified with purified agar (15 g/l). Furthermore, chloramphenicol is added to prevent bacterial parasite development.

Minimal medium

Minimal medium is used to prepare the conidial suspension for **the biodegradability test**: This mineral solution without carbon does not allow mould growth. Only mould able of degrading the material can grow.

Composition:
NH_4NO_3 (1 g/L); KH_2PO_4 (0,7 g/L); K_2HPO_4 (0,7 g/L); $MgSO_4$, $7H_2O$ (0,7 g/L); $FeSO_4$, 7 H_20 (0,01 g/L); NaCl (0,005 g/L); $MnSO_4$ H2O (0,001 g/L); $ZnSO_4$ 7 H2O (0,002 g/L); chloramphenicol (0,1 g/L). Add distilled water to reach a final volume of 1L. pH-value shall be between 6 and 6,5. It is sterilized at 120 ± 1°C for 20 ± 1 minutes in the autoclave.

Complete medium

Complete medium is used to prepare the conidial suspension used for **the fungicidity test.** This solution with organic carbon allows the growth of mould including xerophylic ones if the material does not contain antifungal product.

Composition:
KH_2PO_4 (1 g/L); $MgSO_4$, $7H_2O$ (0,5 g/L); peptone (5 g/L); Glucose (10 g/L); glycerol (220 g/L); chloramphenicol (0,1 g/L). Add distilled water to reach a final volume of 1L. pH-value shall be 5,6. It is sterilized at 120 ± 1°C for 20 ± 1 minutes in the autoclave.

C.5 Preparation of the conidia for experimental contaminations

The moulds shall be incubated for 25 days at 25 ± 0,5°C to obtain conidiation. Day and night periods shall be alternated.

The suspension of conidia is performed extemporaneously.

Conidia is collected from fungal cultures on a solid medium by scraping the surface of the mould with 5 ml of minimal medium and wetting agent. The conidial suspension is collected. This manipulation is repeated 3 times. The suspension of fungal spores of each culture is agitated with glass beads and filter through glass wool to remove mycelial fragments.

The suspension is centrifuged for 5 minutes at 10000 rpm at 4°C and the pellet is taken up in suspension in 25 ml of minimal medium for washing. Centrifugation takes place for 5 more minutes in the same conditions. The pellet is suspended in 50 ml of minimal medium and split in 2 volumes of 25 ml. After a new centrifugation, the pellets shall be suspended in 25 ml of minimal medium or in 25 ml of complete medium.

For each strain, the conidial suspension is then adjusted at 10^6 cells / ml.

The final suspension is composed of a mixture of conidial suspensions of the 7 moulds, calibrated with complete or minimal solution.

C.6 Controls of viability of conidian suspension

The following controls groups shall be prepared and inoculated in the same conditions as the different specimens:

- Suspension control group: inoculation of the complete medium with a suspension of spores to verify their growth.
- Control group without inoculation of mould spores to verify the absence of external contamination on the specimens.
- Filter paper control group with inoculation of the spore suspension to verify the viability of the inoculated mould spores. The paper inoculated with the minimum suspension is used as a source of carbon allowing spore germination and mycelium growth.

C.7 Test procedure

The specimens shall be cut into specimen of 80 x 80 mm and spores of seven moulds shall be inoculated on the surface of the specimens by spraying (around 0,5 ml).
Each test is done in triplicate to validate the experiment's reproducibility.

The various types of specimens shall be then inoculated for 28 days at 28°C temperature and > 95 % relative humidity (without runoff to avoid washout).

Once the inoculation operation is completed (D0), the specimens shall be observed and photographed at D0+5, D0+10, D014, D0+21 and D0+28 days.

C.8 Expression of the results

The levels of mould growth shall be assessed and stated in the ETA in the following scale:

0 = No apparent growth observed with the naked eye or the microscope.
1 = Almost invisible growth with the naked eye but clearly visible under the microscope.
2 = Quite visible growth with the naked eye but covering less than 25 % of the tested surface.
3 =Visible growth with the naked eye, covering more than 25 % of the tested surface.

