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Timber structures — Test methods — Load bearing stapled joints

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee B/518, Structural timber.

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

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Holzbauwerke - Prüfverfahren - Tragende Klammerverbindungen

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European foreword

This document (EN 1381:2016) has been prepared by Technical Committee CEN/TC 124 "Timber Structures", the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by August 2016, and conflicting national standards shall be withdrawn at the latest by August 2016.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 1381:1999.

Compared to EN 1381:1999, the following changes have been made:

— replacement of EN 28970 by EN ISO 8970;

— improvement to figures and definitions.

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1 Scope

This European Standard specifies test methods for determining the strength and deformation characteristics of stapled joints in load-bearing timber structures.

The methods assess joints with members of timber (solid timber and glued laminated timber) or wood-based products in the combination proposed for use in service and using all types of staples up to 3 mm diameter for circular cross-section staples or 4 mm x 2 mm for rectangular or oval cross-section staples.

The methods determine load-slip characteristics and maximum load of joints with laterally loaded staples where various angles between the applied force and the timber grain direction or the main direction of the wood-based products, respectively, are possible.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 322, *Wood-based panels - Determination of moisture content*

EN 323, *Wood-based panels - Determination of density*

EN 14592, *Timber Structures – Dowel-type-fasteners – Requirements*

EN 26891:1991, *Timber structures - Joints made with mechanical fasteners - General principles for the determination of strength and deformation characteristics (ISO 6891:1983)*

EN ISO 8970:2010, *Timber structures - Testing of joints made with mechanical fasteners - Requirements for wood density (ISO 8970:2010)*

ISO 13061-1, *Physical and mechanical properties of wood — Test methods for small clear wood specimens — Part 1: Determination of moisture content for physical and mechanical tests*

ISO 13061-2, *Physical and mechanical properties of wood — Test methods for small clear wood specimens — Part 2: Determination of density for physical and mechanical tests*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
staple
double-bent, u-shaped piece of round, square, rectangular or oval wire with pointed

3.2
staple crown
connection between the two staple legs

3.3
staple leg diameter or side length
nominal diameter of a round staple leg, the side length of a rectangular leg, or the diameter of an oval cross section as defined in EN 14592

3.4
staple length
length of each staple leg, including point

3.5
staple crone width
width across the staple legs

3.6
deformation of the joint
mean value of the measurements of the relative displacements of the two side members with respect to the central member

Note 1 to entry see Figure 1.

4 Symbols and abbreviations

For the purposes of this document, the following symbols and abbreviations apply.

