EUROPEAN ASSESSMENT DOCUMENT

EAD 130167-00-0304

June 2016

STRENGTH GRADED STRUCTURAL TIMBER – SQUARE EDGED LOGS WITH WANE – SOFTWOOD

www.eota.eu

The reference title and language for this EAD is English. The applicable rules of copyright refer to the document elaborated in and published by EOTA.

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).

1 SCOPE OF THE EAD

1.1 Description of the construction product

The product are “Strength graded structural timber – Square edged logs with wane – Softwood” that are full logs of coniferous species, which are edged on four sides maintaining boxed heart and an approximately central pith according to the grading rules of Annex 1.

The square edged logs with wane are full logs

- visually graded according to Annex 1,
- without preservative treatment,
- without flame retardant and
- exclusively made in virgin wood; no recycled wood is used.

Square edged logs with wane do not feature a full square cross section with four sharp arris, but maintain the wane on all four sides along the entire length of the log.

NOTE The cross sections of the square edged logs with wane are virtually squares, i.e. $h \approx b$ according to the grading rules of Annex 1.

Where

h .....Larger side of the cross section, see Anx 1.4.4.1

b .....Smaller side of the cross section, see Anx 1.4.4.1

There are two kind of square edged logs with wane for structural use of softwood,

- with constant external dimensions of the cross section along the entire length;
- with external dimensions of the cross section following the log tapering.

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 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 square edged logs with wane of softwood are intended for load bearing uses in buildings and civil engineering works.

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 structural timber – Square edged logs with wane – Softwood" for the intended use of 50 years when installed in the works, provided that the "Strength graded structural timber – Square edged logs

with wane – Softwood" are subject to appropriate installation, see Clause 1.1. 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[1].

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 Characteristic strength

Population 5 % percentile value, obtained from the results of tests with a duration of (300 ± 120) s until maximum force is achieved, using test pieces at an equilibrium moisture content resulting from a temperature of 20 °C and a relative humidity of 65 %.

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 Nominal cross section

Cross section defined by the rectangle circumscribing the piece of timber at mid-length.

NOTE The cross sections of the square edged logs with wane of softwood are virtually squares, i.e. h ≈ b according to the grading rules of Annex 1.

Where

h ..... Larger side of the cross section, see Anx 1.4.4.1

b ..... Smaller side of the cross section, see Anx 1.4.4.1

1.3.4 Batch

Quantity of timber of one species, one population, and one size graded in one working shift. An order of a combination of different sizes of one customer may be considered as a batch as well.

1.3.5 Species population

Timber from an identifiable source and of a species that is, or is intended to be, strength graded and marketed as a commercially defined product.

[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.

1.3.6 Timber size

For the nominal cross section, see clause 1.3.3, the permitted deviations are given in EN 336[2].

1.3.7 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.

1.3.8 Wane

Original rounded surface of a log, without bark or with restricted residual part of bark, also regularized by machining with the removal of not more than 5 mm under the bark, which connects two adjacent faces of the piece of timber.

[2] Standards and other documents referred to in the EAD are listed in Clause 4.

2 ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

2.1 Essential characteristics of the product

Table 1 shows how the performance of the square edged logs with wane of softwood 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**

№	Essential characteristic	Assessment method	Type of expression of product performance *level, class, description*
Basic requirement for construction works 1: Mechanical resistance and stability			
1	Shape	2.2.1	Description
2	Dimensions	2.2.2	Description
3	Bending strength	2.2.3	Level
4	Tension strength parallel	2.2.4	Level
5	Tension strength perpendicular	2.2.5	Level
6	Compression strength parallel	2.2.6	Level
7	Compression strength perpendicular	2.2.7	Level
8	Shear strength	2.2.8	Level
9	Modulus of elasticity parallel	2.2.9	Level
10	Modulus of elasticity perpendicular	2.2.10	Level
11	Shear modulus	2.2.11	Level
12	Density	2.2.12	Level
13	Dimensional stability	2.2.13	Description
14	Durability of timber	2.2.14	Description
Basic requirement for construction works 2: Safety in case of fire			
15	Reaction to fire	2.2.15	Class
16	Resistance to fire	2.2.16	Description
Basic requirement for construction works 4: Safety and accessibility in use			
17	Same as basic requirement 1	—	—

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.

- Samples shall be selected from the population of timber visually graded according to Annex 1. The specimen shall be representative of the population. The timber shall represent the timber source, sizes and quality that will be graded in production. Each sample shall be from one source.

  NOTE 1 Any known or suspected difference in the mechanical properties of the population distribution due to growth regions, sawmills, tree size or method of conversion should be represented within the number of samples selected, by a similar proportion to their frequency in the population. This should be the major influence in determining the number and size of samples.

- The number of specimens in each sample shall be not less than 40.

  NOTE 2 Where samples are small and/or few in number the characteristic values will be considered according to EN 384.

- Test specimens for shear, tension perpendicular to grain and compression perpendicular to grain strengths are comparatively small and therefore shall be free of strength reducing characteristics, but shall represent the full range of growth areas, density and rates of growth.
- The mechanical properties given in the following Clauses are referred to the nominal cross section, see Clause 1.3.3.

2.2.1 Shape

Shape of square edged logs with wane of softwood is determined by visual inspection and measurement of dimensions regarding wane and external dimensions of the cross section according to Annex 1.

Shape of square edged logs with wane of softwood with regard to wane and external dimensions of the cross section shall conform to Clause 1.1 and

- with either constant external dimensions of the cross section along the entire length,
- or with external dimensions of the cross section following the log tapering.

2.2.2 Dimensions

Dimensions of square edged logs with wane of softwood given in Annex 1 shall be determined according to EN 1309-1.

Tolerances of cross section shall be according to EN 336. Other dimensions shall, according to Clause 1.1, meet the tolerances specified in Annex 1.

2.2.3 Bending strength

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

Calculation of the characteristic value shall be performed according to EN 384 for visual graded timber.

