



# SLOVENSKI STANDARD

## oSIST prEN 17418:2019

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### Dvokomponentna epoksi in poliuretanska lepila za popravilo nalomljenih lesenih konstrukcij na kraju samem - Preskušanje, zahteve in preverjanje trdnosti popravljenih delov

Two-component epoxy and polyurethane adhesives for on-site repair of cracked timber structures - Testing, requirements and repair strength verification

Zwei-Komponenten-Epoxid und Zwei-Komponenten-Polyurethan-Klebstoffe zur Reparatur von beschädigten Holzbauteilen auf der Baustelle - Prüfung, Anforderungen und Nachweis der Reparatur-Festigkeit

Adhésifs bicomposants polyuréthanes et époxydiques pour la réparation sur site de structures en bois fissurées - Essais, exigences et vérification de la résistance des réparations

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## Two-component epoxy and polyurethane adhesives for on-site repair of cracked timber structures - Testing, requirements and repair strength verification

Adhésifs bicomposants polyuréthanes et époxydiques pour la réparation sur site de structures en bois fissurées - Essais, exigences et vérification de la résistance des réparations

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**prEN 17418:2019 (E)**

**European foreword**

This document (prEN 17418:2019) has been prepared by Technical Committee CEN/TC 193 “Adhesives”, the secretariat of which is held by UNE.

This document is currently submitted to the CEN Enquiry.

**iTeh STANDARD PREVIEW**  
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<https://standards.iteh.ai/catalog/standards/sist/1a3b47b6-7f8a-47c9-b917-b7cf79bcde85/sist-en-17418-2021>

## 1 Scope

This document specifies test methods for the determination of the suitability of two- component epoxy and polyurethane adhesives for on-site repair of cracks in timber structures made of solid wood, finger-jointed solid wood, glued solid timber and glued laminated timber made of softwood species by injection of the repair adhesive. The adhesive can also be used to rehabilitate cracks in the area of joints made by nails, screws, dowel-type fasteners and dowels with threads. The adhesive can also be used to fill gaps between the faces of structural components. This document specifies minimum requirements on bond strength and integrity and dimensions of fissures, cracks and openings. This document provides also minimum on-site repair provisions and specifies quality control tests at the structures repaired by bonding.

This document also covers the repair of surface treated wood. It does not cover the repair of modified and stabilized wood with considerably reduced swelling and shrinkage properties, e.g. such as acetylated wood, heat treated wood, polymer impregnated wood and preservative treated wood.

The adhesive is intended for the repair of load bearing timber structures not subjected to temperatures more than 60 °C over a longer time in service classes 1 and 2, see EN 1995-1-1 which are loaded predominantly static or quasi static, see EN 1990 and EN 1991-1-1. A verification of quality and glue line integrity of the on-site repair bonding is given in an informative Annex A.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. 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, *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 302-4, *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 383, *Timber Structures — Test methods — Determination of embedment strength and foundation values for dowel type fasteners*

EN 408, *Timber structures — Structural timber and glued laminated timber — Determination of some physical and mechanical properties*

EN 14080:2013, *Timber structures — Glued laminated timber and glued solid timber, Requirements*

EN 14358, *Timber structures — Calculation and verification of characteristic values*

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EN 13183-2, *Moisture content of a piece of sawn timber - Part 2: Estimation by electrical resistance method*

**3 Terms and definitions**

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <http://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

**3.1 two component epoxy adhesive**  
thermosetting synthetic resin derived from a exothermic polymerization reaction of an epoxide group with amines, acid anhydrides, phenols, alcohols or thiols

**3.2 two component polyurethane (PUR) adhesive**  
urethane polymers which are cross-linked by the reaction between polyol or polyamine with isocyanate

**3.3 service class 1**  
climatic conditions characterized by a moisture content in the materials corresponding to a temperature of 20 °C and the relative humidity of the surrounding air only exceeding 65% for a few weeks per year

Note 1 to entry: In service class 1, which comprises typical indoor conditions, the average moisture content in most soft-woods will not exceed 12 %.

