



EUROPEAN ASSESSMENT DOCUMENT

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STRENGTH GRADED STRUCTURAL TIMBER – STEAM- CURED SOLID TIMBER WITH RECTANGULAR CROSS SECTION WHICH MAY BE FINGER JOINTED OR NOT – SOFTWOOD

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1 SCOPE OF THE EAD

1.1 Description of the construction product

The product, "Strength graded structural timber – steam-cured solid timber with rectangular cross section which may be finger jointed or not – softwood", is a visual or machine graded sawn timber of softwood assigned to a grading class according to EN 1912 with possible additional grading criteria. After grading, the sawn timber is steam-cured. The steam-cured sawn timber members may be finger jointed or not.

The product is

- Graded according to EN 14081-1 in order to be assigned to grading class S10 or S13 according to EN 1912 with possible additional grading criteria
- Without preservative treatment,
- Without flame retardant and
- Exclusively made in virgin wood; no recycled wood is used.

Wood species is European spruce, fir and larch.

Finger joints are glued with one of the following structural adhesives:

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

Glued laminated timber is not part of the EAD.

Steam-cured solid timber with rectangular cross section with significantly reduced swelling and shrinking behaviour is not part of the EAD.

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)

Strength graded structural timber – steam-cured solid timber with rectangular cross section is intended for load bearing uses in buildings and civil engineering works.

The product is subjected to static and quasi static actions only.

The product is intended to be used in service class 1, 2, or 3 according to EN 1995-1-1.

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 strength graded and steam-cured structural timber 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 Steam-curing process

special kind of thermal modification. In contrast to conventional thermal modification procedures for wood the temperature is lower whereas the exposure time is extended. The wood is exposed to a maximum temperature of 120°C and defined humidity conditions for a predefined time range. The required time depends on wood species, size and initial moisture content. Hereby, the swelling and shrinking behaviour is not significantly reduced.

1.3.2 Dry-graded timber

timber that is part of a batch that has intentionally been graded at a mean moisture content of 20 % or less, without any measurement exceeding 24 %.

1.3.3 Population

timber for which the characteristic values are relevant.

1.3.4 Timber source

identifiable geographical origin of a species or species combination from which timber is, or is intended to be, strength graded.

1.3.5 Sample

a number of ungraded specimens of one timber species or species combination, one source, with sizes and quality representative of the timber population.

1.3.6 Sub-sample

part of one or more samples consisting of specimens of one grade.

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.

1.3.7 Specimen

piece of timber from which the test piece is taken.

1.3.8 Visual strength grading

process by which a piece of timber can be sorted, by means of visual inspection, into a grade to which characteristic values of strength, stiffness and density may be allocated.

1.3.9 Machine strength grading

process by which a piece of timber can be sorted, by means of machine procedures, into a grade to which characteristic values of strength, stiffness and density may be allocated.

2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

2.1 Essential characteristics of the product

Table 1 shows how the performance of the strength graded and steam-cured structural timber is assessed in relation to the essential characteristics.

Table 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	Method of assessment	Type of expression of product performance
Basic Works Requirement 1: Mechanical resistance and stability ¹⁾			
1	Bending strength	2.2.1	Description, level
2	Tension strength in direction of grain	2.2.2	Description, level
3	Tension strength perpendicular to direction of grain	2.2.3	Description, level
4	Compression strength in direction of grain	2.2.4	Description, level
5	Compression strength perpendicular to direction of grain	2.2.5	Description, level
6	Shear strength	2.2.6	Description, level
7	Modulus of elasticity in direction of grain	2.2.7	Description, level
8	Modulus of elasticity perpendicular to direction of grain	2.2.8	Description, level
9	Shear modulus	2.2.9	Description, level
10	Density	2.2.10	Description, level
11	Bond integrity of finger joints	2.2.11	Description
12	Dimensional stability	2.2.12	Description, level
13	Durability	2.2.13	Description
14	Creep and duration of the load	2.2.14	Description, level
15	Withdrawal strength	2.2.15	Description, level
16	Embedment strength	2.2.16	Description, level
17	pH-value	2.2.17	Description, level
Basic Works Requirement 2: Safety in case of fire			
18	Reaction to fire	2.2.18	Class
19	Resistance to fire	2.2.19	Description, level
Basic Works Requirement 4: Safety and accessibility in use			
–	Same as BWR 1		
¹⁾ This characteristic also relates to BWR 4.			

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

Characterisation of products to be assessed shall be done in accordance with available specifications, notably by

- Sampling according to EN 384, Clause 5.1.
- Samples shall be selected from one source of timber and shall be graded to subsamples according to the requirements of EN 14081-1 in order to be assigned to grading class S10 or S13 according to EN 1912 with possible additional grading criteria. The timber shall represent the timber source, sizes and quality that will be graded in production.
- For determination of the characteristics in Clauses 2.2.1 to 2.2.10 by testing each sub-sample shall consist of at least 40 specimens and be of one source.
- The mechanical characterization should be performed on timber graded according to EN 14081-1 and after being steam-cured.

