

EUROPEAN ASSESSMENT DOCUMENT

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**PREFABRICATED WOOD SLAB
ELEMENT MADE OF
MECHANICALLY JOINTED
SQUARE-SAWN TIMBER
MEMBERS TO BE USED AS A
STRUCTURAL ELEMENT IN
BUILDINGS**

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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).

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1 SCOPE OF THE EAD

1.1 Description of the construction product

The prefabricated wood slab element of mechanically jointed square-sawn timber members (spruce, fir or pine) is made of vertical solid wood board members, which may be finger jointed, connected together with nails or dowel type fasteners in order to form a slab.

The following fasteners are applied:

- nails according to EN 14592 or European Technical Assessment
- dowel-type fasteners made of hardwood with a minimum density of 500 kg/m³

The product is manufactured of single members of sawn solid wood boards with a minimum thickness of 21 mm and a minimum height of 60 mm which may be finger jointed. Panels can be built with a maximum thickness of approximately 300 mm and a length of up to 20 m. For load bearing walls the maximal height is limited to 3.45 m.

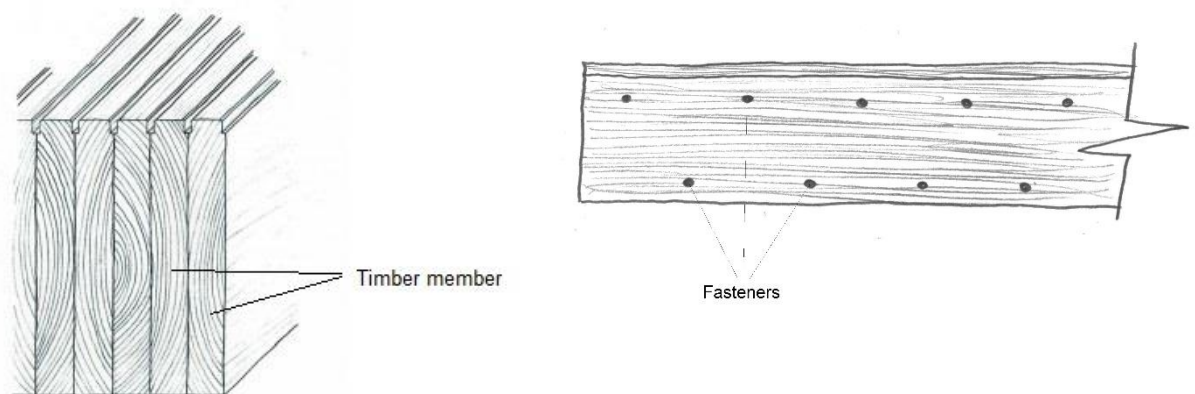
The timber members are oriented parallel to each other. Butt joints between the timber members within one layer are permissible, but must be paid attention to when calculating the carrying capacity of the element and the behavior of fasteners.

Serial toppling (rolling-shear) shall be avoided by suitable design provisions.

Due to the parallel orientation of the constituent timber members, the element is able to transfer loads mainly parallel to the direction of the timber members.

Figure 1 shows the principle structure of the solid wood slab element. However, these examples are not exhaustive.

Figure 1: Principle structure of the prefabricated wood slab element of mechanically jointed square-sawn timber members



The fasteners and the wood species are specified in the ETA.

The surfaces preparations of the product (planed or grinded, etc.) are given in the ETA.

Connections between two wood slab elements or between the elements and other parts of the building are not within the scope of the EAD. Connections can be done according to EN 1995-1-1.

Large finger joints are excluded from the scope of the European Assessment Document.

The application of wood preservatives and flame retardants is not subject of the European Assessment Document.

This EAD is not applicable when recycled wood is used.

The product is not covered by a harmonised European standard (hEN).

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 product is intended to be used as a structural element in buildings to construct walls, floors and roofs (simple buildings e.g. covering stands or covering bus stops are included as well).

The prefabricated wood slab element shall be subjected to static and quasi static actions only.

The product is intended to be used in service classes 1 and 2 according to EN 1995-1-1.

Within a roof construction, the prefabricated wood slab element will not contribute to the water tightness, but will receive a suitable waterproofing and roof covering. Waterproofing and roof covering are not subject of EAD and ETA.

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 prefabricated wood slab element 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 works¹.

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 (if necessary in addition to the definitions in CPR, Art 2)

1.3.1 Finger joint

Interlocking end joint formed by machining a number of similar, tapered, symmetrical fingers in the ends of sawn solid wood boards using a finger joint cutter and then bonded together.

