BRITISH STANDARD

BS EN
438-6:2005

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

The European Standard EN 438-6:2005 has the status of a British Standard

ICS 83.140.20

BSI
British Standards

National foreword

This British Standard is the official English language version of EN 438-6:2005. BS EN 438-6:2005 together with BS EN 438 Parts 1 to 5 and 7 supersedes BS EN 438-1:1991 and BS EN 438-2:1991 which are withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PRI/76, Laminated sheet for decorative purposes, which has the responsibility to:

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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 härtbarer 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 16 August 2004.

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Contents

Foreword

This document (EN 438-6:2005) has been prepared by Technical Committee CEN/TC 249 “Plastics”, the secretariat of which is held by IBN.

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of an identical text or by endorsement, at the latest by July 2005, and conflicting national standards shall be withdrawn at the latest by July 2005.

This document supersedes EN 438-1:1991 and EN 438-2:1991.

This Standard consists of seven 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*

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

1 Scope

This Part of EN 438 applies to Exterior-grade Compact laminates of thickness 2mm and greater. 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 Part of EN 438 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 referenced documents are indispensable for the application 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 438-2, *High-pressure decorative laminates (HPL) — Sheets based on thermosetting resins (Usually called Laminates) — Part 2: Determination of properties*

EN ISO 178, *Plastics — Determination of flexural properties (ISO 178:2001)*

EN ISO 527-2:1996, *Plastics — Determination of tensile properties — Part 2: Test conditions for moulding and extrusion plastics (ISO 527-2:1993 including Corr 1:1994)*

EN ISO 1183-1:2004, *Plastics — Methods for determining the density of non-cellular plastics - Part 1: Immersion method, liquid pyknometer method and titration method (ISO 1183:2004)*

3 Term and definition

For the purposes of this document, the following term and definition applies:

3.1
high-pressure decorative exterior-grade compact laminate(s) (HPL)
sheet(s) consisting of layers of cellulosic fibrous material (e.g. paper) impregnated with thermosetting resins and bonded together by the high pressure process described below. The surface layer(s) on one or both sides, having decorative colours or designs, are impregnated with suitable thermosetting resins (aminoplastic based resins or others). A suitable outer layer or coating may be added to enhance weather and light protecting properties. The core layers are impregnated with phenolic based resins, and may be combined with other fibres and/or fillers during the manufacturing process

The high pressure process is defined as the simultaneous application of heat (temperature ≥ 120 °C) and high specific pressure (≥ 5 MPa), to provide flowing and subsequent curing of the thermosetting resins to obtain a homogeneous non-porous material with increased density (≥ 1,35 g/cm³), and with the required surface finish.

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/prEN 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 Clauses 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, Test Method 4 at a distance of 1,5 m.

5.2.2 Colour and pattern

When inspected in daylight or D65 standard illuminant and again under tungsten illuminant F, there shall be no significant difference between the corresponding colour reference sample held by the supplier and the specimen under test.

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

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.

NOTE Where colour and surface finish are critical, it is recommended 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:

Dirt, spots and similar surface defects

The admissible size of such defects is based on a maximum contamination area equivalent to 2,0 mm^2/m^2 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.

Fibres, hairs and scratches

The admissible size of defects is based on a maximum contamination length equivalent to 20 mm/m^2 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 tolerances

Property	Test method (EN 438-2, Clause no.)	Requirement	
			maximum variation
Thickness	5	2,0 ≤ t < 3,0 mm: 3,0 ≤ t < 5,0 mm: 5,0 ≤ t < 8,0 mm: 8,0 ≤ t < 12,0 mm: 12,0 ≤ t < 16,0 mm: 16,0 ≤ t < 20,0 mm: 20,0 ≤ t < 25,0 mm: 25,0 ≤ t	± 0.20 mm ± 0.30 mm ± 0.40 mm ± 0.50 mm ± 0.60 mm ± 0.70 mm ± 0.80 mm to be agreed between supplier and customer.
Flatness [a)]	9	2,0 ≤ t < 6,0 mm: 6,0 ≤ t < 10,0 mm: 10,0 ≤ t :	maximum deviation 8,0 mm/m 5,0 mm/m 3,0 mm/m
Length and width [b)]	6	+ 10 mm/ – 0 mm	
Straightness of edges [b)]	7	1,5 mm/m maximum deviation	
Squareness [b)]	8	1,5 mm/m maximum deviation	

[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 438-2:2005 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.

