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

Part 4: Classification and specifications for compact laminates of thickness 2 mm and greater

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

Partie 4: Classification et spécifications des stratifiés compacts d'épaisseur égale ou supérieure à 2 mm

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ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

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Foreword

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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. www.iso.org/directives

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT), see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 61, *Plastics*, Subcommittee SC 11, *Products*.

This first edition of ISO 4586-4:2015 cancels and replaces (ISO 4586-1:2004), which has been technically revised.

ISO 4586 consists of the following parts, under the general title *Plastics — High-Pressure Decorative Laminates (HPL, HPDL) — Sheets based on Thermosetting Resins (Usually called Laminates):*

— *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: Classification and specifications for design laminates*

— *Part 8: Classification and specifications for alternative core laminates*

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

Part 4: Classification and specifications for compact laminates of thickness 2 mm and greater

1 Scope

This part of ISO 4586 specifies performance requirements for two types of Compact laminate (defined in Clause 4) of thickness 2 mm or greater intended for interior use.

High-pressure decorative Compact laminates are characterized by their aesthetic qualities, strength, durability and functional performance. Compact HPL sheets are available in a wide variety of colours, patterns and surface finishes; they are extremely strong, and resistant to wear, impact, scratching, moisture, heat and staining; and possess good hygienic and anti-static properties, being easy to clean and maintain.

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

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, Cigarette Burns - 36/37, 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, consult the documentation in specific sections of ISO 4586 for performance requirements. Each specific method has performance requirements particular to that method for individual grades of high-pressure decorative laminate.

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.

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

ISO 178, *Plastics — Determination of flexural properties*

ISO 527-2, *Plastics — Determination of tensile properties — Part 2: Test conditions for moulding and extrusion plastics*

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

3 Terms and definitions

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

3.1
High-Pressure Decorative Compact Laminate(s)
HPL
HPDL
sheet(s) consisting of layers of cellulosic fibrous material (normally paper) impregnated with thermosetting resins and bonded together by the high pressure process described below

Note 1 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

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.

4 Material types and classification system

4.1 General

Compact laminates are defined using a three letter classification system as shown in Table 1.

Table 1 — Compact laminate classification system

FIRST LETTER	SECOND LETTER	THIRD LETTER
C (COMPACT GRADE)	G (GENERAL PURPOSE)	S (STANDARD GRADE) or F (FLAME-RETARDANT GRADE)

4.2 Type CGS - Standard grade decorative Compact laminates. Specified as HPL/ISO 4586-4/CGS.

4.3 Type CGF - Decorative Compact laminates with improved fire retardance similar to type CGS but also meeting special requirements of specified tests which may vary according to the application (e.g. construction, marine, transport) and the country of use (see 6.3.2 and Annex B). Specified as HPL/ISO 4586-4/CGF.

Other laminates having special characteristics are also available but these products are outside the scope of this part of the standard.

5 Characteristics and applications

HPL Compact laminates have the following characteristics:

— Attractive aesthetic qualities

— High mechanical strength

— Durability (high resistance to impact, wear and scratching)

— Good dimensional stability

— High resistance to the effects of water, steam, heat and frost

— Non-corrosive

— Good colour fastness

— Easy to clean and maintain (good anti-graffiti properties)

— Hygienic

— Good chemical resistance

— No dust attraction

— Ease of installation

— Good fire performance

Typical applications include wall cladding, partitions, doors, cubicles, lockers, laboratory bench tops, and various self-supporting components in construction, marine and transport industries.

When Compact laminates are self-supporting they are ready for installation and only require cutting to size, drilling, etc. to suit the application.

6 Requirements

6.1 Compliance

Compact laminate types CGS and CGF shall meet all appropriate requirements specified in 6.2, 6.3, and 6.4. This applies to both full-size sheets and cut-to-size panels.

6.2 Inspection requirements

6.2.1 General

Inspection shall be carried out in accordance with ISO 4586-2, Test Method 4 at a distance of 1,5 m.

6.2.2 Colour and pattern

When inspected in daylight or D65 standard illuminate and again under tungsten illuminate 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.

6.2.3 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.

6.2.4 Visual inspection

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.

6.2.4.1 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.