¹ 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.

1.3.2 Dowel-type fasteners

Dowel-type fasteners made of hardwood with a minimum density of 500 kg/m³ for connecting the single sawn solid wood boards.

1.3.3 Nails

Dowel-type fasteners made of metal according to EN 14592 for connecting the single sawn solid wood boards.

2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

2.1 Essential characteristics of the product

Table 1 and Table 2 show how the performance of the prefabricated wood slab element is assessed in relation to the essential characteristics of the following product-types:

- prefabricated wood slab elements made of finger jointed solid wood board members
- prefabricated wood slab elements made of solid wood board members without finger joints

Table 1 Essential characteristics of the prefabricated wood slab elements made of finger jointed solid wood board members 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⁾			
1	Bending ^{2) 3)}	2.2.1	Description, level
2	Compression	2.2.2	Description, level
3	Tension ³⁾	2.2.3	Description, level
4	Shear ^{2) 3)}	2.2.4	Description, level
5	Fixing of objects	2.2.5	Description
6	Creep and duration of the load	2.2.6	Description, level
7	Dimensional stability	2.2.7	Description
8	In-service environment	2.2.8	Description, level
9	Bond integrity of finger joints	2.2.9	Description
Basic Works Requirement 2: Safety in case of fire			
10	Reaction to fire	2.2.10	Class
11	Resistance to fire	2.2.11	Description

Basic Works Requirement 3: Hygiene, health and the environment			
12	Water vapour permeability – Water vapour transmission	2.2.12	Description, level
Basic Works Requirement 4: Safety and accessibility in use			
13	Same as BWR 1		
Basic Works Requirement 5: Protection against noise			
14	Airborne sound insulation	2.2.13	Description, level
15	Impact sound insulation	2.2.14	Description, level
Basic Works Requirement 6: Energy economy and heat retention			
16	Thermal conductivity	2.2.15	Description, level
17	Air permeability	2.2.16	Description, level
18	Thermal inertia	2.2.17	Description, level
1)	This characteristic also relates to BWR 4.		
2)	Load bearing capacity and stiffness regarding mechanical actions perpendicular to the element.		
3)	Load bearing capacity and stiffness regarding mechanical actions in plane of the element.		

Table 2 Essential characteristics of the prefabricated wood slab elements made of solid wood board members without finger joints 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⁾			
1	Bending ^{2) 3)}	2.2.1	Description, level
2	Compression	2.2.2	Description, level
3	Tension ³⁾	2.2.3	Description, level
4	Shear ^{2) 3)}	2.2.4	Description, level
5	Fixing of objects	2.2.5	Description
6	Creep and duration of the load	2.2.6	Description, level
7	Dimensional stability	2.2.7	Description
8	In-service environment	2.2.8	Description, level
Basic Works Requirement 2: Safety in case of fire			
9	Reaction to fire	2.2.10	Class
10	Resistance to fire	2.2.11	Description

Basic Works Requirement 3: Hygiene, health and the environment			
11	Water vapour permeability – Water vapour transmission	2.2.12	Description, level
Basic Works Requirement 4: Safety and accessibility in use			
12	Same as BWR 1		
Basic Works Requirement 5: Protection against noise			
13	Airborne sound insulation	2.2.13	Description, level
14	Impact sound insulation	2.2.14	Description, level
Basic Works Requirement 6: Energy economy and heat retention			
15	Thermal conductivity	2.2.15	Description, level
16	Air permeability	2.2.16	Description, level
17	Thermal inertia	2.2.17	Description, level
1)	This characteristic also relates to BWR 4.		
2)	Load bearing capacity and stiffness regarding mechanical actions perpendicular to the element.		
3)	Load bearing capacity and stiffness regarding mechanical actions in plane of the element.		

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

The assessment of characteristic values for the prefabricated wood slab element is done by one of the following three methods:

- calculation
- design assisted by testing
- testing.

As the elements are made of timber members that are in general graded and classified according to EN 338 and mechanically jointed by nails according to EN 14592 or European Technical Assessment or dowel-type fasteners according to Clause 1.1, calculation of the load bearing behaviour of the elements may follow EN 1995-1-1.

In case of special grading instructions and characteristic values based on these, the grading instructions shall be described in detail within the ETA.

In addition to this concept, the capability of the product can be tested. Hereby, the number of tests for each configuration shall be at least 30. In case of design assisted by testing a smaller number of tests is acceptable. At least 6 tests shall be performed for each configuration or 3 tests for simple items.

