British Standard

BRITISH STANDARD

BS EN
392:1995

Glued laminated timber — Shear test of glue lines

The European Standard EN 392:1995 has the status of a British Standard

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by Technical Committee B/518, Structural timber, to Subcommittee B/518/3, Glued laminated timber, upon which the following bodies were represented:

British Adhesives and Sealants Association
British Plastics Federation
British Woodworking Federation
Department of the Environment (Building Research Establishment)
Glued Laminated Timber Association
Institution of Civil Engineers
Timber Research and Development Association
Timber Trade Federation
Wood Panel Products Federation
Coopted members

This British Standard, having been prepared under the direction of the Sector Board for Building and Civil Engineering, was published under the authority of the Standards Board and comes into effect on
15 July 1995

The following BSI references relate to the work on this standard:
Committee reference B/518/3
Draft for comment 90/16019 DC

ISBN 0 580 24286 2

Amendments issued since publication

Amd. No.	Date	Comments

Contents

National foreword

This British Standard has been prepared by Subcommittee B/518/3 and is the English language version of EN 392:1995 *Glued laminated timber — Shear test of glue lines*, published by the European Committee for Standardization (CEN). This standard is technically equivalent to Appendix B of BS 4169:1988.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 7 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 392

January 1995

ICS 79.060.00

Descriptors: Laminated boards, gluing, quality control, shear tests, shear strength

English version

Glued laminated timber — Shear test of glue lines

Bois lamellé collé — Essai de cisaillenent des joints de collage

Brettschichtholz — Scherprüfung der Leimfugen

This European Standard was approved by CEN on 1995-01-09. CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

Ref. No. EN 392:1995 E

Foreword

This European Standard was prepared by CEN TC 124, *Timber structures*, of which the secretariat is held by DS.

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 July 1995, and conflicting national standards shall be withdrawn at the latest by July 1995.

NOTE It is considered desirable to maintain the same clause numbers consistently throughout this series of standards. Consequently, some clauses are void in this edition of this standard, but it is envisaged that future editions may need to include text in these clauses.

No existing European Standard is superseded.

In accordance with the CEN/CENELEC Internal Regulations, the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

Contents

1 Scope

This standard specifies a method for measuring the shear strength of the glue line parallel to the direction of grain. The standard is applicable in the field of continuous quality control of the glue line.

2 Normative references

This European Standard incorporates by dated or undated references, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 386, *Glued laminated timber — Performance requirements and minimum production requirements.*

ISO 554:1976, *Standard atmospheres for conditioning and/or testing — Specifications.*

3 Definitions

For the purposes of this standard the following definitions apply.

3.1
drill core

specimen of cylindrical shape drilled out of the glulam

3.2
glued laminated timber (glulam)

structural member formed by bonding together timber laminations with the grain essentially parallel

3.3
test bar

test piece of rectangular right-angled prismatic form

3.4
wood failure

rupture in or between wood fibres

3.5
wood failure percentage

percentage of the wood failure area in relation to the total sheared area

4 Symbols

A	area, in square millimetres;
a	width of machined flat face of drill core, in millimetres;
b	width of test bar, in millimetres;
d	diameter, in millimetres;
F_u	ultimate load, in newtons;
f_v	shear strength, in newtons per square millimetre;
k	modification factor;
l	length of test piece, in millimetres;
t	thickness of test piece, in millimetres.

5 Requirements

None.

6 Shear test of glue lines

6.1 Principle

A shear stress is applied at the glue line until failure occurs.

6.2 Apparatus

6.2.1 *Testing machine*

A calibrated testing machine capable of applying a compressive force to the shearing tool, referred to in **6.2.2**. The accuracy of measuring the maximum load shall be better than ± 3 %.

6.2.2 *Shearing tool*

A shearing tool as illustrated in Figure 1. The cylindrical bearing shall be self-aligning so that the test piece is loaded at the end grain with a stress field uniform in the width direction.

6.3 Preparation of test pieces

6.3.1 ***Test pieces***

Special care shall be taken in preparing the test pieces to ensure that the loaded surfaces are smooth and parallel to each other and perpendicular to the grain direction.

The test piece shall be of the form shown in either Figure 2 or Figure 3. That depicted in Figure 2 shows the normal test piece.

6.3.2 ***Sampling***

6.3.2.1 Test bars shall be cut from the full cross-sectional specimens as described in EN 386. At least three glue lines in each of the lower, middle and upper part shall be tested. If there are less than 10 laminations all glue lines shall be tested.

NOTE It is recommended that the full cross-sectional specimens are taken within areas of the glulam member where sufficient cramping pressure has been established. In practice the specimens are frequently cut from the end of the glulam members where the cramping pressure may be variable and insufficient. If the required shear strength is obtained from test pieces of this nature, the quality of the glue lines in the member should be deemed adequate.