2.2.1 Bending strength

The test shall be carried out in accordance with Clause 19 of EN 408.

Calculation of the characteristic value shall be performed according to Clauses 5.4 and 5.5 of EN 384.

2.2.2 Tension strength in direction of grain

The test shall be carried out in accordance with Clause 13 of EN 408.

Calculation of the characteristic value shall be performed according to EN 384.

2.2.3 Tension strength perpendicular to direction of grain

The test shall be carried out in accordance with Clause 16 of EN 408.

Calculation of the characteristic value shall be performed according to EN 384.

Alternatively, the characteristic value can be determined in accordance with Clause 7 of EN 384 and verified by a minimum of 20 tests according to the provisions given above using calculation assisted by testing.

2.2.4 Compression strength in direction of grain

The test shall be carried out in accordance with Clause 15 of EN 408. The steam-cured timber should be tested with the highest possible moisture content according to the desired service class.

Calculation of the characteristic value shall be performed according to EN 384.

2.2.5 Compression strength perpendicular to direction of grain

The test shall be carried out in accordance with Clause 16 of EN 408. The steam-cured timber should be tested with the highest possible moisture content according to the desired service class.

Calculation of the characteristic value shall be performed according to EN 384.

Alternatively, the characteristic value can be determined in accordance with Clause 7 of EN 384 and verified by a minimum of 20 tests according to the provisions given above using calculation assisted by testing.

2.2.6 Shear strength

The test shall be carried out in accordance with Clause 18 of EN 408.

Calculation of the characteristic value shall be performed according to EN 384.

2.2.7 Modulus of elasticity in direction of grain

The test shall be carried out in accordance with Clause 9 of EN 408.

Calculation of the mean value shall be performed according to Clauses 5.4 and 5.5 of EN 384.

Calculation of the 5 % percentile characteristic value shall be performed according to Clause 7 of EN 384.

2.2.8 Modulus of elasticity perpendicular to direction of grain

The test shall be carried out in accordance with Clause 17 of EN 408.

Calculation of the mean value shall be performed according to EN 384.

Alternatively, the characteristic value can be determined in accordance with Clause 7 of EN 384 and verified by a minimum of 20 tests according to the provisions given above using calculation assisted by testing.

2.2.9 Shear modulus

The test shall be carried out in accordance with Clause 11.1 (where relevant) or 11.2 of EN 408.

Calculation of the mean value shall be performed according to EN 384.

2.2.10 Density

The test shall be carried out in accordance with Clause 5.3.4 of EN 384.

Calculation of the mean value shall be performed with the densities of the individual specimens determined according to Clause 5.3.4 of EN 384.

Calculation of the characteristic value of density as 5 % percentile shall be performed according to Clause 5.4 and 5.5 of EN 384.

2.2.11 Bond integrity of finger joints

The test shall be carried out in accordance with EN 15497. For durability see 2.2.13.

2.2.12 Dimensional stability

Dimensional stability shall be considered as swelling and shrinkage of structural timber due to changes of its moisture content.

Shrinkage as well as swelling tests shall be performed on steam-cured as well as untreated wood on samples according to ISO 4469.

The linear shrinkage shall be determined according to ISO 4469.

For determination of the maximum amount of radial and tangential swelling $\alpha_{\max,r}$ and $\alpha_{\max,t}$ the samples shall be dried till weight constancy according to ISO 4469, measured, and stored in standardized climate (20°C, 65% relative humidity) for 3 to 5 days. Afterwards, the samples are stored in a water bath till saturation according to ISO 4469. $\alpha_{\max} = 100 (l_w - l_0) / l_0$ with l_w as dimension of the saturated sample and l_0 as the dimension of the dried sample.

Linear shrinkage as well as the maximum amount of swelling shall be given in the ETA.

2.2.13 Durability

For the following wood species the natural durability of wood can be given according to EN 350-2: European spruce (*Picea abies* (L.) Karst.), fir (*Abies alba* Mill.) and larch (*Larix decidua* Mill.).

If the wood species is not given in EN 350, it shall be tested according to CEN/TS 15083-1 and CEN/TS 15083-2.

Durability of the finger joints shall be evaluated according to EN 14080, Annex B.3.

2.2.14 Creep and duration of load

Evaluation of the deformation and modification values according to EN 1156, Clause 6 and 7. However, the span of the samples is $L \geq 10$ h. The samples shall be loaded under the conditions of the respective service class by a constant load in the third points following EN 1156.

For evaluation of k_{mod} testing of at least 5 different load levels (e.g. 90, 80, 70, 50, 30 %) below the maximum load is required according to EN 1156. At least 6 specimen shall be tested per load level. The time-deformation plot till rupture shall be recorded. Calculation of modification values shall be performed from approximation of the duration till rupture, see Clause 7.1 in EN 1156 for the respective service class load duration classes according to Table 2.1 of EN 1995-1-1.