In case of testing or calculation assisted by testing, tests shall be performed with different configurations of prefabricated wood slab elements e.g. grades, number and thicknesses of boards as well as type, diameter and spacing of fasteners.

Characteristic values shall be determined according to EN 14358 with factor k_s according to Table 1 and EN 384, whereas the factor k_s from EN 384 should not be taken into account.

Butt joints

Butt joints between the timber members within one layer shall be assessed with regard to load bearing capacity and stiffness. The ETA shall specify the distance of the butt joints between adjacent members.

Assessment of butt joints shall be with bending and shear tests.

For the assessment of butt joints, the same amount of test samples as stated above applies for the critical configurations of the butt joints.

Nails and hardwood dowels

Nails according to EN 14592 or European Technical Assessment.

Dowels-type fasteners made of hardwood with a minimum density of 500 kg/m³.

The hardwood dowels shall be specified with regard to dimensions, in particular diameter, wood species, density and moisture content. All dowels shall be graded. The grading procedure shall consider at least

- wood species
- free of significant knots
- free of abnormal direction of grain
- free of significant reaction wood, fissures, rot, mould and insect infestation

The dowels shall be traceable in batches with regard to the wood they are manufactured of. The specification of the dowels shall be given in the ETA.

2.2.1 Bending

Load bearing capacity and stiffness regarding mechanical actions in plane of the element

Load bearing capacity, M_u (ultimate moment), and the bending stiffness shall be calculated by consideration of members with orientation of grain in span direction only. The technical strength classes specified in EN 338 shall be used. If additional shear stiffness caused by the nails or dowels is taken into account, the slip modulus and the spacing of the fasteners are to be considered in the calculation. For elements with up to three members EN 1995-1-1, Annex B, may be applied. More than three of such members will require numerical methods, e.g. EOTA Technical Report EOTA TR019, section C.1.

Load bearing capacity and stiffness regarding mechanical actions perpendicular to the element

Bending tests shall be performed following EN 408, Clause 19 as well as Clause 9 and 10, observing the principles as given in EN 789. The vector of momentum shall be in plane of the prefabricated wood slab element and perpendicular to the grain of the members. The ultimate moment M_u (load bearing capacity) is defined as the maximum moment.

Alternatively, calculation assisted by testing may be applied. For the calculation the same provisions as for bending in plane of the element apply. The results based on the calculation model have to be verified by bending tests mentioned in the paragraph above.

In the course of this test, the finger joints in the solid wood board members shall be tested according to EN 14080, Annex E, on 30 samples per wood board thickness.

Bending strength of finger joints shall conform to EN 14080, Table 3.

Bending strength and stiffness shall be calculated either by the calculation model given above or from the results of the bending tests according to EN 14358, Clause 4. In case of calculation assisted by testing, the calculation model has to be verified by tests.

2.2.2 Compression

Load bearing capacity and stiffness in compression shall be evaluated according to EN 1995-1-1, Clause 6.1.4 and 6.1.5. In general, the appropriate strength classes specified in EN 338 shall be used.

Alternatively, testing and calculation according to the equations given in EN 408, Clause 15 and 16. The characteristic values shall be determined in accordance with EN 14358, Clause 4.

2.2.3 Tension

Load bearing capacity and stiffness in tension in plane of the prefabricated wood slab shall be evaluated according to EN 1995-1-1, Clause 6.1.2. In general, the appropriate strength classes specified in EN 338 shall be used.

Alternatively, testing and calculation according to the equations given in EN 408, Clause 13. The characteristic values shall be determined in accordance with EN 14358, Clause 4.

Sufficient load distribution must be ensured.

Tension perpendicular to the prefabricated wood slab shall be avoided. Fasteners shall be applied to cover these forces.

2.2.4 Shear

Load bearing capacity and stiffness regarding mechanical actions in plane of the element

If the prefabricated wood slab elements are intended to be used as shear walls without sheathing, shear tests may be performed following the principles of EN 594. From these tests the stiffness of the shear wall and the ultimate shear force are determined. The boundary conditions, such as anchoring of the elements etc., for which the tests results are valid, shall be given.

Alternatively, calculation according to EN 1995-1-1, taking into account the slip modulus of the fasteners. Where calculation does not seem appropriate, tests should be performed.

Load bearing capacity and stiffness regarding mechanical actions perpendicular to the element

In general, the shear strength of the constituent timber members according to EN 338 can be used. If shear failure of the prefabricated wood slab element is already covered by the bending tests, the value derived from these tests may also be used.

