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Descriptors: Adhesives, timber construction, phenoplasts, aminoplasts, classification, specification, mechanical strength

English version

Adhesives, phenolic and aminoplastic,
for load-bearing timber structures:
Classification and performance requirements

Adhésifs, de natures phénolique et
aminoplaste, pour structures portantes en
bois: classification et exigences de
performance

Klebstoffe für tragende Holzbauteile:
Phenoplaste und Aminoplaste —
Klassifizierung und Leistungsanforderungen

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

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Foreword

This European Standard was prepared by Technical Committee 103, Adhesives for wood and derived timber products.

This Standard is one of a series dealing with adhesives for use with timber structures, and is published, in support of Eurocode No. 5, "*Common unified rules for timber structures*". The series consists of a classification and performance requirements for two types of phenolic and aminoplastic adhesive for use in different climatic conditions (EN 301), and four test methods (EN 302-1 to EN 302-4) used to assess the performance of adhesives after specified heat and humidity treatments.

No existing European Standard is superseded.

The standard includes four normative annexes summarizing the conditioning treatments to which test samples are subjected before mechanical testing or visual inspection.

National standards identical to this European Standard shall be published at the latest by 1992-12-31 and conflicting national standards shall be withdrawn at the latest by 1992-12-31.

According to the CEN/CENELEC Common Rules, the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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1 Scope

This European Standard establishes a classification for phenolic and aminoplastic polycondensation adhesives according to their suitability for use for load-bearing timber structures in defined climatic exposure conditions, and specifies performance requirements for such adhesives for the manufacture of load-bearing timber structures only.

The performance requirements of this standard apply to the adhesive only, not to the structure.

This standard is primarily intended for the use of manufacturers of adhesives and of adhesively bonded timber structures to assess or control the quality of adhesives. This standard only specifies the performance of an adhesive for use in an environment corresponding to the defined conditions.

An adhesive meeting the requirements of this standard for its type will perform satisfactorily in a load-bearing structure, provided that the bonding process has been carried out correctly.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 302, *Adhesives for load-bearing timber structures: test methods — Part 1: Determination of bond strength in longitudinal tensile shear — Part 2: Determination of resistance to delamination (laboratory method) — 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.*

3 Definitions

For the purposes of this standard, the following definitions apply.

3.1

polycondensation adhesive

an adhesive, made from a resin formed by a polymerization reaction involving the elimination of water, with a hardener. Such adhesives usually also contain extenders and/or fillers

3.2

phenolic resin

a synthetic resin derived from a condensation reaction between a phenolic compound (e.g. phenol, cresol, xylenol, resorcinol) or a mixture of phenolic compounds with an aldehyde (e.g. formaldehyde, furfuraldehyde) or a mixture of aldehydes

3.3

aminoplastic resin

a synthetic resin derived from a condensation reaction between a synthetic compound containing amino groups (e.g. urea, thiourea, melamine) or allied compounds alone or in combination, with formaldehyde

4 Classification

Two types of adhesive, I and II, are classified according to their suitability for use in the climatic conditions given in Table 1.

5 Requirements

5.1 General Adhesives complying with this European Standard shall meet the performance requirements specified in clause 5 when tested in accordance with EN 302-1 to EN 302-4 using the following test methods.

- The tensile shear test (subclause 5.2 and EN 302-1) using bonded test pieces made from beech (*Fagus sylvatica* L.).
- The delamination test (subclause 5.3 and EN 302-2) on adhesively bonded test pieces made out of spruce (*Picea abies* L.). If the adhesive is specifically claimed to be suitable for use with wood from broad-leaved species and/or specially treated wood, then the adhesive shall also be tested on bonded test pieces made from that species or wood treated in that way.

