BS EN 302-8:2017

BSI Standards Publication

Adhesives for load-bearing timber structures — Test methods

Part 8: Static load test of multiple bond line specimens in compression shear

bsi.

National foreword

This British Standard is the UK implementation of EN 302-8:2017. It supersedes BS EN 15416-2:2007 which is withdrawn.

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

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Klebstoffe für tragende Holzbauteile - Prüfverfahren - Teil 8: Statische Belastungsprüfung an Prüfkörpern mit mehreren Klebstofffugen bei Druck-Scherbeanspruchung

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European foreword

This document (EN 302-8:2017) 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of an identical text or by endorsement, at the latest by July 2017, and conflicting national standards shall be withdrawn at the latest by July 2017.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 15416-2:2007.

Compared to EN 15416-2:2007, the following modifications have been made:

a) title has been changed;

b) EN 301 and EN 16254 are included in the scope;

c) introduction of (50 ± 2) °C and (90 ± 2) °C in Table 1, climate 1, with reference to EN 15425;

d) layout has been made in line with EN 302-1:2013 to EN 302-7:2013;

e) new drawings of the test jig with some adjusted part dimensions are included.

This document is one of a package dealing with adhesives for use with timber structures, and is published in support to EN 1995, *Eurocode 5: Design of timber structures* (all parts).

The package 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), and

— twelve test methods (EN 302 parts 1 to 8, EN 15416 parts 1, 3, 4 and 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*

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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 method of determining the ability of adhesive bonds to resist static load. It is applicable to adhesives used in load bearing timber structures.

It is suitable for the following applications:

a) for assessing the compliance of adhesives according to EN 301, EN 15425 and EN 16254;

b) for assessing the suitability and quality of adhesives for load-bearing timber structures;

c) for assessing the effect on the bond strength resulting from constant load at different climate conditions.

This method is intended primarily to obtain performance data for the classification of adhesives for load bearing timber structures according to their suitability for use in defined climatic environments.

This method is not intended to provide data for structural design, and does not necessarily represent the performance of the bonded member in service.

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 301:2013, *Adhesives, phenolic and aminoplastic, for load-bearing timber structures — Classification and performance requirements*

EN 15425:2017, *Adhesives — One component polyurethane (PUR) for load-bearing timber structures — Classification and performance requirements*

EN 16254:2013+A1:2016, *Adhesives — Emulsion polymerized isocyanate (EPI) for load-bearing timber structures — Classification and performance requirements*

3 Principle

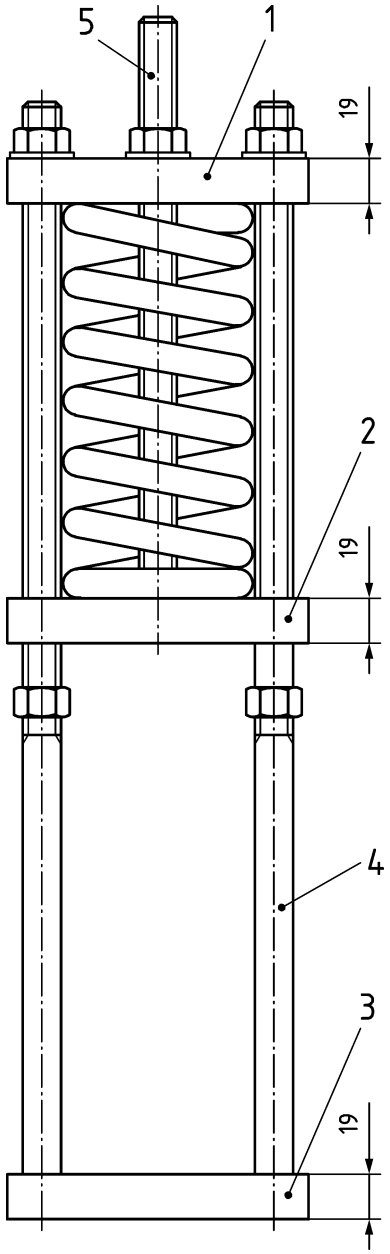
Bonded test pieces are subjected to a constant compression shear load under a series of three different climates. Number of failures and the amount of deformation is measured after the end of the last climate cycle.