ANNEX D – DETERMINATION OF DIMENSIONAL VARIATIONS ASSOCIATED WITH CHANGES IN RELATIVE HUMIDITY

D.1 Specimen preparation

3 specimens 80 mm x 280 mm (for industrial boards at 200 mm off the edge) shall be cut in direction of production as well as perpendicular to direction of production. The centre is marked on the two opposite edges of the width as shown in Figure D.1.1.

Figure D.1.1: Marking of the centre and inserts

A hole is drilled with concrete drill bit 4 mm at the centre and a depth of 8 mm. Glue and insert shall be introduced immediately.

Prior to testing the specimen shall be stored at 23 ± 2°C and 50 ± 5% relative humidity in a climatic chamber until equilibrium. Equilibrium is reached at constant mass which is defined as two successive weighing 24h apart, differing by less than 0,1 %.

D.2 Test procedure

Dimensional variations shall be measured in a measuring device, see Figure D.2.1, according to the following conditioning protocol:

- 3 cycles: each cycle consists of: 2h water immersion / 7 days 23 ± 2°C and 50 ± 5% relative humidity.

Figure D.2.1: Measuring device for dimensional variation, upper and lower contact elements ballpoint and standard bar

Before measuring the length, the equipment shall be calibrated using a 280 mm standard bar before each series. Identify the high side of the specimen at the first measurement, to make the following measurement in the same direction.

The following procedure shall be followed:

- Turn the bar on its axe for stabilize the values (always in same direction)
- Weigh the specimen
- Put the specimen on the measuring device for dimensional variation,
- Record the value read on the measuring device for dimensional variation
- Return the specimen in its conditioning.

Record the dimension values and mass for 3 weeks, according to Table D.2.1 below.

Table D.2.1: Plan and conditions for the determination of dimensional variations associated with changes in relative humidity

Condition		Cycle 1								Cycle 2			
		Day 1		Day 2	Day 3	Day4	Day5	Day 6	Day 7	Day 8		Day 9	…
		Initial 23°C 50%rH	After 2h immersion	23°C 50% rH						23°C 50%rH	After 2h immersion	23°C 50% rH	…
	value	X_{ini} ; m_{ini}	X_{im} ; m_{im}	X_2 ; m_2	X_3 ; m_3	X_4 ; m_4	X_5 ; m_5	X_6 ; m_6	X_7 ; m_7	X_8 m_8	X_{8im} m_{8im}	X_7 ; m_7	…

X = Value of specimen (mm); M = mass of specimen

D.3 Results

After each record and each specimen, the dimensional variations and mass variations shall be calculated according to the following equations:

Dimensional variations (mm/m):

$$\frac{\Delta L}{L} = 1000 * \left[{(X - X_{ini})}/{(B_{etalon\_} + X_{ini})} \right]$$

$\frac{\Delta L}{L}$ = Dimensional variation (mm/m)
X_{ini} = initial value of specimen (23 ± 2°C and 50 ± 5% relative humidity) (mm)
X = Value of specimen (mm)
B_{etalon} = dimension of standard bar (mm).

Mass variations (%)

$$\frac{(M - M_{ini})}{M_{ini}} * 100$$

M_{ini} = initial mass
M = mass of specimen.

For each timing, the average value of the 3 specimens, in direction of production as well as perpendicular to direction of production (see example graph below).

Final Result is the total amplitude between the minimum and maximum value after the 3 cycles (see example in Figure D.3.1).

- Size variations (maximum-minimum) (mm/m)

- Mass Variations (maximum-minimum) (%).

