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МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ

Decorative high-pressure laminates (HPL) — Sheets based on thermosetting resins —

Part 1 : Specification

Stratifiés décoratifs haute pression (HPL) — Plaques à base de résines thermodurcissables —

Partie 1 : Spécifications

Reference number
ISO 4586-1 : 1986 (E)

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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 4586-1 was prepared by Technical Committee ISO/TC 61, *Plastics*.

This second edition cancels and replaces the first edition (ISO 4586-1 : 1981), of which it constitutes a technical revision.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

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Contents

Decorative high-pressure laminates (HPL) — Sheets based on thermosetting resins —

Part 1 : Specification

0 Introduction

This part of ISO 4586 includes requirements for the types of materials that are classified in clause 4.

The requirements for several properties may be satisfied by alternative test methods. These have been included where the requirements by either method are approximately equivalent, and either where expensive equipment of different types is in satisfactory use, or where experience is limited to one of the alternatives in certain countries.

1 Scope and field of application

This part of ISO 4586 classifies decorative laminated sheets according to their performance and main recommended fields of application, and provides also for materials of special characteristics, for example postformability or defined reaction to fire.

Requirements are specified for those types of materials that are most generally used, but additional types may be added as required. The limit values specified apply to the most commonly used types of materials, but within each classification, it may be possible to obtain variants having much higher performance figures.

These materials are characterized by their decorative surfaces, which are relatively hard and resistant to wear, scratching, impact, boiling water, domestic stains and moderate heat. They are intended for interior applications as follows:

— Thin single-faced laminates usually less than 2 mm thick, for bonding to a substrate.

— Compact laminates, single- or double-faced, approximately 2 to 5 mm thick, which need to be rigidly supported without necessarily being bonded to a substrate.

— Compact laminates, self-supporting, double-faced, usually thicker than 5 mm, the thickness of which will be selected according to application and panel dimensions.

The back surface of sheets having only one decorative face is made suitable for adhesive bonding to a substrate.

This part of ISO 4586 applies only to decorative laminated sheets as defined in clause 3. ISO 4586-2 specifies the methods of test relevant to this part of ISO 4586.

2 Reference

ISO 4586-2, *Decorative high-pressure laminates (HPL) — Sheets based on thermosetting resins — Part 2: Determination of properties.*

3 Definition

For the purpose of this part of ISO 4586, the following definition applies:

decorative high-pressure laminated sheet: A sheet consisting of layers of fibrous sheet material (for example, paper) impregnated with thermosetting resins and bonded together by means of heat and a pressure of not less than 5 MPa*, the outer layer or layers on one or both sides having decorative colours or designs.

Decorative high-pressure laminated sheet as defined in this part of ISO 4586 is made from core layers impregnated with phenolic resins and a surface layer or layers impregnated with aminoplastic resins (mainly melamine resins).

4 Classification

4.1 Application characteristics

Materials are available in the classes defined in table 1. The list of typical applications given for each class is for guidance only and is not intended to be comprehensive.

* 1 MPa = 1 MN/m²

Table 1 — Application characteristics

Class	Performance category	Typical applications
C (Compact)	Thick materials of high performance for special use in horizontal and vertical applications requiring particularly high impact and moisture resistance	Doors, partitions, walls, various self-supporting components in construction and transportation
HD (Heavy duty)	Materials with greater resistance to abrasion than Class HG	Flooring and supermarket check-out counters
HG (Horizontal, general purpose)	Materials of high performance for general use in horizontal applications, and for use in vertical applications requiring particularly high performance	Kitchen working surfaces; restaurant and hotel tables; heavy-duty door and wall coverings; interior walls of public transport vehicles
VG (Vertical, general purpose)	Materials of less high performance than Class HG, for general use in vertical applications, and for use in some horizontal applications where only moderate performance is required	Kitchen front panels; wall coverings; shelves
VL (Vertical, light duty)	Materials of moderate performance for use in vertical applications where the requirements are less demanding than in Class VG	Exposed side components of cupboards
CL (Cabinet liner)	Materials of moderate performance but with lower standards of surface appearance, colour fastness and resistance to heat and moisture than in Class VL for use in vertical applications not normally exposed to light or view	Interior components of cupboards

4.2 Special characteristics

The classes of material listed in 4.1 are all available as standard type decorative laminated sheet (type S) having the basic characteristics described in clause 1.