[SOURCE: EN 1995-1-1:2004, 2.3.1.3] <https://standards.iteh.ai/catalog/standards/sist/1a3b47b6-7f8a-47c9-b917-b7cf79bcde85/sist-en-17418-2021>

**3.4 service class 2**  
climatic conditions characterized by a moisture content in the materials corresponding to a temperature of 20 °C and the relative humidity of the surrounding air only exceeding 85% for a few weeks per year

Note 1 to entry: In service class 2, to which most covered exterior conditions belong, the average moisture content in most softwoods will not exceed 20 %.

[SOURCE: EN 1995-1-1:2004, 2.3.1.3]

**3.5 glue line**  
adhesive layer between the wood members

[SOURCE: EN 301:2017, 3.7]

**3.6 thick glue line**  
glue line of nominal thickness in the range of 0,3 mm to 8,0 mm at the time of bonding



Note 1 to entry: Thick glue lines are achieved by using spacers, grooves or similar devices with a thickness of 0,3 mm to 8,0 mm when two plain members are glued together.

[SOURCE: EN 301:2017, 3.8, modified — Maximum thickness has been increased to 8 mm.]

### 3.7

#### close contact glue line

glue line thickness of maximum 0,1 mm

Note 1 to entry: Close contact glue line is achieved by pressing together two plane wood members with a clamping pressure of  $(0,8 \pm 0,1)$  N/mm<sup>2</sup> without grooves, spacers or similar device.

[SOURCE: EN 301:2017, 3.9]

## 4 Symbols

$b$	specimen width of the net cross-section, in millimetres (mm)
$b_1$	specimen width, in millimetres (mm)
$b_2$	specimen width of the net cross-section, in millimetres (mm)
$d$	nominal rod diameter, in millimetres (mm)
$f_{c,app}$	apparent compression strength, in Newtons per square millimetre (N/mm <sup>2</sup> )
$f_{h,app}$	apparent embedment strength, in Newtons per square millimetre (N/mm <sup>2</sup> )
$f_{t,app}$	apparent tensile strength, in Newtons per square millimetre (N/mm <sup>2</sup> )
$f_{v,app}$	apparent shear strength, in Newtons per square millimetre (N/mm <sup>2</sup> )
$F_{c,max}$	compression test failure load, in Newtons (N)
$F_{max}$	embedment test failure load, in Newtons (N)
$F_{t,max}$	tensile test failure load, in Newtons (N)
$F_u$	ultimate load, in Newtons (N)
$F_{v,max}$	shear test failure load, in Newtons (N)
$H$	specimen height, in millimetres (mm)
$H_w$	component height, in millimetres (mm)
$t$	specimen thickness of the net cross section, in millimetres (mm)
$t_B$	glue line thickness, in millimetres (mm)
$\sigma_{m,n}$	bending stress, in Newtons per square millimetre (N/mm <sup>2</sup> )
$\sigma_{t,90,u}$	tensile stress perpendicular to grain, in Newtons per square millimetre (N/mm <sup>2</sup> )
$\tau_n$	shear stress, in Newtons per square millimetre (N/mm <sup>2</sup> )

**prEN 17418:2019 (E)****5 General requirements**

Adhesives for structural purpose shall produce joints of such strength and durability that the integrity of the bond in the rehabilitated element is maintained throughout the expected life of the structure.

**6 Classification**

If the adhesive meets the requirements of Clauses 7 to 9, the adhesive shall be classified as type I. The classification of adhesive consists of:

- Number of this document;
- Type of adhesive (I);
- Temperature in bond creep rupture test in °C;
- Maximum crack width/glue line thickness in millimetres;
- Working properties (Adhesives tested for working properties according to Clause 11 are specified by the letter “w” at the end of the designation code.).

EXAMPLE EN 17418-I-60-8-w

The wood species shall be given in the manufacturer’s declaration.