Alternatively, shear tests may be performed following EN 408, Clause 19, observing principles as given in EN 789. Vector of momentum shall be in plane of the solid wood slab element and perpendicular to the grain of the members. The forces shall be imposed approximately at a distance $2 \times h$ from the supports to result in shear failure.

2.2.5 Fixing of objects

In the assessment the edges of the prefabricated wood slab elements and the joints between the boards shall be considered. In general the edges of the individual boards shall be considered as edges for the fasteners.

For tension loads perpendicular to the prefabricated solid wood slab element sufficient load distribution must be ensured.

2.2.6 Creep and duration of load

Factors k_{mod} and k_{def} as specified in EN 1995-1-1, Table 3.1 and Table 3.2, shall be used.

2.2.7 Dimensional stability

Dimensions of cross section shall be measured according to EN 1309-1.

Tolerances of dimensions

The dimensions of the prefabricated wood slab elements are to be checked and the measured values assessed for compliance with specifications supplied by the manufacturer with the specific tolerances.

The prefabricated wood slab elements shall have manufacturing tolerances within such limits, so that its performance and stability will be maintained.

Numeric values of the nominal dimensions and tolerances, e.g. on length, width and depth, shall be given in the ETA.

Stability of dimensions

An assessment shall be made of the effect on the prefabricated wood slab elements dimensions of variations in moisture content between installation and service as well as during their service life.

The dimensional changes due to varying moisture content shall not have inadmissible effects on its performance and stability.

Special attention should be paid to dimensional changes in transverse direction.

The moisture content at delivery and the nominal dimensions shall be given in the ETA.

Thermal expansion

Thermal expansion is governed by the thermal expansion coefficient. For timber structures in buildings, thermal expansion is normally not relevant, as it interferes with much larger moisture effects.

2.2.8 In-service environment

Natural durability shall be taken as given in EN 350-2, Table 2. If the species is not given in EN 350-2, it shall be tested according to EN 350-1.

The service classes according to EN 1995-1-1, Clause 2.3.1.3 shall be given.

2.2.9 Bond integrity of finger joints

The following structural adhesives with suitable behaviour in fire and suitable long term behaviour are used:

- Adhesives type I according to EN 301
- Adhesives type I according to EN 15425 and EN 14080, Annex B.2.

2.2.10 Reaction to fire

The prefabricated wood slab element is considered to satisfy the requirements for performance class D-s2,d0 (excluding floorings) and class D_{FL}-s1 for floorings of the characteristic reaction to fire in accordance with the EC Decision 2003/43/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 D-s2,d0 (excluding floorings) and class D_{FL}-s1 for floorings.

If the above mentioned EC decision is not applicable, the prefabricated wood slab element shall be tested, using the test method(s) relevant for the corresponding reaction to fire class, in order to be classified according to Commission Delegated Regulation (EU) 2016/364.

2.2.11 Resistance to fire

The charring rate of the prefabricated wood slab element shall be assessed in accordance with EN 1995-1-2.

The part of the works or assembled system in which the solid wood slab element is intended to be incorporated, installed or applied shall be tested, using the test method relevant for the corresponding fire resistance class, in order to be classified according to EN 13501-2.

2.2.12 Water vapour permeability – water vapour transmission

Design values according to EN ISO 10456, Table 3, shall be given in the ETA.

2.2.13 Airborne sound insulation

Testing according to EN ISO 10140-2 considering EN ISO 10140-1 and EN ISO 10140-5. The weighted sound reduction index, R_w (C; C_{tr}) shall be given according to EN ISO 717-1.

2.2.14 Impact sound insulation

Testing according to EN ISO 10140-3 considering EN ISO 10140-1 and EN ISO 10140-5. The weighted normalised impact sound pressure level, $L_{n,w}$ (C_i) shall be given according to EN ISO 717-2.

Alternatively, calculation according to EN 12354-2.

2.2.15 Thermal conductivity

Design values according to EN ISO 10456, Table 3, shall be given in the ETA.

2.2.16 Air permeability

Testing according to EN 12114. Results shall be given according to EN 12207.

2.2.17 Thermal inertia

Design values according to EN ISO 10456, Table 3, shall be given in the ETA.

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: Decision 1997/176/EC as amended

The systems are:

- 1** for prefabricated wood slab elements made of finger jointed solid wood board members
- 2+** for prefabricated wood slab elements made of solid wood board members without finger joints

3.3 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.

