INTERNATIONAL STANDARD

ISO 4586-5

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

Part 5: Classification and specifications for flooring grade laminates less than 2 mm thick intended for bonding to supporting substrates

Stratifiés décoratifs haute pression (HPL, HPDL) — Plaques à base de résines thermodurcissables (communément appelées stratifiés) —

Partie 5: Classification et spécifications des stratifiés pour revêtement de sol d'épaisseur inférieure à 2 mm destinés à être collés sur des supports

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 11, *Products*.

This second edition cancels and replaces the first edition (ISO 4586-5:2015), which has been technically revised.

The main changes compared to the previous edition are as follows:

— correction of errors due to typographical, formatting, and omission issues.

A list of all parts in the ISO 4586 series can be found on the ISO website.

Introduction

High-pressure decorative flooring laminates are characterized by their high resistance to abrasion, aesthetic qualities, and durability. They have good hygienic and anti-static properties and are easy to clean and maintain.

In an effort to harmonize ISO 4586 with other high-pressure decorative laminate standards, multiple methods may be published that demonstrate similar properties. In these instances, the same test method title is given and is annotated as either “Method A” or “Method B”. This is the case in the following tests: Edge squareness — 8/9, Dry heat — 17/18, Dimensional stability at elevated temperatures — 19/20, Dimensional stability at ambient temperature — 21/22, Staining — 30/31, Lightfastness — 32/33, Formability — 38/39, and Blistering — 40/41. In these instances, either method may be utilized in testing. Compliance to both methods is not required. While these tests are similar they are by no means identical and results of one method do not necessarily correspond to the results of the accompanying test. In these situations, it is intended that the documentation in specific parts of ISO 4586 for performance requirements be consulted. Each specific method has performance requirements particular to that method for individual grades of high-pressure decorative laminate.

This document has been harmonized with EN 438-5 whenever possible.

In addition, Annex A provides information on electrostatic properties and is included as a convenient reference to answer common questions.

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

Part 5: Classification and specifications for flooring grade laminates less than 2 mm thick intended for bonding to supporting substrates

1 Scope

This document applies to five classes of flooring grade laminates less than 2 mm thick intended for bonding to supporting substrates, to produce high-pressure decorative laminates (HPL, HPDL) flooring elements. For laminate floor covering applications they meet the surface property requirements specified in EN 13329[2].

The requirements in this document apply only to the high-pressure laminate, and additional properties are intended to be specified in order to define the functional performance of the finished flooring product.

ISO 4586-2 specifies the methods of test relevant to this document.

2 Normative references

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.

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

ISO 4586-2:2018, *High-pressure decorative laminates (HPL, HPDL) — Sheets based on thermosetting resins (usually called laminates) — Part 2: Determination of properties*

ISO 10874, *Resilient, textile and laminate floor coverings — Classification*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at https://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

3.1
high-pressure decorative compact laminate
HPL
HPDL
sheet consisting of layers of cellulosic fibrous material (normally paper) impregnated with thermosetting resins and bonded together by the *high pressure process* (3.2)

Note 1 to entry: This is a general definition of high-pressure decorative laminate(s). More specific product definitions can be found in ISO 4586-3 to ISO 4586-8.

Note 2 to entry: The surface layer(s) on one or both sides, having decorative colours or designs, are typically impregnated with melamine based resins. The core layers are typically impregnated with phenolic based resins.

3.2
high-pressure process
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/cm^3), and with the required surface finish

3.3
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 or other decorative design surfaces such as metal foils, wood-veneers, and textiles, etc. which are not necessarily treated with thermosetting resin

3.4
core layer
fibrous material (usually paper) impregnated with thermosetting resins (usually phenolic based resins) or other curable resins, possibly reinforced by metal layer(s) or metal mesh(es) and others which are not necessarily treated with thermosetting resin

4 Classification, designation and coding

The classification system makes reference to ISO 10874 (level of use) in combination with the abrasion class (AC) given by a numerical rating of 1 to 6 defining the level of abrasion resistance, 6 being the highest and 1 the lowest performance.

Table 1 shows how the five abrasion classes of flooring grade laminate relate to level of use and some examples of typical applications.