6.2.4.2 Edge quality

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

6.3 Dimensional tolerance requirements

Dimensional tolerance requirements are specified in Table 2.

Table 2 — Dimensional tolerances

Property	Test method (ISO 4586-2, Clause no.)	Requirement
Thickness	5	2,0 ≤ *d* < 3,0 mm: ± 0,20 mm maximum variation 3,0 ≤ *d* < 5,0 mm: ± 0,30 mm maximum variation 5,0 ≤ *d* < 8,0 mm: ± 0,40 mm maximum variation 8,0 ≤ *d* < 12,0 mm: ± 0,50 mm maximum variation 12,0 ≤ *d* < 16,0 mm: ± 0,60 mm maximum variation 16,0 ≤ *d* < 20,0 mm: ± 0,70 mm maximum variation 20,0 ≤ *d* < 25,0 mm: ± 0,80 mm maximum variation 25,0 ≤ *d* To be agreed between supplier and customer. (where *d* = nominal thickness)
Length and width [1]	6	+ 10 mm/−0 mm
Straightness of edges [1]	7	1,5 mm/m maximum deviation
Squareness(Method A) [1] or	8	1,5 mm/m maximum deviation
Squareness(Method B) [1]	9	≤ 6 mm

Note 1 Tolerances for cut-to-size panels shall be agreed between supplier and purchaser.

Note 2 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 ISO 4586-2:2015, Clause 10. 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.

Table 2 *(continued)*

Property	Test method (ISO 4586-2, Clause no.)	Requirement
Flatness [2]	10	2,0 ≤ *d* < 6,0 mm: 8,0 mm/m maximum deviation 6,0 ≤ *d* < 10,0 mm: 5,0 mm/m maximum deviation 10,0 ≤ *d*: 3,0 mm/m maximum deviation (where *d* = nominal thickness)

Note 1 Tolerances for cut-to-size panels shall be agreed between supplier and purchaser.

Note 2 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 ISO 4586-2:2015, Clause 10. 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.

6.4 Test requirements

6.4.1 General requirements

General requirements are specified in Table 3.

Table 3 — General requirements

Property	Test method (ISO 4586-2, Clause no.)	Property or attribute	Unit (max. or min.)	Laminate grade	
				CGS	CGF
Resistance to surface wear	11	Wear resistance	Revolutions (min) Initial point Wear value	 150 350	 150 350
Resistance to immersion in boiling water	13	Mass increase Thickness Increase Appearance	% (max) 2 mm ≤ *d* < 5 mm *d* ≥ 5 mm % (max) 2 mm ≤ *d* < 5 mm *d* ≥ 5 mm (where *d* = nominal thickness) Rating (min) Gloss finish other finishes	 5,0 2,0 6,0 2,0 3 4	 7,0 3,0 9,0 6,0 3 4
Resistance to water vapour	14	Appearance	Rating (min) Gloss finish Other finishes	 3 4	 3 4

[a] L = in the longitudinal (or machine) direction of the fibrous sheet material (normally the direction of the longest dimension of the laminate).

[b] T = in the cross-longitudinal (cross-machine) direction of the fibrous sheet material (at right angles to direction L)

[c] When tested at the specified drop height, the diameter of indentation shall not exceed 10 mm.

[d] Machine crosshead speed 2 mm/min.

[e] Specimen type 1A. Machine crosshead speed 5 mm/min. Tested in accordance with procedure A using specimen III.

Table 3 *(continued)*

Property	Test method (ISO 4586-2, Clause no.)	Property or attribute	Unit (max. or min.)	Laminate grade	
				CGS	CGF
Resistance to dry heat (180 °C) (Method A) or	17	Appearance	Rating (min) gloss finish other finishes	 3 4	 3 4
Resistance to dry heat (180 °C) (Method B)	18	Appearance	Rating (min) gloss finish other finishes	 3 4	 3 4
Dimensional stability at elevated temperature (Method A) or	19	Cumulative Dimensional Change	% (max) 2 mm ≤ *d* < 5 mm L[a] T[b] *d* ≥ 5 mm L[a] T[b] (where *d* = nominal thickness)	 0,40 0,80 0,30 0,60	 0,40 0,80 0,30 0,60
Dimensional stability at elevated temperature (Method B)	20	Cumulative Dimensional Change	% (max) L[a] T[b]	 0,40 0,80	 0,40 0,80
Dimensional stability at ambient temperature (Method A) or	21	Cumulative Dimensional Change	% (max) 2 mm ≤ *d* < 5 mm L[a] T[b] *d* ≥ 5 mm L[a] T[b] (where *d* = nominal thickness)	 0,40 0,80 0,30 0,60	 0,40 0,80 0,30 0,60
Dimensional stability at ambient temperature (Method B)	22	Cumulative Dimensional Change	% (max) L[a] T[b]	 0,40 0,80	 0,40 0,80