a staple crone width, see Figure 1, in millimetres

b width of member cross-section, in millimetres

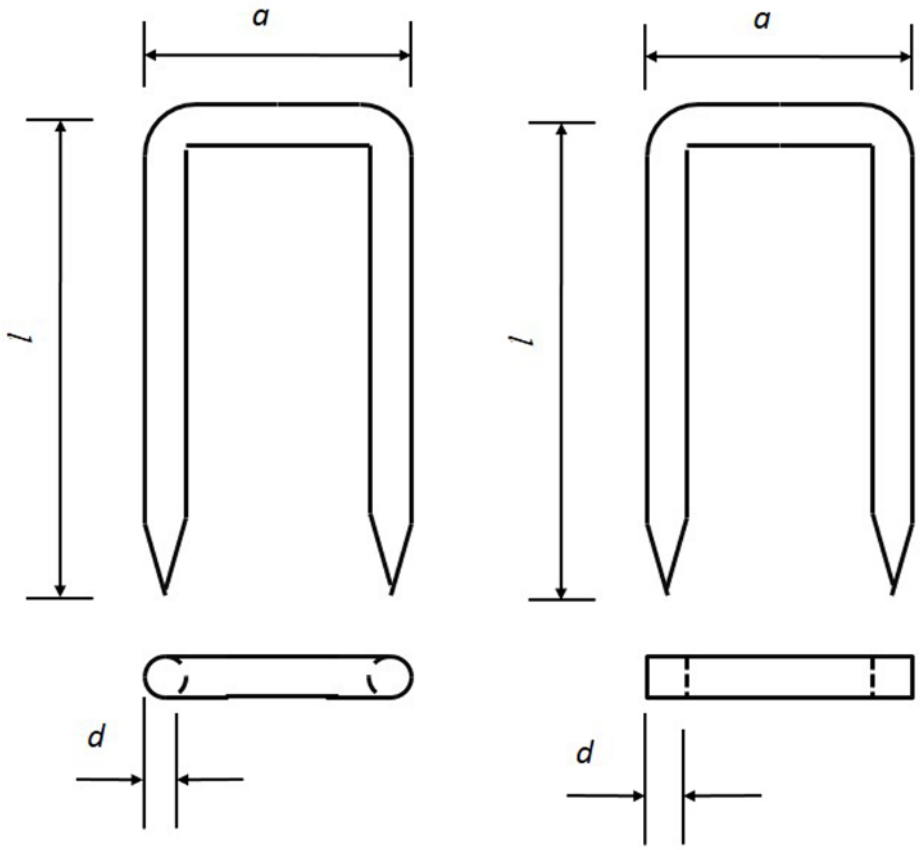
d nominal value of the diameter of a round staple leg, the side length of a rectangular leg, or the diameter of an oval cross section as defined in EN 14592, see Figure 1, in millimetres.

F load, in newtons

t member thickness, in millimetres

l staple length including the point, see Figure 1, in millimetres

α_{crn} angle between the direction of a staple crown and the grain direction or the main direction of the wood-based products, respectively, see Figure 2, in degrees



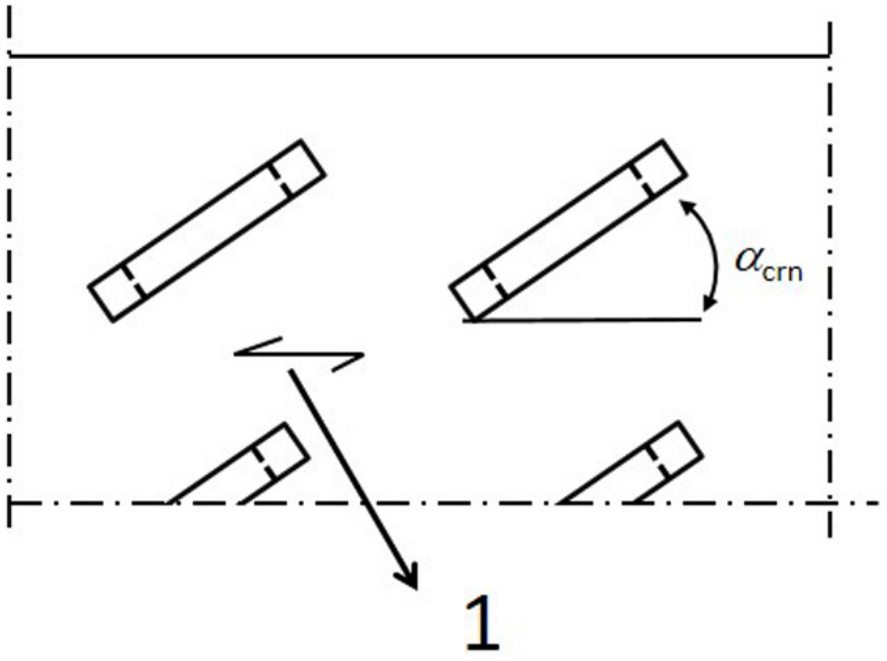
Key

l is staple length

d is diameter

a is staple crown width

Figure 1 — Staple dimensions



Key

1 grain direction

Figure 2 — Angle between the staple direction and the grain direction or the main direction of a wood-based product

5 Materials

5.1 Timber

The timber shall be selected in accordance with the method given in EN ISO 8970:2010.

For each test piece, the density of the individual members to be joined shall not differ more than 10 %.