2.2.4 Tension strength parallel

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

If no structural size test data are available, the characteristic value shall be determined in accordance with EN 384.

2.2.5 Tension strength perpendicular

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

If no structural size test data are available, the characteristic value shall be determined in accordance with EN 384.

2.2.6 Compression strength parallel

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

If no structural size test data are available, the characteristic value shall be determined in accordance with EN 384.

2.2.7 Compression strength perpendicular

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

If no structural size test data are available, the characteristic value shall be determined in accordance with EN 384.

2.2.8 Shear strength

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

If no structural size test data are available, the characteristic value shall be determined in accordance with EN 384.

2.2.9 Modulus of elasticity parallel

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

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

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

2.2.10 Modulus of elasticity perpendicular

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

If no structural size test data are available, calculation of the mean characteristic values shall be performed according to EN 384.

2.2.11 Shear modulus

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

If no structural size test data are available, calculation of the mean characteristic value shall be performed according to EN 384.

2.2.12 Density

The measurements shall be carried out in accordance with ISO 3131.

NOTE Where not all the specimens are tested to failure, the density of each specimen is permitted to be determined from the mass and volume of the whole specimen and adjusted to density of the small defect-frees prism given in ISO 3131 by dividing by 1.05.

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

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

2.2.13 Dimensional stability

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

Swelling and shrinkage value of timber can be regarded as a constant value in the perpendicular to grain as given in EN 336 and as a small constant value along the grain.

2.2.14 Durability of timber

Natural durability without preservative treatment shall be taken as given in EN 350-2. If the species is not given in EN 350-2, it shall be tested according to EN 350-1.

The timber have adequate natural durability in accordance with EN 350-2 for the respective service classes as defined in EN 1995-1-1, which is given.

2.2.15 Reaction to fire

The square edged logs with wane of softwood is considered to satisfy the requirements for performance class D-s2, d0 of the characteristic reaction to fire in accordance with the Commission Decision 2003/43/EC, as amended[3], 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 class D-s2, d0.

Otherwise the square edged logs with wane of softwood 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.

2.2.16 Resistance to fire

Charring rates as given in EN 1995-1-2 apply.

[3] See in particular amendment by Commission Decision 2003/593/EC of 7 August 2003.

3 ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCE

3.1 System of assessment and verification of constancy of performance to be applied

For the product covered by the EAD the applicable European legal act is: Decision 97/176/EC.

The system is: 2+.

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

№	Subject of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Factory production control (FPC)					
1	According to EN 14081-1 for visual strength grading timber				

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 square edged logs with wane of softwood are laid down in Table 3.

Table 3 Control plan for the notified body – Cornerstones

№	Subject 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 product certification body shall verify the ability of the manufacturer for a continuous and orderly manufacturing of the product according to the European Technical Assessment. In particular the following items shall be appropriately considered – personnel and equipment – the suitability of the factory production control established by the manufacturer – full implementation of the prescribed test plan				—
Continuous surveillance, assessment and evaluation of factory production control					
2	The notified product certification body shall verify that – the manufacturing process – the system of factory production control – the implementation of the prescribed test plan are maintained.				Once per 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 336	Structural timber – Sizes, permitted deviations
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	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 384	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 1309-1	Round and sawn timber – Method of measurement of dimensions – Part 1: Sawn timber
EN 1310	Round and sawn timber – Method of measurement of features
EN 1995-1-1	Eurocode 5 – Design of timber structure – Part 1-1: General – Common Rules and rules for building
EN 1995-1-2	Eurocode 5 – Design of timber structure – Part 1-1: General – Structural fire design
EN 13183-1	Moisture content of a piece of sawn timber – Determination by oven dry method
EN 13183-2	Moisture content of a piece of sawn timber – Part 2: Estimation by electrical resistance method
EN 13501-1	Fire classification of construction products and building elements – Part 1: Classification using data from reaction to fire tests
EN 14081-1	Timber structures – Strength graded structural timber with rectangular cross section – Part 1: General requirements
ISO 3131	Wood – Determination of density for physical and mechanical tests
1997/176/EC	Commission Decision 97/176/EC of 17 February 1997 on the procedure for attesting the conformity of construction products pursuant to Article 20 (2) of Council Directive 89/106/EEC as regards structural timber products and ancillaries, OJ L 73 of 14.03.1997, p. 19, Amended by Commission Decision 2001/596/EC of 8 January 2001, OJ L 209 of 02.08.2001, p. 33
2003/43/EC	Commission Decision 2003/43/EC of 17 January 2003 establishing the classes of reaction-to-fire performance for certain construction products, OJ L 13, 18.01.2003, p. 35 Amended by Commission Decision 2003/593/EC of 07 August 2003, OJ L 201, 08.08.2003, p. 25, Commission Decision 2006/673/EC of 05 October 2006, L 276, 07.10.2006, p. 77, Commission Decision 2007/348/EC of 15 May 2007, OJ L 131, 23.05.2007, p. 21, and corrected by Corrigendum, OJ L 33, 08.02.2003, p. 44
2016/364	Commission Delegated Regulation (EU) 2016/364 of 1 July 2015 on the classification of the reaction to fire performance of construction products pursuant to Regulation (EU) № 305/2011 of the European Parliament and of the Council, OJ L 68 of 15 March 2016, p. 4

