

SLOVENSKI STANDARD
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**Lepila za nosilne lesene konstrukcije - Preskusne metode - 2. del: Ugotavljanje
odpornosti lepljenega stika proti razslojevanju (delaminaciji)**

Adhesives for load-bearing timber structures - Test methods - Part 2: Determination of
resistance to delamination

Klebstoffe für tragende Holzbauteile - Prüfverfahren - Teil 2: Bestimmung der
Delaminierungsbeständigkeit

Adhésifs pour structures portantes en bois - Méthodes d'essais - Partie 2 : Détermination
de la résistance à la délamination

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

Adhésifs pour structures portantes en bois - Méthodes
d'essais - Partie 2 : Détermination de la résistance à la
délamination

Klebstoffe für tragende Holzbauteile - Prüfverfahren - Teil 2:
Bestimmung der Delaminierungsbeständigkeit

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.

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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.

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

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

Contents	Page
Foreword.....	3
Introduction	4
1 Scope	6
2 Normative references	6
3 Principle	6
4 Apparatus	6
5 Method	7
5.1 Selection of timber.....	7
5.2 Preparation of the bonded members	7
5.2.1 Bonded members with thin gluelines	7
5.2.2 Bonded members with 2 mm gluelines	8
5.3 Preparation of test pieces	9
5.3.1 Bonded members with thin gluelines	9
5.3.2 Bonded members with 2 mm gluelines	9
5.4 Test procedures	9
5.4.1 General.....	9
5.4.2 High temperature procedure (for type I adhesives)	9
5.4.3 Low temperature procedure (for type II adhesives)	10
5.5 Measurement and evaluation of delamination.....	11
6 Expression of results	12
7 Test report	12
7.1 The adhesives	12
7.2 Preparation of test pieces and testing procedure	12
7.3 Test results.....	13
Bibliography	14

Foreword

This document (FprEN 302-2:2015) has been prepared by Technical Committee CEN/TC 193 “Adhesives”, the secretariat of which is held by AENOR.

This document is currently submitted to the CEN enquiry.

This document will supersede EN 302-2:2013.

Compared to EN 302-2:2013 the following modifications have been made:

- a) preparation of bonded members with 2 mm glueline thickness added as 5.2.2;
- b) preparation of test pieces with 2 mm glueline thickness added as 5.3.2.

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Introduction

This document is one of a series dealing with adhesives for use with timber structures, and is published in support of EN, 1995 *Eurocode 5: Design of 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 polymerised isocyanate adhesives (EN 16254), and all together eleven test methods (EN 302-1, EN 302-2, EN 302-3, EN 302-4, EN 302-5, EN 302-6 and EN 302-7 and EN 15416-2, EN 15416-3, EN 15416-4 and EN 15416-5).

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 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, *Adhesives for load-bearing timber structures — Test methods*

- *Part 1: Determination of longitudinal tensile shear strength*
- *Part 2: Determination of resistance to delamination*
- *Part 3: Determination of the effect of acid damage to wood fibres by temperature and humidity cycling on the transverse tensile strength*
- *Part 4: Determination of the effects of wood shrinkage on the shear strength*
- *Part 5: Determination of maximum assembly time under referenced conditions*
- *Part 6: Determination of the minimum pressing time under referenced conditions*
- *Part 7: Determination of the working life under referenced conditions*

EN 15416, *Adhesives for load bearing timber structures other than phenolic and aminoplastic — Test methods*

- *Part 2: Static load test of multiple bondline specimens in compression shear*
- *Part 3: Creep deformation test at cyclic climate conditions with specimens loaded in bending shear*
- *Part 4: Determination of open assembly time for one component polyurethane adhesives*
- *Part 5: Determination of conventional pressing time*

Safety statement

Persons using this document should be familiar with the normal laboratory practice, if applicable. This document 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 standard can have a negative environmental impact. As technological advantages lead to better alternatives for these materials, they will be eliminated from this standard to the greatest extent possible.

At the end of the test, it is recommended that the user of the standard take care to carry out an appropriate disposal of the wastes, according to local regulations.

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1 Scope

This European Standard specifies a method for determining the resistance to delamination in glue lines.

It is suitable for the following applications:

- a) for assessing the compliance of adhesives with EN 301, EN 15425 and EN 16254;
- b) for assessing the suitability and quality of adhesives for load-bearing timber structures;
- c) for comparing the effects on the bond strength resulting from the choice of bonding conditions, from different climatic conditioning and from the treatment of the test pieces before and after bonding.

This test is not applicable for modified and stabilized wood with strongly reduced swelling and shrinkage properties, such as acetylated wood, heat-treated wood and polymer impregnated wood.

This test 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

Not applicable.

3 Principle

Bonded, laminated specimens are subjected to an impregnation-drying procedure. The specimens are impregnated with water by immersing them and applying alternating high and low (vacuum) pressure. They are then dried rapidly in a specified air stream at low humidity (see 4.4). The extent of open glue lines, delamination, as a result of these treatments is measured and compared with the total length of glue lines on both end-grain faces of the specimen.

4 Apparatus

4.1 Autoclave or similar pressure vessel, designed to safely withstand a pressure of at least 625 kPa absolute (525 kPa above nominal atmospheric pressure).

4.2 Vacuum pump or similar device, capable of reducing the pressure in the vessel (4.1) to below 20 kPa absolute (80 kPa below nominal atmospheric pressure).