**7 Bond strength of adhesive-wood interface****7.1 General**

Adhesives complying with this document shall meet the performance requirements specified in 7.2.1 to 7.2.4 when tested in accordance with the following test methods:

- a) tensile shear test (see 7.3.1) using bonded specimens made from beech (*Fagus sylvatica* L.);
- b) delamination test (see 7.3.2) on bonded specimens made from Norway spruce (*Picea abies* L. H.KARST). The test with Norway spruce also covers silver fir (*Abies alba* MILL.) and Scots pine (*Pinus sylvestris* L.). If the adhesive is to be used on wood from other conifers species or treated wood, also prepare four laminated members using representative samples from those species or wood treated that way and perform the delamination test according to 7.3.2;
- c) shrinkage stress test (see 7.3.3) on bonded specimens made from Norway spruce (*Picea abies* L. H.KARST);
- d) multiple compression shear test (see 7.3.4) on bonded specimens made from beech (*Fagus sylvatica* L.).

The adhesives shall be applied according to the manufacturer’s instructions.

**7.2 Requirements****7.2.1 Bond strength in longitudinal tensile shear tests**

When tested in accordance with 7.3.1, the tensile shear strength values of close contact glue lines, 1,0 mm and thick glue lines shall meet the requirements given in Table 1.

**Table 1 — Minimum mean tensile shear strengths for close contact and gap joints on beech specimens (in N/mm<sup>2</sup>)**

Treatment Serial no EN 302-1	Close contact glue line	Thick glue line 1,0 mm	Thick glue line 3,0 mm	Thick glue line 4,0 mm
	Type I	Type I	Type I	Type I
A1	10,0	8,0	7,0	6,0
A2	6,0	4,0	3,5	3,0
A3	8,0	6,4	5,6	4,8
A4	6,0	4,0	3,5	3,0
A5	8,0	6,4	5,6	4,8
A7	8,0	5,5	5,0	4,5

NOTE Treatment A8 is not included in Table 1 due to the temperature limitation give in the scope.

### 7.2.2 Resistance to Delamination

When tested in accordance with 7.3.2, the limits on delamination for specimens of any glue line thickness shall be less or equal than 5 % in any specimen.

### 7.2.3 Effect of wood shrinkage on the shear strength

When tested in accordance with 7.3.3, the average shear strength after climatic treatment shall not be lower than 1,5 N/mm<sup>2</sup>.

### 7.2.4 Effect of compression shear and climatic changes

When tested in accordance with 7.3.4, not more than one of the six specimens is allowed to fail during the test period. The mean creep deformation of all the glue lines in each of the remaining test samples shall not exceed 0,05 mm after the test.

If a failure within a specimen occurs as a solid wood failure without any interference with the glue line, the specimen shall not be counted and four of the five remaining specimens shall fulfil the requirements. In the case that more than two specimens in a test series collapse due to solid wood failure (low wood quality), the whole test shall be repeated.

## 7.3 Test methods

### 7.3.1 Determination of bond strength in longitudinal tensile shear test

The tests shall be made in accordance with EN 302-1, but with glue line thicknesses close contact, 1,0 mm and 4,0 mm. In case the glue line thickness in use  $t_b$  is  $\leq 1$  mm the tests shall be made with a glue line thickness of 3 mm instead of 4 mm. The specimens with thick glue lines shall be prepared with a pressureless preparation of the specimens.

### 7.3.2 Determination of resistance to delamination

The tests shall be made in accordance with EN 302-2, with the following exceptions: the test with close contact glue line may be replaced by a test with a defined (spacers) glue line thickness of 0,2 mm. The tests with a glue line thickness of 4 mm shall be performed except for the case that the glue line thickness in use  $t_b$  is  $\leq 1$  mm where the tests shall be made with a glue line thickness of 3 mm instead of 4 mm. The specimens with thick glue lines shall be prepared with a pressureless preparation of the specimens. Different from EN 302-2 the tests with bonded members with thin/close contact glue line shall be performed exclusively with two specimens with long assembly time.

