

High-pressure decorative laminates (HPL) - Sheets based on thermosetting resins (usually called laminates) - Part 2: Determination of properties

EESTI STANDARDI EESSÕNA**NATIONAL FOREWORD**

See Eesti standard EVS-EN 438-2:2016+A1:2018 sisaldab Euroopa standardi EVS-EN 438-2:2016+A1:2018 ingliskeelset teksti.	This Estonian standard EVS-EN 438-2:2016+A1:2018 consists of the English text of the European standard EVS-EN 438-2:2016+A1:2018.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 19.12.2018.	Date of Availability of the European standard is 19.12.2018.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

ICS 83.140.20

Standardite reprodutseerimise ja levitamise õigus kuulub Eesti Standardikeskusele

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonsesse süsteemi või edastamine ükskõik millises vormis või millisel teel ilma Eesti Standardikeskuse kirjaliku loata on keelatud.

Kui Teil on küsimusi standardite autorikaitse kohta, võtke palun ühendust Eesti Standardikeskusega:
Koduleht www.evs.ee; telefon 605 5050; e-post info@evs.ee

The right to reproduce and distribute standards belongs to the Estonian Centre for Standardisation

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, without a written permission from the Estonian Centre for Standardisation.

If you have any questions about copyright, please contact Estonian Centre for Standardisation:

Homepage www.evs.ee; phone +372 605 5050; e-mail info@evs.ee

ICS 83.140.20

English Version

High-pressure decorative laminates (HPL) - Sheets based on thermosetting resins (usually called laminates) - Part 2: Determination of properties

Stratifiés décoratifs haute pression (HPL) - Plaques à base de résines thermodurcissables (communément appelées stratifiés) - Partie 2: Détermination des propriétés

Dekorative Hochdruck-Schichtpressstoffplatten (HPL) - Platten auf Basis härtpbarer Harze (Schichtpressstoffe) - Teil 2: Bestimmung der Eigenschaften

This amendment A1 modifies the European Standard EN 438-2:2016; it was approved by CEN on 5 October 2018.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for inclusion of this amendment into the relevant national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This amendment exists 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.



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	10
1 Scope	11
2 Normative references	11
3 Terms and definitions	12
4 Assessment of appearance	12
4.1 Principle	12
4.2 Apparatus	12
4.3 Test specimen	12
4.4 Procedure	12
4.5 Test report	13
5 Determination of thickness	13
5.1 Principle	13
5.2 Apparatus	13
5.3 Test specimen	13
5.4 Procedure	13
5.5 Test report	14
6 Determination of length and width	14
6.1 Principle	14
6.2 Apparatus	14
6.3 Test specimen	14
6.4 Procedure	14
6.5 Expression of results	14
6.6 Test report	14
7 Determination of edge straightness	15
7.1 Principle	15
7.2 Apparatus	15
7.3 Test specimen	15
7.4 Procedure	15
7.5 Expression of results	15
7.6 Test report	16
8 Determination of edge squareness	16
8.1 Principle	16
8.2 Apparatus	16

8.3	Test specimen.....	16
8.4	Procedure	16
8.5	Expression of results.....	17
8.6	Test report.....	17
9	Determination of flatness	17
9.1	Principle.....	17
9.2	Apparatus.....	17
9.3	Test specimens.....	18
9.4	Procedure	18
9.5	Expression of results.....	18
9.6	Test report.....	18
10	Resistance to surface wear	18
10.1	Principle	18
10.2	Materials.....	18
10.3	Apparatus.....	19
10.3.1	Abrasion resistance testing machine.....	19
10.4	Test specimens.....	21
10.5	Preparation of specimens and abrasive paper.....	21
10.6	Procedure	21
10.6.1	Preparation of abrasive wheels.....	21
10.6.2	Calibration of abrasive paper	21
10.6.3	Abrasion of specimen	21
10.7	Expression of results.....	22
10.8	Test report.....	22
11	Resistance to abrasion (flooring grade laminates)	23
12	Resistance to immersion in boiling water	23
12.1	Principle	23
12.2	Apparatus.....	23
12.3	Test specimens.....	23
12.4	Procedure	24
12.5	Expression of results.....	24
12.5.1	Calculation.....	24
12.5.2	Surface rating scale	25
12.5.3	Edge rating scale.....	25
12.6	Test report.....	25
13	Substrate protection against water vapour.....	25

