



BSI Standards Publication

High-pressure decorative laminates (HPL) — Sheets based on thermosetting resins (usually called laminates)

Part 6: Classification and specifications for Exterior-grade compact laminates of thickness 2 mm and greater

National foreword

This British Standard is the UK implementation of EN 438-6:2016. It supersedes BS EN 438-6:2005 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PRI/76, Laminated sheet for decorative purposes.

A list of organizations represented on this committee can be obtained on request to its secretary.

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**High-pressure decorative laminates (HPL) - Sheets based
on thermosetting resins (usually called laminates) - Part 6:
Classification and specifications for Exterior-grade
compact laminates of thickness 2 mm and greater**

Stratifiés décoratifs haute pression (HPL) - Plaques à base de résines thermodurcissables (communément appelées stratifiés) - Partie 6: Classification et spécifications des stratifiés compacts pour usage en extérieur d'épaisseur égale ou supérieure à 2 mm

Dekorative Hochdruck-Schichtpressstoffplatten (HPL) - Platten auf Basis härthbarer Harze (Schichtpressstoffe) - Teil 6: Klassifizierung und Spezifikationen für Kompakt-Schichtpressstoffe für die Anwendung im Freien mit einer Dicke von 2 mm und größer

This European Standard was approved by CEN on 13 December 2015.

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

Contents	Page
European foreword	3
1 Scope	4
2 Normative references	4
3 Terms, definitions, symbols and abbreviations	4
3.1 Terms and definitions	4
3.2 Symbols	5
4 Material types and classification system	5
5 Requirements	5
5.1 Compliance	5
5.2 Inspection requirements	5
5.2.1 General	5
5.2.2 Colour and pattern	6
5.2.3 Surface finish	6
5.2.4 Visual inspection	6
5.3 Dimensional tolerance requirements	7
5.4 Test requirements	7
5.4.1 Physical property requirements	7
5.4.2 Weather resistance requirements	8
5.4.3 Notes on requirements for reaction to fire	9
Annex A (informative) Addendum to sub-clause 5.4.3, relating to fire performance	10
Bibliography	11

European foreword

This document (EN 438-6:2016) 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 August 2016, and conflicting national standards shall be withdrawn at the latest by August 2016.

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This document supersedes EN 438-6:2005.

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*

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1 Scope

This European Standard applies to Exterior-grade Compact laminates of thickness 2 mm and greater produced by using a high pressure process. It specifies requirements for standard and flame-retardant laminates intended for use under outdoor weather conditions such as direct sunlight rain and frost. Two levels of performance are specified; one for moderate exterior conditions, and the other for severe exterior conditions.

Laminates complying with this European Standard are referred to as Exterior-grade Compact laminates, and are characterized by their high tensile strength, high impact resistance, thermal shock resistance, and resistance to weather and corrosion. They are available in a variety of decorative colours, with high resistance to colour change and aging in outdoor applications. When they are self-supporting Exterior-grade Compact laminates are ready for installation, and only require cutting to size, drilling, etc. to suit the application. EN 438-2 specifies the methods of test relevant to this part of EN 438.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 438-2:2016, *High-pressure decorative laminates (HPL) — Sheets based on thermosetting resins (usually called laminates) — Part 2: Determination of properties*

EN 13501-1, *Fire classification of construction products and building elements — Part 1: Classification using data from reaction to fire tests*

EN 13722, *Furniture — Assessment of the surface gloss*

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

EN ISO 1183-1, *Plastics — Methods for determining the density of non-cellular plastics — Part 1: Immersion method, liquid pycnometer method and titration method (ISO 1183-1)*

EN ISO 11664-2, *Colorimetry — Part 2: CIE standard illuminants (ISO 11664-2)*

3 Terms, definitions, symbols and abbreviations

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1.1

high-pressure decorative laminate(s)

HPL

sheet(s) consisting of decorative surface layer(s) and core layers bonded together by an high pressure process

Note 1 to entry: Typical values for the high pressure process are a temperature of ≥ 120 °C and a pressure of ≥ 5 MPa.

3.1.2

surface layer

upper decorative layer consisting in one or more sheets of fibrous material (usually paper) impregnated with aminoplastic thermosetting resins (usually melamine based resins) or other curable resins, eventually with a suitable outer layer or coating to enhance weather and light protecting properties

Note 1 to entry: The surface layers can appear on one or both side(s) of the laminate(s). In case of one-sided laminates, the back of the sheet(s) may be made suitable for adhesive bonding to a substrate.

3.1.3

core layer

fibrous material (usually paper) impregnated with thermosetting resins (usually phenolic based resins) or other suitable curable resins

3.2 Symbols

For the purposes of this document, the following symbol applies.

t nominal thickness

4 Material types and classification system

Exterior-grade Compact laminates are defined using the three letter classification system shown in Table 1.

Table 1 — Classification system

First letter	Second letter	Third letter
E (exterior grade)	G (moderate use) or D (severe use)	S (standard grade) or F (flame-retardant grade)

For example an Exterior-grade flame-retardant HPL for severe outdoor conditions is specified as HPL/EN 438-6/EDF.