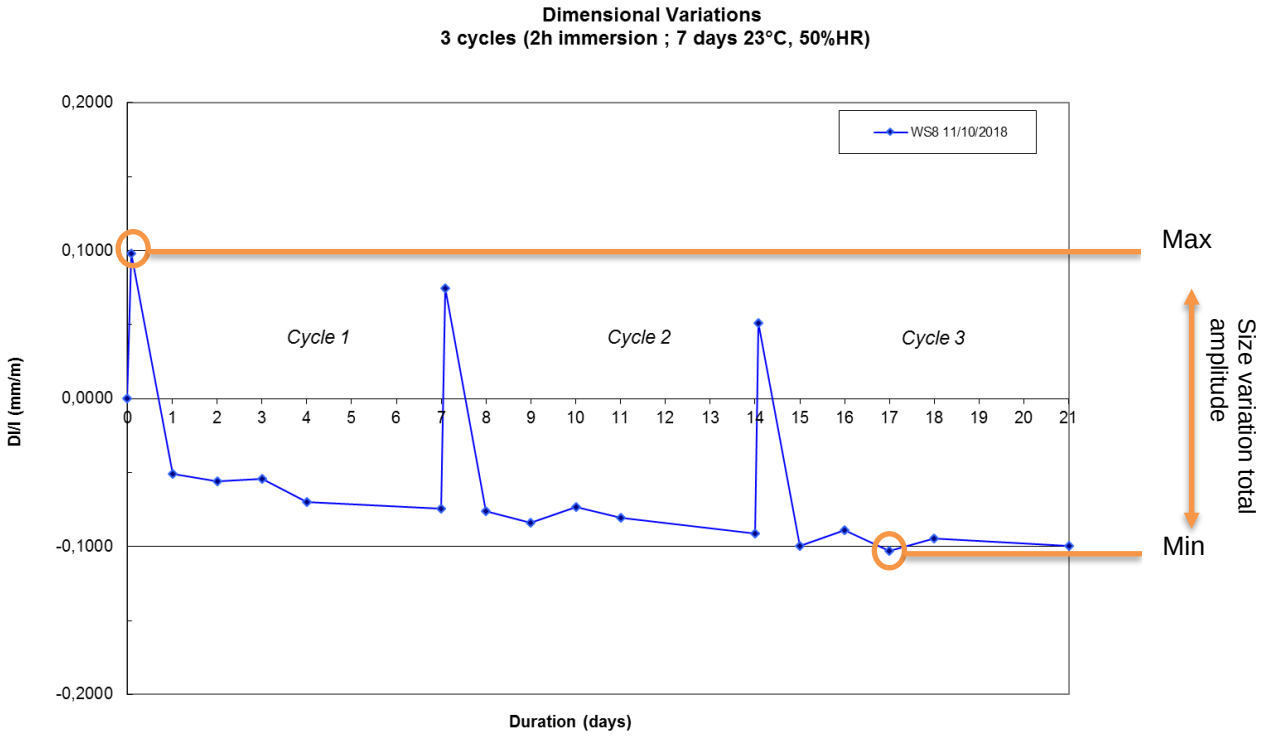


Figure D.3.1: Example of dimensional variations given as total amplitude between the minimum and maximum values after 3 cycles

ANNEX E – RESISTANCE TO GROWTH OF MOULD ON THE SURFACE OF BOARDS IN AN ENVIRONMENTAL CHAMBER (ASTM-METHOD)

E.1 Testing principle

The specimens shall be suspended above a bed of spore-inoculated soil within a chamber kept at high humidity.

The board specimens shall be inoculated with 3 species of mould spores and exposed for 4 weeks in a climatic chamber set at 32,5 ± 1°C and 95 to 98 % relative humidity.

The preparation of the medium with spores is performed with mould suspensions from 3 fungi cultures (Aureobasidium, Aspergillus niger, and Penicillium species). They shall be spread evenly over soil surface and allowed to incubate for 14 days.

After inoculation operation, the specimens shall be observed and photographed (50 and 100 magnification photo-graphic standards) once a week. Rating of level of fungal defacement is performed on a scale of 0 to 10 (10 is no visual defacement).

E.2 Moulds reference

The mould spores shall be identified hereafter:

- Aureobasidium pullulans, ATCC 9348
- Spergillus niger. ATCC 6275
- Penicillium, Sp. 12667 or ATCC 9849.

E.3 Media used for fungi culture

The following media is used for the fungi culture:

- Good quality greenhouse-grade potting soil, suitable for plant propagation, containing 25 % peat moss. pH-value of the soil shall fall from 5,5 to 7,6. No compaction is allowed.

E.4 Panels used for testing

The panels used for the tests:

- Boards 75 x 100 mm, thickness 12,7 mm.

