



SLOVENSKI STANDARD
oSIST prEN 17334:2019
01-januar-2019

Vlepljene palice v lepljenih lesenih gradbenih proizvodih - Preskušanje, zahteve in klasifikacija strižne trdnosti spojev

Glued-in rods in glued structural timber products - Testing, requirements and bond shear strength classification

Eingeklebte Stangen in tragenden geklebten Holzprodukten - Prüfung, Anforderungen und Scherfestigkeitsklassifizierung

Goujons collés dans les produits en bois de structure collé - Essais, exigences et classification de la résistance au cisaillement du joint

<https://standards.iteh.ai/catalog/standards/sist/3258062c-5b48-4c7b-8545-9cc987f979d2/ksist-pr-en-17334-2020>

Ta slovenski standard je istoveten z: prEN 17334

ICS:

83.180	Lepila	Adhesives
91.080.20	Lesene konstrukcije	Timber structures

oSIST prEN 17334:2019

en,fr,de

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[kSIST FprEN 17334:2020](#)

<https://standards.iteh.ai/catalog/standards/sist/3258062c-5b48-4c7b-8545-9cc987f979d2/ksist-fpren-17334-2020>

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

DRAFT
prEN 17334

November 2018

ICS 83.180

English Version

Glued-in rods in glued structural timber products - Testing, requirements and bond shear strength classification

Goujons collés dans les produits en bois de structure
collé - Essais, exigences et classification de la résistance
au cisaillement du joint

Eingeklebte Stangen in tragenden geklebten
Holzprodukten - Prüfung, Anforderungen und
Scherfestigkeitsklassifizierung

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 193.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

This draft European Standard was established by CEN in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of 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 United Kingdom.

Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Warning : This document is not a European Standard. It is distributed for review and comments. It is subject to change without notice and shall not be referred to as a European Standard.



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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

Contents	Page
European Foreword.....	4
1 Scope	5
2 Normative references	5
3 Terms and definitions	6
4 Symbols	7
5 General requirements	9
6 Classification	10
7 Bond strength of adhesive-wood interface	10
7.1 General	10
7.2 Requirments	10
7.2.1 Bond strength in longitudinal tensile shear test	10
7.2.2 Resistance to Delamination	11
7.2.3 Effect of wood shrinkage on the shear strength	11
7.2.4 Effect of compression shear and climatic changes	11
7.3 Test methods	11
7.3.1 Determination of bond strength in longitudinal tensile shear test	11
7.3.2 Determination of resistance to delamination	12
7.3.3 Determination of the effect of wood shrinkage on the shear strength	12
7.3.4 Determination of compression shear and climatic changes	12
8 Bond shear strength of glued-in steel rods	12
8.1 General	12
8.2 Test piece	12
8.2.1 Build-up, dimensions	12
8.2.2 Timber material	13
8.2.3 Steel rod	14
8.3 Procedure	15
8.3.1 Manufacture of bond	15
8.3.2 Test schemes	15
8.3.3 Test procedure	17
8.4 Expression of test results	18
8.5 Determination of declared characteristic bond shear strength values	19
9 Determination of bond temperature resistance	20
9.1 General	20
9.2 Test piece	20
9.3 Procedure	21
10 Bond creep rupture test at very high and low moisture content	24
10.1 General	24
10.2 Test piece	24
10.3 Procedure	24
10.4 Requirement	24
11 Working properties of the adhesive	25
11.1 Determination of working life under reference conditions	25
11.2 Determination of open assembly time	25

11.3	Determination of curing time under reference conditions	25
11.4	Determination of time to fully cured state	26
11.4.1	General	26
11.4.2	Test pieces and manufacture.....	26
11.4.3	Number and treatment of the specimens	28
11.4.4	Test procedures	28
11.4.5	Expression of results	29
11.4.6	Determination of time to fully cured state	29
11.4.7	Declared time to fully cured state.....	30
12	Test report	30
12.1	The adhesive.....	30
12.2	Preparation of test pieces and testing procedure	31
12.3	Test results.....	31
Annex A	(informative) Design procedure for glued in rods in GLT, GST, LVL and CLT(1)	32
A.1	General	32
A.2	Loading parallel to rod axis	32
A.3	Lateral load-carrying capacity of glued-in rods	35
A.4	Combined axial and lateral loading	37
Annex B	(informative) Common alternatives for adhesive infill in drilled holes	38
Bibliography	39