Evaluation of k_{def} is performed according to Clause 7.2 of EN 1156 using the approximated time-deformation plots at a load level of 30 % after 50 years. Determination of k_{def} shall follow Equation (2.3) of EN 1995-1-1.

The numeric value for k_{mod} and k_{def} shall be given in the ETA for the relevant service class and duration of load.

2.2.15 Withdrawal strength

Withdrawal strength shall be tested according to EN 1382.

A minimum of 20 self-tapping screws shall be tested under an angle of 90° between fastener axis and grain direction.

Calculation of the characteristic values according to EN 14358.

2.2.16 Embedment strength

Embedment strength shall be tested according to EN 383.

A minimum of 20 self-tapping screws shall be tested under an angle of 90° between fastener axis and grain direction.

Calculation of the characteristic values according to EN 14358.

2.2.17 pH-value

Determination of the pH-value shall be carried out with an electrode on a suspension of 2 g wood powder in 20 ml distilled water after a reaction time of two hours.

The pH-value of the steam-cured timber should be considered when determining an appropriate corrosion protection for the fasteners.

2.2.18 Reaction to fire

The strength graded, steam-cured and finger jointed structural timber with rectangular cross section shall be tested, using the test method(s) relevant for the corresponding reaction to fire class, in order to be classified according to EN 13501-1.

Testing shall be performed according to EN 13823. For assembly of the specimen see Clause 5.8 of EN 14080.

2.2.19 Resistance to fire

The part of the works or assembled system in which the strength graded, steam-cured and finger jointed structural timber with rectangular cross section 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.

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 97/176/EC

The system is: **1** for strength graded structural timber – steam-cured solid timber with rectangular cross section **with finger joints**

The system is: **2+** for strength graded structural timber – steam-cured solid timber with rectangular cross section **without finger joints**

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 2.

Table 2 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	According to EN 14081-1 for strength grading of timber				
2	Steam-curing process	Technical parameters	(1)	Every steam-curing batch	100 %
3	Finger joints	EN 15497 and EN 14080, Annex B.3	EN 15497 and EN 14080, Annex B.3	EN 15497 and EN 14080, Annex B.3	EN 15497 and EN 14080, Annex B.3

(1) According to the specification of the strength graded structural timber – steam-cured solid timber with rectangular cross section which may be finger jointed or not – softwood

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 strength graded and steam-cured structural timber are laid down in Table 3.

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 <i>(for systems 1 and 2+)</i>					
1	<p>The notified product certification body shall verify the ability of the manufacturer for a continuous and orderly manufacturing of the product according to the test plan. In particular the following items shall be appropriately considered</p> <ul style="list-style-type: none"> – personnel and equipment – the suitability of the factory production control established by the manufacturer – full implementation of the test plan 				—
Continuous surveillance, assessment and evaluation of factory production control <i>(for systems 1 and 2+)</i>					
2	<p>The notified product certification body shall verify that</p> <ul style="list-style-type: none"> – the manufacturing process – the system of factory production control – the implementation of the test plan <p>are maintained.</p>				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.

- EN 301: Adhesives, phenolic and aminoplastic, for load-bearing timber structures — Classification and performance requirements
- EN 350-1 (05.1994): 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 (05.1994): 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 383: Timber structures – Test methods – Determination of embedment strength and foundation values for dowel type fasteners
- EN 384 (08.2016): Structural timber – Determination of characteristic values of mechanical properties and density
- EN 408: Timber structures – Structural timber and glued laminated timber – Determination of some physical and mechanical properties
- EN 1382: Timber structures – Test methods – Withdrawal capacity of timber fasteners
- EN 1912: Structural Timber – Strength classes — Assignment of visual grades and species
- EN 1995-1-1 (11.2004) +AC (06.2006) +A1 (06.2008) +A2 (05.2014): Eurocode 5 – Design of timber structures — Part 1-1: General – Common rules and rules for buildings
- 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 13823: Reaction to fire tests for building products – Building products excluding floorings exposed to the thermal attack by a single burning item
- EN 14080 (06.2013): Timber structures – Glued laminated timber and glued solid timber – Requirements
- EN 14081-1: Timber structures – Strength graded structural timber with rectangular cross section – Part 1: General requirements
- EN 14358: 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 15497: Structural finger jointed solid timber – Performance requirements and minimum production requirements
- CEN/TS 15083-1: Durability of wood and wood-based products – Determination of the natural durability of solid wood against wood-destroying fungi, test methods – Part 1: Basidiomycetes
- CEN/TS 15083-2: Durability of wood and wood-based products – Determination of the natural durability of solid wood against wood-destroying fungi, test methods – Part 2: Soft rotting micro-fungi
- ISO 4469: Wood – Determination of radial and tangential shrinkage