E.5 Apparatus

Climatic chamber able to maintain a temperature of 32,5 ± 1°C and 95 to 98 % relative humidity and able to provide a continuous inoculation of the surface of exposed panels with mould spores. The chamber shall be located in a temperature-controlled room with temperatures in between 21 and 24°C or alternatively the chamber shall be insulated with suitable materials to minimize heat loss.

Cabinet capable to store the necessary number of specimens (at least 25) constructed as follows:

- Polypropylene or polyethylene tank of minimum size 46x46x61 cm with an offset shoulder at the top rim. The top shall be constructed in a way that moisture condensation shall run down the sides and recirculate.
- Heating coil sized to allow a uniform heating of the water even during opening of the chamber. The heating coil is immersed when there are 50 to 75 mm of water in the bottom of the chamber.
- Stainless steel or plastic tray, 25 to 75 mm deep and approximately 25 mm smaller in dimensions than the chamber equipped with a non-corrodible metal mesh at the bottom. The tray shall be centred and supported 25 mm above the water level. In case of need (for holding soil) one layer of fine plastic or fiberglass screen may be placed over the metal mesh.
- Series of bars (wood, glass, fiberglass reinforced plastic) arranged across the width of the chamber. Height and spacing according to the following test panel arrangement: 00 mm, vertically hanging test panels with approximately 75 mm clearance above the inoculated soil. A wire frame or a large clip may be used to fasten the boards.

E.6 Specimen preparation

Media shall be placed in the tray and water added to the desired depth. After 24 hours equilibration inoculating the soil is inoculated with the mould suspension.

Mould slants of all three cultures shall be prepared and aged 10 to 14 days or purchased. For the preparation of the suspension one drop of 25 % non-ionic surfactant solution is added to 95 to 100 mL sterile deionized or distilled water and shaken. 5 mL of this solution is given onto the mould slant by a pipet. The surface of the slant is scrubbed with a sterile cotton swab without digging up the surface of the agar. Water is poured back from the scrubbed slant into the surfactant-sterile water mixture for dilution and shaken for 15 to 20 minutes. The mould suspensions shall be distributed evenly over the surface of the media by a pipet in the tray.

After two weeks of continuous operation of the mould a test can be started.

The ability of the mould to grow can be checked at with malt agar or potato dextrose agar plates placed open and face up at random placed on the panel support rods. After 1 hour plated shall be covered and placed in an incubator at 32,5 ± 1°C for 3 days or left in the cabinet (mould growth shall be medium-heavy to heavy and cover the complete surface of the agar plate when working).

E.7 Test procedure

Panels shall be conditioned at 23 ± 2°C and 50 ± 5% relative humidity for 4 days before testing.

Boards and substrates shall be introduced randomly to the sporulating chamber by vertical hanging (fingerprints on the panels shall be avoided for example by wearing gloves). Free air circulation shall take place, contact between the specimens shall be avoided. In order to check the orderly operating of the chamber comparative specimen with the ability to mould growth shall be stored in the chamber as well to check if the substrate is working (a mould growth rating 4 to 6 shall be developed within 2 to 3 weeks when working).

E.8 Results

Report the results at the end of the 4-week exposure giving the mean and range of the three panels. The result from any panel that differs by more than 2 rating units from either of the others can be considered manifestly faulty and discarded and the mean of the remaining two panels reported. If all panels in a set differ by more than 2 units in their ratings, discard all results and repeat the test.

Fungal growth pattern is observed and determined to be either spot growth, non-uniform spread, or complete coverage.

The percentage of surface coverage is determined and assigned a rating of 0-10. A rating of 10 corresponds to no fungal growth while a rating of 0 requires 50 % (or greater) surface coverage.

ANNEX F – DETERMINATION OF COMPRESSIVE STRENGTH PERPENDICULAR TO THE PLANE OF THE BOARDS FOR USE IN SERVICE CLASS 3

F.1 Specimen preparation

Tests shall be performed on specimens of one single layer of board (of relevant thickness) cut with dimensions of 50 x 50 mm. The specimens shall be cut not less than 300 mm away from the edges of the boards.

