BS EN 15416-5:2017

BSI Standards Publication

Adhesives for load bearing timber structures other than phenolic and aminoplastic — Test methods

Part 5: Determination of minimum pressing time under referenced conditions

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National foreword

This British Standard is the UK implementation of EN 15416-5:2017. It supersedes BS EN 15416-5:2006 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PRI/52, Adhesives.

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

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English Version

Adhesives for load bearing timber structures other than phenolic and aminoplastic - Test methods - Part 5: Determination of minimum pressing time under referenced conditions

Adhésifs pour structures portantes en bois de type autre que phénolique et aminoplaste - Méthodes d'essais - Partie 5 : Détermination du temps de pressage minimal dans des conditions de référence

Klebstoffe für tragende Holzbauteile ausgenommen Phenolharzklebstoffe und Aminoplaste - Prüfverfahren - Teil 5: Bestimmung der Mindestpresszeit bei Referenzbedingungen

This European Standard was approved by CEN on 30 October 2016.

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European foreword

This document (EN 15416-5:2017) 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of an identical text or by endorsement, at the latest by July 2017, and conflicting national standards shall be withdrawn at the latest by July 2017.

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

This document supersedes EN 15416-5:2006.

Compared to EN 15416-5:2006, the following main modifications have been made:

a) title has been changed;

b) application for EPI adhesives according to EN 16254 has been added;

c) the pressing times are determined for both close contact glue line and 0,3 mm thick glue line when testing PUR adhesives (EN 15425) and EPI adhesives in category "General purpose" (EN 16254), and close contact glue line and 0,2 mm thick glue for EPI adhesives designed for category "Small dimensions" (EN 16254);

d) some parts of this European Standard are made in line with EN 302-6:2013;

e) some of the wording in EN 302-1:2013 have been used to describe how to evaluate and report % wood failure (fibre failure) in the tested test pieces;

f) it is stated that the glue application shall be done at the temperature used for conditioning and pressing of the material. When screening tests are performed, the material may, however, be removed from the test temperature for glue application;

g) measurement and reporting of glue line thickness has been deleted.

This document is one of a series dealing with adhesives for use with timber structures, and is published in support of product standards for bonded load-bearing timber structures.

The series consists of three classification and performance requirements for adhesives for load-bearing timber structures, phenolic and aminoplastic adhesives (EN 301), one component polyurethane adhesives (EN 15425) and emulsion polymerized isocyanate adhesives (EN 16254), together with 12 test methods (EN 302 Parts 1 to 8 and EN 15416 Parts 1 and 3 to 5).

These European Standards have the following titles:

— EN 301, *Adhesives — phenolic and aminoplastic, for load-bearing timber structures — Classification and performance requirements*

— EN 15425, *Adhesives — One component polyurethane (PUR) for load-bearing timber structures - Classification and performance requirements*

— EN 16254, *Adhesives — Emulsion polymerized isocyanate (EPI) for load-bearing timber structures — Classification and performance requirements*

— EN 302-1, *Adhesives for load-bearing timber structures — Test methods — Part 1: Determination of longitudinal tensile shear strength*

— EN 302-2, *Adhesives for load-bearing timber structures — Test methods — Part 2: Determination of resistance to delamination*

— EN 302-3, *Adhesives for load-bearing timber structures —Test methods — Part 3: Determination of the effect of acid damage to wood fibres by temperature and humidity cycling on the transverse tensile strength*

— EN 302-4, *Adhesives for load-bearing timber structures — Test methods — Part 4: Determination of the effects of wood shrinkage on the shear strength*

— EN 302-5, *Adhesives for load-bearing timber structures — Test methods — Part 5: Determination of maximum assembly time under referenced conditions*

— EN 302-6, *Adhesives for load-bearing timber structures —Test methods — Part 6: Determination of the minimum pressing time under referenced conditions*

— EN 302-7, *Adhesives for load-bearing timber structures — Test methods — Part 7: Determination of the working life under referenced conditions*

— EN 302-8, *Adhesives for load-bearing timber structures — Test methods — Part 8: Static load test of multiple bond line specimens in compression shear*

— EN 15416-1, *Adhesives for load bearing timber structures other than phenolic and aminoplastic — Test methods — Part 1: Long-term tension load test perpendicular to the bond line at varying climate conditions with specimens perpendicular to the glue line (Glass house test)*

— EN 15416-3, *Adhesives for load bearing timber structures other than phenolic and aminoplastic — Test methods — Part 3: Creep deformation test at cyclic climate conditions with specimens loaded in bending shear*

— EN 15416-4, *Adhesives for load bearing timber structures other than phenolic and aminoplastic — Test methods — Part 4: Determination of open assembly time under referenced conditions*

— EN 15416-5, *Adhesives for load bearing timber structures other than phenolic and aminoplastic — Test methods — Part 5: Determination of minimum pressing time under referenced conditions*

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

Safety statement

Persons using this European Standard should be familiar with the normal laboratory practice, if applicable. This European Standard cannot address all of the safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and to ensure compliance with any regulatory conditions.