Table 1 — Adhesive types for use in different climatic conditions

Temperature	Climatic equivalent to ^a	Examples	Adhesive type
> 50 °C	Not specified	Prolonged exposure to high temperature	I
≤ 50 °C	> 85 % r.h. at 20 °C	Full exposure to the weather	I
	≤ 85 % r.h. at 20 °C	Heated and ventilated building. Exterior protected from the weather. Short periods of exposure to the weather	II

^a 85 % r.h. at 20 °C will result in a moisture content of approximately 20 % in softwoods and most hardwoods, and a somewhat lower moisture content in wood-based panels.

c) The fibre damage test (subclause 5.4 and EN 302-3) on adhesively bonded test pieces made out of spruce (*Picea abies* L.).

d) The shrinkage stress test (subclause 5.5 and EN 302-4) on adhesively bonded test pieces made out of spruce (*Picea abies* L.).

5.2 Tensile shear test

The minimum tensile shear failing loads, measured in accordance with EN 302-1, of close contact joints (approximately 0,1 mm) in beech test pieces after the treatments specified in Annex A shall be as given in Table 2.

Table 2 — Minimum tensile shear failing loads for close contact joints on beech test pieces

Treatment (see Annex A)	Adhesive type	
	I	II
	Minimum failing load (in N)	
A1	2 000	2 000
A2	1 200	1 200
A3	1 600	1 600
A4	1 200	NR ^a
A5	1 600	NR ^a

^a NR = not required for this adhesive type.

The failing loads, measured in accordance with EN 302-1, of beech test pieces made using gap joints (1 mm ± 0,1 mm) after the conditioning treatments specified in Annex A shall in all cases be no lower than 80 % of the value shown in Table 2 for the corresponding close contact joint.

5.3 Delamination test

The resistance to delamination of bonded laminated specimens following the treatments given in Annex B, determined by the method in EN 302-2, shall be as given in Table 3.

Table 3 — Requirements for resistance to delamination

Conditioning treatment (see Annex B)	Adhesive type	
	I	II
	Maximum delamination in any specimen (in %)	
B1	NR ^a	10
B2	5	NR ^a

^a NR = not required for this adhesive type.

5.4 Fibre damage test

The average (arithmetic mean) tensile transverse load at failure of the untreated control determined by the method in EN 302-3 shall be not lower than 2,5 kN.

The average (arithmetic mean) tensile transverse load at failure of the test joints after exposure to the cyclic treatment described in EN 302-3 and summarized in Annex C shall be not lower than 80 % of the average value obtained for the control.

5.5 Shrinkage test

The average (arithmetic mean) compressive shear load at failure after the shrinkage test, summarized in Annex D, determined by the method in EN 302-4, shall be not lower than 30 kN.

6 Additional information

The following information concerning the use of the adhesive shall be provided by the manufacturer, if requested by the laboratory that is responsible for the execution of the tests.

6.1 General description of adhesive as received

- Short description of the adhesive (type of resin and hardener and field of application).
- Shelf life of the components.
- Exact proportions of the components in the adhesive as prepared for use.

6.2 Physical properties of adhesive prepared for use

- Dynamic viscosity of the adhesive as prepared for use.
- pH of the adhesive mix.
- Pot life (end of the usable life) of the adhesive as prepared for use.

6.3 Use of the adhesive

- Adhesive spread and instruction on whether or not the adhesive has to be spread on both surfaces to be bonded.
- Minimum and recommended temperatures for spreading and curing.
- Maximum open and closed assembly times expressed in minutes.
- Minimum pressure value.
- Minimum clamping time.
- Minimum storage time at 20 °C and 65 % r.h. before testing of the bonded test piece.

Annex A (normative)

Treatments prior to shear test

The assemblies are bonded and then conditioned for 7 days in the standard atmosphere [20/65]. The test pieces are cut out and subjected to the appropriate treatment given in Table A.1.

Table A.1 — Type and duration of treatment prior to shear test

Designation	Treatment
A1	7 days in standard atmosphere [20/65] ^a
A2	7 days in standard atmosphere [20/65] ^a 4 days in water (15 ± 5) °C Samples tested in the wet state
A3	7 days in standard atmosphere [20/65] ^a 4 days in water (15 ± 5) °C Drying for 7 days in standard atmosphere [20/65] ^a Samples tested in the dry state
A4	7 days in standard atmosphere [20/65] ^a 6 h in boiling water 2 h in water (15 ± 5) °C Samples tested in the wet state
A5	7 days in standard atmosphere [20/65] ^a 6 h in boiling water 2 h in water (15 ± 5) °C Drying for 7 days in standard atmosphere [20/65] ^a Samples tested in the dry state

^aThe standard atmosphere [20/65] is defined as a temperature of (20 ± 2) °C and a relative humidity of (65 ± 5) %.

Annex B (normative)

Cyclic treatments used for the delamination test

The members are bonded and then conditioned for a minimum of 7 days in the standard atmosphere [20/65]. The test pieces are then cut out and subjected to the appropriate cyclic treatment given in Table B.1.

Table B.1 — Summary of conditions for testing resistance to delamination

Treatment	Parameters	Units	Designation	
			B1	B2
Impregnation (water at (15 ± 5) °C)	Absolute pressure	kPa	25 ± 5	25 ± 5
	Duration	min	15	5
	Absolute pressure	kPa	600 ± 25	600 ± 25
	Duration	h	2	1
Drying	Number of impregnation cycles		2	2
	Temperature	°C	28 ± 1	65 ± 5
	Air humidity	%	30 ± 5	< 15
	Air speed	m/s	2,25 ± 0,25	2,25 ± 0,25
Number and duration of treatment	Duration	h	96	22
	Number of complete (two impregnation and one drying) cycles		2	3
	Total duration	days	8	3

Annex C (normative)**Cyclic treatment prior to the tensile test**

The assemblies are bonded and then conditioned for a minimum of 7 days in the standard atmosphere [20/65]. Test pieces are then cut out and subjected to four cycles of the treatments A, B and C specified in Table C.1.

Table C.1 — Cyclic treatment prior to the tensile test

Part	Duration h	Temperature °C	Rel. humidity %
A	24	50 ± 2	≈ 100
B	8	10 ± 2	≈ 100
C	16	50 ± 2	≤ 20

After the temperature and humidity cycles shown above have been carried out, the test pieces are conditioned at the standard atmosphere [20/65] until constant mass has been reached (≤ 0.1 % change in mass in 24 h).

Annex D (normative)**Treatment used for the shrinkage test**

The assemblies are bonded and then conditioned for a minimum of 7 days in the standard atmosphere [20/65]. Test pieces are then prepared and subjected to the following treatment:

- a) conditioning at 40 °C and 30 % r.h. until an average moisture content as determined by weighing of (8 ± 1) % is attained; followed by
- b) storage in the standard atmosphere [20/65] for 2 weeks.

National appendix NA (informative)

Committees responsible

The United Kingdom participation in the preparation of this European Standard was entrusted by the Adhesives Standards Policy Committee (ADC/-) to Technical Committee ADC/6, upon which the following bodies were represented:

British Adhesives and Sealants Association
British Chemical Distributors' and Traders' Association Limited
British Furniture Manufacturers' Federation
British Plastics Federation
British Railways Board
Department of the Environment (Building Research Establishment)
Furniture Industry Research Association
Ministry of Defence
Timber Research and Development Association

National appendix NB (informative)

Cross-references

The British Standards corresponding to the European Standards referred to in EN 301 are as follows.

European Standard	Corresponding British Standard
	BS EN 302 Adhesives for load-bearing timber structures: test methods
EN 302-1:1992	Part 1:1992 Determination of bond strength in longitudinal tensile shear
EN 302-2:1992	Part 2:1992 Determination of resistance to delamination (laboratory method)
EN 302-3:1992	Part 3:1992 Determination of the effect of acid damage to wood fibres by temperature and humidity cycling on the transverse tensile strength
EN 302-4:1992	Part 4:1992 Determination of the effects of wood shrinkage on the shear strength