ITeh STANDARD PREVIEW

(standards.iteh.ai)

[kSIST FprEN 17334:2020](https://standards.iteh.ai/catalog/standards/sist/3258062c-5b48-4c7b-8545-9cc987f979d2/ksist-fpren-17334-2020)

<https://standards.iteh.ai/catalog/standards/sist/3258062c-5b48-4c7b-8545-9cc987f979d2/ksist-fpren-17334-2020>

prEN 17334:2018 (E)

European foreword

This document (prEN 17334:2018) 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
(standards.iteh.ai)**

[kSIST FprEN 17334:2020](https://standards.iteh.ai/catalog/standards/sist/3258062c-5b48-4c7b-8545-9cc987f979d2/ksist-fpren-17334-2020)

<https://standards.iteh.ai/catalog/standards/sist/3258062c-5b48-4c7b-8545-9cc987f979d2/ksist-fpren-17334-2020>

1 Scope

This document specifies test methods for the determination of the suitability of two component epoxy and two component polyurethane adhesives for glued-in steel rods in glued laminated timber (GLT) and glued solid timber (GST) according to EN 14080, cross laminated timber (CLT) according to EN 16351 and laminated veneer lumber (LVL) according to EN 14374.

It specifies performance requirements and the determination of characteristic bond strength values for such adhesives for the prefabrication under factory or factory-like conditions of load-bearing timber-steel rod joints only. This document does not cover the performance of adhesives for on-site gluing (except for factory-like conditions).

Several provisions of this document can apply to repair and upgrading of existing timber structures including (cracked/fissured) solid wood beams. For adhesives for on-site repair or applications with solid timber additional provisions need to be taken into account. Such provisions are not part of this document.

This document also covers glued-in rods in surface treated wood. It does not cover glued-in rods in 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 joints are intended for load-bearing timber structures subjected to temperatures up to 60 °C over a longer time in service classes 1 and 2 which are loaded predominantly static or quasi static according to EN 1990 and EN 1991-1-1.

A design procedure for glued-in rods for timber structures is given in an informative Annex A.

2 Normative references (standards.iteh.ai)

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 923, *Adhesives - Terms and definitions*

EN 1990, *Eurocode - Basis of structural design*

prEN 17334:2018 (E)

EN 1991-1-1, *Eurocode 1: Actions on structures - Part 1-1: General actions - Densities, self-weight, imposed loads for buildings*

EN 10080, *Steel for the reinforcement of concrete - Weldable reinforcing steel - General*

EN 13183-1, *Moisture content of a piece of sawn timber - Part 1: Determination by oven dry method*

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

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

EN 14374, *Timber structures - Structural laminated veneer lumber - Requirements*

EN 16351, *Timber structures - Cross laminated timber - Requirements*

EN ISO 898-1, *Mechanical properties of fasteners made of carbon steel and alloy steel - Part 1: Bolts, screws and studs with specified property classes - Coarse thread and fine pitch thread (ISO 898-1)*

EN ISO 3506-1, *Mechanical properties of corrosion-resistant stainless steel fasteners - Part 1: Bolts, screws and studs (ISO 3506-1)*

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:

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

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]

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 4,0 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 4,0 mm when two plain members are glued together.

[SOURCE: EN 301:2017, 3.8, modified — Maximum thickness has been increased to 4 mm.]