In some classes of material, additional types (type P and type F) are also available, possessing the special properties described below.

4.2.1 Type P — Postformable decorative laminated sheet

Type P sheet is similar to type S, but it can also be formed under controlled temperature and flexure in accordance with the manufacturer's recommendations.

4.2.2 Type F — Decorative laminated sheet having defined reaction to fire

Type F sheet is similar to type S, but it also meets special requirements of specified fire tests, which may vary according to the application of the material and the country of use.

4.3 Nomenclature

The symbols for classes and types are combined in describing the materials covered by this specification; for example, horizontal general purpose postformable laminate is described as type HGP.

5 Requirements

5.1 Compliance

In order to comply with the requirements of this part of ISO 4586, material of each type shall meet the requirements of every property for which a value or requirement is specified in clause 6.

Two methods of test are given for the measurement of dimensional stability, resistance to impact, resistance to colour change in artificial light, formability and resistance to cigarette burns. When there is a choice of method, material satisfying the requirements of either method shall be deemed to comply with the specification for that property: however, the choice of method may be agreed between the interested parties. The method selected shall be stated in the test report.

5.2 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.

At present, it is not possible, with any test, to predict compliance with all national and other requirements. No test is therefore included in this specification and reference must be made to those other requirements when appropriate.

The selection of a suitable test or tests for inclusion in this part of ISO 4586 will be considered when International Standards specifying fire tests for building materials and structures have been agreed.

6 Properties

6.1 Colour and pattern

When inspected in daylight or D 65 Standard Illuminant and again under a tungsten illuminant, there shall be no significant difference between a standard agreed by the supplier and the specimen under test.

6.2 Surface finish

6.2.1 Finish matching

When inspected at different viewing angles, there shall be no significant difference between a standard agreed by the supplier and the specimen under test.

6.2.2 Bonding

The reverse side of sheets having only one decorative surface shall be suitable for adhesive bonding if so required.

6.3 Thickness

No requirements for nominal thickness are specified for individual types of material listed in table 4; however, variations from the nominal thickness supplied shall at no point exceed the limits shown in table 2, when thickness is measured in accordance with ISO 4586-2, clause 4.

Table 2 — Permitted variations of thickness

Values in millimetres

Nominal thickness		Maximum variation
Greater than or equal to	Less than	
0,5	1,0	±0,10
1,0	2,0	±0,15
2,0	2,5	±0,18
2,5	3,0	±0,20
3,0	4,0	±0,25
4,0	5,0	±0,30
5,0		as agreed

6.4 Appearance

The following inspection requirements are intended as a general guide, indicating the minimum acceptable quality for laminates supplied as full size sheets. 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 discussion. It should be noted that only a small percentage of sheets in a batch should be of the minimum acceptable quality.

6.4.1 Surface defects

When inspected according to ISO 4586-2, clause 5, at a distance of 1,5 m (3,0 m for CL-type), the following surface defects are permissible:

6.4.1.1 Spots, dirt and similar surface defects

The admissible size of defects is based on a maximum contamination area equivalent to 1,0 mm^2/m^2 laminate and is proportional to the sheet size under inspection.

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

6.4.1.2 Fibres, hairs, scratches

The admissible length of defects is based on a maximum contamination area equivalent to 10 mm/m^2 laminate and is proportional to the sheet size under inspection.

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

6.4.1.3 Accumulated surface defects

When the defect types described in 6.4.1.1 and 6.4.1.2 occur simultaneously on a single sheet, then the maximum level for each of the two types of defect shall not exceed half of the levels prescribed in 6.4.1.1 and 6.4.1.2.

6.4.2 Edge defects

In principle, defects can be present on all four edges of the laminate provided that the defect-free section of a defective edge is not less than 20 mm shorter than the nominal length of that edge.

6.4.3 Broken corners

One broken corner of $\leqslant$ 3 cm or two broken corners of $\leqslant$ 1,5 cm are allowed.

These values refer to the distance between the original corner and the fracture line.

6.4.4 Sanding defects

Slight chatter marks are allowed.

