BS EN 15416-4:2017

BSI Standards Publication

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

Part 4: Determination of open assembly time under referenced conditions

bsi.

National foreword

This British Standard is the UK implementation of EN 15416-4:2017. It supersedes BS EN 15416-4:2006 which is withdrawn.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.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Published by BSI Standards Limited 2017

ISBN 978 0 580 85716 4

ICS 83.180

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 January 2017.

Amendments/corrigenda issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 15416-4

January 2017

ICS 83.180

Supersedes EN 15416-4:2006

English Version

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

Adhésifs pour structures portantes en bois de type autre que phénolique et aminoplaste - Méthodes d'essais - Partie 4 : Détermination du temps d'assemblage ouvert dans des conditions de référence

Klebstoffe für tragende Holzbauteile ausgenommen Phenolharzklebstoffe und Aminoplaste - Prüfverfahren - Teil 4: Bestimmung der offenen Wartezeit bei Referenzbedingungen

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

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

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

Ref. No. EN 15416-4:2017 E

Contents

Page

European foreword

This document (EN 15416-4:2017) 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of an identical text or by endorsement, at the latest by July 2017, and conflicting national standards shall be withdrawn at the latest by July 2017.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 15416-4:2006.

Compared to EN 15416-4:2006, the following main modifications have been made:

a) title has been changed;

b) 7.2 covering failure mode has been introduced;

c) new definition of open assembly time has been given in 3.1;

d) time intervals for open assembly times in Table 1 divided into slow and fast systems;

e) requirement has been added as Clause 8.

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 open assembly time in standard climate (20 ±2) °C and (65 ±5) % relative humidity (hereafter climate [20/65]).

This European Standard is intended to determine the open assembly time using a defined procedure for obtaining a reliable base for comparison of open assembly 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 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*

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
open assembly time
time interval under specified conditions from adhesive spread until the surfaces to be bonded are joined

4 Principle

Standard beech lap joints are tested in tensile shear after various open assembly times until it is found that the shear strength value is below 10 N/mm^2, the coefficient of variation increases considerably or the failure mode changes considerably.

5 Apparatus

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 6 sets each of at least 10 test specimens with close contact glue lines as specified in EN 302-1:2013, Clause 7.

6.2 Preparation of bonded assemblies

After conditioning to (12 ± 1) % moisture content in climate [20/65], the panels shall be divided into 6 equal groups of samples, one for each of the 6 test series given in Table 1.

Table 1 — Example of time intervals for open assembly times at 20 °C and 65 % RH

Test series (nr)	**1**	**2**	**3**	**4**	**5**	**6**
Open assembly time for slow systems (min)	40	50	60	70	80	90
Open assembly time for fast systems (min)	1	2	3	4	5	6

EXAMPLE If the expected open assembly time is 70 min, use the time intervals for slow systems. If the expected open assembly time is 4 min, use the time intervals for fast systems.

If the expected open assembly time does not fit the examples given in Table 1, adjust the intervals in a similar manner and according to the adhesive manufacturer recommendation.

The adjustment shall be such that at least a total of 6 test series covering the time range below and over the expected open assembly time is tested.

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

An adhesive spread of 200 g/m^2 on one side only shall be used unless another amount is requested by the manufacturer. Comply with the adhesive manufacturer's instructions regarding the processing conditions, including the preparation and application of the adhesive and report them in the test report. After adhesive application, the boards are open assembled with the chosen times in climate (20 ± 1) °C and (65 ± 5) % relative humidity before bonded together.

A strict climate control is very important as small changes in air temperature and relative humidity will influence the drying tendency of the applied adhesive and thus influence the open assembly time. The circulation of air should be as low as possible.

Before pressure application, the boards shall be laid together as shown in EN 302-1:2013, Figure 2, ensuring that the matching boards are used to produce the bonded assembly joint.

6.3 Preparation of samples for testing

After bonding and pressing, and before testing, conditioning the assembly for 7 days to 14 days in climate [20/65]. The test pieces shall be cut from the bonded panels according to EN 302-1:2013, 7.3.

Before testing, measure and record the glue line thickness in all test pieces in each test set. The glue line thickness shall be checked with a magnifying glass with which the glue line thickness can be determined with an accuracy of 10 %. For a spread rate of 200 g/m^2, allow a maximum glue line thickness of 0,2 mm.

6.4 Test procedure

The test specimens shall be tested according to EN 302-1:2013, 7.6.

Test a sufficient number of test pieces to provide 10 valid results for each of the chosen open assembly time. Stop the testing after the first 10 valid results. Results from tests in which failure occurred in the wood at values below 10 N/mm^2 are invalid. All results, valid or invalid, shall be reported.

7 Expression of results

7.1 Tensile shear strength

Calculate the tensile shear strength f_V in Newtons per square millimetre (N/mm^2) using the following formula:

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

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 first 10 valid 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) on the tested surface to the nearest 10 %.

8 Requirement

The longest open assembly time in climate (20/65) is expressed as the mean of 10 individual results that gives tensile shear strength of at least 10 N/mm^2 and a glue line thickness ≤ 0,2 mm.

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 method, temperature, clamping pressure and duration);

d) type of testing machine a) or b) according to Clause 5, and speed of loading increase;

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

f) the highest, the lowest and the average glue line thickness measured in each of the test series.

9.4 Test results

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

a) individual shear strength and failure mode for each tested test piece (valid or invalid);

b) minimum, maximum, mean, standard deviation and coefficient of variation of the measurements taken in each series of the first 10 valid samples;

c) estimation of the proportion of wood failure (wood fibre) on the tested surface;

d) the longest open assembly time that fulfils the requirement.

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

This page deliberately left blank

This page deliberately left blank

British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards -based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at bsigroup.com/standards or contacting our Customer Services team or Knowledge Centre.

Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at bsigroup.com/shop, where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

Copyright in BSI publications

All the content in BSI publications, including British Standards, is the property of and copyrighted by BSI or some person or entity that owns copyright in the information used (such as the international standardization bodies) and has formally licensed such information to BSI for commercial publication and use.

Save for the provisions below, you may not transfer, share or disseminate any portion of the standard to any other person. You may not adapt, distribute, commercially exploit, or publicly display the standard or any portion thereof in any manner whatsoever without BSI's prior written consent.

Storing and using standards

Standards purchased in soft copy format:

- A British Standard purchased in soft copy format is licensed to a sole named user for personal or internal company use only.
- The standard may be stored on more than 1 device provided that it is accessible by the sole named user only and that only 1 copy is accessed at any one time.
- A single paper copy may be printed for personal or internal company use only.

Standards purchased in hard copy format:

- A British Standard purchased in hard copy format is for personal or internal company use only.
- It may not be further reproduced – in any format – to create an additional copy. This includes scanning of the document.

If you need more than 1 copy of the document, or if you wish to share the document on an internal network, you can save money by choosing a subscription product (see 'Subscriptions').

Reproducing extracts

For permission to reproduce content from BSI publications contact the BSI Copyright & Licensing team.

Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to bsigroup.com/subscriptions.

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

PLUS is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit bsigroup.com/shop.

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email subscriptions@bsigroup.com.

Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

Useful Contacts

Customer Services
Tel: +44 345 086 9001
Email (orders): orders@bsigroup.com
Email (enquiries): cservices@bsigroup.com

Subscriptions
Tel: +44 345 086 9001
Email: subscriptions@bsigroup.com

Knowledge Centre
Tel: +44 20 8996 7004
Email: knowledgecentre@bsigroup.com

Copyright & Licensing
Tel: +44 20 8996 7070
Email: copyright@bsigroup.com

BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

bsi.