4 Apparatus

4.1 Test jig

The test Equipment is shown in Figure 1 and Figure 2.

Dimensions in millimetres

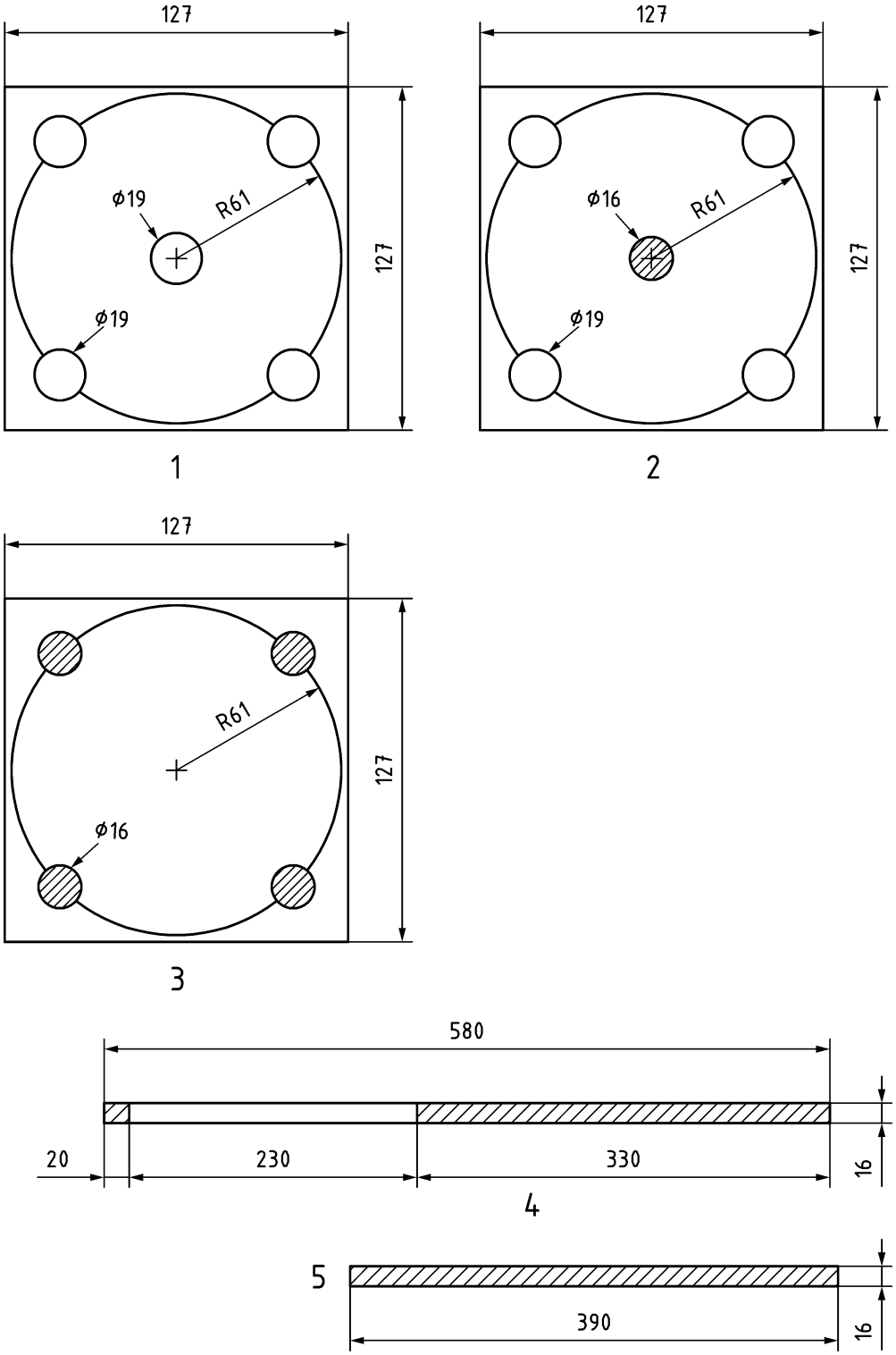


Key

1 top plate
2 spacer plate
3 base plate
4 tension rod
5 centre rod

Figure 1 — Test jig

Dimensions in millimetres



Key

1	top plate	3	base plate
2	spacer plate	4	tension rod (the given lengths are minimum values)
		5	centre rod. (the given length is a minimum value)