Table 3 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	Grading of timber members	Grading acc. to EN 14081 or specific	EN 14081 or specific	100 %	acc. to EN 14081
2	Visual inspection of the prefabricated wood slab element	(1)	(1)	100 %	Per batch
3	Visual inspection of the fasteners and grading of dowels	Marking of packages	Nails acc. EN 14592 or ETA Dowel-type fasteners acc. ETA	--	Continuously
4	Finger joints (if relevant)	EN 14080	EN 14080	EN 14080	EN 14080

(1) According to the specification and configuration of the prefabricated wood slab element and their components.

3.4 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 prefabricated wood slab elements are laid down in Table 4.

Table 3 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					
1	The notified body shall ascertain that, in accordance with the test plan, the manufacturing plant of the single product manufacturer, in particular personnel and equipment, and the factory production control are suitable to ensure a continuous and orderly manufacturing of the solid wood slab element according the European Technical Assessment.				—
Continuous surveillance, assessment and evaluation of factory production control					
2	It shall be verified that the system of factory production control and the specified manufacturing process are maintained taking account of the test plan.				2/year

4 REFERENCE DOCUMENTS

As far as no edition date is given in the list of standards thereafter, the standard in its current version at the time of issuing the European Technical Assessment, is of relevance.

EOTA TR019 (2005-02): Calculation models for prefabricated wood-based loadbearing stressed skin panels for use in roofs

EN 301: Adhesives, phenolic and aminoplastic, for load-bearing timber structures — Classification and performance requirements

EN 338: Structural timber — Strength classes

EN 384: Structural timber - Determination of characteristic values of mechanical properties and density

EN 350-1: Durability of wood and wood-based products - Natural durability of solid wood – Part 1: Guide to the principles of testing and classification of the natural durability of wood

EN 350-2 (1994-05): Durability of wood and wood-based products — Natural durability of solid wood — Part 2: Guide to natural durability and treatability of selected wood species of importance in Europe

EN 408 (2012-07): Timber structures — Structural timber and glued laminated timber — Determination of some physical and mechanical properties

EN 594: Timber structures – Test methods – Racking strength and stiffness of timber frame wall panels

EN 789: Timber structures — Test methods — Determination of mechanical properties of wood based panels

EN 1995-1-1 (2005-11) +AC (2006-06) +A1 (2008-06) +A2 (2014-05): Eurocode 5 — Design of timber structures — Part 1 1: General – Common rules and rules for buildings

EN 1995-1-2: Eurocode 5 — Design of timber structures — Part 1 2: General — Structural fire design

EN 12114: Thermal performance of buildings — Air permeability of building components and building elements — Laboratory test method

EN 12207: Windows and doors — Air permeability — Classification

EN 12354-2: Building acoustics - Estimation of acoustic performance of buildings from the performance of elements - Part 2: Impact sound insulation between rooms

EN 13501-1: Fire classification of construction products and building elements — Part 1: Classification using data from reaction to fire tests

EN 13501-2: Fire classification of construction products and building elements — Part 2: Classification using data from fire resistance tests, excluding ventilation services

EN 14080 (2013-06): Timber structures — Glued laminated timber and glued solid timber — Requirements

EN 14592: Timber structures — Dowel-type fasteners — Requirements

EN 14358 (2006-12): Timber structures — Calculation of characteristic 5-percentile values and acceptance criteria for a sample

EN 15425: Adhesives — One component polyurethane for load bearing timber structures — Classification and performance requirements

EN ISO 717-1: Acoustics — Rating of sound insulation in buildings and of building elements — Part 1: Airborne sound insulation

EN ISO 717-2: Acoustics — Rating of sound insulation in buildings and of building elements — Part 2: Impact sound insulation

EN ISO 10140-1: Acoustics — Laboratory measurement of sound insulation of building elements — Part 1: Application rules for specific products

EN ISO 10140-2: Acoustics — Laboratory measurement of sound insulation of building elements — Part 2: Measurement of airborne sound insulation

EN ISO 10140-3: Acoustics — Laboratory measurement of sound insulation of building elements — Part 3: Measurement of impact sound insulation

EN ISO 10140-5: Acoustics — Laboratory measurement of sound insulation of building elements — Part 5: Requirements for test facilities and equipment

EN ISO 10456 (2007-12) +AC (2009-12): Building materials and products — Hygrothermal properties — Tabulated design values and procedures for determining declared and design thermal values