13.1	Principle	25
13.2	Apparatus	26
13.3	Test specimens	26
13.4	Procedure	26
13.5	Expression of results	27
13.6	Test report	27
14	Resistance to water vapour	27
14.1	Principle	27
14.2	Apparatus	28
14.3	Test specimen	28
14.4	Procedure	28
14.5	Expression of results	28
14.6	Test report	28
15	Resistance to wet conditions (Exterior grade laminates)	30
15.1	Principle	30
15.2	Apparatus	30
15.3	Test specimens	30
15.4	Procedure	30
15.5	Expression of results	30
15.5.1	Calculation	30
15.5.2	Visual examination	31
15.6	Test report	31
16	Resistance to dry heat	32
16.1	Principle	32
16.2	Apparatus and materials	32
16.3	Test specimen	34
16.4	Test procedure	34
16.5	Examination of the test specimen	34
16.6	Expression of results	34
16.7	Test report	35
17	Dimensional stability at elevated temperature	35
17.1	Principle	35
17.2	Apparatus	35
17.3	Test specimens	36
17.4	Procedure	36
17.5	Expression of results	36

17.6	Test report.....	37
18	Resistance to wet heat.....	37
18.1	Principle	37
18.2	Apparatus and materials.....	38
18.3	Test specimens.....	38
18.4	Procedure	39
18.5	Expression of results.....	39
18.6	Test report.....	40
19	Resistance to climatic shock (exterior grade laminates)	40
19.1	Principle	40
19.2	Apparatus.....	40
19.3	Test specimens.....	41
19.4	Procedure	41
19.5	Expression of results.....	42
19.5.1	Flexural strength and modulus of elasticity in flexure	42
19.5.2	Appearance	42
19.6	Test report.....	42
20	Resistance to impact by small-diameter ball.....	42
20.1	Principle	42
20.2	Materials.....	43
20.3	Apparatus.....	43
20.4	Test specimens.....	46
20.5	Calibration of the impact tester	46
20.6	Procedure	47
20.7	Expression of results.....	48
20.8	Test report.....	48
21	Resistance to impact by large diameter ball	48
21.1	Principle	48
21.2	Materials.....	49
21.3	Apparatus.....	49
21.4	Test specimens.....	49
21.5	Procedure	49
21.6	Expression of results.....	51
21.7	Test report.....	52
22	Resistance to impact by large diameter ball (flooring grade laminates)	52
22.1	Principle	52

22.2	Materials	52
22.3	Apparatus	52
22.4	Test specimens.....	53
22.5	Procedure	53
22.6	Expression of results	53
22.7	Test report.....	53
23	Resistance to cracking under stress (laminates ≤ 2 mm thick)	54
23.1	Principle.....	54
23.2	Apparatus	54
23.3	Test specimens.....	54
23.4	Procedure	56
23.5	Expression of results	56
23.6	Test report.....	57
24	Resistance to crazing (Compact laminates)	58
24.1	Principle.....	58
24.2	Apparatus	58
24.3	Test specimens.....	58
24.4	Procedure	58
24.5	Expression of results	58
24.6	Test report.....	59
25	Resistance to scratching.....	60
25.1	Principle.....	60
25.2	Materials	60
25.3	Apparatus	60
25.4	Calibration of apparatus.....	62
25.5	Test specimen.....	62
25.6	Procedure	62
25.7	Expression of results	66
25.8	Test report.....	66
26	Resistance to staining.....	66
26.1	Principle.....	66
26.2	Staining agents.....	66
26.3	Apparatus and Materials.....	68
26.3.1	Discs.....	68
26.3.2	Glass Petri dish	68
26.3.3	Tweezers.....	68