ANNEX 1 GRADING OF STRENGTH GRADED STRUCTURAL TIMBER – SQUARE EDGED LOGS WITH WANE

Anx 1.1 Symbols

$\overline{AC}$	.....	—	..... Geometrical axis of the piece of timber
$\overline{BC}$	.....	—	..... Grain direction, determined with the marking tool
A	.....	—	.....
A_g	.....	—	..... Ratio of the sum of the minimum diameters of the grouped knots to the side of the cross section on which the knots are measured
b	.....	mm	..... Smaller side of the cross section
F	.....	—	..... Spring
h	.....	mm	..... Larger side of the cross section
k_1, k_2	.....	—	..... Orthogonal projections of the wanes on the smaller side of the cross section
L	.....	m	..... Length of the piece of timber
n	.....	—	..... Number of measurements of moisture content
N	.....	—	..... Number of rings included in Z
n_1	.....	—	..... Single knot
n_2	.....	—	..... Knot grouping, aligned and closer than 150 mm
n_3	.....	—	..... Single knots, aligned but more than 150 mm apart
n_4	.....	—	..... Knot grouping, more than 150 mm apart but the grain does not regain its original direction between the knots
n_5	.....	—	..... Single knots, although within a distance of 150 mm, they are not aligned and the grain between them regains its original direction
n_6	.....	—	..... Knot grouping, the grain does not regain its original direction between them
r_{max}	.....	mm	..... Maximum radius of the ring shake
s	.....	—	..... Ratio of the wane projections on a side of the cross section to the side dimension
S	.....	—	..... Twist
u_1, u_2, … u_n	..	%	..... Individual measurement values of moisture content
u_{mean}	.....	%	..... Arithmetic mean of all measurements of moisture content
v_1, v_2	.....	—	..... Orthogonal projections of the wanes on the larger side of the cross section
Z	.....	mm	..... longest line perpendicular to the growth rings, at least 75 mm (when possinle)
ε	.....	mm	..... Eccentricity is given by the distance $\overline{AB}$
ω	.....	mm	..... Ring width

Anx 1.2 General

This Annex specifies the terminology, the methods to measure the characteristics and the rules for visual strength grading of timber intended to be use as load-bearing element.

This Annex covers structural solid timber of any size and moisture content, only identifiable with the definition of strength graded structural timber – Square edged logs with wane of softwood, see Clause 1.1.

The product is either dry-graded as defined in Clause 1.3.2 or not.

Anx 1.3 Terms and definitions

For the purposes of this Annex the following terms and definitions apply.

Anx 1.3.1 External dimension

Distance between the opposite faces of a piece of timber at a specified place of measurement.

Anx 1.3.2 Cross section

Section defined by the rectangle circumscribing the piece of timber and perpendicular to the longitudinal axis.

Anx 1.3.3 Eccentricity

Distance between the pith and the geometric centre of the cross section of the piece of timber.

Anx 1.3.4 Taper

Gradual reduction in cross section of the piece of timber along its length.

Anx 1.3.5 Warp

Distortion from the ideal straight geometrical shape of the piece of timber due to spring or twist.

Anx 1.3.6 Nominal cross section

Cross section defined by the rectangle circumscribing the piece of timber at mid-length.

NOTE The cross sections of the square edged logs with wane of softwood are virtually squares, i.e. $h \approx b$ according to the grading rules of Annex 1.

Anx 1.3.7 Grade

The group to which the piece of timber is assigned by visual strength grading according the rules of this Annex.

Anx 1.4 Measurement of Characteristic

Anx 1.4.1 General

Each piece of visual graded timber can be assigned to a grade if it meets the requirements given for that grade. Therefore, it is the worst defect, wherever it is located, that determines the grade assignment.

If the piece of timber cannot be assigned to any of the specified grades, it shall be rejected as not gradable for structural uses.

The limitations on the characteristics for the different timber populations are reported in Table 5 and Table 6.

Anx 1.4.2 Reference moisture content

When a piece of timber is graded at a moisture content higher than 20 %, some characteristics may not be visible or may not be easy to assess.

The moisture content of a seasoned or dried piece of timber shall be determined by the electric method in accordance with EN 13183-2, with one or more measuring points. In the case of multiple measuring points, the reference value is given by the arithmetic mean of all measurements, by the equation

$$u_{mean} = \frac{1}{n} \cdot (u_1 + u_2 + \ldots + u_n)$$

Where

u_1, u_2, … u_n ..... % ..... Individual measurement values

n ..... — ..... Number of measurements

Because of the strong influence of the surface moisture content and the possible variations of the moisture content in transversal direction, it is opportune to use insulated electrodes with fully efficient insulation.

Other measurement methods are also accepted if the correspondence with the electric method in accordance with EN 13183-2 is proved. In the cases of dispute, different agreements between the parties excepted, the estimation of the average moisture content shall be performed by the oven dry method defined in EN 13183-1.

Anx 1.4.3 Strength-reducing characteristics

Anx 1.4.3.1 Knots

The following instructions apply to single knots and to knot groupings. The practical instructions to distinguish them are illustrated in Figure 1.

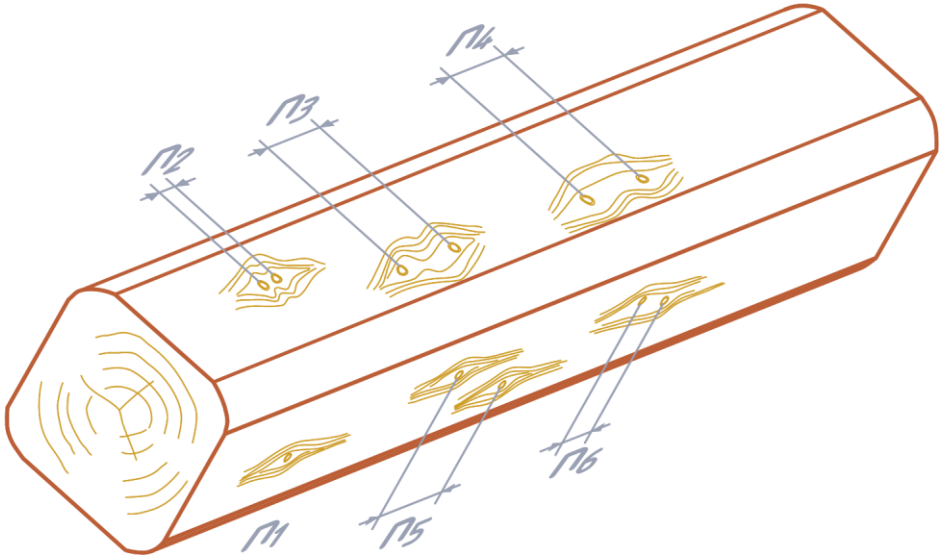


Figure 1 Examples of single knots and knot groupings

Where

n_1 ..... Single knot

n_2 ..... Knot grouping, aligned and closer than 150 mm

n_3 ..... Single knots, aligned but more than 150 mm apart

n_4 ..... Knot grouping, more than 150 mm apart but the grain does not regain its original direction between the knots

n_5 ..... Single knots, although within a distance of 150 mm, they are not aligned and the grain between them regains its original direction

n_6 ..... Knot grouping, the grain does not regain its original direction between them

Single knots having a diameter, d, smaller than 5 mm are not considered.