3.7**close contact glue line****cc**

glue line thickness of maximum 0,1 mm

[kSIST FprEN 17334:2020](https://standards.iteh.ai/catalog/standards/sist/3258062c-5b48-4c7b-8545-9c987d79d2/ksist-fpren-17334-2020)

<https://standards.iteh.ai/catalog/standards/sist/3258062c-5b48-4c7b-8545-9c987d79d2/ksist-fpren-17334-2020>

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/mm² without grooves, spacers or similar device.

[SOURCE: EN 301:2017, 3.9, modified — Symbol cc has been added.]

4 Symbols

a	cross-section length of specimen, in millimetres (mm)
a_{200}	equation parameter, in newtons per square millimetre (N/mm ²)
a_{400}	equation parameter, in newtons per square millimetre (N/mm ²)
a_{500}	equation parameter, in newtons per square millimetre (N/mm ²)
a_{600}	equation parameter, in newtons per square millimetre (N/mm ²)
c_{200}	equation parameter, in newtons per cubic millimetre (N/mm ³)
c_{500}	equation parameter, in newtons per cubic millimetre (N/mm ³)
γ_M	partial factor for material properties, also accounting for model uncertainties and dimensional variations
d	nominal rod diameter, in millimetres (mm)

prEN 17334:2018 (E)

d_{drill}	diameter of drilled hole, in millimetres (mm)
$f_{t,\text{app}}$	apparent tensile strength, in newtons per square millimetre (N/mm ²)
$F_{t,\text{max}}$	tensile test failure load, in newtons (N)
$F_{v,\text{max}}$	block shear test failure load, in newtons (N)
F_{target}	target load (temperature resistance test), in newtons (N)
$F_{t,\text{DOL}}$	target load (creep rupture test at very high and low moisture content), in newtons (N)
$f_{t,\text{app}}$	apparent tensile strength, in newtons per square millimetre (N/mm ²)
f_{vr}	bond shear strength in N/mm ² , in newtons per square millimetre (N/mm ²)
f_v	block shear strength in N/mm ² (monolithic adhesive specimen), in newtons per square millimetre (N/mm ²)
$f_{\text{vr},\rho_{\text{ref}}}$	density corrected bond shear strength, in newtons per square millimetre (N/mm ²)
$f_{\text{vr},l_a,t_{B,k}}$	characteristic bond strength value (5 % quantile), in newtons per square millimetre (N/mm ²)
$f_{\text{vr},l_a,t_{B,\text{mean}}}$	mean arithmetic mean bond strength value in newtons per square millimetre (N/mm ²)
$f_{\text{vr},k,\text{dc}}$	declared characteristic bond shear strength (5% quantile), in newtons per square millimetre (N/mm ²)
$k_{d,a}$	bond strength ratio between two bond line thicknesses
k_{mod}	modification factor for duration of load and moisture content
l	total length of timber specimen, in millimetres (mm)
l_a	bond length of steel rod, in millimetres (mm)
l_{clamping}	length to fix the rod in the grips of the test machine, in millimetres (mm)
l_{drill}	drill length of hole, in millimetres (mm)
$l_{\text{not bonded}}$	length of the rod inside the drill hole that is not able to take load (e.g. spacers), in millimetres (mm)
l_m	distance between the grounds of the drilled holes in the specimen, in millimetres (mm)
$l_{\text{rod,tot}}$	total rod length, in millimetres (mm)
ρ	density of the timber specimen at 12 % moisture content, in kilograms per cubic metre (kg/m ³)
ρ_{ref}	reference density, in kilograms per cubic metre (kg/m ³)
t_b	bond line thickness, in millimetres (mm) ($t_b = (d_{\text{drill}} - d)/2$)
t_B	total bond line thickness, in millimetres (mm) ($t_B = 2 t_b$)
T_{app}	applied temperature, in °C

$T_{\text{bond,target}}$	target temperature at bond line, in °C
t_{cool}	cooling down period, in minutes
$t_{\text{cycle},1}$	time of first heating-cooling-load-cycle, in minutes
t_{heat}	heating period, in minutes
t_{Trod60}	constant temperature period, in minutes
t_{total}	total time of both temperature-load cycles, in minutes