26.3.4	Absorbent paper or tissue	68
26.3.5	Cleaning cloth	68
26.3.6	Diffuse light source.....	68
26.4	Test specimens.....	69
26.5	Test procedure.....	69
26.6	Examination of the test panel	70
26.7	Assessment of results	70
26.8	Test report.....	71
27	Light fastness (Xenon arc)	71
27.1	Principle	71
27.2	Apparatus.....	71
27.3	Test specimen.....	72
27.4	Procedure	72
27.5	Assessment and expression of results.....	73
27.6	Test report.....	73
28	Resistance to UV light (Exterior grade laminates).....	73
28.1	Principle	73
28.2	Apparatus.....	73
28.3	Test specimens.....	73
28.4	Procedure	74
28.5	Evaluation and expression of results.....	74
28.5.1	General.....	74
28.5.2	Contrast	74
28.5.3	Appearance	74
28.6	Test report.....	74
29	Resistance to artificial weathering (Exterior grade laminates)	75
29.1	Principle	75
29.2	Apparatus.....	75
29.3	Test specimens.....	76
29.4	Procedure	76
29.5	Examination and expression of results.....	76
29.5.1	General.....	76
29.5.2	Contrast	77
29.5.3	Appearance	77
29.6	Test report.....	77
30	Determination of the microscratch resistance.....	77

30.1	Principle	77
30.2	Terms and definitions	77
30.3	Apparatus and materials	78
30.3.1	Martindale tester	78
30.3.2	Holder for scrub material	78
30.3.3	Diffuse light source	78
30.3.4	Reflectometer	78
30.3.5	Positioning device	79
30.4	Assembly and maintenance of the Martindale tester	80
30.5	Method for checking the Lissajous figure	80
30.6	Preparation and conditioning	81
30.6.1	Preparation	81
30.6.2	Test surface	81
30.7	Test procedure	81
30.7.1	General	81
30.7.2	Testing	81
30.8	Classification of the image after scratching according to procedure B	83
30.9	Test report	84
31	Formability (Method A)	84
31.1	Principle	84
31.2	Apparatus	84
31.3	Test specimens	85
31.4	Procedure	85
31.4.1	Calibration of test apparatus	85
31.4.2	Test procedure	86
31.5	Test report	87
32	Formability (Method B)	87
32.1	Principle	87
32.2	Apparatus	88
32.3	Test specimens	88
32.4	Procedure	89
32.5	Test report	90
33	Resistance to blistering (Method A)	91
33.1	Principle	91
33.2	Apparatus	91
33.3	Test specimens	91

33.4	Procedure	91
33.4.1	Calibration of test apparatus	91
33.4.2	Test procedure.....	91
33.5	Test report.....	91
34	Resistance to blistering (Method B).....	92
34.1	Principle.....	92
34.2	Apparatus.....	92
34.3	Test specimens.....	92
34.4	Procedure	92
34.4.1	General.....	92
34.4.2	Calibration of test apparatus	92
34.4.3	Test procedure.....	92
34.5	Test report.....	92
Annex A (informative) Surface finish and colour influence on surface evaluations		94
Annex B (informative) Calibration and maintenance of abrasion equipment		95
Annex C (normative) Measurement of shore A hardness.....		99

European foreword

This document (EN 438-2:2016+A1:2018) has been prepared by Technical Committee CEN/TC 249 "Plastics", the secretariat of which is held by NBN.

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 June 2019, and conflicting national standards shall be withdrawn at the latest by June 2019.

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 includes Amendment 1 approved by CEN on 28 August 2018.

This document supersedes A1 EN 438-2:2016. A1

The start and finish of text introduced or altered by amendment is indicated in the text by tags A1 A1.

EN 438, *High-pressure decorative laminates (HPL) — Sheets based on thermosetting resins (usually called laminates)*, consists of the following parts:

- *Part 1: Introduction and general information*
- *Part 2: Determination of properties*
- *Part 3: Classification and specifications for laminates less than 2 mm thick intended for bonding to supporting substrates*
- *Part 4: Classification and specifications for Compact laminates of thickness 2 mm and greater*
- *Part 5: Classification and specifications for flooring grade laminates less than 2 mm thick intended for bonding to supporting substrates*
- *Part 6: Classification and specifications for Exterior-grade Compact laminates of thickness 2 mm and greater*
- *Part 7: Compact laminate and HPL composite panels for internal and external wall and ceiling finishes*
- *Part 8: Classification and specifications for design laminates*
- *Part 9: Classification and specifications for alternative core laminates*

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: 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 the United Kingdom.

1 Scope

This document specifies the methods of test for determination of the properties of high-pressure decorative laminates as defined in Clause 3. These methods are primarily intended for testing the sheets specified in EN 438-3, EN 438-4, EN 438-5, EN 438-6, EN 438-8, and EN 438-9.