[a] L = in the longitudinal (or machine) direction of the fibrous sheet material (normally the direction of the longest dimension of the laminate).

[b] T = in the cross-longitudinal (cross-machine) direction of the fibrous sheet material (at right angles to direction L)

[c] When tested at the specified drop height, the diameter of indentation shall not exceed 10 mm.

[d] Machine crosshead speed 2 mm/min.

[e] Specimen type 1A. Machine crosshead speed 5 mm/min. Tested in accordance with procedure A using specimen III.

Table 3 *(continued)*

Property	Test method (ISO 4586-2, Clause no.)	Property or attribute	Unit (max. or min.)	Laminate grade	
				CGS	CGF
Resistance to impact by large diameter ball	25	Drop height[c]	mm (min) $2 \le d < 6$ $6 \le d$ (where d = nominal thickness)	 1 400 1 800	 1 400 1 800
Resistance to crazing	28	Appearance	Grade (min)	4	4
Resistance to scratching	29	Force	Rating (min) (see Annex A) smooth finishes textured finishes	 2 3	 2 3
Resistance to staining (Method A) or	30	Appearance	Rating (min) Groups 1 and 2 Group 3	 5 4	 5 4
Resistance to staining (Method B)	31	Appearance	Cleanability Stains 1 to 10 (min) Stains 11 to 15 (min)	< 20 5 3	< 20 5 3
Light fastness (xenon arc) (Method A) or	32	Contrast	Grey scale rating	4 to 5	4 to 5
Light fastness (xenon arc) (Method B)	33	Contrast	Rating (min)	≥ 4	≥ 4
Resistance to cigarette burns-radiant heat (Method A) or	36	Appearance	Rating (min)	3	3
Resistance to cigarette burns-radiant heat (Method B)	37	Appearance	Seconds	≥ 200	≥ 200
Resistance to wet heat (100°C)	42	Appearance	Rating (min) gloss finish other finishes	 3 4	 3 4
Flexural modulus	ISO 178[d]	Stress	MPa (min)	9 000	9 000

[a] L = in the longitudinal (or machine) direction of the fibrous sheet material (normally the direction of the longest dimension of the laminate).

[b] T = in the cross-longitudinal (cross-machine) direction of the fibrous sheet material (at right angles to direction L)

[c] When tested at the specified drop height, the diameter of indentation shall not exceed 10 mm.

[d] Machine crosshead speed 2 mm/min.

[e] Specimen type 1A. Machine crosshead speed 5 mm/min. Tested in accordance with procedure A using specimen III.

Table 3 *(continued)*

Property	Test method (ISO 4586-2, Clause no.)	Property or attribute	Unit (max. or min.)	Laminate grade	
				CGS	CGF
Flexural strength	ISO 178[d]	Stress	MPa (min)	80	80
Tensile strength	ISO 527-2[e]	Stress	MPa (min)	60	60
Density	ISO 1183-1	Density	g/cm^3 (min)	1,30	1,30

[a] L = in the longitudinal (or machine) direction of the fibrous sheet material (normally the direction of the longest dimension of the laminate).

[b] T = in the cross-longitudinal (cross-machine) direction of the fibrous sheet material (at right angles to direction L)

[c] When tested at the specified drop height, the diameter of indentation shall not exceed 10 mm.

[d] Machine crosshead speed 2 mm/min.

[e] Specimen type 1A. Machine crosshead speed 5 mm/min. Tested in accordance with procedure A using specimen III.

6.4.2 Notes on requirements for reaction to fire (see Annex B)

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, however Annex B gives examples of how high-pressure laminates relate to ASTM E-84 and EN 13501-1[2] and some of the more common fire test scenarios.