For a group of similar test pieces, separate planks shall be used for each test piece.

The members shall be free from major defects that could lead to premature failure in the area away from the fasteners.

5.2 Wood-based materials

The specification of these products shall be established. The products used for the individual members of the test pieces shall be representative of the class or range of product to which they belong and the relevant properties shall be declared.

One unique grade shall be used to make the test pieces. For each test piece, the individual members In the joint shall be selected from separate pieces of material.

5.3 Staples

The technical specification of the staple wire and the staples shall be established if unknown.

6 Test methods

6.1 General

The moisture content and density of the timber or wood-based products members at test shall be determined as specified in ISO 13061-1, ISO 13061-2, EN 322 or EN 323 as appropriate.

6.2 Conditioning

In case of staples with smooth legs the test pieces shall be manufactured with the timber or wood-based products at an equilibrium moisture content corresponding to (20 ± 2) °C and (85 ± 5) % relative humidity.

After manufacture the test pieces shall be stored for at least one week at (20 ± 2) °C and (65 ± 5) % relative humidity.

For other staples the test pieces shall be manufactured with the timber or wood-based products at an equilibrium moisture content corresponding to (20 ± 2) °C and (65 ± 5) % relative humidity.

After manufacture the test pieces shall be stored at (20 ± 2) °C and (65 ± 5) % relative humidity.

The material is conditioned when it attains constant mass. Constant mass is considered to be attained when, the results of two successive weightings, carried out at an interval of 6 h, do not differ by more than 0,1 % of the mass of the material.

For certain investigations other moisture conditioning may be appropriate, and shall be reported.

For some deciduous wood species a much longer storing period may be necessary or the test pieces should be made with appropriate gaps between the members.

6.3 Fabrication of the test pieces

If there are no special requirements, timber elements shall be planed. Test pieces shall be fabricated with the staple leg perpendicular to the member surface. The insertion of the staples shall follow normal practice, which shall be reported.

NOTE The depth of staple crown indentation will have an influence on the test results, particular for joints loaded in double shear. It is not allowed that the staple crown protrudes above the surface.

6.4 Preparation of the test pieces

6.4.1 Load parallel to grain

For joints consisting solely of timber or wood-based products (or combinations thereof) the test pieces shall be made as three-member joints with four staples from each side, loaded in single shear, see Figure 3.

Test shall be made with test pieces with $\alpha_{crn} = 30°$. If wood-based products are included in the test piece the test shall be carried out at either $\alpha_{crn} = 30°$ or $\alpha_{crn} = 60°$, whichever gives the smallest load carrying capacity.

NOTE The 50 mm minimum end length shown in Figure 3 may not be appropriate to thin timber or wood-based products subjected to compression loads.

6.4.2 Load perpendicular to grain

For joints consisting solely of timber or wood-based products (or combinations thereof) the test pieces shall be made as three-member joints with four staples from each side, loaded in single shear, see Figures 4 and 5.

Test shall be made with test pieces with $\alpha_{crn} = 30°$. If wood-based products are included in the test piece the test shall be carried out at either $\alpha_{crn} = 30°$ or $\alpha_{crn} = 60°$, whichever gives the smallest load carrying capacity.