All types of knots are admissible (intergrown, loose, sound, unsound, etc.).

Single knots and knot groupings are permitted if they satisfy the limitations specified for the grade.

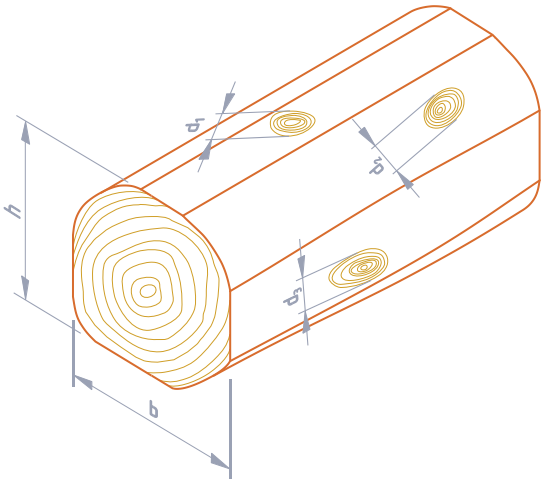


Figure 2 Measurement of knot diameter

For single knots, see Figure 2, the ratio of knot minimum diameter to the thickness upon which the knot is taken shall be calculated, according to the equation

$$A = \max \begin{cases} \dfrac{d_1}{b} \\ \dfrac{d_2}{\min \begin{cases} b \\ h \end{cases}} \\ \dfrac{d_3}{h} \end{cases}$$

Where

d_1, d_2, d_3 ..... mm ..... Minimum knot diameter

b, h ..... mm ..... Thickness upon which the knot is taken

For the knots at the wane, the minimum knot diameter d shall be divided by the smaller side of the timber cross section at the point of knot measurement.

For knot grouping, the minimum diameter of all the grouped knots shall be added and the ratio A_g is calculated as this sum, divided by the thickness upon which the knot grouping is measured.

The greater ratio of the four faces of the piece of timber shall be considered.

Anx 1.4.3.2 Slope of grain

The slope of grain is calculated as height *x* divided by the horizontal length *y*, see Figure 3. This ratio is expressed in percentage according to the equation

$$F = \frac{x}{y} \cdot 100$$

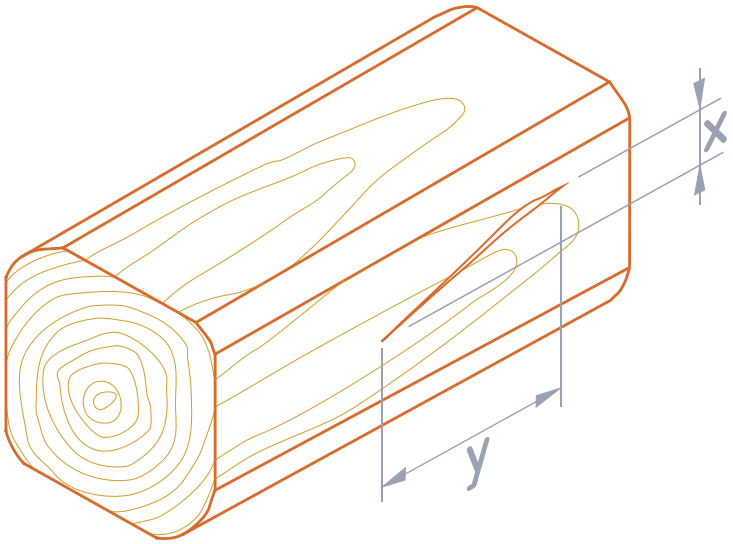


Figure 3 Measurement of the slope of grain by means of shrinkage fissures

Where

x ..... mm..... height

y ..... mm..... length

The slope of grain can be determined based on the fissures if visible, or with the correct use of a marking tool, see Figure 4, in accordance with EN 1310.

Figure 4 Measurement of the slope of grain using the marking tool

Where

A–B ..... —..... Grain direction, determined with the marking tool

A–C ..... —..... Direction of geometrical axis of the piece of timber

$\overline{BC}$ ..... mm..... Distance B–C, i.e. deviation of grain direction from axis of the piece of timber over the length A–C

$\overline{AC}$ ..... mm..... Distance A–C along the axis of the piece of timber

Slope of grain is given by the equation

$$\frac{\overline{BC}}{\overline{AC}} \cdot 100$$

Anx 1.4.3.3 Density

The average density shall be determined for each piece of timber by the ratio of its mass *M* in kilograms, measured with an accuracy of 1 %, and its volume *V* in cubic metres, obtained by multiplying the area of the mid cross section by the length of the piece of timer and expressing the result with at least 3 significant figures, and at the moisture content of 20 %, see Anx 1.4.2.