Environmental statement

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

At the end of the test, it is recommended that the user of this European Standard take care to carry out an appropriate disposal of the wastes, according to local regulation.

1 Scope

This European Standard specifies a laboratory method of determining the minimum pressing time for two glue line thicknesses, close contact and 0,2 mm or 0,3 mm, at three temperatures and three wood moisture contents.

This European Standard is intended to determine the minimum pressing time using a defined procedure for obtaining a reliable base for comparison of minimum pressing time between adhesives under referenced conditions.

The method gives a result that cannot be applied to the safe manufacture of timber structures without taking into account the influence in variation of factors such as timber density, moisture content, factory temperature and relative air humidity.

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 302-1:2013, *Adhesives for load-bearing timber structures — Test methods — Part 1: Determination of longitudinal tensile shear strength*

EN 923:2015, *Adhesives — Terms and definitions*

EN 15425, *Adhesives — One component polyurethane (PUR) for load-bearing timber structures — Classification and performance requirements*

EN 16254, *Adhesives — Emulsion polymerized isocyanate (EPI) for load-bearing timber structures — Classification and performance requirements*

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

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 923:2015 and the following apply.

3.1
pressing time
time for which an adhesive joint is pressed

3.2
minimum pressing time
shortest pressing time until the minimum bonding strength has been reached

Note 1 to entry: The minimum bonding strength is specified in Clause 8 “Requirement”.

4 Principle

Standard beech lap joints are tested in tensile shear after various curing times until it is found that a tensile shear strength of at least 4 N/mm^2 is achieved at a given temperature and wood moisture content.

5 Apparatus

5.1 Climate cabinets

Climatic cabinet capable of maintaining a temperature of (20 ± 2) °C and a relative humidity of (50 ± 5) %, (65 ± 5) % or (75 ± 5) % to enable conditioning of the beech panels to a wood moisture content of (9 ± 1) %, (12 ± 1) %, or (15 ± 1) %, respectively.

Temperature cabinets capable of maintaining air temperature of (15 ± 2) °C, (20 ± 2) °C and (30 ± 2) °C respectively.

5.2 Testing machine

The testing machine shall be:

a) either capable of maintaining a constant rate of loading of (2,0 ± 0,5) kN/min;

b) or capable of maintaining constant crosshead speed as described in ISO 5893.

The jaws of the testing machine shall grip the test pieces firmly and prevent slippage during loading. The grip shall be fixed in hinged manner.

6 Procedure

6.1 General

Sufficient beech panels shall be prepared to enable manufacturing of 15 sets each of at least 10 test specimens as defined in EN 302-1:2013, Clause 7 with the following glue line thickness:

— adhesives tested according to EN 15425: close contact and (0,3 ± 0,1) mm;

— adhesives tested according to EN 16254: close contact and (0,3 ± 0,1) mm for application area “General purpose”, or close contact and (0,2 ± 0,1) mm for application area “Small dimension”.

For very fast setting adhesives and close contact glue line, individual single lap joint test pieces (see EN 302-1:2013, Figure 3) may be prepared for the bonding and the performance of the test.

6.2 Preparation of bonded assemblies

After conditioning nine sets to (12 ± 1) %, three sets to (9 ± 1) % and three sets to (15 ± 1) % wood moisture content in the climate cabinet, the panels shall be lightly planed or lightly sanded (using an abrasive paper of grain size P100 as defined in ISO 6344-2) before being divided into groups. The panels with (12 ± 1) % shall be divided into 3 equal groups, one for each of the 3 test temperatures given in Table 1. All the groups shall be stored in an adequate manner to prevent a change in moisture content.

Each group of panels, or a sufficient number of prepared individual test pieces, shall be transferred to an atmosphere at one of the test temperatures described in Table 1. The adhesive to be used shall also be stored under these three temperatures respectively.

Table 1 — Nominal climatic conditions and examples of pressing times

Wood moisture content	**Temperature**	**Pressing time**		
%	°C	h		
9	20	1	2	4
12	15	1	2	4
12	20	1	2	4
12	30	1	2	3
15	20	1	2	3

If recommended by the adhesive manufacturer, shorter or longer pressing times than those given in Table 1 may be used.