6.4.5 Warping

The flatness of laminates is dependent on atmospheric conditions within the storage area. Provided that the laminates are stored in the conditions recommended by the manufacturer, they shall not show a departure of the surface from a straightedge of 1 m length in any position, of more than the limits listed in table 3 when the laminate is laid concave side up on a flat surface.

Table 3 — Permitted departure from flatness

Values in millimetres

Composition	Thickness t	Maximum warp
Single-faced laminate	$t < 2,0$	120
	$2,0 \leqslant t < 5,0$	50
Double-faced laminate	$2,0 \leqslant t < 5,0$	10
	$5,0 \leqslant t$	5

6.4.6 Length and width of a full-size laminate

The laminate shall be the nominal size with a tolerance of $^{+10}_{0}$ mm.

6.4.7 Straightness of edges

The edges shall be straight with a tolerance of 1,5 mm per metre length of the edge (value a in figure 1). The edge being measured shall be at least as long as the 1 m straightedge.

6.4.8 Squareness of the laminate

The panel shall be rectangular with a tolerance of 1,5 mm per metre length of the edge (value b in figure 2). The edge being measured shall be at least as long as the 1 m straightedge.

Values in millimetres

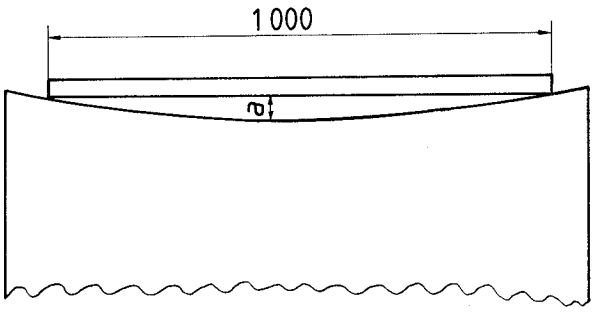


Figure 1 — Measurement of straightness

Values in millimetres

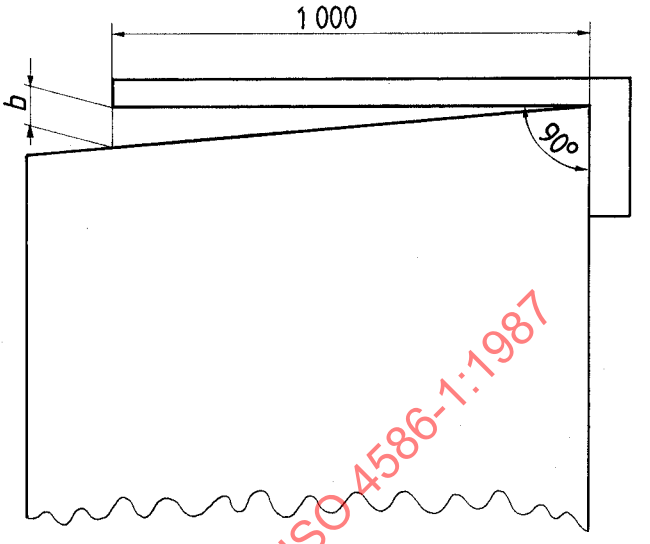


Figure 2 — Measurement of squareness

6.5 Other properties

When tested by the appropriate methods, the properties for each type of material shall be as listed in table 4.