Anx 1.4.3.4 Ring width

The ring width shall be measured at both ends of the piece of timber. It is the average width of the growth rings, expressed in millimetres. The measurement is taken on the longest line as perpendicular as possible to the growth rings and starting at y = 25 mm from the pith, see Figure 5. The ring width is given by the equation

$$\omega = \frac{Z}{N}$$

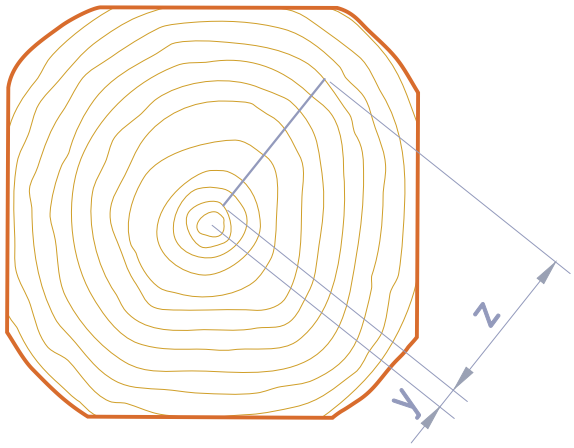


Figure 5 Measurement of ring width

Where

Z ..... mm..... Longest line perpendicular to the growth rings, at least 75 mm if possible

N..... —..... Number of rings included in Z

ω ..... mm..... Ring width

y ..... mm..... minimum distance from the pith

Anx 1.4.3.5 Shrinkage fissures

The length and the depth of the shrinkage fissures is linked to the moisture content of the piece of timber, therefore, the grade limitations apply only to timber at a moisture content of 20 % or lower, see Anx 1.4.2.

Anx 1.4.3.6 Ring shake

Single shakes, not reaching a lateral surface but visible on the ends, are permitted if not continuous for the whole length of the piece of timber and if they meet the limitations on maximum radius and eccentricity specified for the different timber populations.

If grading is performed on timber having a moisture content higher than the fibre saturation point a “probable ring shake” shall be considered, when a growth ring, visible in the cross section, has a width at least twice the width of the narrowest of the two rings immediately adjacent, preceding and following. Any probable ring shake has to be considered as an effective shake, and to be permitted, it shall satisfy the same limitations as the effective shake, see Figure 8.

Figure 6 and Figure 7 show the methods to measure the following parameters

– the maximum radius of the ring shake and
– the eccentricity.

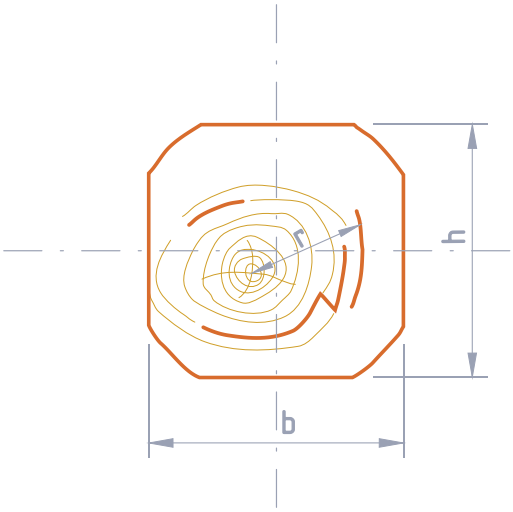


Figure 6 Measurement of the maximum radius of ring shake

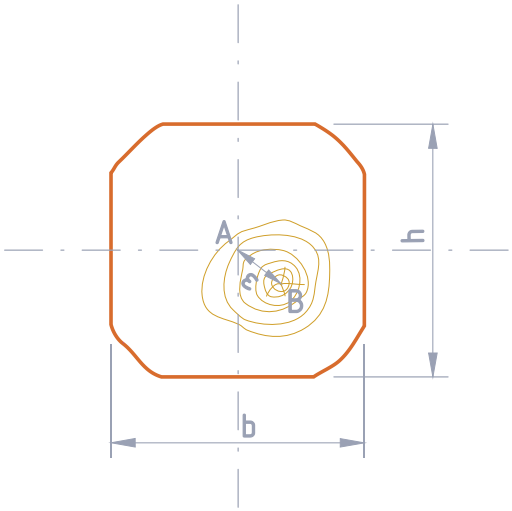
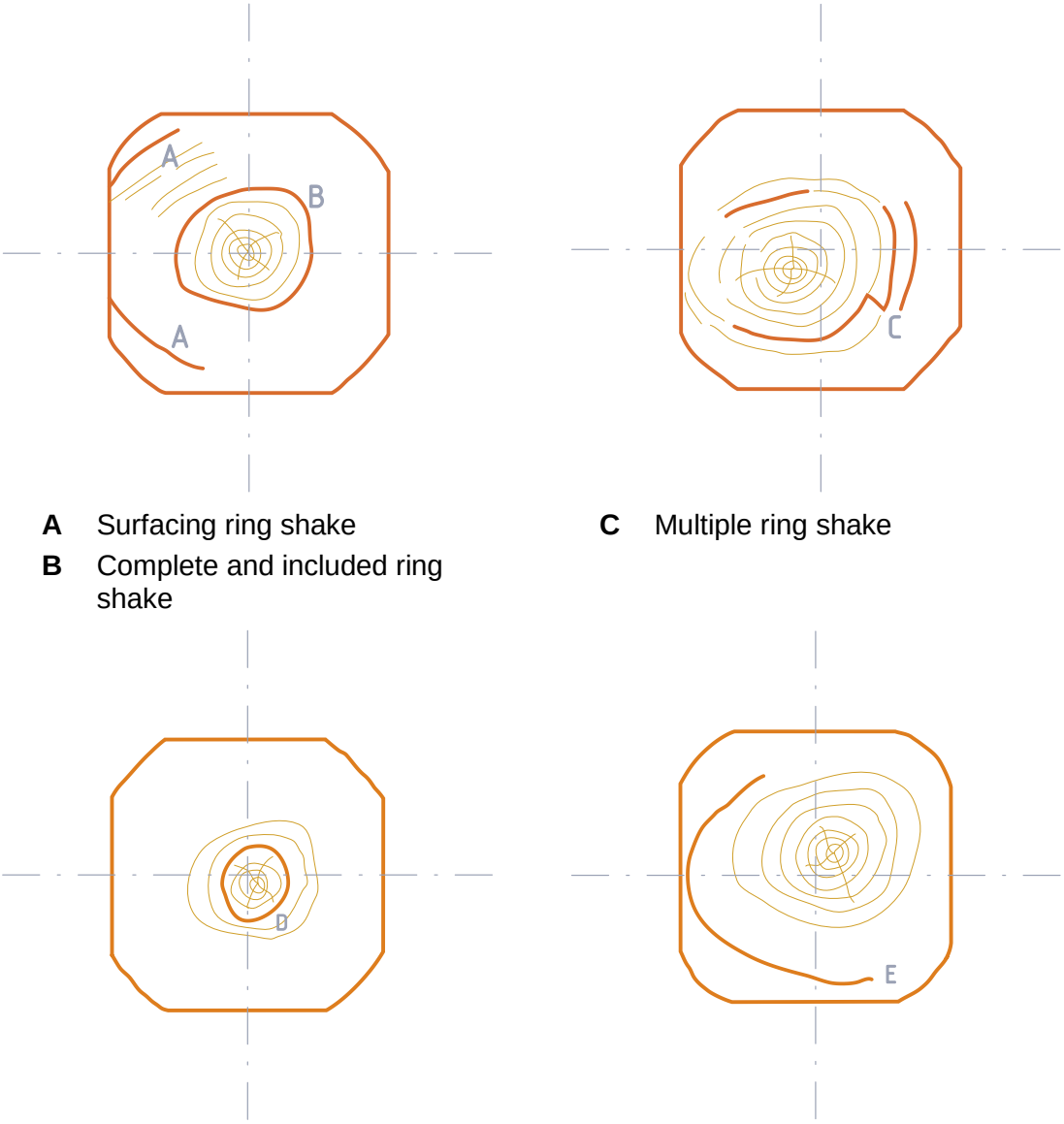


