BS EN 16556:2014

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# Determination of the maximum open time for thermoplastic wood adhesives for non-structural applications

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

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EUROPEAN STANDARD

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EUROPÄISCHE NORM

**EN 16556**

November 2014

ICS 83.180

English Version

# Determination of the maximum open time for thermoplastic wood adhesives for non-structural applications

Détermination du temps ouvert maximal des adhésifs thermoplastiques pour bois pour applications non structurales

Bestimmung der maximalen offenen Wartezeit bei thermoplastischen Holzklebstoffen für nicht tragende Anwendungen

This European Standard was approved by CEN on 20 September 2014.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

**CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels**

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# Foreword

This document (EN 16556:2014) has been prepared by Technical Committee CEN/TC 193 “Adhesives”, the secretariat of which is held by AENOR.

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of an identical text or by endorsement, at the latest by May 2015 and conflicting national standards shall be withdrawn at the latest by May 2015.

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It is understood that some of the material permitted in this standard can have negative environmental impact. As technological advantages lead to better alternatives for these materials, they will be eliminated from this standard to the extent possible.

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## 1 Scope

This European Standard defines the test method for the determination of the maximum open time for thermoplastic wood adhesives for non-structural applications by tensile shear strength. It is carried out on standardized test pieces glued with increasing open times.

## 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 923, *Adhesives - Terms and definitions*

EN 1067, *Adhesives - Examination and preparation of samples for testing*

EN ISO 15605, *Adhesives - Sampling (ISO 15605)*

ISO 5893, *Rubber and plastics test equipment — Tensile, flexural and compression types (constant rate of traverse) — Specification*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 923 and the following apply.

**3.1**
**maximum open time**
the longest time within which two wooden adherends, where the adhesive is applied, can remain decoupled ensuring a tensile force value ≥ 10 N/mm$^2$ and a wood failure > 0 %

Note 1 to entry: The open time is expressed in minutes (min).

## 4 Symbols and abbreviations

$A$ bonded test surface, in square millimetres (mm²);

$a$ thickness of bond-line, in millimetres (mm);

$\alpha$ angle between growth ring and surfaces to be bonded, in grades ( ° );

$b$ width of test piece, in millimetres (mm);

$F_{max}$ the applied load at failure, in Newton (N);

$l_1$ length of test piece, in millimetres (mm);

$l_2$ length of overlap (length of tested surface), in millimetres (mm);

$s$ thickness of the panels, in millimetres (mm);

$\tau$ shear strength, in Newton (N).

## 5 Sampling

Samples of the adhesive shall be taken according to EN ISO 15605 and prepared for testing according to EN 1067.

## 6 Principle

A symmetrical bonded single lap joint between two wooden adherends glued with increasing open times, is strained to rupture by a tensile force parallel to the grain.

## 7 Apparatus

a) Conditioning room capable of ensuring to the test pieces the temperature at (23 ± 2) °C and (50 ± 5) % relative humidity or (20 ± 2) °C and (65 ± 5) %.

b) Notched trowel suitable to apply on the surface of the boards the required adhesive amount.

c) The testing machine shall be a constant-rate-of-traverse machine as described in ISO 5893. The machine shall be capable to apply a rate of 50 mm/min. The machine shall apply a force of at least 5 kN ± 2%.

d) The jaws shall grip the test pieces with a wedge action and permit self alignment whilst the test pieces are being pulled.

e) Apparatus suitable to obtain individual test pieces from the boards coupled as reported in 8.2, for example a circular saw fitted with blade having a thickness of cut of about 2,5 mm.

f) Press suitable to glue two boards (8.1) as indicated in 8.2 with the required pressure.

## 8 Procedure

### 8.1 General

Cut two panels (see Figure 1) from a thick unsteamed, conditioned, straight-grained board of beech (Fagus sylvatica L.) with a density of (700 ± 50) kg/m$^3$ when the moisture content is (12 ± 1) %.

Ensure that the angle between the growth rings and the surface to be bonded is between 30º and 90º.

Condition the boards for at least 7 days in 7 a) conditions. The adhesive shall be conditioned for at least 24 h.

Not more than 24 h before bonding, either lightly plane or lightly sand each surface to be bonded (using an abrasive paper of grain size P100 complying with ISO 6344-2 is recommended). Remove any dust carefully. Do not touch or soil the prepared surfaces.

### 8.2 Preparation of test pieces

All the adhesive application procedures shall be carried out in the standard atmosphere (see 7a)). Assembly instructions:

— The adhesive application shall be on one adherend only.