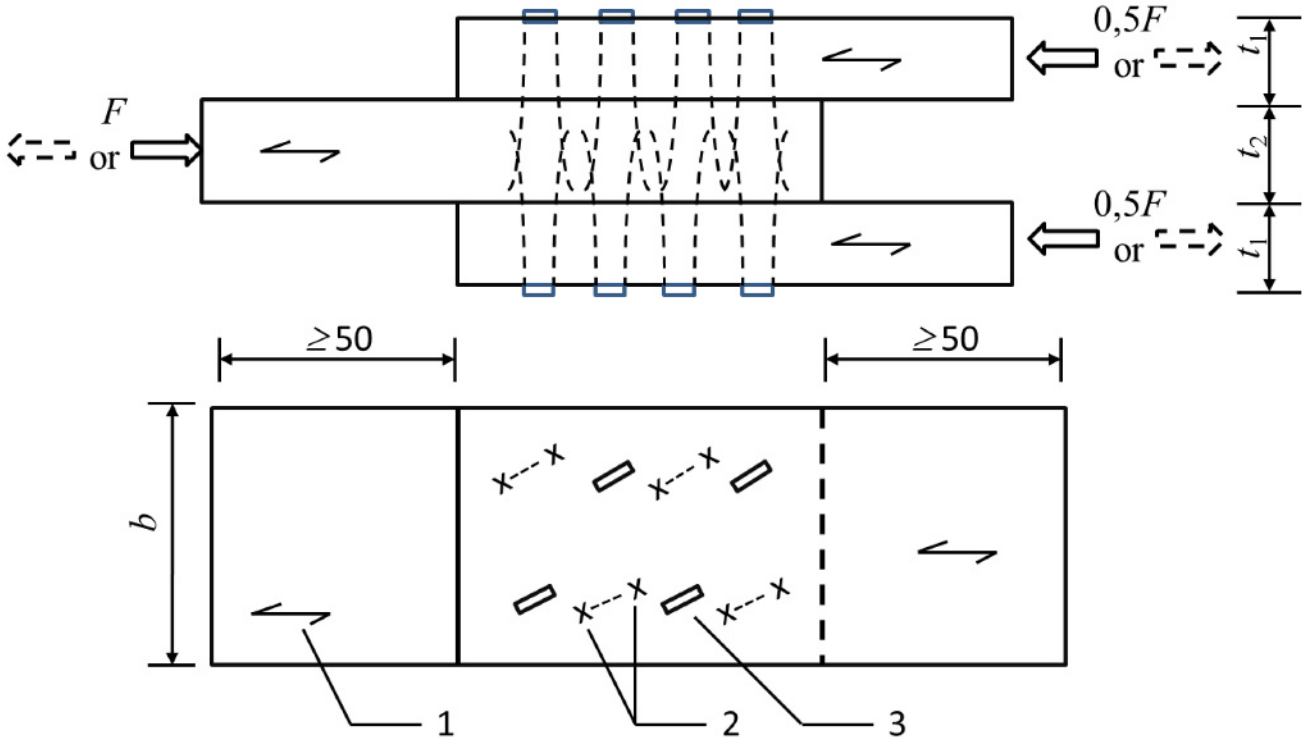
6.5 Test procedure

The tests shall be carried out in accordance with Clauses 7 and 8 of EN 26891:1991 with the following additions:

a) if compressive test pieces are used, instability of the members shall be prevented and;

b) the separation of the side members in combination with pulling out the staple shall not be significantly hindered by the loading equipment.