The dimensions of the specimens shall be measured to the nearest 0,1 mm and the area of each specimen shall be calculated.

Specimens shall be conditioned at 45 ± 3°C until constant weight.

The minimum number of specimens is 10 (5 in machine direction and 5 in cross direction) for each condition.

F.2 Test procedure

Specimens shall be weighted immediately after conditioning to a mass to 0,1 g and tested immediately after weighting.

The compressive test apparatus according to EN 789 shall be able to provide a loading at a strain rate of 4 mm/minute ± 5 s and shall apply the load continuously. The minimum diameter of the supporting and load plates shall be 75 mm.

Tests shall be performed in dry, humid as well as immersed conditions. The sizes of the specimens shall be measured with an accuracy of 0,5 mm in order to determine the surface area (A).

For the humid conditions, the specimens shall be stored for 7 days in a humid chamber, which is regulated at 30 ± 2°C and 90 ± 3 % humidity. After 7 days, the specimens shall be tested immediately on the mechanical press.

For the immersed conditions, the specimens shall be placed in a water bath at 23 ± 2°C, large enough to hold the specimens. The specimens shall be placed horizontally but not resting flat on the bottom of the container. They shall be covered with 25 mm of water for 2 hours ± 2 minutes. After the elapsed time, the specimens shall be removed from the bath, and the surface and edges shall be wiped in order to eliminate the excess water. The specimens shall be tested immediately on the mechanical press.

Failure load F is the maximum load at the end of the elastic part of the loading. Test can be ended at any time after the maximum elastic load is reached.

F.3 Results

The compressive strength f is calculated as the quotient of the failure load F by the surface area, and expressed in N/mm².

ANNEX G – ESSENTIAL CHARACTERISTICS FOR DIFFERENT PRODUCT TYPES

The essential characteristics relevant for the products are listed in Table G.1:

- Product type 1: gypsum plasterboards, column 1 in Table G.1
- Product type 2a: gypsum boards with mat reinforcement, column 2a in Table G.1
- Product type 2b: gypsum boards with mat reinforcement with reduced water absorption type H1, column 2b in Table G.1
- Product type 3: gypsum fibre boards, column 3 in Table G.1
- Product type 4: expanded glass boards with fibrous reinforcement, column 4 in Table G.1

Table G.1: Essential characteristics for the product types

No	Essential characteristic	Product type				
		1	2a	2b	3	4
Basic requirement for construction works 1: Mechanical resistance and stability						
1	Bending strength	+	+		+	+
2	Shear strength	+	+		+	+
3	Compressive strength	+	+		+	+
4	Tensile strength	+	+		+	+
5	Load bearing capacity of the wall elements	+	+		+	+
6	Embedment strength of fasteners (staples, nails, screws) in boards	+	+		+	+
7	Head pull-through resistance of fasteners (staples, nails, screws) in boards	+	+		+	+
8	Creep and duration of the load	+	+		+	+
9	Structure of the cohesion of the core at high temperature	+	+		-	-
10	Dimensional stability	+	+		+	+
11	Surface hardness	+	+		+	+
12	Static ductility of dowel-type fasteners (staples, screws) in boards	+	+		+	-
Basic requirement for construction works 2: Safety in case of fire						
13	Reaction to fire	+	+		+	+
Basic requirement for construction works 3: Hygiene, health and the environment						
14	Water vapour permeability (expressed as water vapour resistance factor)	+	+		+	+
15	Water absorption of board surface	+	+		+	+
16	Resistance to water penetration	-	-	+	-	-
17	Total water absorption	+	+		+	+
18	Moisture absorption	-	-	+	-	-

Basic requirement for construction works 4: Safety and accessibility in use					
19	Hard body impact resistance	+	+	+	+
Basic requirement for construction works 5: Protection against noise					
20	Airborne sound insulation	+	+	+	+
21	Sound absorption	+	+	+	+
Basic requirement for construction works 6: Energy economy and heat retention					
22	Thermal resistance (expressed as thermal conductivity)	+	+	+	+
23	Air permeability	+	+	+	+
24	Coefficient of thermal expansion	-	-	-	+
Aspects of durability					
25	Mould resistance	+	+	+	-