— The adhesive spread shall be (150 ± 10) g/m$^2$. The distribution of the adhesive shall be uniformly done over the whole surface of the board.

— Immediately after the adhesive application has been completed, the measurement of the open time shall start.

— The closed assembly time shall be (180 ± 30) s.

— The pressing pressure shall be (0,8 ± 0,1) N/mm$^2$.

— The pressing time shall be a minimum of 2 h.

Assemble the boards at increasing open times (see note) or according to the manufacturer's instructions (range of the maximum open time to be tested and the interval).

NOTE e.g. 0-3-6-9-12 min.

The glued boards shall be conditioned for 7 days in standard atmosphere (see 7a)).

Cut five strips of width $b$ = (20 ± 0,2) mm from each bonded assembly along the grain, avoiding areas within 7,5 mm of the outside long edges of the panel as shown in Figure 1. Cut these strips into test pieces of length $l_1$ = (150± 5) mm as shown in Figure 2.

Make flat bottomed cuts of (2,5 ± 0,5) mm wide in the bonded sections across the grain so that an overlap of length $l_2$ = (10,0 ± 0,2) mm is defined in the middle section (see Figure 2). The cuts are to separate the wood layers. Take care that the cuts completely cut through the bond line but only penetrate as little as possible into the other part of the joint.

For a screening test only (e.g. to determine a rough value of the open time), single lap joint specimens (e.g: see EN 205:2003, Annex A), may be used.

### 8.3 Number of test pieces

Test a sufficient number of test pieces to provide 10 valid results for each of the open times selected.

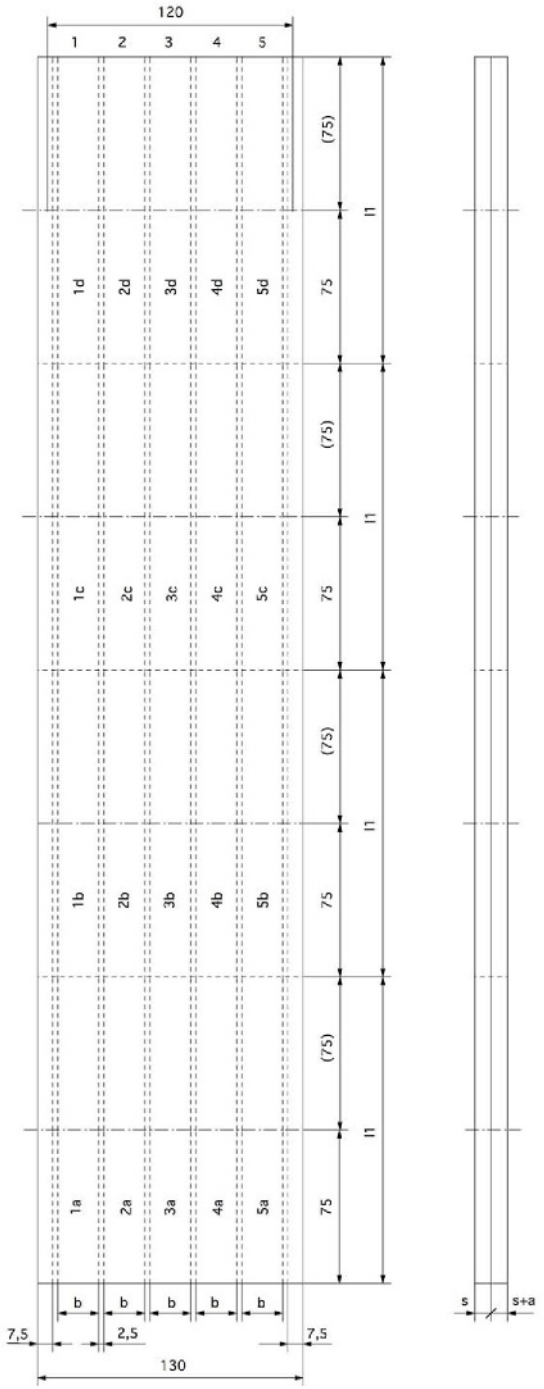
Results from tests in which failure occurred in the wood (100 % of wood failure) at values ≤ 10 N/mm$^2$ shall be invalid.

### 8.4 Tensile shear test

Test the test pieces shown in Figure 2 in the tensile testing machine (see 7 c)).