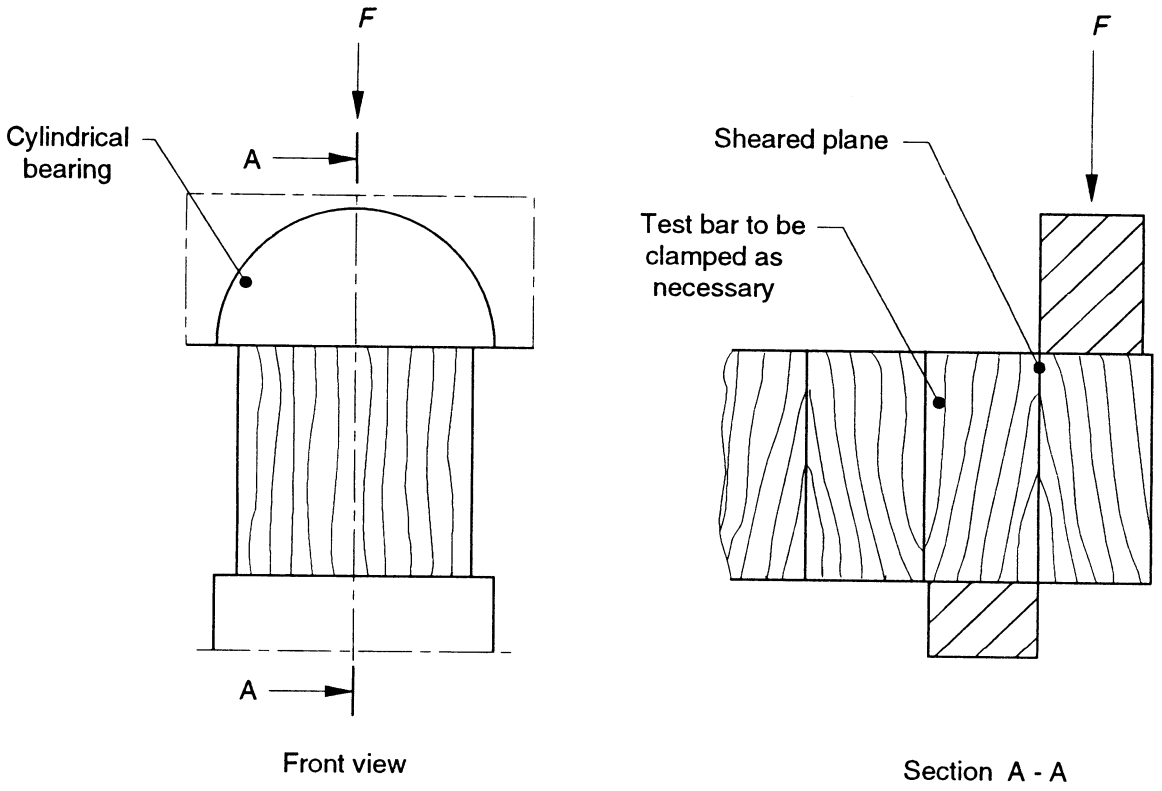
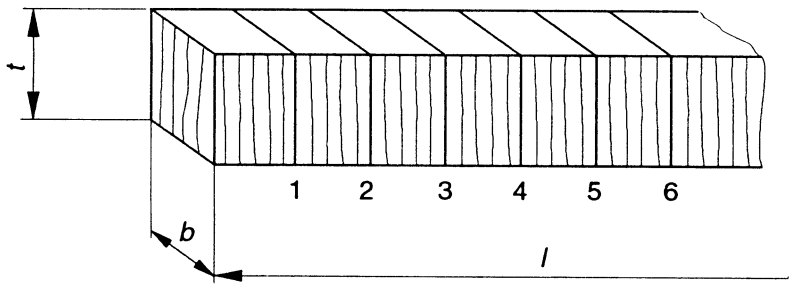


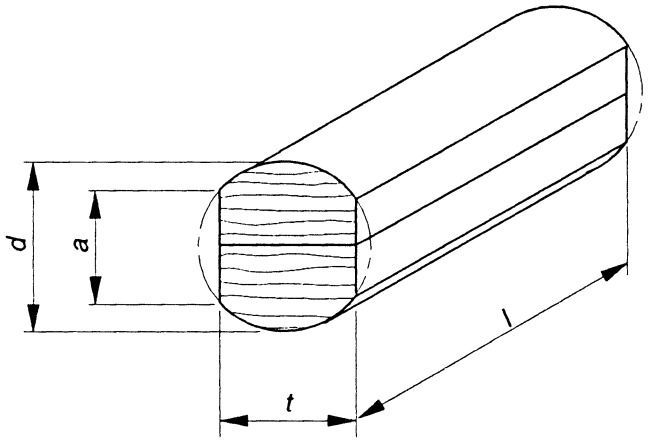
Figure 1 — Shearing tool with a test bar inserted



Sizes: length, l;
width, b: 40 mm to 50 mm;
thickness, t: 40 mm to 50 mm.