Figure 7 Measurement of the eccentricity

Where

r_{max} ..... mm ..... Maximum radius of the ring shake
b ..... mm ..... Smaller side of the cross section
h ..... mm ..... Larger side of the cross section
A ..... — ..... Geometrical centre of the section
B ..... — ..... Pith
ε ..... mm ..... Excentricity

The eccentricity is given by $\varepsilon = \overline{AB}$.



A Surfacing ring shake

B Complete and included ring shake

C Multiple ring shake

D Permitted ring shake

E Ring shake not permitted because of the excessive radius

Figure 8 Examples of ring shake

Anx 1.4.4 Geometrical characteristics

Anx 1.4.4.1 Wane

The wane is measured as the ratio of its projection on one side to the side length, see Figure 9. It is given by

On one face of the piece of timber

$$s = \frac{1}{h} \cdot (v_1 + v_2)$$

Where

v_1, v_2 ..... — ..... Orthogonal projections of the wanes on the larger side of the cross section

h ..... — ..... Larger side of the cross section

On another face of the piece of timber

$$s = \frac{1}{b} \cdot (k_1 + k_2)$$

Where

k_1, k_2 ..... — ..... Orthogonal projections of the wanes on the smaller side of the cross section

b ..... — ..... Smaller side of the cross section

The determination of the wane shall be carried out where the ratio is a maximum.

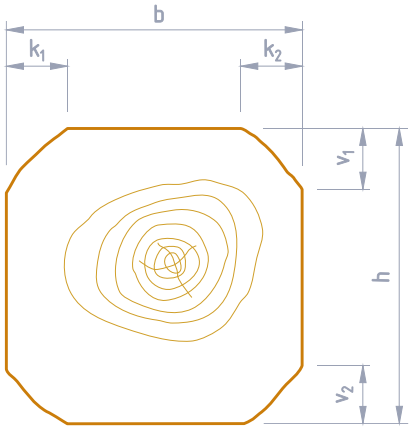


Figure 9 Measurement of wane

Where

b ..... mm ..... Smaller side of the cross section

h ..... mm ..... Larger side of the cross section

v_1, v_2 ..... — ..... Orthogonal projections of the wanes on the larger side of the cross section

k_1, k_2 ..... — ..... Orthogonal projections of the wanes on the smaller side of the cross section

Anx 1.4.4.2 Warp

The measurement of warp is illustrated in Figure 10.

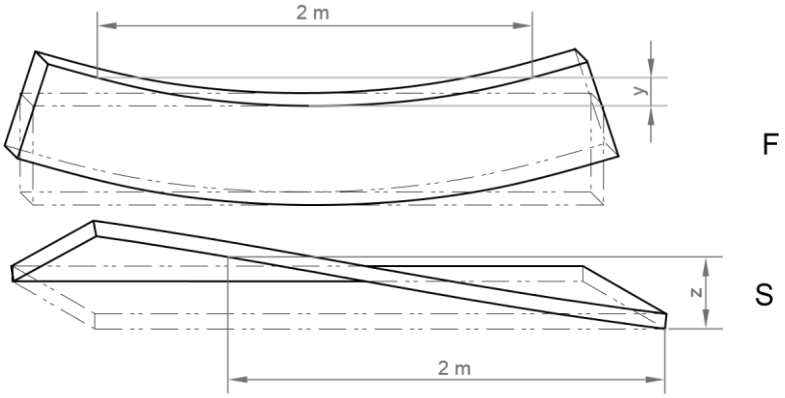


Figure 10 Measurement of warp, measuring length 2 m

Where

F ..... — ..... Spring

y	mm		Spring, measured over 2 m length
S	—		Twist
z	mm		Twist, measured over 2 m length and the full side length

Anx 1.4.4.3 Taper

Ratio of the maximum difference between the thicknesses of the cross sections at the ends of the piece of timber divided by its length, expressed in mm/m. The measurement of taper is explained in Figure 11.