Clamp the ends of the test pieces in the jaws of the tensile testing machine up to a length of 40 mm to 50 mm. Ensure that the force is applied centrally and in the plane of the bond. Load the test piece until rupture. Record the applied maximum force $F_{max}$ in Newton (N).

Dimensions in mm

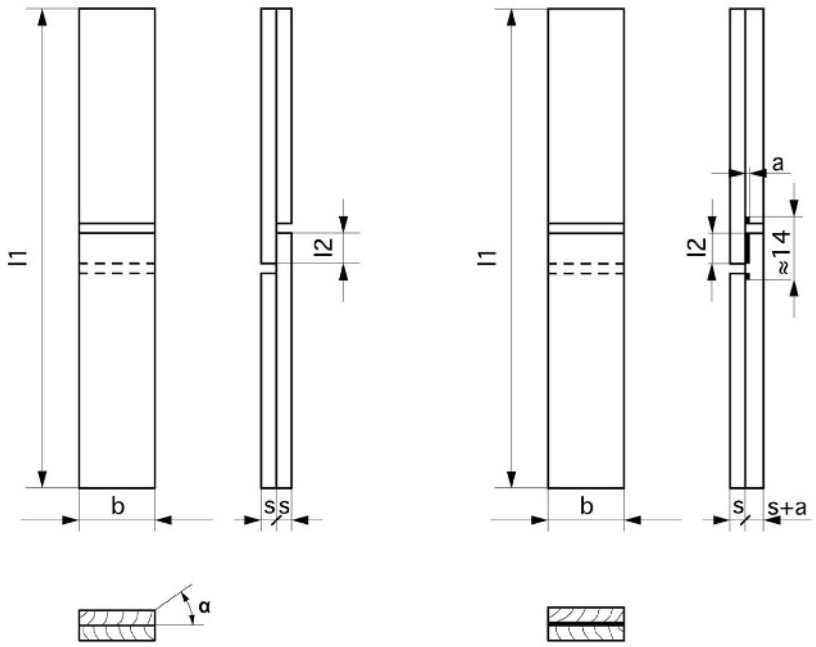



**Key**

| | | | |
|---|---|---|---|
| *a* | = | (1,0 ± 0,1) mm | thickness of bond-line |
| *b* | = | (20,0 ± 0,2) mm | width of test piece |
| $l_1$ | = | (150 ± 5) mm | length of test piece |
| *s* | = | (5,0 ± 0,1) mm | thickness of the panels |

**Figure 1 — Example of a bonded panel marked for division into individual test pieces using 2,5 mm saw cuts.**

Dimensions in mm




**Key**

| | | | |
|---|---|---|---|
| $\alpha$ | = | 30° to 90° (grades) | angle between growth ring and surfaces to be bonded |
| $b$ | = | (20,0 ± 0,2) mm | width of test piece (width of tested surface) |
| $l_1$ | = | (150 ± 5) mm | total length of test piece |
| $l_2$ | = | (10,0 ± 0,2) mm | length of overlap (length of tested surface) |
| $s$ | = | (5,0 ± 0,1) mm | thickness of the panels |

**Figure 2 — Lap joint test piece**

## 9 Expression of results

For each of the test pieces (see Figure 2) the results shall be expressed as follows:

The strength $\tau$ in Newton per square millimetre (N/mm$^2$) shall be calculated using formula:

$$\tau = \frac{F_{max}}{l_2 \times b} \quad (1)$$

where

$F_{max}$ is the applied maximum force in Newton (N);

$l_2$ is the nominal length of the bonded test surface in millimetres (mm);

$b$ is the nominal width of the bonded test surface in millimetres (mm);

$l_2$ x $b$= 200 mm$^2$.

The adhesive strength for each open time value considered shall be assumed to be the arithmetical mean of the values found on the individual test piece.

## 10 Test report

The test report shall contain the following information:

a) a reference to this European Standard;

b) the identification elements of the adhesive tested: (e.g. commercial name, etc.);

c) the characteristic data relating to the procedure followed to perform the gluing (see 8.2);

d) the open time in minutes;

e) any deviation from the standard;

f) the date of test;

g) the reference to the used conditioning atmosphere.

# Bibliography

[1] ISO 6344-2, *Coated abrasives — Grain size analysis — Part 2: Determination of grain size distribution of macrogrits P12 to P220*

[2] EN 205:2003, *Adhesives — Wood adhesives for non-structural applications — Determination of tensile shear strength of lap joints*

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