Additional symbols of Annex A:

a_1	minimum distance of axially loaded glued-in rods (in grain direction), in millimetres (mm)
a_2	minimum distance of axially loaded glued-in rods (normal grain direction), in millimetres (mm)
$a_{1,c}, a_{2,c}$	minimum edge distance of axially loaded glued-in rods, in millimetres (mm)
$a_{3,t}$	minimum distance of axially loaded glued-in rods (loaded end grain face), in millimetres (mm)
$a_{3,c}$	minimum distance of axially loaded glued-in rods (unloaded end grain face), in millimetres (mm)
$a_{4,t}$	minimum distance of axially loaded glued-in rods (loaded edge), in millimetres (mm)
$a_{4,c}$	minimum distance of axially loaded glued-in rods (unloaded edge), in millimetres (mm)
$a_{e,f}$	stress design relevant cross-section of steel rod, in square millimetres (mm ²)
$F_{\text{ax,Rd}}$	design value for the withdrawal (pull-out) capacity, in newtons (N)
$F_{v,Ed,1}, F_{v,Ed,2}$	design values of shear force at both sides of the connection, in newtons (N)
$f_{v,r,d}$	design value of bond shear strength, in newtons per square millimetre (N/mm ²)
$f_{y,d}$	design value of yield strength of steel rod, in newtons per square millimetre (N/mm ²)
$F_{90,Rd}, F_{90,Rk}$	design value and characteristic value of resistance to tension perpendicular to grain of the loaded member, in newtons (N)
h_b	depth and width of timber member, in millimetres (mm)
h_e	projected rod embedment length perpendicular to grain, in millimetres (mm)
$l_{a,\text{min}}$	minimum bond length, in millimetres (mm)

5 General requirements

Adhesives for structural purpose shall produce joints of such strength and durability that the integrity of the bond in the glued-in rod joint is maintained throughout the expected lifetime of the structure.

prEN 17334:2018 (E)**6 Classification**

If the adhesive meets the requirements of Clauses 7 to 10 the adhesive shall be classified as type I. The classification of adhesive consists of:

- number of the standard;
- type of adhesive (I);
- temperature in bond creep rupture test, in °C;
- maximum bond length, in millimetres;
- maximum bond 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 WI 00193319-I-60-500-4 w

The type of rod (rebars, rods with metric thread), the tested rod dimensions d and l_a , the applicable wood product (GLT, GST, CLT, LVL including lay-up) and wood species shall be given in the manufacturer's declaration.

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

Adhesives complying with this European Standard shall meet the performance requirements specified in 7.2.1 to 7.2.3 when tested in accordance with the following test methods:

- a) tensile shear test (see 7.3.1) using bonded test pieces made from beech (*Fagus sylvatica L.*);
- b) delamination test (see 7.3.2) on bonded test pieces made from Norway spruce (*Picea abies L.*). The test with Norway spruce also covers silver fir (*Abies alba*) and Scots pine (*Pinus sylvestris*). 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 test pieces made from Norway spruce (*Picea abies L.*);
- d) multiple compression shear test (see 7.3.4) on bonded test pieces made from beech (*Fagus sylvatica L.*).

These adhesives shall be applied according to the manufacturer's instructions.

7.2 Requirments**7.2.1 Bond strength in longitudinal tensile shear test**

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 test pieces (in N/mm²)

Treatment	Close contact glue line	Thick glue line 1,0 mm	Thick glue line 3,0 mm	Thick glue line 4,0 mm
Designation according to EN 302-1	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 given 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/mm².

7.2.4 Effect of compression shear and climatic changes

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

If a failure within a test piece occurs as a solid wood failure without any interference with the bond line, the test piece shall not be counted and four of the five remaining test pieces shall fulfill the requirements. In case more than two test pieces 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 ≤ 1 mm the tests shall be made with a glue line thickness of 3 mm instead of 4 mm. The test pieces with thick glue lines shall be prepared with a pressureless preparation of the test pieces.