Figure 2 — Dimensions of plates and rods

If longer rods are used, distance blocks need to be placed on top and/or under the specimen. The distance blocks shall be prepared in such a way that the two contact surfaces, between the distance block and the jig and between the distance block and the specimen, are parallel. Dimension of distance blocks: at least 48 mm × 51 mm × 10 mm.

NOTE Blocks produced from several pieces of plywood bonded together have been found suitable

The spring shall have the following characteristics:

— outside diameter (unloaded): 105 mm;

— end fix: both ends fixed and grounded;

— free length: 320 mm;

— compression at maximum load: 45 mm to 50 mm.

NOTE A spring rate of 81 N/mm has shown to be suitable.

4.2 Equipment for climate control

The used equipment shall be capable of maintaining (50 ± 2) °C, (70 ± 2) °C or (90 ± 2) °C with a relative humidity of (10 ± 5) % in order to reach one of the climate conditions 1 a), 1 b) or 1 c) in Table 1, and the two climates (20 ± 2) °C and (85 ± 5) % relative humidity and (50 ± 2) °C and (75 ± 5) % relative humidity.

4.3 Testing machine

A testing machine capable to apply a compression load is required.

5 Test specimens

5.1 Selection of wood

Untreated beech wood (Fagus sylvatica L.) with a density of (700 ± 50) kg/m^3 at 12 % moisture content shall be used. The material shall be straight-grained and free from knots, machining defects (such as chipped grain, dubbed ends, feed roll polish, coarse knife marks and feed roll compression) and any drying defects such as case hardening, collapse, splits or checks. The angle of the annual rings to the surface to be bonded shall be between 30° and 60°.

5.2 Preparation of laminations

Condition the wood at (20 ± 2) °C and (65 ± 5) % relative humidity (hereafter climate [20/65] until a moisture content of (12 ± 1) % has been obtained. Plane each lamination not more than 4 h before applying the test adhesive.

The parts, of which the specimen is built of, shall have the same direction for the annual rings in the cross section (according to Figure 3).

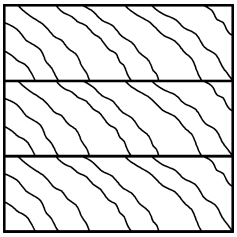


Figure 3 — Orientation of annual rings in cross section of lamination

Three laminated wood members shall be prepared in order to produce six test samples. The laminated members shall be prepared from boards (16,0 ± 0,1) mm thick (after planing) by (60,0 ± 0,1) mm wide by (305,0 ± 0,1) mm along the grain. Each laminated member shall be made from two outer lamellas as above and alternate spacers and wood sections for the inner part. The wood sections shall be sliced from a third board identical to those above. The wood sections shall be (28,5 ± 0,1) mm along the grain by (16,0 ± 0,1) mm thick by (60,0 ± 0,1) mm wide (according to Figure 4).

Spacers shall be made of suitable material, which makes it possible to remove them without destroying the specimen or disturb the positioning of the central pieces.

Dimension of spacers: length (6,4 ± 0,1) mm, thickness slightly less than the mid-section pieces, width (60,0 ± 0,1) mm.

NOTE Spacers made from PTFE have shown to be a suitable material.