4.3 Pump or similar device, for obtaining a pressure of at least 600 kPa absolute (500 kPa above nominal atmospheric pressure).

4.4 Air-circulating oven(s) or chamber(s), capable of drying the test pieces (see 5.4) in the following climate condition:

- a) for low temperature procedure (type II adhesive) a temperature of $(27,5 \pm 2,5) ^\circ\text{C}$, circulating the air within the chamber, maintaining a constant relative humidity of $(30 \pm 5) \%$; and

- b) for high temperature procedure (type I adhesive) a temperature of $(65 \pm 3) ^\circ\text{C}$, circulating the air within the chamber, maintaining a relative humidity of $(12,5 \pm 2,5) \%$.

NOTE Air speed velocity of 2 m/s to 3 m/s in empty chamber has shown to be suitable to achieve drying times according to 5.4.2 and 5.4.3.

4.5 Balance, allowing measurements with an accuracy of ± 1 g.

4.6 Wood chisel and hammer, or similar devices capable of opening the glue lines.

5 Method

5.1 Selection of timber

Use flat-sawn, straight-grained Norway spruce (*Picea abies* L.), free of reaction wood, with a density of $(450 \pm 25) \text{ kg/m}^3$ at $(12 \pm 1) \%$ moisture content. Preferably, knot-free wood should be used, but allowances are made for boards with knots up to a maximum of 20 mm in diameter, but splay (spike) knot is not allowed. The test with Norway spruce also covers approval of silver fir (*Abies alba*) and Scots pine (*Pinus sylvestris*).

If the adhesive is to be used on wood from other conifer species like larch (*Larix decidua*), Douglas fir (*Pseudotsuga menziesii*) and pines with coloured heartwood (other than Scots pine (*Pinus sylvestris*)), from hardwood species and/or on preservative treated wood, also prepare four laminated members using representative samples using wood with mean density.

Condition the timber in the standard climate [20/65] ($(20 \pm 2) ^\circ\text{C}$ and a relative humidity of $(65 \pm 5) \%$) for at least 7 days prior to bonding, ensuring that the timber has a moisture content of $(12 \pm 1) \%$.

5.2 Preparation of the bonded members

5.2.1 Bonded members with thin gluelines

Make four laminated members, two with short assembly time and two with long assembly time. For each laminated member, prepare six lamellae at least $(150 \pm 5) \text{ mm}$ wide, $(30 \pm 1) \text{ mm}$ thick and approximately 500 mm long from six different boards. The desired thickness is achieved by planing 38 mm thick lamellae. Store the lamellae in standard climate [20/65] before planing and gluing. Bond the lamellae in accordance with Table 1, within 8 h of planing. Within each assembly, ensure that the six lamellae present the same growth ring symmetry.

Table 1 — Preparation of the bonded members

Parameters	Members 1 and 2	Members 3 and 4
Adhesive spread, single sided (can be 2 faces for hardwood) Mixed and/or separate	For aminoplastic and phenolic adhesives: 250 g/m ² For other adhesives as recommended by the adhesive manufacturer	For aminoplastic and phenolic adhesives: 400 g/m ² For other adhesives as recommended by the adhesive manufacturer
Air temperature	(20 ± 2) °C	(20 ± 2) °C
Open assembly time	Maximum 5 min ^c	Maximum 5 min ^c
Closed assembly time	Minimum ^d	Maximum ^d
Pressure (conifers) ^a	(0,6 ± 0,1) N/mm ²	(0,6 ± 0,1) N/mm ²
Pressure time ^b	As recommended ^b	As recommended ^b
^a For hardwood species, larch, Douglas fir and pines with coloured heartwood, the pressure shall be that recommended by the adhesive manufacturer. ^b As recommended by the adhesive manufacturer for a curing temperature of (20 ± 2) °C. ^c Or as recommended by the adhesive manufacturer. ^d As recommended by the adhesive manufacturer at standard climate.		

If the adhesive system is intended for only separate application, then premixed adhesive and hardener shall not be tested by this standard.

After bonding and pressing and before cutting and testing, condition the assembly for 7 days to 14 days in the standard climate [20/65].

5.2.2 Bonded members with 2 mm gluelines

Make two laminated members. For each laminated members, prepare six lamellas at least (160 ± 5) mm wide, (30 ± 1) mm thick and approximately 500 mm long from 6 different boards. Prepare sufficient spacers of 160 mm x 20 mm x (2 ± 0,01) mm. 5 spacers will be required per lamella. Lay these on the surface of the wood spaced (100,0 ± 0,5) mm apart with the lengths across the width of the surface. Prepare all the lamellas with spacers prior to gluing. For the first lamella, fill the gap between the spacers with adhesive. Apply a thin layer of adhesive on the adjacent lamella. Put this lamella on top of the first lamella and continue filling the gaps between the spacers. After finishing the application of the adhesive, clamp the laminated member with the gluelines in vertical direction. Apply sufficient pressure to ensure contact between the spacers and the lamellas. To ensure pressure less gluing, keep the topside open to allow excess adhesive and air bubbles to escape from the gluelines.

NOTE The use of a wide tape to seal one long edge of each board has shown to be suitable to prevent excessive loss of adhesive from the glueline.

After bonding and pressing and before cutting and testing, condition the assembly for 7 days to 14 days in the standard climate [20/65].