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## 7.3.3 Determination of the effect of wood shrinkage on the shear strength

The tests shall be made in accordance with EN 302-4, but with a glue line thickness 2 mm.

## 7.3.4 Determination of compression shear and climatic changes

The tests shall be made in accordance with EN 302-8 but with a temperature of 60 °C in the first cycle.

## 8 Tests on cohesive strength of thick monolithic adhesive specimens

## 8.1 General

Following the manufacture, testing and evaluation of monolithic adhesive specimens subject to tensile, compression and shear testing is specified.

As the glue lines between two opposite crack surfaces can have a thickness up to 8 mm, the adhesive layer acts as separate component/layer subject to any combined stress state occurring in the bonded timber layers. Hence the bulk adhesive strength properties are equally important as the bond/interface performance versus the timber.

## 8.2 Tensile tests

## 8.2.1 Specimen

Figure 1 shows the geometry and dimensions of the monolithic compact shoulder shaped tension specimen.

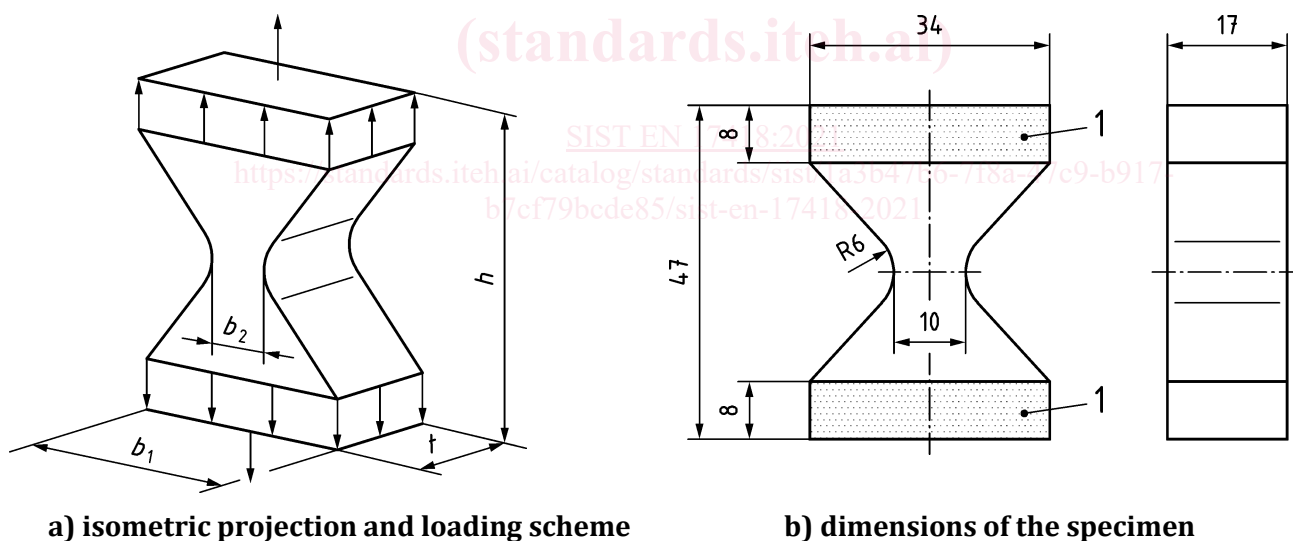


Figure 1 — Shape, dimensions and loading scheme of the tensile specimens

The specimens can be manufactured by pouring the undermixed adhesive in specifically shaped negative forms made of material (e.g. polytetrafluoroethylene (PTFE)) which does not exhibit any bond with the adhesive, see Figure 2. Alternatively, the specimens can be cut or milled to the required size and shape from rectangular monolithic adhesive bars produced in a first step by pouring the undermixed adhesive in a bar shaped form, see Figure 3. The manufacture of the specimens shall be performed at  $(20 \pm 2)$  °C.