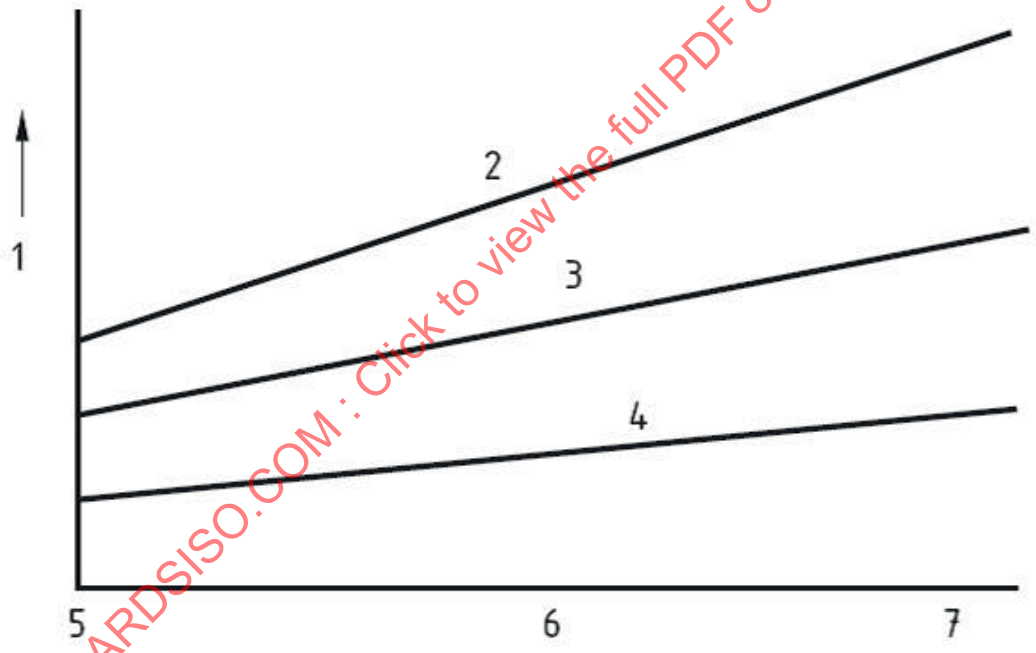
Annex A
(informative)

Addendum to Table 3 relating to Test Method 25: Scratch Resistance

The degree to which decorative laminates show scuff and scratch marks is influenced by surface finish and colour, and the limits given in Table 3 indicate the minimum acceptable performance for each grade of laminate. However, superior scratch resistance performance can be achieved by selecting particular combinations of surface finish, colour and pattern.

In general terms, scuff and scratch marks are less easily seen on textured surfaces than on plane surface finishes; light colours are better than dark colours; and prints are usually better than plain colours.

Figure A.1 gives an indication of the effect of surface finish and colour on the scratch resistance performance of laminates. The choice of surface finish, colour and print can be made to suit the particular application.



Key

1 scratch resistance (force)
2 deep textures
3 shallow textures
4 smooth finishes
5 dark colours
6 medium colours
7 light colours

Figure A.1 — Effects of surface finish and colour on scratch resistance

Annex B
(informative)

Addendum to 6.4.2, relating to fire performance

In Europe, laminate panels intended for construction applications are tested in accordance with EN 13823[3] (SBI test) and ISO 11925-2[1] (Small-burner test), and the resulting reaction-to-fire performance is expressed in accordance with EN 13501-1.

Table B.1 shows typical EN 13501-1 reaction-to-fire classifications of Compact laminates.

Table B.1 — Typical EN 13501–1 classifications of Compact Laminates

Product type	EN 13501–1 **classification**
CGF ≥ 6 mm thick	B-s2,d0
CGF < 6 mm thick	C-s2,d0 or better
CGS	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 B.2 shows some examples of how Compact Laminates typically relate to some of the more common European test methods.

Table B.2 — Examples of typical fire performance of Compact Laminates

Test method	**Test standard**	**Typical performance levels**	
		CGF	CGS
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.			

In North America, laminate panels intended for construction applications are tested in accordance with ASTM E-84 and rated accordingly.

Table B.3 shows typical ASTM E-84 reaction-to-fire classifications of Compact Laminates.