Laminate grades EGS and EGF are intended for moderate outdoor conditions, for example applications involving medium term exposure to average levels of sunlight and weathering.

Laminate grades EDS and EDF are intended for severe outdoor conditions, for example applications involving long term exposure to strong sunlight and weather.

5 Requirements

5.1 Compliance

Exterior-grade Compact laminate types EGS, EGF, EDS and EDF shall meet all appropriate requirements specified in 5.2, 5.3 and 5.4. This applies to both full-size sheets and cut-to-size panels.

5.2 Inspection requirements

5.2.1 General

Inspection shall be carried out in accordance with EN 438-2:2016, Clause 4 at a distance between 750 mm to 1500 mm.

5.2.2 Colour and pattern

When inspected in daylight or D65 standard illuminant, as specified in EN ISO 11664-2, and also under tungsten filament lightning illuminant A as specified in EN ISO 11664-2, a slight difference between the corresponding colour reference sample held by the supplier and the specimen under test is acceptable.

NOTE 1 Where colour and surface finish are critical, it is advised that sheets be checked for colour and surface-finish compatibility before fabrication or installation.

NOTE 2 Some of these products are directional in surface finish or colour and it advised to install them in the correct orientation.

5.2.3 Surface finish

When inspected at different viewing angles, there shall be no significant difference between the corresponding surface-finish reference sample held by the supplier and the specimen under test.

The maximum permitted deviations for the gloss value determined according to EN 13722 are:

Gloss surface	> 70	GU	maximum deviation ± 15 GU
Semi Gloss surface	30 – 70	GU	maximum deviation ± 10 GU
Semi Matt surface	10 – 30	GU	maximum deviation ± 5 GU
Matt surface	< 10	GU	maximum deviation ± 3 GU

GU = gloss units

The measurement shall be carried out with the same device as comparison between reference sample and specimen or between different lots of specimen.

NOTE Where colour and surface finish are critical, it is advised that sheets be checked for colour and surface-finish compatibility before fabrication or installation.

5.2.4 Visual inspection

5.2.4.1 General

The following inspection requirements are intended as a general guide, indicating the minimum acceptable quality for each decorative face of a laminate supplied as a full-size sheet.

Cut-to-size panels and certain applications involving full-size sheets may call for special quality requirements which can be negotiated between supplier and purchaser; in such cases the following requirements may be used as a basis for agreement.

It should be noted that only a small percentage of sheets in a batch (the level to be agreed with the customer) should contain defects of the minimum acceptable level.

It may be agreed between purchaser and supplier that the visual quality standard applies to one decorative face only.

5.2.4.2 Surface quality

The following surface defects are permissible:

- a) dirt, spots and similar surface defects.

The admissible size of such defects is based on a maximum contamination area equivalent to 2,0 mm²/m² of laminate and is proportional to the sheet size under inspection.

The total admissible area of contamination may be concentrated in one spot or dispersed over an unlimited amount of smaller defects.

b) fibres, hairs and scratches.

The admissible size of defects is based on a maximum contamination length equivalent to 20 mm/m² of laminate and is proportional to the sheet size under inspection.

The total admissible length of contamination may be concentrated in one defect or dispersed over an unlimited amount of smaller defects.

5.2.4.3 Edge quality

Edge chipping up to 3 mm on each side is permissible.

5.3 Dimensional tolerance requirements

Dimensional tolerance requirements are specified in Table 2.

Table 2 — Dimensional tolerance requirements

Property	Test method (EN 438-2:2016, clause number)	Requirement	
		thickness	maximum variation
Thickness	5	$2,0 \leq t < 3,0$ mm: $3,0 \leq t < 5,0$ mm: $5,0 \leq t < 8,0$ mm: $8,0 \leq t < 12,0$ mm: $12,0 \leq t < 16,0$ mm: $16,0 \leq t < 20,0$ mm: $20,0 \leq t < 25,0$ mm: $25,0 \leq t$	$\pm 0,20$ mm $\pm 0,30$ mm $\pm 0,40$ mm $\pm 0,50$ mm $\pm 0,60$ mm $\pm 0,70$ mm $\pm 0,80$ mm to be agreed between supplier and customer
Length and width ^b	6	+ 10 mm/ – 0 mm	
Edges straightness ^b	7	1,5 mm/m maximum deviation	
Edges squareness ^b	8	1,5 mm/m maximum deviation	
Flatness ^a	9	$2,0 \leq t < 6,0$ mm: $6,0 \leq t < 10,0$ mm: $10,0 \leq t$	maximum deviation 8,0 mm/m 5,0 mm/m 3,0 mm/m
^a Provided that the laminates are stored in the manner and conditions recommended by the manufacturer they shall comply with the flatness requirements specified in Table 2 when measured in accordance with EN 438-2:2016, Clause 9. The flatness values specified in Table 2 apply to laminates with two decorative faces. Limits for laminates with one Face sanded shall be agreed between supplier and customer. ^b Tolerances for cut-to-size panels shall be agreed between supplier and purchaser.			