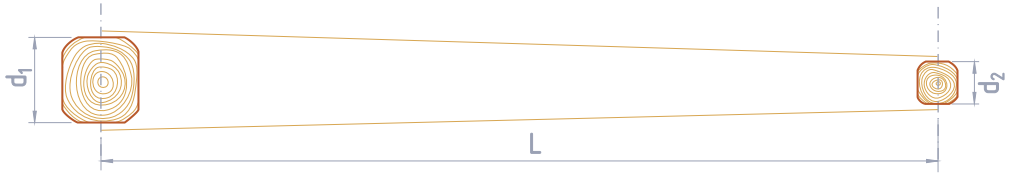


Figure 11 Measurement of taper

Where

d_1	mm		Larger thickness of the piece of timber
d_2	mm		Smaller thickness of the piece of timber
L	m		Length of piece of timber
R	—		Taper

The taper is given by the equation

$$R = \frac{1}{L} \cdot (d_1 - d_2)$$

Anx 1.4.4.4 Eccentric pith

The eccentric pith is given by the percentage of the eccentricity ε to the larger side of the cross section. It is measured at the ends of the piece of timber, see Figure 12, and the greater value is considered.

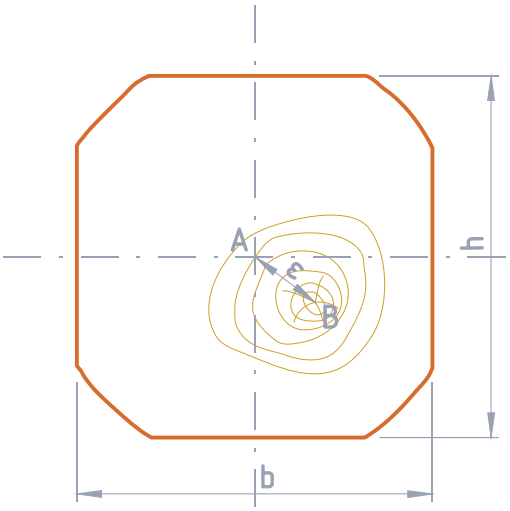


Figure 12 Measurement of eccentricity

Where

b	mm		Smaller side of the cross section
h	mm		Larger side of the cross section

A ..... — ..... Geometrical centre of the section

B ..... — ..... Pith

ε ..... — ..... Eccentricity is given by the distance $\overline{AB}$

The eccentricity is given by the equation

$$\varepsilon = \frac{\overline{AB}}{h}$$

Anx 1.4.4.5 Regularity of cross section

The regularity of the cross section is given by the difference between the two contiguous sides, see Figure 13, i.e. $h - b$, measured where this difference is the greatest.

NOTE The cross sections of the square edged logs with wane of softwood are virtually squares, i.e. $h \approx b$ according to the grading rules of Annex 1.

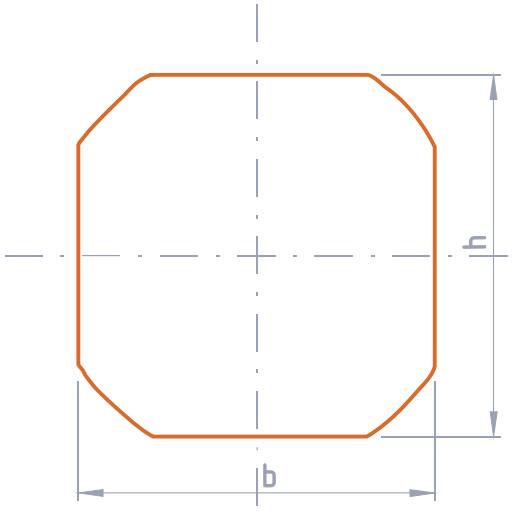


Figure 13 Measurement of regularity

Where

b ..... mm ..... Smaller side of the cross section

h ..... mm ..... Larger side of the cross section

Anx 1.4.5 Biological characteristics

Anx 1.4.5.1 Insect damage

Insects shall be taken into consideration that can infest and proliferate in green and seasoned wood (generally Anobiidae, Lyctidae, Ceramycidae).

Anx 1.4.5.2 Fungal damage

Any signs of fungi alteration (such as rot or dote) shall be considered.

Anx 1.4.6 Other characteristics

Anx 1.4.6.1 Reaction wood

Reaction wood shall be measured on the ends where it appears with the following method. The area of reaction wood shall be measured and referred to the cross-sectional area, see Anx 1.3.2, where it appears, taking into account always the greater value.

Anx 1.4.6.2 Damage

Damages are the lesions of the wood tissues caused in the standing tree by frost, lightning, wind and other traumas of various origins. In the same way, mechanical damages due to work done in the forest or at the sawmill and mistletoe damages has to be considered, if their effects could compromise timber strength.

Fissures, see Anx 1.4.3.5, and ring shakes, see Anx 1.4.3.6, are not part of this characteristic.

Anx 1.4.7 Other criteria

Only strength-affecting criteria or characteristics that directly influence the timber use in constructions can be taken into consideration for grading purposes. If a piece of timber shows defects not listed in this Annex, they shall be assessed comparing them to those listed. If these defects, in the judgement of the grader, affect the timber strength less than the defects listed in this document, they can be considered permitted.

Anx 1.5 Grading rules

Anx 1.5.1 Procedures for visual strength grading

Visual strength grading shall be performed as follows

a) Choice of the rule depending on the timber population;

b) Visual inspection of all the faces and both ends of each piece of timber;

c) Verify the limitations for all the timber characteristics;

d) Assign the sawn timber to the worst grade of those obtained in c);

e) If the piece of timber cannot be assigned to any of the specified grades, it shall be rejected as not gradable for structural use.

Anx 1.5.2 Choice of the grading rule

The grading rule shall be selected according to Table 4.