Dimensions in millimetres

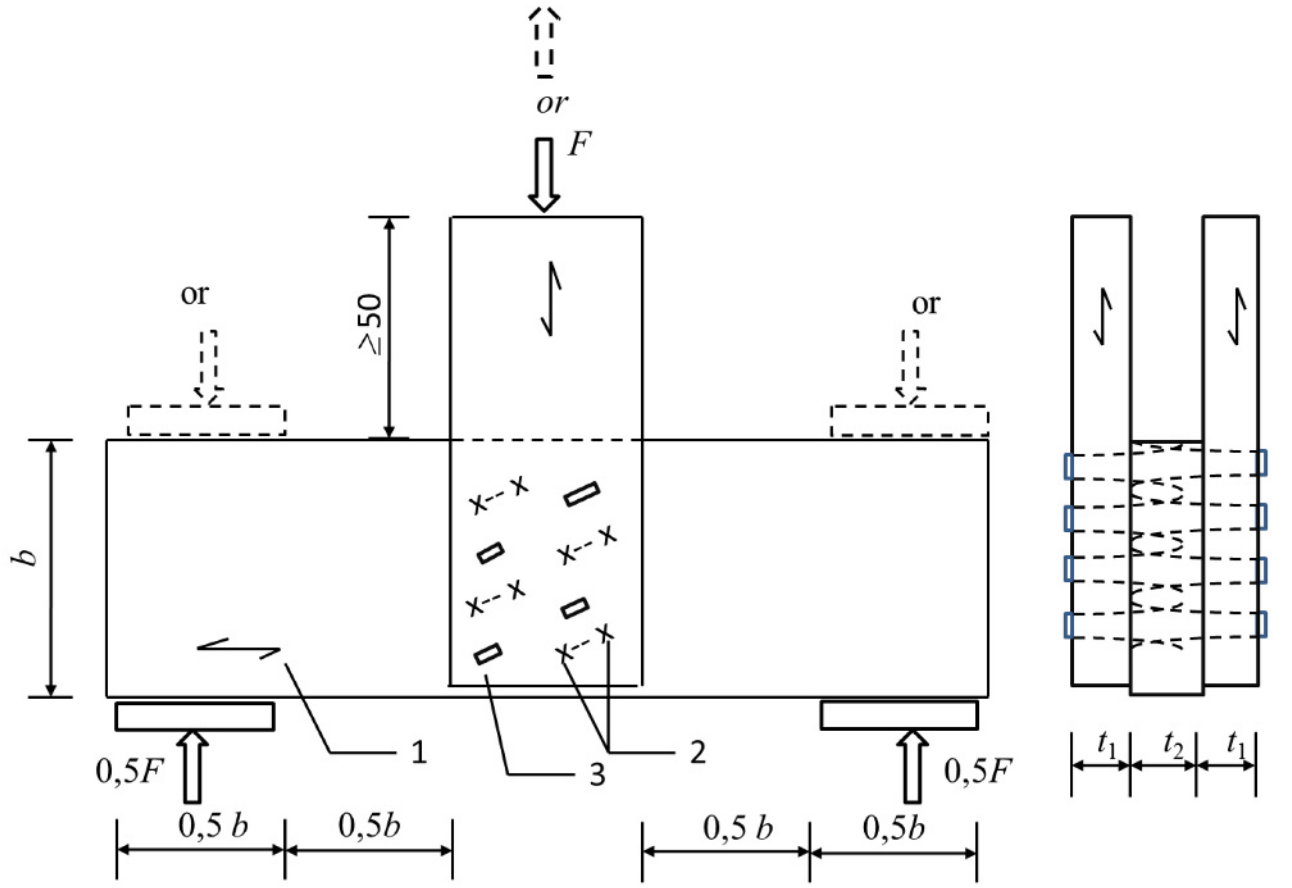


Key

1 grain direction
2 staple point
3 staple crown

Figure 3 — Timber joint, single shear, loaded in tension or compression; staples $\alpha_{crn} = 30°$