Dimensions in millimetres

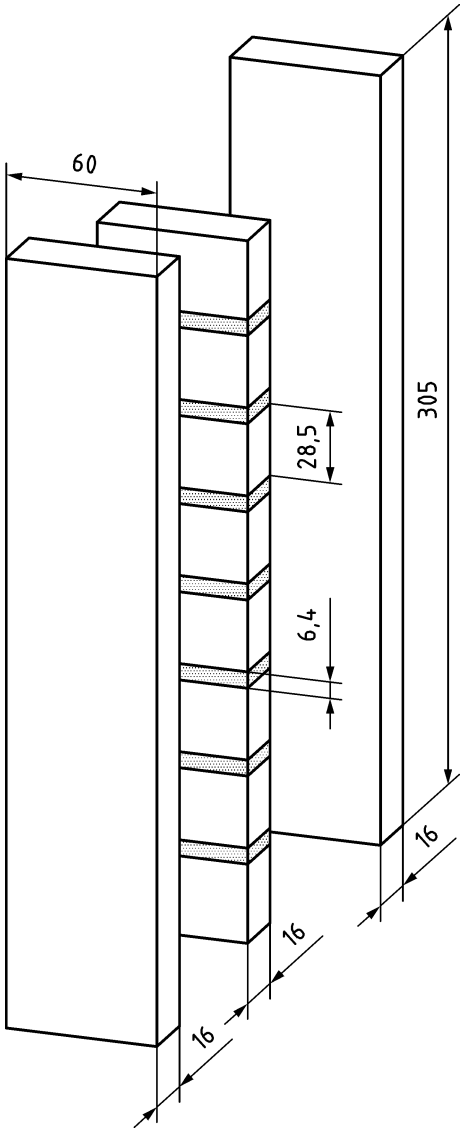


Figure 4 — Test specimen layers prior to bonding

Dimensions in millimetres

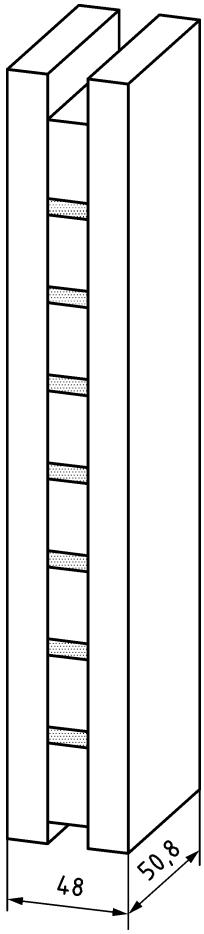


Figure 5 — Test specimen after bonding and planing

The centre layer of the assembly shall be made of 7 spacers and 8 wood sections alternately placed tightly adjacent to each other (according to Figure 4).

The wood sections should be slightly thicker than the spacers to obtain adequate pressure on the glue lines. The gluing shall be done in climate [20/65] according to the adhesive manufacturer´s recommendations. Carefully clamp the mid-section lengthwise to be sure that no movement will occur when pressing the whole piece together (according to Figure 4).

NOTE It has been found that running a 13 mm wide piece of tape completely around the 15 loose pieces holds them together when mounting the laminations.

The outer lamellas shall then be applied overlapping approximately 13 mm at each end and the entire assembly carefully clamped and the adhesive cured as recommended. The positioning of the centrepieces shall be secured. Spacers shall be removed and excess adhesive removed as soon as it can be done without moving the centrepieces. The spacers shall be pushed gently (not impact driven) out.

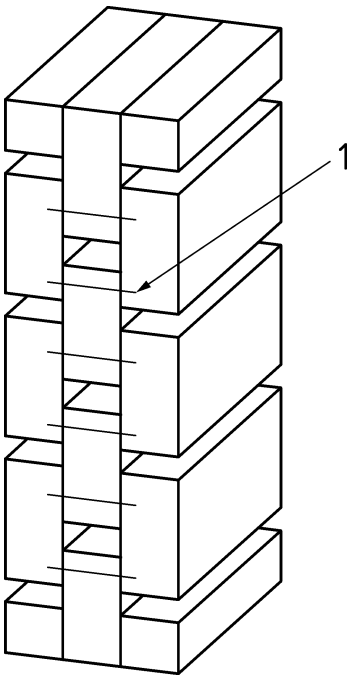
After gluing, the specimens shall be conditioned for a minimum of 14 days in climate [20/65] before the preparation of the test specimens.