NOTE If the test bar is cut from a position higher in the cross section the numbers of the lines do not start with 1 (see **6.3.3**).

Figure 2 — The normal test piece, a test bar, and the numbering of the individual glue lines for a test bar cut at the bottom of the cross section



Sizes: length, l: 70 mm to 80 mm;
diameter, d: approx. 35 mm;
straight edges, a: approx. 23;
thickness, t: approx. 26 mm.

Figure 3 — Drill core with machined parallel plane surfaces

6.3.2.2 The shear testing shall include as far as possible the total cross-sectional width of the glulam member. The number of test bars to be taken shall be as given in Table 1.

Table 1 — Number of test bars

Width of full cross section (see Figure 4) mm	**Number of test bars**
≤ 100	1
>100, ≤ 160	2
> 160	3

6.3.2.3 If two or more members are cramped in one operation, see Figure 6, the test bars necessary according to the testing quantity quoted in **6.3.2.2** have to be taken from each of the members.

6.3.2.4 For testing glue lines within the glulam member, drill cores shall be sampled.

The drill cores shall be cut out perpendicular to the face of the glulam member in such a way that the glue line to be tested is situated in the middle of the core.

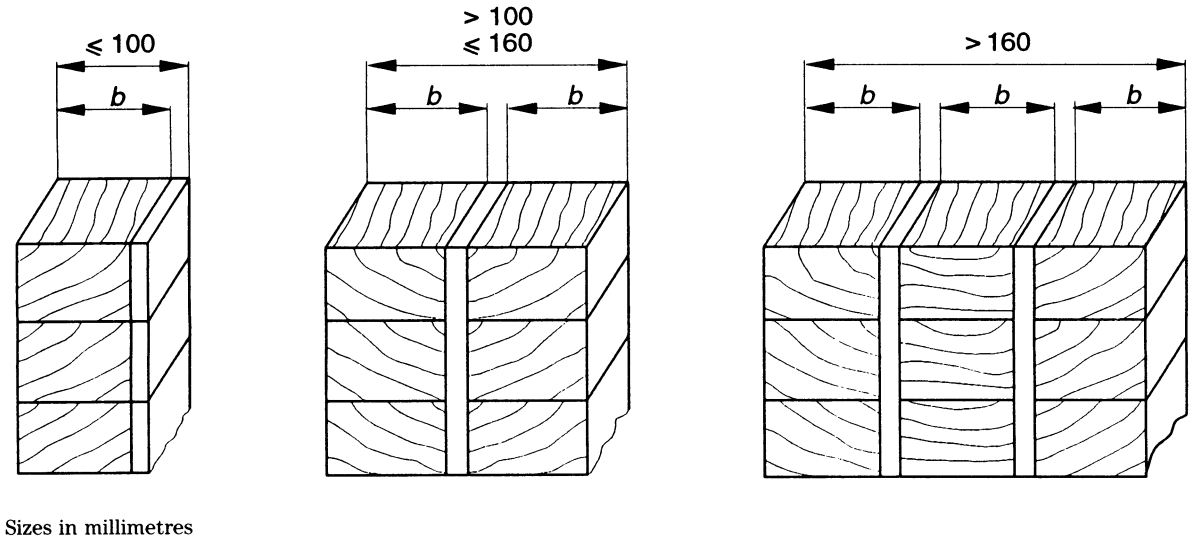
NOTE For guidance of the drilling tool it is recommended that an appropriate support is used.

The drill cores shall be machined at two faces perpendicular to the glue line as shown in Figure 3 and divided lengthwise so that the test pieces have a rectangular shearing area.

6.3.3 *Marking*

Every test bar shall be marked with a durable identification. This shall indicate the location of the test bar within the cross section of the glulam member.

NOTE 1 The relationship between identification and location may be as shown in Figure 5.
If the glulam member is glued vertically the front side of the element should be marked with U and the back side with L.
The glue lines of the glulam member should be numbered beginning with the bottom edge of the member, see Figure 2.
NOTE 2 If two glulam members are cramped in one operation, the test bars from the lower member should be marked additionally with 1 and those from the upper member with 2. An example of this marking is shown in Figure 6.