After at least 12 h conditioning in the test temperature, the panels or the individual test pieces shall be glued and pressed in the same temperature using a glue spread of 200 g/m^2 (single sided application). When samples with 0,2 mm and 0,3 mm thick glue lines are prepared, pour additional adhesive into the grooves of the grooved panel. The open and closed assembly time shall be as recommended by the adhesive manufacturer, but the total assembly time shall not exceed 10 min.

The test pieces shall not be removed from the test temperature during the pressing period. The clamping pressure shall be 0,8 N/mm^2. Table 1 gives examples for the pressing time for each pair of panels.

The pressing times are chosen in a way that at least one of the three pressing times gives a mean tensile shear strength below 4 N/mm^2 and at least one gives a strength above 4 N/mm^2. If this is not achieved with the three chosen pressing times, make additional tests with shorter or longer pressing times.

NOTE It is a common practice before bonding is started to store overnight the adhesive components and the timber at the specified temperature whereby the timber will be packaged as air tight as possible to prevent changes of moisture content.

When screening tests are performed, the material may be removed from the test temperature for glue application only. The gluing operation shall be done as quickly as possible.

6.3 Preparation of test specimens

Immediately after the pressing time has elapsed, the panels shall be unclamped and 10 test specimens cut from each of the bonded panels according to EN 302-1:2013, 7.3.

6.4 Test procedure

The test specimens shall be tested according to EN 302-1:2013, 7.6 without delay. The time from unclamping to testing shall not be longer than 10 % of the clamping time. If this is not achieved for short clamping times, then use smaller beech panels than described in 6.1 and prepare less than 10 test pieces each time or use individual test pieces as described in 6.1.

7 Expression of results

7.1 Tensile shear strength

Calculate the tensile shear strength f_V in Newtons per square millimetre (N/mm^2) for all tested test pieces rounded to the nearest 0,1 N/mm^2 using Formula (1).

$$f_v = F_{max} / A = F_{max} / 200\,mm^2 \quad (1)$$

where

F_{max} applied load at failure in Newtons (N);

A bonded test surface in square millimetres (mm^2).

NOTE f_v is always calculated with the area A of 200 mm^2.

For each test series, calculate the mean tensile shear strength of the 10 results rounded to the nearest 0,1 N/mm^2, and the coefficient of variation.

7.2 Failure mode

For each test specimen, estimate and record the percentage wood failure (wood fibre) to the nearest 10 %.

8 Requirement

The minimum pressing time shall be calculated by linear interpolation of those pressing times and their related tensile shear strength that are most near to the time corresponding to a tensile shear strength of 4 N/mm^2. The tensile shear strength at the shortest pressing time for each temperature and moisture content shall be less than 4 N/mm^2.

The calculated minimum pressing time shall be expressed to the nearest 5 min (for under 1 h), to the nearest 10 min (for between 1 h and 2 h) and to the nearest 15 min (for longer than 2 h), rounded up to the next higher value.

EXAMPLE A pressing time of 2 h gives a mean tensile strength of 2 N/mm^2, while the mean tensile shear strength for 4 h pressing time is 5 N/mm^2. The result of the linear interpolation for 4 N/mm^2 is 3 h 20 min. This calculated value would be rounded up to 3 h 30 min.

9 Test report

9.1 General information

The following general information shall be included:

a) date of testing and issue of the report;

b) statement that the test was carried out in accordance with this European Standard.

9.2 Information about the adhesive

The following information about the adhesive shall be included in the test report:

a) chemical nature and origin of the sample of adhesive tested;

b) manufacturer's name and batch number or other means of uniquely identifying the sample;

c) number of components and method of preparation and application.

9.3 Preparation of test pieces and testing procedure

The following information about the preparation of the test pieces and the testing procedure shall be included:

a) wood density at 12 % moisture content expressed in kilograms per cubic metre (kg/m^3);

b) any special treatment of the panels to be bonded;

c) method of making the bond (i.e. application, temperature, pressure and duration);

d) type of testing machine a) or b) according to 5.2, and speed of loading increase;

e) date of bonding and preparation of the test pieces.

9.4 Test results

The following information about the test results shall be included in the test report:

a) individual shear strength and failure type for each test piece;

b) minimum, maximum, mean, standard deviation and coefficient of variation of the measurements taken in each series;

c) estimation of the proportion of the tested surface covered by wood fibre;

d) the interpolated minimum pressing time;

Shear strengths shall be expressed to the nearest 0,1 N/mm^2, the proportion of wood fibre to the nearest 10 %.

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