Flooring grade laminates are specified according to abrasion class (e.g. HPL/ISO 4586-5/AC1).

Table 1 — Classification system and typical applications

ISO 10874 classification	Level of use	Description	Examples of applications	Abrasion class
21	Moderate domestic	Residential areas with low or intermittent use	Bedrooms	AC1
22	General domestic	Residential areas with medium use	Living rooms, entrance halls	AC2
23	Heavy domestic	Residential areas with intense use	Living rooms, entrance halls	AC3
31	Moderate commercial	Commercial areas with low or intermittent use	Hotel rooms, small offices, hotel boutiques	

Table 1 *(continued)*

ISO 10874 classification	Level of use	Description	Examples of applications	Abrasion class
32	General commercial	Commercial areas with medium use	Classrooms, small offices, hotel boutiques	AC4
33	Heavy commercial	Commercial areas with heavy use	Corridors, department stores, schools, multipurpose halls, open plan offices	AC5
34	Very heavy commercial	Commercial areas with very heavy use	Airports, multi-purpose halls, counter halls, department stores	AC6

5 Requirements

5.1 Compliance

Laminates classified in Table 1 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 ISO 4586-2:2018, Clause 4 at a distance of 0,75 m to 1,5 m.

5.2.2 Colour and pattern

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

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.

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 Reverse side

The reverse side of sheets shall be suitable for adhesive bonding (e.g. sanded). In the case of sanded backs, slight chatter marks are permitted.

5.2.5 Visual inspection

5.2.5.1 General

The following inspection requirements are intended as a general guide, indicating the minimum acceptable quality for laminates. 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.

5.2.5.2 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 1,0 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 10 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.

5.2.5.3 Edge quality

Visual defects (e.g. moisture marks, lack of gloss, corner damage, etc.) can be present on all four edges of the laminate, providing the defect-free length and width are at least the nominal size minus 10 mm.

5.3 Dimensional tolerance requirements

Dimensional tolerance requirements are specified in Table 2.

Table 2 — Dimensional tolerances

Property	Test method (ISO 4586-2:2018 **Clause No.**)	Requirement
Thickness	5	0,5 ≤ *d* ≤ 1,0 mm: ±0,10 mm maximum variation 1,0 < *d* ≤ 2,0 mm: ±0,15 mm maximum variation (where *d* = nominal thickness)
Length and width[a]	6	+10 mm/−0 mm
Straightness of edges[a]	7	1,5 mm/m maximum deviation
Squareness[a] (Method A) or	8	1,5 mm/m maximum deviation
Squareness[a] (Method B)	9	< 6 mm
Flatness[b]	10	60 mm/m maximum deviation

[a] Tolerances for cut-to-size panels shall be agreed between supplier and purchaser.

[b] Provided that the laminates are stored in the manner and conditions recommended by the manufacturer.

5.4 Test requirements

5.4.1 General requirements

General requirements are specified in Table 3.

Table 3 — General requirements

Property	Test method (ISO 4586-2:2018 Clause No., unless otherwise stated)	Property or attribute	Unit (max. or min.)	Level of use according to ISO 10874					
				21	22	23/31	32	33	34
Abrasion class	12	Abrasion resistance initial point (IP)	Revolutions (min.)	AC1	AC2	AC3	AC4	AC5	AC6
Abrasion resistance				500	1 000	2 000	4 000	6 000	8 500
Resistance to water vapour	15	Appearance	Rating (min.)	4	4	4	4	4	4
Dimensional stability at elevated temperature (Method A) or	19	Cumulative dimension change	% (max.)						
			d < 1 mm						
			L[c]	0,65	0,65	0,65	0,65	0,65	0,65
			T[d]	1,15	1,15	1,15	1,15	1,15	1,15
			1 ≤ d < 2 mm						
			L[c]	0,45	0,45	0,45	0,45	0,45	0,45
			T[d]	0,90	0,90	0,90	0,90	0,90	0,90
			(where d = nominal thickness)						
Dimensional stability at elevated temperature (Method B)	20	Cumulative dimension change	% (max.)						
			d < 1 mm						
			L[c]	1,10	1,10	1,10	1,10	1,10	1,10
			T[d]	1,40	1,40	1,40	1,40	1,40	1,40
			1 ≤ d < 2 mm						
			L[c]	0,45	0,45	0,45	0,45	0,45	0,45
			T[d]	0,90	0,90	0,90	0,90	0,90	0,90
			(where d = nominal thickness)						
Impact resistance[a]									
By small diameter ball[b]	24	Spring force	N (min.)	20	20	20	20	20	20
By large diameter ball	26	Drop height indentation diameter	mm (min.)	1 600	1 600	1 600	1 600	1 600	≥ 1 600
			mm (max.)	10	10	10	10	10	≥ 10