Dimensions in millimetres



Key

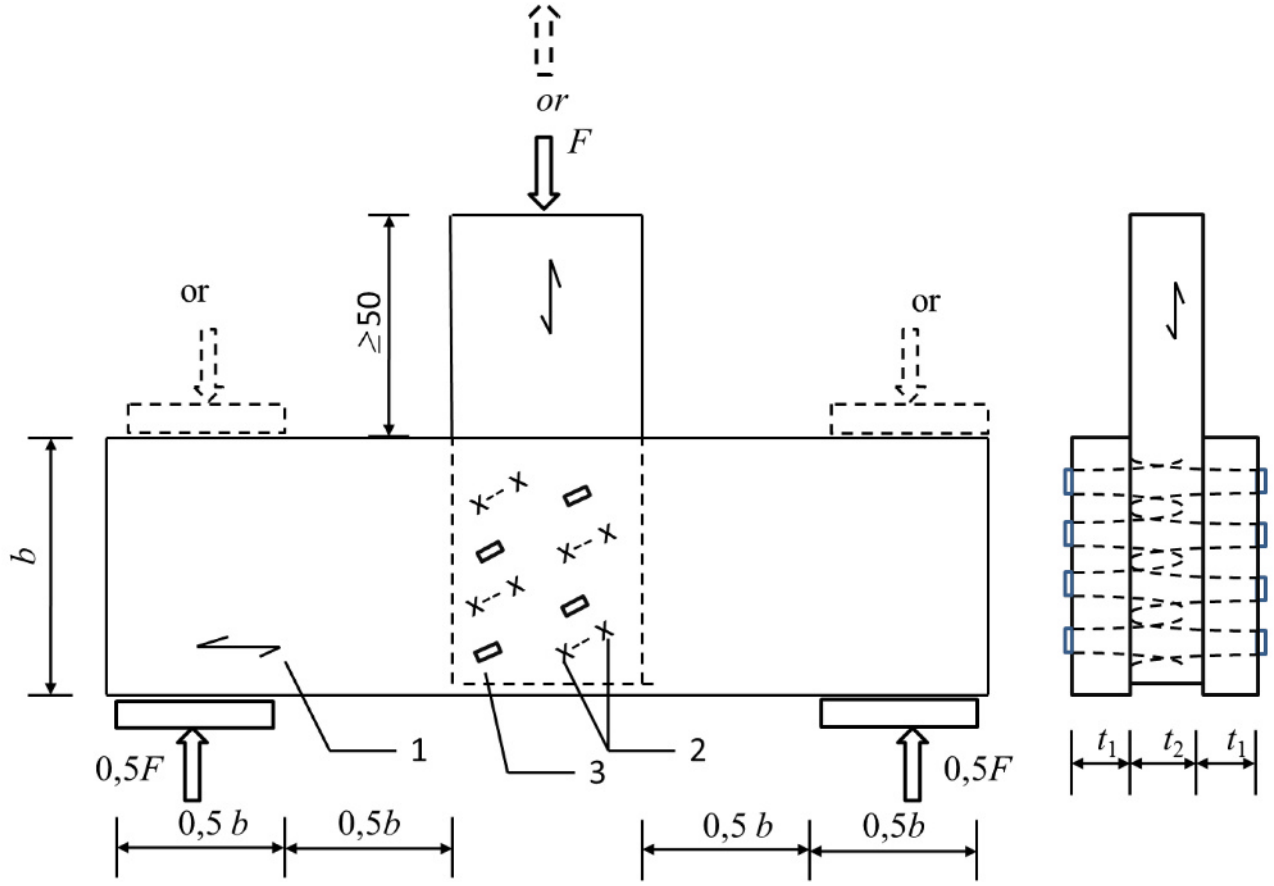
1 grain direction

2 staple point

3 staple crown

Figure 4 — Single shear test piece loaded in tension or compression - centre member loaded perpendicular to the grain

Dimensions in millimetres



Key

1 grain direction

2 staple point

3 staple crown

Figure 5 — Single shear test piece loaded in tension or compression - side members loaded perpendicular to the grain

6.6 Test Result

The test results shall be determined in accordance with 8.5 of EN 26891:1991.

6.7 Test Report

The test report shall contain the following information

a) species, density and other relevant properties of timber and/or wood based products;

b) quality, strength properties and surface finish of the materials of the staples, including anti-corrosive protection;

c) dimensions of the joints, size and number of the staples, details of gaps between members;

d) mode of insertion of the staples;

e) spacing, end and edge distances of the staples;

f) main direction (in the case of wood-based products);

g) depth of staple point penetration;

h) crown angle with respect to grain direction and depth of staple crown indentation, if any;

i) conditioning of materials of the test specimens before and after manufacture, moisture content of the materials at manufacture and at test, fissures etc.;

j) the loading procedure used, including whether in compression or tension, and a statement of any deviations;

k) individual test results and any relevant information regarding adjustments, mean values and standard deviations, and descriptions of the modes of failure;

l) number of tests.

NOTE Characteristic values can be determined using EN 14358.

Bibliography

[1] EN 14358, *Timber structures - Calculation of characteristic 5-percentile values and acceptance criteria for a sample*

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