The table indicates

– species/origin combination

– the grading rule to apply

– the grade to which each piece of timber, after grading, can be assigned

Table 4 Grading rules for square edged logs with wane of softwood from different timber populations, see Clause 1.1

Species/Origin	Grading rule	Grade
Softwoods		
Spruce, Fir, and Larch [1)]	Softwood with constant external dimension of the cross section along the entire length, with wane and boxed heart and an approximately central pith	A

Species/Origin	Grading rule	Grade
Spruce, Fir, and Larch [1)]	Softwood with external dimensions of the cross section following the log tapering, with wane and boxed heart and an approximately central pith	B

[1)] Includes fir (*Abies alba* Mill), spruce (*Picea abies* Karst) and larch (*Larix decdua* Mill) from defined origin.

Table 5 Visual strength grading – Rule for square edged logs with wane of softwood – Softwood with constant external dimension of the cross section along the entire length with wane and boxed heart and an approximately central pith

Characteristic	Grade A
Wane[1)]	$s \leq \frac{9}{10}$
Single knots[2)] Knot grouping	$A \leq \frac{2}{5}$ and in any case $d \leq 70$ mm $A_g \leq \frac{2}{3}$
Ring width	≤ 6 mm
Slope of grain	$\leq \frac{1}{8}$ = 12.5 %
– shrinkage fissures – ring shake – damage (lightning, frost, lesions)	Permitted. If through the thickness permitted with limitation[3)] Not permitted for larch Permitted with limitation for spruce and fir[4)] Not permitted
Fungal damage – blue stain – brown and white rot	 Permitted Not permitted
Eccentric pith	≤ 20 %[5)]
Regularity of the cross section	≤ 2 cm
Reaction wood	Up to $\frac{2}{5}$ = 40 % of the cross-sectional area
Insect damage	Permitted with limitation[6)]
Mistletoe	Not permitted
Warps – spring – twist	 Not larger than 10 mm over a length of 2 m Not larger than 1 mm over a length of 2 m and a cross section side of 25 mm
Taper	Not permitted

Characteristic	Grade A

1) s is the ratio of the wane projections on a side of the cross section to the side dimension.

2) A is the ratio of the knot minimum diameter d to the side of the cross section on which the knot is measured.
For the knots at the wane, the ratio A of the minimum knot diameter d to the smaller side of the cross section is calculated.
A_g is the ratio of the sum of the minimum diameters of the grouped knots to the side of the cross section on which the knots are measured.

3) Fissure through the thickness only permitted at the ends, with a length not larger than the width of the piece of timber.

4) Generally not permitted, only for spruce and fir the visible or probable ring shake is permitted if $r_{max} \leq \frac{b}{3}$ and $\varepsilon \leq \frac{b}{6}$.
Where

r_{max} ..... mm ..... Maximum radius of the ring shake

b ..... mm ..... Smaller side of the cross section

ε ..... — ..... Eccentricity, that is the maximum distance between the pith and the geometrical centre of the cross section

5) The eccentricity of the pith is determined at the end of the piece of timber by the measured eccentricity, ε, divided by the larger side of the cross section.

6) Only holes with a blackish ring, or round holes, without a blackish ring, with diameter between 1.5 mm and 2.5 mm (Anobidae) are permitted, as long as the infestation is actually terminated. A maximum of 10 holes, uniformly distributed, per metre of length (the sum of all faces) is permitted.

Table 6 Visual strength grading – Rule for square edged logs with wane of softwood – Softwood with external dimension of the cross section following the log tapering with wane and boxed heart and an approximately central pith

Characteristics	Grade B
Wane[1)]	$s \leq \frac{9}{10}$
Single knots[2)] Knot grouping	$A \leq \frac{2}{5}$ and in any case $d \leq 70$ mm $A_g \leq \frac{2}{5}$
Ring width	≤ 6 mm
Slope of grain	$\leq \frac{1}{8} = 12.5\ \%$
– shrinkage fissures – ring shake – damage (lightning, frost, lesions)	Permitted. If through the thickness permitted with limitation[3)] Not permitted for larch Permitted with limitation for spruce and fir[4)] Not permitted
Fungal damage – blue stain – brown and white rot	 Permitted Not permitted

Characteristics	Grade B
Eccentric pith	≤ 20 %[5)]
Regularity of the cross section	≤ 2 cm
Reaction wood	Up to $\frac{2}{5}$ = 40 % of the cross-sectional area
Insect damage	Permitted with limitation[6)]
Mistletoe	Not permitted
Warps – spring – twist	 Not larger than 8 mm over a length of 2 m Not larger than 1 mm over a length of 2 m and a cross section side of 25 mm
Taper[7)]	$R \leq 6$ mm/m

1) s is the ratio of the wane projections on a side of the cross section to the side dimension.

2) A is the ratio of the knot minimum diameter d to the side of the cross section on which the knot is measured.
For the knots at the wane, the ratio A of the minimum knot diameter d to the smaller side of the cross section is calculated.
A_g is the ratio of the sum of the minimum diameters of the grouped knots to the side of the cross section on which the knots are measured.

3) Fissure through the thickness only permitted at the ends, with a length not larger than the width of the piece of timber.

4) Generally not permitted; only for Spruce and Fir the visible or probable ring shake is permitted if $r_{max} \leq \frac{b}{3}$ and $\varepsilon \leq \frac{b}{6}$,

Where

r_{max} ..... mm ..... Maximum radius of the ring shake

b ..... mm ..... Smaller side of the cross section

ε ..... — ..... Eccentricity, that is the maximum distance between the pith and the geometrical centre of the cross section

5) The eccentricity of the pith is determined at the end of the piece of timber by the measured eccentricity, ε, divided by the larger side of the cross section.

6) Only holes with a blackish ring, or round holes, without a blackish ring, with diameter between 1.5 mm and 2.5 mm (Anobidae) are permitted, as long as the infestation is actually terminated. A maximum of 10 holes, uniformly distributed, per metre of length (the sum of all faces) is permitted.

7) Reduction in size permitted for each side of the section, along the longitudinal axis of the piece of timber.