[a] These requirements equate to Impact Class IC3 in EN 13329.

[b] The test is carried out with the laminate bonded to 6 mm ± 0,3 mm thick dry process fibreboard (MDF) of density 850 kg/m^3 ± 50 kg/m^3 as defined in EN 316[1], using PVAc adhesive.

[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).

Table 3 *(continued)*

Property	Test method (ISO 4586-2:2018 Clause No., unless otherwise stated)	Property or attribute	Unit (max. or min.)	Level of use according to ISO 10874					
				21	22	23/ 31	32	33	34
Resistance to staining (Method A) or	30	Appearance	Rating (min.)						
			groups 1 and 2	5	5	5	5	5	5
			group 3	4	4	4	4	4	4
Resistance to staining (Method B)	31	Appearance	Cleanability (max.)	20	20	20	20	20	20
			Stain 1 to 10 (min.)	5	5	5	5	5	5
			Stains 11 to 15 (min.)	3	3	3	3	3	3
Light fastness-xenon arc (Method A) or	32	Contrast	Grey scale rating	4 to 5	4 to 5	4 to 5	4 to 5	4 to 5	4 to 5
Light fastness-xenon arc (Method B)	33	Contrast	Rating (min.)	4	4	4	4	4	4
Resistance to radiant heat	36	Appearance	s (min.)						
			$d \leq 1$ mm	60	60	60	60	60	60
			d > 1 mm	125	125	125	125	125	125
			(where d = nominal thickness)						
Resistance to wet heat	41	Appearance	Rating (min.)	4	4	4	4	4	4
Density	ISO 1183-1	Density	g/cm^3 (min.)	1,35	1,35	1,35	1,35	1,35	1,35

[a] These requirements equate to Impact Class IC3 in EN 13329.

[b] The test is carried out with the laminate bonded to 6 mm ± 0,3 mm thick dry process fibreboard (MDF) of density 850 kg/m^3 ± 50 kg/m^3 as defined in EN 316[1], using PVAc adhesive.

[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).

5.4.2 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 various test methods specific to individual nation where the material is installed. 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.

Annex A
(informative)

Addendum relating to electrostatic properties

High-pressure decorative flooring grade laminates have a surface resistivity of between 1×10^9 Ω and 1×10^{12} Ω under normal ambient conditions (i.e. 23 °C ± 2 °C and 50 % ± 10 % RH).

HPL (HPDL) surfaces do not easily build-up an electrostatic charge, and do not attract dust.

For special applications such as computer tables, dissipative HPL (HPDL) is available with surface resistivity between 1×10^5 Ω and 1×10^9 Ω and volume resistivity between $7{,}5 \times 10^5$ Ω·cm and 1×10^9 Ω·cm (according to IEC 61340-5-1[3] and IEC/TR 61340-5-2[4]).

Bibliography

[1] EN 316, *Wood fibreboards — Definitions, classification and symbols*

[2] EN 13329, *Laminate floor coverings — Specifications, requirements and test methods*

[3] IEC 61340-5-1, *Electrostatics — Part 5-1: Protection of electronic devices from electrostatic phenomena — General requirements*

[4] IEC/TR 61340-5-2, *Electrostatics — Part 5-2: Protection of electronic devices from electrostatic phenomena — User guide*

[5] EN 438-5, *High-pressure decorative laminates (HPL) — Sheets based on thermosetting resins (usually called laminates) — Part 5: Classification and specifications for flooring grade laminates less than 2 mm thick intended for bonding to supporting substrates*

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