Table 4 — Property requirements

Property	Test method, ISO 4586-2, clause No.	Property, or attribute	Unit max. or min.	Material type										
				HDS	HGS	HGP	HGF	VGS	VGP	VGF	VLS	CLS	Compact S	Compact F
Resistance to surface wear	6	Wear resistance	revolutions min.	1 000	350	350	350	150	150	150	50	x	350 d	350 d
Resistance to immersion in boiling water	7	Mass increase	% max.	See curve 1, annex A										
		Thickness increase	% max.	See curve 2, annex A										
		Appearance	Grade (not worse than)	4	4	3	4	4	3	4	3	3	4	4
Resistance to dry heat at 180 °C	8	Appearance gloss	Grade (not worse than)	3	3	3	3	x	x	x	x	x	3	3
		others		4	4	4	4	x	x	x	x	x	4	4
Dimensional stability at elevated temperature	9 (alternative)	Dimensional change	% max. (L) % max. (T)	See curve 3, annex A										
Dimensional stability at 20 °C	10 y (alternative)	Dimensional change	% max. (L) % max. (T)	See curve 4, annex A										
Resistance to impact by small diameter ball	11 u	Spring force	N min.	25	25	20	25	20	15	20	15	15	a	a
Resistance to impact by large diameter ball	12	Height of free-falling ball	cm min.	c	c	c	c	c	c	c	c	c	c	c
		Diameter of indentation	mm max.	10	10	10	10	10	10	10	10	10	10	10
Resistance to cracking (thin laminates)	13 u	Susceptibility	Grade (not worse than)	4	4	4	4	4	4	4	4	3	a	a
Resistance to scratching	14	Load	See annex B N min.	3,0	2,0	2,0	2,0	1,75	1,75	1,75	1,5	x	e 2,0	e 2,0
Resistance to staining	15 f	Appearance Groups 1 and 2	Grade (not worse than)	5	5	5	5	5	5	5	5	5	5	5
		Groups 3 and 4		4	4	3	4	4	3	4	4	4	4	4
Resistance to colour change in xenon arc light	16 (alternative)	Wool standard	min.	6	6	6	6	6	6	6	6	x	b 6	b 6
in enclosed carbon arc light	17 (alternative)	Wool standard	min.	5	5	5	5	5	5	5	5	x	b 5	b 5
Resistance to cigarette burns	18 (alternative)	Appearance	Grade (not worse than)	3	3	3	3	x	x	x	x	x	3	3
	19 (alternative)	Time to failure	s min.	110	110	100	100	x	x	x	x	x	110	100
Formability Method A	20	Radius	mm max.	a	a	15 z	a	a	10 z	a	a	a	a	a
Method B	21	Radius	mm max.	a	a	15 z	a	a	10 z	a	a	a	a	a

Table 4 (*concluded*)

Property	Test method, ISO 4586-2, clause No.	Property, or attribute	Unit max. or min.	Material type										
				HDS	HGS	HGP	HGF	VGS	VGP	VGF	VLS	CLS	Compact S	Compact F
Resistance to blistering														
Method A	22	Time to blister	s min.	a	a	15	a	a	10	a	a	a	a	a
Method B	23	Time to blister	s min.	a	a	15	a	a	10	a	a	a	a	a
Resistance to steam	24	Appearance	Grade (not worse than)	4	4	3	4	4	3	4	3	3	4	4
Resistance to fire	25			x	x	x	q	x	x	q	x	x	x	q
Resistance to crazing (thick laminate)	26	Susceptibility	Grade (not worse than)	a	a	a	a	a	a	a	a	a	4	4
Modulus of elasticity	ISO 178	Stress	MPa min.	a	a	a	a	a	a	a	a	a	10,000	9,000
Flexural modulus	ISO 178	Stress	MPa min.	a	a	a	a	a	a	a	a	a	100	80
Tensile strength	ISO/R 527	Stress	MPa min.	a	a	a	a	a	a	a	a	a	70	60

Key to letters used in table 4

a Not applicable.
b Test sample shall be reduced by machining to a thickness of < 3 mm.
c Under consideration.
d Test samples shall be reduced by machining to a thickness of < 15 mm.
e Test samples shall be reduced by machining to a thickness of < 8 mm.
f Acids and alkalis in concentrations stronger that those shown in group 3, which can be contained in commercial cleaning agents, can cause surface damage or marking even with very short contact times. Any spillage of such materials must be washed off the laminate surface immediately.
L In the longitudinal (or machine) direction of the fibrous sheet material (normally the direction of the longest dimension of the laminated sheet).
q The material shall meet specific requirements for reaction to fire in its application in the country of use.
T In the cross-longitudinal (or cross-machine) direction of the fibrous sheet material (at right angles to direction L).
u Applies only to materials less than 2 mm thick.
x No requirement.
y Intended to indicate performance under normal climatic conditions.
z Limits for laminates > 1,5 mm shall be agreed between the interested parties.