Note: (where t = nominal thickness)

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, Clause no. unless otherwise stated)	Property or attribute	Unit (max. or min.)	Laminate grade	
				EGS and EDS	EGF and EDF
Flexural modulus	EN ISO 178:2003 [a]	Stress	MPa (min)	9000	9000
Flexural strength	EN ISO 178:2003 [a]	Stress	MPa (min)	80	80
Tensile strength	EN ISO 527-2:1996 [b]	Stress	MPa (min)	60	60
Density	EN ISO 1183-1:2004	Density	g/cm ^{3} (min)	1,35	1,35
Resistance to impact by large diameter ball (shatter resistance)	21	Drop height [c]	mm (min) $2 \le t < 6$mm $6 \ge t$ mm (where t = nominal thickness)	1400 1800	1400 1800
Resistance to wet conditions [d]	15	Mass increase Appearance	% (max) $2 \le t < 5$ $t \ge 5$ (where t = nominal thickness) Rating (min)	7 5 4	10 8 4
Dimensional stability at elevated Temperature [d]	17	Cumulative dimensional change	% (max) 2 mm ≤ t < 5 mm L [e] T [f] t ≥ 5 mm L T (where t = nominal thickness)	 0,40 0,80 0,30 0,60	 0,40 0,80 0,30 0,60

[a] Machine crosshead speed 2 mm/min.
[b] Specimen type 1A. Machine crosshead speed 5 mm/min.
[c] When tested at the specified drop height, the diameter of indentation shall not exceed 10 mm.
[d] See Annex B.
[e] L = in the longitudinal (or machine) direction of the fibrous sheet material (normally the direction of the longest dimension of the laminate).
[f] T = in the cross-longitudinal (cross-machine) direction of the fibrous sheet material (at right angles to direction L).
[g] Tested in accordance with procedure A using specimen III.

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) Clause no.)	Property or attribute	Unit (max. or min.)	Laminate grade	
				EGS and EGF	EDS and EDF
Resistance to climatic shock	19	Appearance Flexural strength index Ds Flexural modulus index Dm	Rating (min) (min) (min)	4 0,95 0,95	4 0,95 0,95
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 (see Annex A)

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 Clause 5.4.3, relating to fire performance.

In Europe, laminate panels intended for construction applications are tested in accordance with EN 13823 (SBI test) and EN ISO 11925-2 (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.

Product type	EN 13501-1 classification
EGF and EDF ≥ 6mm thick	B-s2,d0
EGF and EDF < 6mm thick	C-s2,d0 or better
EGS and EDS	D-s2,d0 or better
NOTE The laminate manufacturer should be contacted for details of fire test reports and certifications held, and for information on fire test methods and specifications.	

For applications other than construction, test methods and specifications may vary from one country to another.

Table A.2 shows some examples of how Exterior-grade Compact laminates typically relate to some of the more common European test methods.

Table A.2 Examples of typical fire performance of Exterior-grade Compact laminates.

Test method	Test standard	Typical performance levels	
		EDF and EGF	EGS and EDS
Spread of flame	BS 476-7	Class 1	Class 2
Brandschacht	DIN 4102-1	B1	B2
Epiradiateur	NF P 92-501	M1	M3 or better
Smoke density and toxicity	NF F 16-101	F2 or better	F2 or better
NOTE The laminate manufacturer should be contacted 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.

Annex B
(informative)

Assessment of conformity

The key performance characteristics for Exterior-grade Compact laminates are:-

Density	(EN ISO 1183-1)
Flexural modulus	(EN ISO 178)
Flexural strength	(EN ISO 178)
Resistance to wet conditions	(EN 438-2, Method 15)

Bibliography

EN 13501:2002, *Fire classification of construction products and building elements – Part 1: Classification using test data from reaction to fire tests*

EN 13823:2002, *Reaction to fire tests for building products – Building products excluding floorings exposed to the thermal attack by a single burning item*

EN ISO 11925-2:2002*, Reaction to fire tests – Ignitability of building products subjected to direct impingement of flame – Part 2: Single-flame source test (ISO 11925-2:2002)*

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