The precision of the test methods, specified in this European Standard, is not known because inter-laboratory data are not yet available. When inter-laboratory data will be obtained, precision statements will be added to the test method at the following revision. For those test methods having an end point determination based on subjective judgement, it is not meaningful to make a statement of precision.

2 Normative references

A1 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. **A1**

EN 204, *Classification of thermoplastic wood adhesives for non-structural applications*

EN 312, *Particleboards — Specifications*

EN 316, *Wood fibre boards — Definition, classification and symbols*

EN 438-1, *High-pressure decorative laminates (HPL) — Sheets based on thermosetting resins (usually called laminates) — Part 1: Introduction and general information*

EN ISO 62, *Plastics — Determination of water absorption (ISO 62)*

EN ISO 178, *Plastics — Determination of flexural properties (ISO 178)*

EN ISO 291, *Plastics — Standard atmospheres for conditioning and testing (ISO 291)*

EN ISO 2813, *Paints and varnishes — Determination of gloss value at 20°, 60° and 85° (ISO 2813)*

EN ISO 3668, *Paints and varnishes — Visual comparison of the colour of paints (ISO 3668)*

EN ISO 4287, *Geometrical product specifications (GPS) — Surface texture: Profile method — Terms, definitions and surface texture parameters (ISO 4287)*

EN ISO 4288, *Geometrical product specifications (GPS) — Surface texture: Profile method — Rules and procedures for the assessment of surface texture (ISO 4288)*

EN ISO 4892-1, *Plastics — Methods of exposure to laboratory light sources — Part 1: General guidance (ISO 4892-1)*

EN ISO 4892-2:2013, *Plastics — Methods of exposure to laboratory light sources — Part 2: Xenon-arc lamps (ISO 4892-2:2013)*

EN ISO 4892-3, *Plastics — Methods of exposure to laboratory light sources — Part 3: Fluorescent UV lamps (ISO 4892-3)*

EN ISO 6506-1, *Metallic materials — Brinell hardness test — Part 1: Test method (ISO 6506-1)*

EN ISO 12945-2, *Textiles — Determination of fabric propensity to surface fuzzing and to pilling — Part 2: Modified Martindale method (ISO 12945-2)*

EN ISO 12947-1, *Textiles — Determination of the abrasion resistance of fabrics by the Martindale method — Part 1: Martindale abrasion testing apparatus (ISO 12947-1)*

ISO 48, *Rubber, vulcanized or thermoplastic — Determination of hardness (hardness between 10 IRHD and 100 IRHD)*

ISO 105-A02, *Textiles — Tests for colour fastness — Part A02: Grey scale for assessing change in colour*

ISO 209:2007, *Aluminium and aluminium alloys — Chemical composition*

ISO 1770, *Solid-stem general purpose thermometers*

ISO 7267-2, *Rubber-covered rollers — Determination of apparent hardness — Part 2: Shore-type durometer method*

ISO 9370, *Plastics — Instrumental determination of radiant exposure in weathering tests — General guidance and basic test method*

CIE 85:1989, *Solar Spectral Irradiance*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 438-1 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>

4 Assessment of appearance

4.1 Principle

Laminates shall be inspected for surface appearance under standardised conditions of lighting and viewing.

4.2 Apparatus

4.2.1 Horizontal inspection table, of height approximately 700 mm and large enough to accommodate the largest sheets to be inspected.

4.2.2 The light source shall provide a diffused illumination of (1200 ± 400) lx over the whole area of the largest sheets to be inspected. This may be either diffused daylight or diffused artificial daylight.

A1 Deleted text. **A1** When artificial daylight is used, it shall have a correlated colour temperature of 5000 K to 6500 K. Both of them shall be in accordance with EN ISO 3668.

A convenient distance of the lights from the inspection table is approximately 1,5 m.

4.3 Test specimen

The specimen shall be the laminate under test, as supplied by the manufacturer.

4.4 Procedure

Place the laminate, decorative face uppermost, on the inspection table. Wipe it free of any loose contamination with a soft cloth, using a suitable cleaning agent if necessary. Inspect it from the distance required by the relevant part of EN 438 for defects such as smudges, smears, fingerprints, scratches,