Annex A

Addendum to specification table 4, relating to test methods 7, 9 and 10

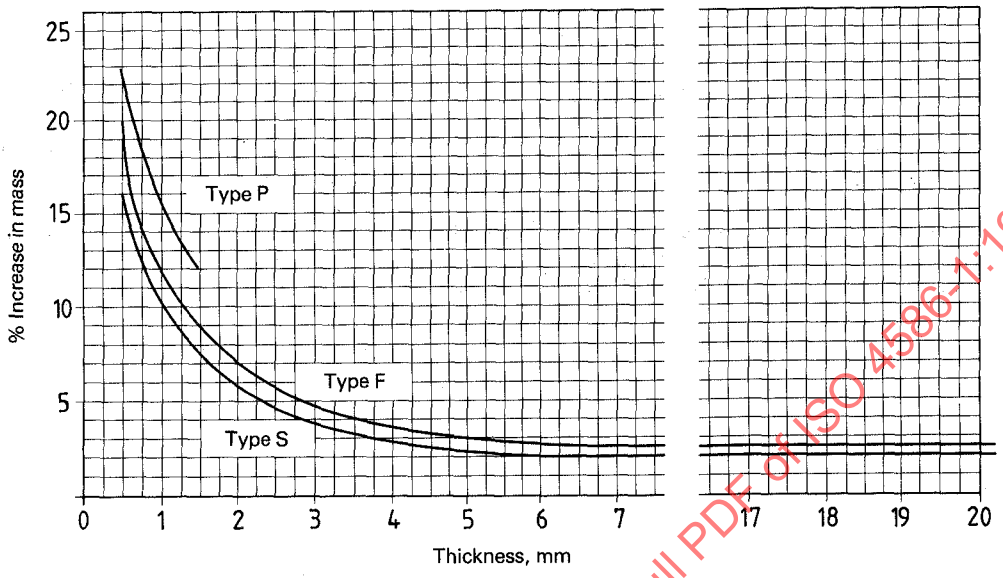
(This annex forms an integral part of the Standard.)

In table 4, reference is made to curves 1 to 4 in specifying resistance to boiling water and dimensional stability.

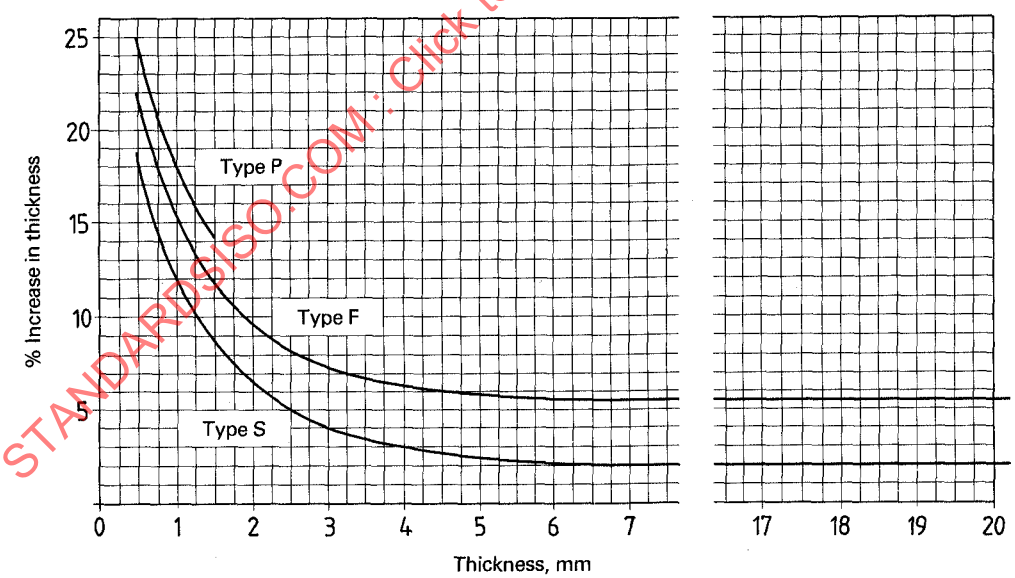
The charateristics are dependent on laminate thickness, and the curves therefore provide more complete information than discrete limits.

The curves give the maximum limiting values for each laminate type (S, P and F). No attempt has been made to prescribe specific laminate thicknesses to the various fields of application, but in determining the quality of a laminate of a given thickness, it is important to know where these properties lie in relation to the appropriate limit curves.

In knowing the expected performance, the customer can select the thickness of laminate which will best meet the requirements of a particular application.



Curve 1 — Water absorption — % increase in mass



Curve 2 — Water absorption — % increase in thickness