5.4 Test requirements

5.4.1 Physical property requirements

Physical property requirements are specified in Table 3.

Table 3 — Physical property requirements

Property	Test method (EN 438-2:2016, clause number unless otherwise stated)	Property or attribute	Unit (max. or min.)	Laminate grade	
				EGS and EDS	EGF and EDF
Resistance to wet conditions	15	Mass increase Appearance	% (max) $2 \leq t < 5$ $t \geq 5$ Surface rating (min) Edge rating (min)	7 5 4 3	10 8 4 3
Dimensional stability at elevated temperature	17	Cumulative dimensional change	% (max) $2 \text{ mm} \leq t < 5 \text{ mm L}^c$ T^d $t \geq 5 \text{ mm L}^c$ T^d	0,40 0,80 0,30 0,60	0,40 0,80 0,30 0,60
Resistance to impact by large diameter ball (shatter resistance)	22	Drop height ^b	mm (min) $2 \leq t < 6$ $6 \leq t$	1400 1800	1400 1800
Flexural modulus ^e	EN ISO 178 ^a	Stress	MPa (min) L^c and T^d	9000	9000
Flexural strength ^e	EN ISO 178 ^a	Stress	MPa (min) L^c and T^d	80	80
Density	EN ISO 1183-1	Density	g/cm ³ (min)	1,35	1,35
^a Machine crosshead speed 10 mm/min ^b When tested at the specified drop height, the diameter of indentation shall not exceed 10 mm. ^c L: in the longitudinal (or machine) direction of the fibrous sheet material (normally the direction of the longest dimension of the laminate). ^d T: in the cross-longitudinal (cross-machine) direction of the fibrous sheet material (at right angles to direction L). ^e The test results can be affected by the sample handling and by the humidity absorption from the air during the step previous to the conditioning.					

5.4.2 Weather resistance requirements

Weather resistance requirements are specified in Table 4.

Weather resistance is the behaviour of Exterior-grade laminates in relation to degradation of the surface, colour fading and reduction of mechanical properties, due to exposure to sunlight, rain, frost, etc.

Table 4 — Weather resistance requirements

Property	Test method (EN 438-2:2016, clause number)	Property or attribute	Unit (max. or min.)	Laminate grade	
				EGS and EGF	EDS and EDF
Resistance to climatic shock	19	Appearance	Rating (min)	4	4
		Flexural strength index Ds	(min)	0,80	0,80
		Flexural modulus index Dm	(min)	0,80	0,80
Resistance to UV light	28	Contrast Appearance	Grey scale rating (not worse than) Rating (min)	No requirement No requirement	3 (after 1500 hours exposure) 4 (after 1500 hours exposure)
Resistance to artificial weathering (including light fastness)	29	Contrast Appearance	Grey scale rating (not worse than) Rating (min)	3 (after 325 MJ/m ² radiant exposure) 4 (after 325 MJ/m ² radiant exposure)	3 (after 650 MJ/m ² radiant exposure) 4 (after 650 MJ/m ² radiant exposure)

5.4.3 Notes on requirements for reaction to fire

The requirements for reaction to fire are determined by the fire regulations of the country in which the material is to be used.

The reaction-to-fire of construction products is classified in accordance with EN 13501-1.

For applications other than construction, fire test methods and performance requirements may vary from one country to another, and at present it is not possible, with any test, to predict compliance with all national and other requirements.

No fire performance test is therefore included in this specification, however Annex A gives examples of how Exterior-grade Compact laminates relate to EN 13501-1 and some of the more common European fire test methods.

Annex A (informative)

Addendum to sub-clause 5.4.3, relating to fire performance

In Europe, laminate panels intended for construction applications are tested in accordance with EN 13823 [1] (SBI test) and EN ISO 11925-2 [2] (Small-burner test), and the resulting reaction-to-fire performance is expressed in accordance with EN 13501-1.

Table A.1 shows typical EN 13501-1 reaction-to-fire classifications of Exterior-grade Compact laminates.

Table A.1 — Typical EN 13501-1 classifications of Exterior-grade Compact laminates in the field of building construction

Product type	EN 13501-1 classification
EGF and EDF $\geq$ 6mm thick	B-s2,d0
EGF and EDF < 6mm thick	C-s2,d0 or better
EGS and EDS	D-s2,d0 or better
NOTE It is advised to contact the laminate manufacturer for details of fire test reports and certifications held, and for information on fire test methods and specifications.	

NOTE Flame-retardant additives used in Exterior-grade Compact laminates are not halogen based and remain effective throughout the service life of the product.

Bibliography

- [1] EN 13823, *Reaction to fire tests for building products — Building products excluding floorings exposed to the thermal attack by a single burning item*
- [2] EN ISO 11925-2, *Reaction to fire tests — Ignitability of products subjected to direct impingement of flame — Part 2: Single-flame source test (ISO 11925-2)*

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BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK