भारतीय मानक

Indian Standard

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ISO 4586-8 : 2018

सजावटी थर्मोसेटिंग सिंथेटिक रेज़िनबॉन्डेड लेमिनेटेड चादरें — विशिष्टि

भाग 8 वैकल्पिक कोर लैमिनेट्स के लिए वर्गीकरण और विशिष्टियाँ

(तीसरा पुनरीक्षण)

Decorative Thermosetting Synthetic Resin Bonded Laminated Sheets — Specification

Part 8 Classification and Specifications for Alternative Core Laminates

(Third Revision)

ICS 83.140.20

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NATIONAL FOREWORD

This Indian Standard (Part 8) (Third Revision) which is identical to ISO 4586-8 : 2018 'High-pressure decorative laminates (HPL, HPDL) — Sheets based on thermosetting resins (usually called laminates) — Part 8: Classification and specifications for alternative core laminates' issued by the International Organization for Standardization (ISO) was adopted by the Bureau of Indian Standards on the recommendations of the Plastics Sectional Committee and approval of the Petroleum, Coal and Related Products Division Council.

This standard was first published in 1962 and subsequently revised in 1969 and 1995. The 1962 version was published to meet the general demand for a standard to cover the use of synthetic resin bonded sheets as a decorative material having a surface which is characterized by its hardness and the materials covered were suitable for use as wall panels or as veneer for wood or other surfaces.

The first revision of this standard was based on BS 3794 : 1964 'Specification for decorative laminated plastics sheets' issued by the British Standards Institution. The second revision was necessitated to harmonize the standard with EN 438-1 : 1991 and EN 438-2 : 1992 issued by the European Committee for Standardization (CEN).

This revision has been brought out to align the Indian Standard to the ISO 4586 (all parts) High-pressure decorative laminates (HPL, HPDL) — Sheets based on thermosetting resins (usually called laminates). Since the ISO standard is published in 8 parts, the standard (IS 2046) has been also bifurcated in 8 parts.

Other parts in this series are:

Part 1 Introduction and general information

Part 2 Determination of properties

Part 3 Classification and specifications for laminates less than 2 mm thick and 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

The text of ISO standard has been approved as suitable for publication as an Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'; and

b) Comma (,) has been used as a decimal marker while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

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Introduction

High-pressure decorative laminates are characterized by their qualities, durability, and functional performance. HPL sheets are available in a wide variety of colours, patterns, and surface finishes. They are resistant to wear, scratching, impact, moisture, heat, and staining; and possess good hygienic and anti-static properties, being 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 438-9 whenever possible.

Indian Standard

DECORATIVE THERMOSETTING SYNTHETIC RESIN BONDED LAMINATED SHEETS — SPECIFICATION

PART 8 CLASSIFICATION AND SPECIFICATIONS FOR ALTERNATIVE CORE LAMINATES

(Third Revision)

1 Scope

This document specifies performance requirements for high-pressure decorative laminates (HPL, HPDL) intended for interior use that have core compositions not covered by ISO 4586-1 through ISO 4586-7. The core composition types (coloured core and metal reinforced core) are defined in this document.

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 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*

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

ISO 12572, *Hygrothermal performance of building materials and products — Determination of water vapour transmission properties — Cup method*

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 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 back of the sheet(s) is made suitable for adhesive bonding to a substrate.

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
alternative core laminate
high-pressure decorative laminate (3.1), consisting of decorative surface layers and alternative core layers

Note 1 to entry: The decorative surface layer(s) impregnated with melamine resin may appear on one or both sides of the laminate.

3.4
colored core laminate
high-pressure decorative *alternative core laminate* (3.3), the core material of which consists of cellulosic fibrous layers (normally paper), impregnated with thermosetting resins (typically aminoplastic thermosetting resins)

Note 1 to entry: To achieve a coloured core laminate, either the cellulosic fibres or the resins can be coloured. A translucent laminate can be achieved by using clear resins and bleached fibres.

Note 2 to entry: The surface and the core layers can have a similar colour producing a uniformly coloured laminate or be different colour to achieve a succession of coloured layers.

3.5
metal reinforced core laminate
high-pressure decorative *alternative core laminate* (3.3), the core material of which consists of metal layer(s) or mesh(es) and cellulosic fibrous layers (normally paper) impregnated with phenolic or aminoplastic thermosetting resins

Note 1 to entry: The purpose of including metal layers is to improve the mechanical, fire, or permeability performance of the laminate. Additionally the metal layers can give aesthetic improvements to the edge.

4 Material types

High pressure decorative alternative core laminates are defined using a three letter classification system as shown in Table 1.

Table 1 — Numerical classification

First letter	Second letter	Third letter
B (Coloured core laminate)	C (Compact)	S (Standard grade)
H (Metal reinforced core laminate)	T (Thin laminate, < 2 mm)	F (Flame-retardant grade)
Type S — Standard grade high pressure decorative alternative core laminates. Type F — High pressure decorative alternative core laminates with improved fire retardance; similar to type S but also complying special requirements of specified fire tests which may vary according to the application (e.g. construction, marine, transport) and the country of use (see 5.4.3). In addition to the abbreviation "HPL" or "HPDL" and the number of this document, materials shall be specified by the alphabetical classification system. NOTE As an example, coloured core standard grade thin high-pressure decorative laminate is designated as HPL/ISO 4586-8 BTS or HPDL/ISO 4586-8 BTS.		

5 Requirements

5.1 Compliance

High-pressure decorative design laminates classified in Table 1 shall comply with all the 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, pattern and surface finish

When inspected in daylight or D65 standard illuminant and under tungsten-filament lighting illuminant A, a slight difference between the corresponding colour reference sample held by the supplier and the specimen under test is acceptable.

As colour and surface finish are critical, it is recommended that the sheets are checked for colour and surface finish compatibility without protective film 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 is acceptable.

As colour and surface finish are critical, it is recommended that the sheets are checked for colour and surface finish compatibility without protective film before fabrication or installation.

5.2.4 Reverse side

The reverse side of single-sided sheets shall be suitable for adhesive bonding (e.g. sanded). In the case of sanded backs, slight chatter marks shall be 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. Cut-to-size panels and certain applications involving full-size sheets may call for special quality requirements which can be negotiated between the supplier and purchaser, in such cases the following requirements may be used as a basis for agreement. Only a small percentage of sheets in a batch (the level to be agreed upon between the supplier and the customer) shall contain defects of the minimum acceptable level.

In the case of a double faced laminate, it may be agreed between the purchaser and supplier that the visual quality standard applies to one decorative face only.

5.2.5.2 Surface quality

The following defects are permissible:

— Dirt, spots dents, 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 such defects is based on a maximum contamination area equivalent to 10 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.

5.2.5.3 Edge quality

Visual defects (e.g. moisture marks, lack of gloss, corner damage) can be present on all four edges of the laminate, providing the defect-free length and width are at least the nominal size minus 20 mm.

For compact laminate grades, edge chipping up to 3 mm on each side is permissible.

5.3 Dimensional tolerance requirements

5.3.1 Dimensional tolerance requirements for coloured core laminates

Dimensional tolerance requirements for coloured core laminates are specified in Tables 2 and 3.

Table 2 — Dimensional tolerance requirements for thin coloured core laminates

Property	Test method (ISO 4586-2:2018 Clause No.)	Requirement
Thickness	5	0,5 mm ≤ *d* ≤ 1,0 mm: ±0,15 mm maximum deviation 1,0 mm < *d* ≤ 2,0 mm: ±0,18 mm maximum deviation 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 (Method A)[a]	8	1,5 mm/m maximum deviation
Squareness (Method B)[a]	9	< 6 mm
Flatness[b]	10	100 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.

Table 3 — Dimensional tolerance requirements for compact coloured core laminates

Property	Test method (ISO 4586-2:2018 Clause No.)	Requirement
Thickness	5	2,0 mm ≤ *d* < 3,0 mm: ±0,25 mm maximum deviation 3,0 mm ≤ *d* < 5,0 mm: ±0,40 mm maximum deviation 5,0 mm ≤ *d* < 8,0 mm: ±0,50 mm maximum deviation 8,0 m ≤ *d* < 12,0 mm: ±0,70 mm maximum deviation 12,0 mm ≤ *d* < 16,0 mm: ±0,80 mm maximum deviation 16,0 mm ≤ *d* < 20,0 mm: ±0,90 mm maximum deviation 20,0 mm ≤ *d* < 25,0 mm: ±1,00 mm maximum deviation 25,0 mm ≤ *d*: to be agreed upon between the supplier and customer 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 (Method A)[a]	8	1,5 mm/m maximum deviation
Squareness (Method B)[a]	9	< 6 mm
Flatness[b]	10	2,0 ≤ *d* < 6,0 mm: 12,0 mm/m maximum deviation 6,0 ≤ *d* < 10,0 mm: 8,0 mm/m maximum deviation 10,0 ≤ *d*: 5, 0mm/m maximum deviation where *d* = nominal thickness

[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.

5.3.2 Dimensional tolerance requirements for metal reinforced core laminates

Dimensional tolerance requirements for metal reinforced core laminates are specified in Table 4 and Table 5.

Table 4 — Dimensional tolerance requirements for thin metal reinforced core laminates

Property	Test method (ISO 4586-2:2018 Clause No.)	Requirement
Thickness	5	0,5 mm ≤ *d* < 2,0 mm: ±0,18 mm maximum deviation 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 (Method A)[a]	8	1,5 mm/m maximum deviation
Squareness (Method B)[a]	9	< 6 mm
Flatness[b]	10	100 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.

Table 5 — Dimensional tolerance requirements for compact metal reinforced core laminates

Property	Test method (ISO 4586-2:2018, Clause No.)	Requirement
Thickness	5	2,0 mm ≤ *d* < 3,0 m: ±0,25 mm maximum deviation 3,0 mm ≤ *d* < 5,0 mm: ±0,40 mm maximum deviation 5,0 mm ≤ *d* < 8,0 mm: ±0,50 mm maximum deviation 8,0 mm ≤ *d* < 12,0 mm: ±0,70 mm maximum deviation 12,0 mm ≤ *d* < 16,0 mm: ±0,80 mm maximum deviation 16,0 mm ≤ *d* < 20,0 mm: ±0,90 mm maximum deviation 20,0 mm ≤ *d* < 25,0 mm: ±1,00 mm maximum deviation 25,0 mm ≤ *d*: to be agreed upon between the supplier and customer 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 (Method A)[a]	8	1,5 mm/m maximum deviation
Squareness (Method B)[a]	9	< 6 mm
Flatness[b]	10	2,0 mm ≤ *d* < 6,0 mm: 8,0 mm/m maximum deviation 6,0 mm ≤ *d* < 10,0 mm: 5,0 mm/m maximum deviation 10,0 mm ≤ *d*: 3,0 mm/m maximum deviation where *d* = nominal thickness

[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 for coloured core laminates

General requirements for coloured core laminates are specified in Table 6.

Table 6 — General requirements for coloured core laminates

Property	Test method (ISO 4586-2:2018, Clause No. unless otherwise stated)	Property or attribute	Unit (max. or min.)	Laminate grade	
				BTS	BCS
Resistance to surface wear	11	Wear resistance	Revolutions (min.)		
			Initial point	150	150
			Wear value	350	350
Resistance to immersion in boiling water	13	Appearance	Rating (min.)		
			Gloss finish	3	3
			Other finishes	4	4
		Mass increase	% (max.)[a]		
			2 mm ≤ d < 5 mm	—	5,0
			d ≥ 5 mm	—	3,0
		Thickness increase	% (max.)[a]		
			2 mm ≤ d < 5 mm	—	6,0
			d ≥ 5 mm	—	4,0
Resistance to water vapour	15	Appearance	Rating (min.)		
			Gloss finish	3	3
			Other finishes	4	4
Resistance to dry heat (Method A)	17	Appearance	Rating (min.)		
			Gloss finish	3	3
			Other finishes	4	4
Resistance to dry heat (Method B)	18	Appearance	Rating (min.)		
			Gloss finish	3	3
			Other finishes	4	4

[a] Where d = nominal thickness.

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

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

[d] Extraneous darkening and/or photochroism are due to the shock effect of accelerated exposure and are not characteristic of natural exposure.

[e] Machine crosshead speed of 10 mm/min.

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

[g] The moderate crack lines run along all the edge of the specimen.

Table 6 *(continued)*

Property	Test method (ISO 4586-2:2018, Clause No. unless otherwise stated)	Property or attribute	Unit (max. or min.)	Laminate grade	
				BTS	BCS
Dimensional stability at elevated temperature (Method A) or	19	Cumulative dimensional change	% (max.)[a]		
			d < 2 mm		
			L[b]	0,80	—
			T[c]	1,40	—
			% (max.)[a]		
			2 mm ≤ d < 5 mm		
			L	—	0,60
			T[c]	—	1,00
			% (max)[a]		
			d ≥ 5 mm		
			L[b]	—	0,50
			T[c]	—	0,80
Dimensional stability at elevated temperature (Method B)	20	Cumulative dimensional change	% (max.)[a]		
			d < 2 mm		
			L[b]	0,75	—
			T[c]	1,35	—
			% (max.)[a]		
			2 mm ≤ d < 5 mm		
			L[b]	—	0,55
			T[c]	—	0,95
			% (max.)[a]		
			d ≥ 5 mm		
			L[b]	—	0,45
			T[c]	—	0,75

[a] Where d = nominal thickness.

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

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

[d] Extraneous darkening and/or photochroism are due to the shock effect of accelerated exposure and are not characteristic of natural exposure.

[e] Machine crosshead speed of 10 mm/min.

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

[g] The moderate crack lines run along all the edge of the specimen.

Table 6 *(continued)*

Property	Test method (ISO 4586-2:2018, Clause No. unless otherwise stated)	Property or attribute	Unit (max. or min.)	Laminate grade	
				BTS	BCS
Dimensional stability at ambient temperature (Method A) or	21	Cumulative dimensional change	% (max.)[a]		
			$d < 2$ mm		
			L[b]	0,75	—
			T[c]	1,35	—
			% (max.)[a]		
			2 mm ≤ $d < 5$ mm		
			L[b]	—	0,50
			T[c]	—	0,90
			% (max.)[a]		
			$d \geq 5$ mm		
			L[b]	—	0,45
			T[c]	—	0,85
Dimensional stability at ambient temperature (Method B)	22	Cumulative dimensional change	% (max.)[a]		
			$d < 2$ mm		
			L[b]	0,70	—
			T[c]	1,30	—
			% (max.)[a]		
			2 mm ≤ $d < 5$ mm		
			L[b]	—	0,50
			T[c]	—	0,90
			% (max.)[a]		
			$d \geq 5$ mm		
			L[b]	—	0,40
			T[c]	—	0,70
Resistance to crazing	28	Appearance	Rating (min.)	—	Surface: 4 Core: 3[g]
Resistance to scratching	29	Appearance	Rating (min.)		
			Gloss finish	2	2
			Other finishes	3	3

[a] Where d = nominal thickness.

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

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

[d] Extraneous darkening and/or photochroism are due to the shock effect of accelerated exposure and are not characteristic of natural exposure.

[e] Machine crosshead speed of 10 mm/min.

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

[g] The moderate crack lines run along all the edge of the specimen.

Table 6 *(continued)*

Property	Test method (ISO 4586-2:2018, Clause No. unless otherwise stated)	Property or attribute	Unit (max. or min.)	Laminate grade	
				BTS	BCS
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 (max.) Stain 1 to 10 Stain 11 to 15	20 5 3	20 5 3
Light fastness (xenon arc) (Method A) or	32	Contrast	Grey scale rating (min.)	Surface: 4[d] Core: 3[d]	Surface: 4[d] Core: 3[d]
Light fastness (xenon arc) (Method B)	33	Contrast	Colour change(min.)	Surface: 4[d] Core: 3[d]	Surface: 4[d] Core: 3[d]
Resistance to radiant heat	36	Appearance	s (min.)	150	200
Density	ISO 1183-1	Density	g/cm^3 (min.)	1,35	1,35
Flexural strength	ISO 178[e]	Stress	MPa (min.)	—	80
Flexural modulus	ISO 178[e]	Stress	MPa (min.)	—	9 000
Tensile strength	ISO 527-2[f]	Stress	MPa (min.)	—	60

[a] Where d = nominal thickness.

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

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

[d] Extraneous darkening and/or photochroism are due to the shock effect of accelerated exposure and are not characteristic of natural exposure.

[e] Machine crosshead speed of 10 mm/min.

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

[g] The moderate crack lines run along all the edge of the specimen.

5.4.2 General requirements for metal reinforced core laminates

General requirements for metal reinforced core laminates are specified in Table 7.

Table 7 — General requirements for metal reinforced core laminates

Property	Test method (ISO 4586-2:2018, Clause No. unless otherwise stated)	Property or attribute	Unit (max. or min.)	Laminate grade			
				HTS	HTF	HCS	HCF
Resistance to surface wear	11	Wear resistance	Revolutions (min.)				
			Initial point	150	150	150	150
			Wear value	350	350	350	350
Resistance to immersion in boiling water	13	Appearance	Rating (min.)				
			Gloss finish	3	3	3	3
			Other finishes	4	4	4	4
		Mass increase	% (max.)[a]				
			2 mm ≤ d < 5 mm	—	—	5,0	7,0
			d ≥ 5 mm	—	—	2,0	3,0
		Thickness increase	% (max.)[a]				
			2 mm ≤ d < 5 mm	—	—	6,0	9,0
			d ≥ 5 mm	—	—	2,0	6,0
Resistance to water vapour	15	Appearance	Rating (min.)				
			Gloss finish	3	3	3	3
			Other finishes	4	4	4	4
Resistance to dry heat (Method A)	17	Appearance	Rating (min.)				
			Gloss finish	3	3	3	3
			Other finishes	4	4	4	4
Resistance to dry heat (Method B)	18	Appearance	Rating (min.)				
			Gloss finish	3	3	3	3
			Other finishes	4	4	4	4

[a] Where d = nominal thickness.

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

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

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

[e] Extraneous darkening and/or photochroism are due to the shock effect of accelerated exposure and are not characteristic of natural exposure.

[f] Machine crosshead speed of 10 mm/min.

[g] Specimen type 1A. Machine crosshead speed of 5 mm/min.

Table 7 *(continued)*

Property	Test method (ISO 4586-2:2018, Clause No. unless otherwise stated)	Property or attribute	Unit (max. or min.)	Laminate grade			
				HTS	HTF	HCS	HCF
Dimensional stability at elevated temperature (Method A) or	19	Cumulative dimensional change	% (max.)[a]				
			$d < 2$ mm				
			L[b]	0,75	0,75	—	—
			T[c]	1,25	1,25	—	—
			% (max.)[a]				
			$2 \text{ mm} \leq d < 5$ mm				
			L[b]	—	—	0,60	0,60
			T[c]	—	—	1,00	1,00
			% (max.)[a]				
			$d \geq 5$ mm				
			L[b]	—	—	0,50	0,50
			T[c]	—	—	0,80	0,80
Dimensional stability at elevated temperature (Method B)	20	Cumulative dimensional change	% (max.)[a]				
			$d < 2$ mm				
			L[b]	0,75	0,75	—	—
			T[c]	1,35	1,35	—	—
			% (max.)[a]				
			$2 \text{ mm} \leq d < 5$ mm				
			L[b]	—	—	0,55	0,55
			T[c]	—	—	0,95	0,95
			% (max.)[a]				
			$d \geq 5$ mm				
			L[b]	—	—	0,45	0,45
			T[c]	—	—	0,75	0,75

[a] Where d = nominal thickness.

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

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

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

[e] Extraneous darkening and/or photochroism are due to the shock effect of accelerated exposure and are not characteristic of natural exposure.

[f] Machine crosshead speed of 10 mm/min.

[g] Specimen type 1A. Machine crosshead speed of 5 mm/min.

Table 7 *(continued)*

Property	Test method (ISO 4586-2:2018, Clause No. unless otherwise stated)	Property or attribute	Unit (max. or min.)	Laminate grade			
				HTS	HTF	HCS	HCF
Dimensional stability at ambient temperature (Method A) or	21	Cumulative dimensional change	% (max.)[a]				
			$d < 2$ mm				
			L[b]	0,75	0,75	—	—
			T[c]	1,35	1,35	—	—
			% (max.)[a]				
			2 mm ≤ $d < 5$ mm				
			L[b]	—	—	0,55	0,55
			T[c]	—	—	0,85	0,85
			% (max.)[a]				
			$d \geq 5$ mm				
			L[b]	—	—	0,45	0,45
			T[c]	—	—	0,75	0,75
Dimensional stability at ambient temperature (Method B)	22	Cumulative dimensional change	% (max.)[a]				
			$d < 2$ mm				
			L[b]	0,70	0,70	—	—
			T[c]	1,30	1,30	—	—
			% (max.)[a]				
			2 mm ≤ $d < 5$ mm				
			L[b]	—	—	0,50	0,50
			T[c]	—	—	0,90	0,90
			% (max.)[a]				
			$d \geq 5$ mm				
			L[b]	—	—	0,40	0,40
			T[c]	—	—	0,70	0,70
Resistance to impact by large diameter ball (optional)	25	Drop height	mm (min.)[a]				
			$d < 2$ mm	1 000[d]	1 000[d]	—	—
			2 mm ≤ $d < 6$ mm	—	—	1 400[d]	1 400[d]
			$d \geq 6$ mm	—	—	1 800[d]	1 800[d]

[a] Where d = nominal thickness.

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

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

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

[e] Extraneous darkening and/or photochroism are due to the shock effect of accelerated exposure and are not characteristic of natural exposure.

[f] Machine crosshead speed of 10 mm/min.

[g] Specimen type 1A. Machine crosshead speed of 5 mm/min.

Table 7 *(continued)*

Property	Test method (ISO 4586-2:2018, Clause No. unless otherwise stated)	Property or attribute	Unit (max. or min.)	Laminate grade			
				HTS	HTF	HCS	HCF
Resistance to cracking under stress (optional)	27	Appearance	Rating (min.)	4	4	—	—
Resistance to crazing	28	Appearance	Rating (min.)	—	—	4[e]	4[e]
Resistance to scratching	28	Appearance	Rating (min.)				
			Gloss finish	2	2	2	2
			Other finishes	3	3	3	3
Resistance to staining (Method A) or	30	Appearance	Rating (min.)				
			Groups 1 and 2	5	5	5	5
			Group 3	4	4	4	4
Resistance to staining (Method B)	31	Appearance	Cleanability (max.)	20	20	20	20
			Stain 1 to 10	5	5	5	5
			Stain 11 to 15	3	3	3	3
Light fastness (xenon arc) (Method A) or	32	Contrast	Grey scale rating (min.)	4[e]	4[e]	4[e]	4[e]
Light fastness (xenon arc) (Method B)	33	Contrast	Colour change(min.)	4[e]	4[e]	4[e]	4[e]
Resistance radiant heat	36	Appearance	Seconds (min.)	150	150	150	150
Resistance to wet heat	41	Appearance	Rating (min.)				
			Gloss finish	3	3	3	3
			Other finishes	4	4	4	4
Density	ISO 1183-1	Density	g/cm^3 (min.)	1,35	1,35	1,35	1,35
Flexural strength	ISO 178[f]	Stress	MPa (min.)	—	—	80	80
Flexural modulus	ISO 178[f]	Stress	MPa (min.)	—	—	9 000	9 000
Tensile strength	ISO 527-2[g]	Stress	MPa (min.)	—	—	60	60
Permeability	ISO 12572	Permeability	μ	Wet cup = 110; Dry cup = 250			

[a] Where d = nominal thickness.

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

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

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

[e] Extraneous darkening and/or photochroism are due to the shock effect of accelerated exposure and are not characteristic of natural exposure.

[f] Machine crosshead speed of 10 mm/min.

[g] Specimen type 1A. Machine crosshead speed of 5 mm/min.

5.4.3 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, however Annex A gives examples of how high-pressure laminates relate to ASTM E84[5] and EN 13501-1[3] and some of the more common fire test scenarios.

Annex A
(informative)

Addendum to 5.4.3, relating to fire performance

In Europe, laminate panels intended for construction applications are tested in accordance with EN 13823[4] (SBI test) and 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 HPL composite panels with wood-based substrates.

Table A.1 — Typical EN 13501–1 classifications of HPL composite panels with wood-based substrates

Product type	Typical EN 13501-1 classification
Composite panels comprising HPL type F bonded to fire rated wood-based substrates	B-s2,d0
Composite panels comprising HPL type non F bonded to non-fire rated wood-based substrates	D-s2,d0
NOTE Fire test performance will depend on laminate thickness and construction, substrate type and thickness, and adhesive used. The laminate manufacturer should be contacted for details of 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 high-pressure laminates typically relate to some of the more common European test methods.

Table A.2 — Examples of typical fire performance of high-pressure laminates

Test method	Test standard	Typical performance levels	
		ISO 4586-3 HPL Type F	ISO 4586-3 HPL Types S and P
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
Heat release	IMO Res. A653 (16)	Pass	Pass
NOTE 1 Fire test performance will depend on laminate thickness and construction, substrate type and thickness, and adhesive used. The laminate manufacturer should be contacted for details of test reports and certifications held, and for information on fire test methods and specifications. NOTE 2 Flame-retardant additives used in high-pressure decorative laminates are not halogen based and remain effective throughout the service life of the product.			

In North America, laminate panels intended for construction applications are tested in accordance with ASTM E84 and rated accordingly.

Table A.3 shows typical ASTM E84 reaction-to-fire classifications of HPDL composite panels with wood-based substrates.

Table A.3 — Typical ASTM E84 classifications of HPDL composite panels with wood-based substrates

Product type	Typical ASTM E84 classification
Composite panels comprising HDPL type F bonded to fire rated wood-based or inorganic based substrates	Class A
NOTE 1 Fire test performance will depend on laminate thickness and construction, substrate type and thickness, and adhesive used. The laminate manufacturer should be contacted for details of test reports and certifications held, and for information on fire test methods and specifications.	
NOTE 2 Flame-retardant additives used in high-pressure decorative laminates are not halogen based and remain effective throughout the service life of the product.	

Bibliography

[1] ISO 11664-2, *Colorimetry — Part 2: CIE standard illuminants*

[2] ISO 11925-2, *Reaction to fire tests — Ignitability of products subjected to direct impingement of flame — Part 2: Single-flame source test*</std>

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

[4] EN 13823, *Reaction to fire tests for building products — Building products excluding floorings exposed to the thermal attack by a single burning item*

[5] ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*

[6] BS 476-7, *Fire tests on building materials and structures. Method of test to determine the classification of the surface spread of flame of products*

[7] DIN 4102-1, *Fire behaviour of building materials and building components — Part 1: Building materials; concepts, requirements and tests*

[8] NF P92-501, *Sécurité contre l'incendie — Bâtiment — Essais de réaction au feu des matériaux — Essai par rayonnement applicable aux matériaux rigides ou rendus tels (matériaux de revêtement collés) de toute épaisseur et aux matériaux souples d'épaisseur supérieure à 5 mm*

[9] NF F16-101, *Matériel roulant ferroviaire — Comportement au feu — Choix des matériaux*

[10] IMO Res. A653 (16) Adopted on 19 October 1989 Agenda item 10 Recommendation on improved fire test procedures for surface flammability of bulkhead, ceiling, and deck finish materials</unknown>

[11] Council Directive 96/98/EC of 20 December 1996 on marine equipment (OJ L 46, 17.2.1997, P. 25-26 and Corrigendum to Council Directive 96/98/EC of 20 December 1996 on marine equipment (Official Journal of the European Communities L 46 of 17 February 1997)

[12] EN 438-9, *High-pressure decorative laminates (HPL) — Sheets based on thermosetting resins (usually called laminates) — Part 9: Classification and specifications for alternative core laminates*

NATIONAL ANNEX B

(*National Foreword*)

B-1 PACKING AND MARKING

B-1.1 Packing

The material shall be supplied in packages as agreed to between the purchaser and the supplier.

B-1.2 Marking

B-1.2.1 The consignment shall be marked suitably with the following information:

a) Manufacturer details and trade mark, if any;

b) Type and class of the material;

c) Month and year of manufacture; and

d) Batch number and code number.

B-1.2.2 *BIS Certification Marking*

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the rules and regulations framed thereunder, and the products may be marked with the Standard Mark.

(*Continued from second cover*)

In this adopted standard, reference appears to certain International Standards for which Indian Standards also exist. The corresponding Indian Standards, which are to be substituted in their respective places, are listed below along with their degree of equivalence for the editions indicated:

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
ISO 178 Plastics — Determination of flexural properties	IS 13360 (Part 5/Sec 7) : 2022/ ISO 178 : 2019 Plastics — Method of testing: Part 5 Mechanical properties Section 7 Determination of flexural properties (*second revision*)	Identical
ISO 527-2 Plastics — Determination of tensile properties — Part 2: Test conditions for moulding and extrusion plastics	IS 13360 (Part 5/Sec 2) : 2017/ ISO 527-2 : 2012 Plastics — Methods of testing: Part 5 Mechanical properties Section 2 Determination of tensile properties — Test conditions for moulding and extrusion plastics (*first revision*)	Identical
ISO 1183-1 Plastics — Methods for determining the density of non-cellular plastics — Part 1: Immersion method, liquid pyknometer method and titration method	IS 13360 (Part 3/Sec 10) : 2021/ ISO 1183-1 : 2019 Plastics — Methods of testing: Part 3 Physical and dimensional properties Section 10 Determination of density of non-cellular plastics — Immersion method, liquid pyknometer method and titration method (*first revision*)	Identical
ISO 4586-2 : 2018 High-pressure decorative laminates (HPL, HPDL) — Sheets based on thermosetting resins (usually called laminates) — Part 2: Determination of properties	IS 2046 (Part 2) : 20XX/ISO 4586-2 : 2018 Decorative thermosetting synthetic resin bonded laminated sheets — Specification: Part 2 Determination of properties (*under preparation*)	Identical

The Committee has reviewed the provisions of the following International Standard referred in this adopted standard and has decided that it is acceptable for use in conjunction with this standard:

International Standard	*Title*
ISO 12572	Hygrothermal performance of building materials and products — Determination of water vapour transmission properties — Cup method

The standard makes a reference to the packing and marking of the product, details of which are given in National Annex B.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 'Rules for rounding off numerical values (*second revision*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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This Indian Standard has been developed from Doc No.: PCD 12 (25653).

Amendments Issued Since Publication

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