5.3 Preparation of test specimens

After curing, each laminated assembly shall be trimmed along the sides to leave a width of (50,8 ± 0,1) mm (according to Figure 5). The outer lamellas of the specimen shall then be cut with a width of (3,2 ± 0,1) mm. The cuts shall divide each centre piece symmetrically, resulting in an overlapping glue line of (12,7 ± 0,1) mm. The cuts shall separate the wood layer and the adhesive layer, but they shall not go beyond the adhesive layer.

From each of the three laminations, two test specimens with a length (133,5 ± 0,1) mm are made, each containing four centre pieces. Each of the six specimen will then contain a total of 12 glue lines (nominal dimension 50,8 mm × 12,7 mm) for axial compression loading, providing a series of 6 pairs of load bearing glue lines. Each pair of load bearing glue lines has a total nominal glue line area of 1 290 mm^2. The two outer lamellas are then trimmed, in order to make the terminal surfaces parallel to each other and with an angle of 90 ° in relation to the loading direction.

Prior to testing, use a straightedge and a razor blade to cut marks perpendicular to every adhesive glue line for measuring possible slippage (according to Figure 6).



Key

1 mark made with a razor blade

Figure 6 — The final shape of the specimen (48,0 mm × 50,8 mm ×133,6 mm)

6 Test procedure

6.1 Application of load

Insert the test specimens in the test jigs assuring that the specimens are placed in the centre of the jigs and do not touch the rods. Use distance blocks below and/or under if necessary. Position the spacer plate on top. Insert the spring and position the top plate on top of the spring. Ensure that the spacer plate is parallel to the top end of the test piece.

The load is applied on the top plate by using a steel pipe thread down over the centre bolt. Bring the corner nuts on the rods before loading. Load the entire unit in a compression testing machine to a total load of (3 870 ± 40) N. The time to reach full load shall be 1 min to 2 min. Then tighten the corner nuts as soon as possible by hand to maintain the spring compression. Position the keeper nut on the centre rod and tighten to within 10 mm of the top plate, thus retaining the spring in case of bond line failures. Climate treatment shall be started within 30 min from loading the last sample.

6.2 Test climates

The 6 loaded specimens are exposed to the climate cycle according to Table 1.

Table 1 — Climate treatment cycles

Climate cycles[a]	Temperature °C	Relative humidity %	Period d
1a	50 ± 2	10 ± 5[b]	14
1b	70 ± 2		14
1c	90 ± 2		14
2	20 ± 2	85 ± 5	14
3	50 ± 2	75 ± 5	14

[a] According to EN 301:2013, Table 1, EN 15425:2017, Table 1 or EN 16254:2013+A1:2016, Table 1.

[b] The given climate cycle can be achieved either with a climate chamber or with a heating chamber placed in an appropriate environment.

For the climate cycle 1, only 1a, 1b or 1c shall be chosen. Each climate cycle shall immediately follow the previous.

Should the test jigs need to be moved from one climate to another, this should be done without vibration, shock or impact and as quickly as possible.

6.3 Measurements and evaluation of result

The specimens need to be evaluated at least once a week to discover possible failures. At the end of the 42-day test period, the test jigs shall be removed from the climatic chamber and unloaded.

If at least 5 samples still are intact, measure the slippage (deformation) across the razor blade marks for all glue lines on both sides to the nearest 0,01 mm and calculate the mean value. Measurement of slippage shall be made immediately after unloading.

NOTE Measurement of slippage can be made with a light microscope or by a digital camera with a pixel size not exceeding 0,005 mm.

7 Test report

The test report shall include, at least, the following:

a) statement that the test was carried out in accordance with this European Standard (EN 302-8);

b) date on which the test was carried out;

c) date of the report;

d) manufacturer's name of adhesive tested;

e) chemical nature of adhesive tested;

f) origin of sample of adhesive tested;

g) density of wood at (12 ± 1) % moisture content in kilograms per cubic metre (kg/m^3);

h) application and bonding conditions used for the laminations including date of gluing;

i) if it comes to a failure, the climate in use shall be stated;

j) slippage values obtained;

k) method used for measurement of slippage.

Bibliography

[1] EN 923:2015, *Adhesives — Terms and definitions*

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