Sizes in millimetres

Figure 4 — Test bars to be cut from a full cross-sectional specimen

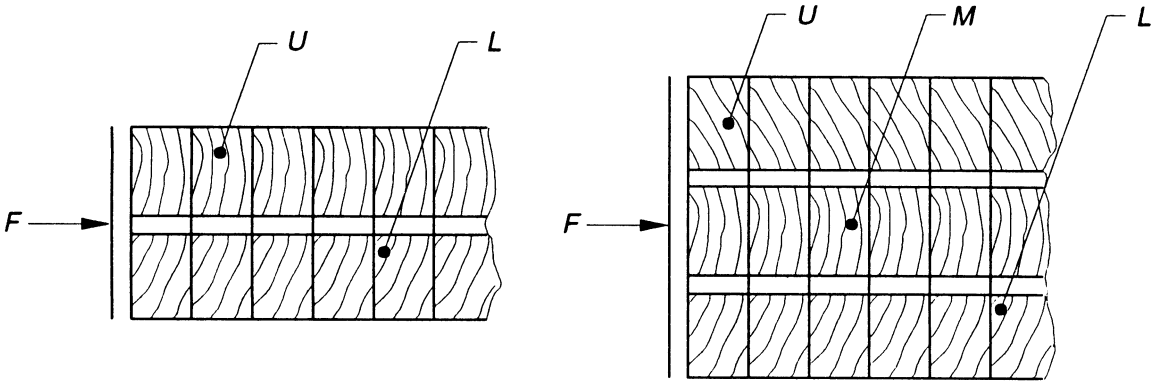


Figure 5 — Suggested identification showing the location of the test bars in the cross section in a member glued horizontally

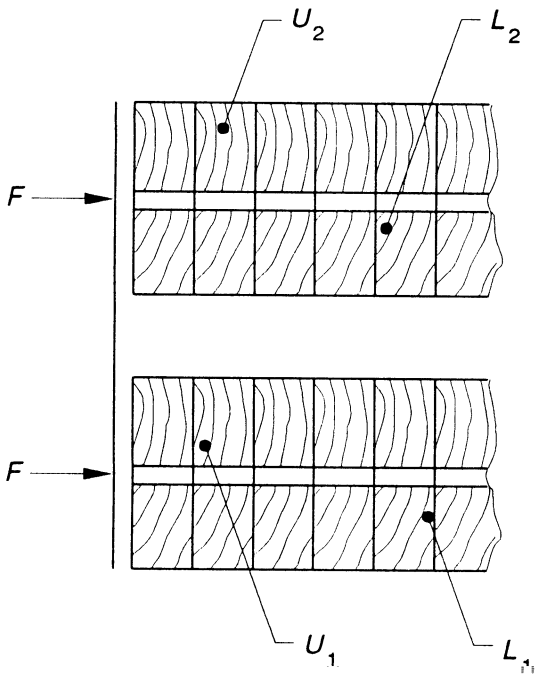


Figure 6 — Additional identification with numbers showing the location of the glulam member during the cramping

6.4 Procedure

6.4.1 The test pieces shall be conditioned to an equilibrium moisture content in the standard climate 20/65, given in ISO 554, i.e. temperature (20 ± 2) °C and a relative humidity of (65 ± 5) %. For internal quality control the moisture content of the wood shall be uniform over the test piece and within the range of 8 % to 13 %.

6.4.2 Measure the sizes from which the sheared area is determined to the nearest 0,5 mm. Use, for example, a sliding gauge.

6.4.3 Place the test piece in the shearing tool so that it is loaded in the direction of the grain. The glue line shall be positioned so that the distance between this and the sheared plane nowhere exceeds 1 mm.

6.4.4 The loading shall be undertaken at a constant rate and so that failure occurs after at least 20 s.

6.4.5 Estimate the amount of wood failure percentage rounded off to the nearest figure divisible by 5.

6.4.6 From every tested test bar with at least five remaining glue lines a part shall be marked with the order number, element number, gluing date and position of the test piece according to **6.3.3**, and stored for a period as agreed with the certification body.

6.5 Results

Determine the shear strength f_v with two significant digits from the following equation:

$$f_v = k\frac{F_u}{A}$$

where

A is the sheared area (for a test bar $A = bt$, and for a drill core $A = lt$);

k is a modification factor: $k = 0{,}78 + 0{,}0044\ t$;

t is the thickness, in millimetres.

NOTE The factor k modifies the shear strength for test pieces where the thickness in the grain direction of the sheared area is less than 50 mm.

6.6 Test report

The test report shall include the following items.

a) Date of the test.

b) Identification of test pieces and members from which they have been cut. Any other relevant information, e.g. about preconditioning.

c) Species of timber.

d) Type of adhesive.

e) Sizes of the test piece.

f) Ultimate load and shear strength.

g) Any relevant observation made during or after testing.

h) Signature of the person responsible for the testing.

NOTE The information mentioned in items e) to h) is not required to be registered and filed directly, if other data are filed from which the information may be derived.

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