Technical Construction File
EN 438-4:2016
High-pressure decorative laminates (HPL) - Sheets based on thermosetting resins (usually called laminates) - Part 4: Classification and specifications for compact laminates of thickness 2 mm and greater

Report reference No.....:	TCSD19111520754
Compiled by (+ signature).....:	Stephen Zhang / Test Engineer
Approved by (+ signature).....:	Kosco Vent / Project Manager
Date of issue.....:	April 28, 2020
Reviewing laboratory.....:	Shanghai Global Testing Services Co., Ltd.
Reviewing location.....:	Floor 2nd, Building D-1, No. 128, Shenfu Road, Minhang District, Shanghai, China.
Applicant.....:	SHANDONG SUNFULL INDUSTRIAL CO.,LTD
Address.....:	NO. 98, TIAN JIN ROAD, ECONOMIC DEVELOPMENT ZONE, PENGLAI, SHANDONG, CHINA
Manufacturer.....:	SHANDONG SUNFULL INDUSTRIAL CO.,LTD
Address.....:	NO. 98, TIAN JIN ROAD, ECONOMIC DEVELOPMENT ZONE, PENGLAI, SHANDONG, CHINA
Factory.....:	The same as Manufacturer
Address.....:	The same as Manufacturer
Standard.....:	☒ EN 438-4:2016
Review Report Form No.....:	438
TRF originator.....:	GTS
Master TRF.....:	Reference No. EN 438-4
Review procedure .....:	GTS
Type of Review object.....:	COMPACT LAMINATE
Trademark.....:	-
Model/type reference.....:	8MM 10MM 12MM
Rating.....:	/

GLOBAL TESTING SERVICES CO.,LTD CERTIFICATION

Possible review case verdicts: - review case does not apply to the test object..... : N(.A.) - review object does meet the requirement..... : P(ass) - review object does not meet the requirement..... : F(ail)
General remarks:
"(see remark #)" refers to a remark appended to the report. "(see appended table)" refers to a table appended to the report. Throughout this report a comma is used as the decimal separator. The review results presented in this report relate only to the object reviewed. This report shall not be reproduced except in full without the written approval of the third party.

Testing:	
Date of receipt of review item:	November 15, 2019
Date(s) of performance of review:	November 15, 2019 to April 28, 2020

General product information: COMPACT LAMINATE
Summary of reviewing: This review report includes: Annex I: **2** page(s) of photo documentation.
Copy of marking plate

COMPACT LAMINATE, Model 8MM 10MM 12MM SHANDONG SUNFULL INDUSTRIAL CO.,LTD	No marking

LIGHT STAR

<table>
<tr><td>4</td><td>Material types and classification system</td><td></td><td>P</td></tr>
<tr><td></td><td>Compact laminates are defined using a three letter classification system as shown in Table 1</td><td></td><td>P</td></tr>
<tr><td>5</td><td>Table 1 — Compact laminate classification system<table><tr><th>First letter</th><th>Second letter</th><th>Third letter</th></tr><tr><td>C (compact grade)</td><td>G (general purpose)</td><td>S (standard grade)
or F (flame-retardant grade)</td></tr></table></td><td></td><td>P</td></tr>
<tr><td></td><td>Type CGS Standard grade decorative Compact laminates are specified as HPL/EN 438-4/CGS</td><td></td><td>P</td></tr>
<tr><td></td><td>Type CGF Decorative Compact laminates with improved fire retardance are 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 6.4.2 and Annex A). Specified as HPL/EN 438-4/CGF.</td><td></td><td>P</td></tr>
<tr><td></td><td>Other laminates having special characteristics are also available but these products are outside the scope of this part of the standard</td><td></td><td>P</td></tr>
<tr><td></td><td>5 Characteristics and applications</td><td></td><td>P</td></tr>
<tr><td></td><td>HPL Compact laminates have the following characteristics:</td><td></td><td>P</td></tr>
<tr><td></td><td>— Attractive aesthetic qualities;</td><td></td><td>P</td></tr>
<tr><td></td><td>— High mechanical strength</td><td></td><td>P</td></tr>
<tr><td></td><td>— Durability (high resistance to impact, wear and scratching)</td><td></td><td>P</td></tr>
<tr><td></td><td>— Good dimensional stability;</td><td></td><td>P</td></tr>
<tr><td></td><td>— High resistance to the effects of water, steam, heat and frost;</td><td></td><td>P</td></tr>
<tr><td></td><td>— Non-corrosive;</td><td></td><td>P</td></tr>
<tr><td></td><td>— Good colour fastness;</td><td></td><td>P</td></tr>
<tr><td></td><td>— Easy to clean and maintain (good anti-graffiti properties);</td><td></td><td>P</td></tr>
<tr><td></td><td>— Hygienic;</td><td></td><td>P</td></tr>
<tr><td></td><td>— Good chemical resistance;</td><td></td><td>P</td></tr>
<tr><td></td><td>— No dust attraction;</td><td></td><td>P</td></tr>
<tr><td></td><td>— Ease of installation</td><td></td><td>P</td></tr>
<tr><td></td><td>— Good fire performance.</td><td></td><td>P</td></tr>
<tr><td>6</td><td>Requirements</td><td></td><td>P</td></tr>
<tr><td>6.1</td><td>Compliance</td><td></td><td>P</td></tr>
<tr><td></td><td>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.</td><td></td><td>P</td></tr>
<tr><td>6.2</td><td>Inspection requirements</td><td></td><td>P</td></tr>
<tr><td>6.2.1</td><td>General</td><td></td><td>-</td></tr>
<tr><td></td><td>Inspection shall be carried out in accordance with EN 438-2:2016, Clause 4 at a distance between 750 mm to 1500</td><td></td><td>-</td></tr>
</table>

	mm.		
6.2.2	Colour and pattern		-
	When inspected in daylight or D65 standard illuminant, as specified in EN ISO 11664-2, and also under tungsten filament lightning illuminant A as specified in EN ISO 11664-2, a slight difference between the corresponding colour reference sample held by the supplier and the specimen under test is acceptable		P
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.		P
	The maximum permitted deviations for the gloss value determined according to EN 13722 are Gloss surface > 70 GU maximum deviation ± 15 GU Semi Gloss surface 30 – 70 GU maximum deviation ± 10 GU Semi Matt surface 10 – 30 GU maximum deviation ± 5 GU Matt surface < 10 GU maximum deviation ± 3 GU GU = gloss units		P
	The measurement shall be carried out with the same device as comparison between reference sample and specimen or between different lots of specimen.		P
6.2.4	Visual inspection		-
6.2.4.1	General		-
	The following inspection requirements are intended as a general guide, indicating the minimum acceptable quality for each decorative face of a laminate supplied as a full-size sheet.		P
	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.		P
	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.		P
6.2.4.2	Surface quality		-
	The following surface defects are permissible:		-
	a) 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		P
	b) 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		P

<table>
<tr><td></td><td>concentrated in one defect or dispersed over an unlimited amount of smaller defects</td><td></td><td></td></tr>
<tr><td>6.2.4.3</td><td>Edge quality</td><td></td><td>-</td></tr>
<tr><td></td><td>Edge chipping up to 3 mm on each side is permissible</td><td></td><td>P</td></tr>
<tr><td>6.3</td><td>Dimensional tolerance requirements</td><td></td><td>-</td></tr>
<tr><td></td><td>Dimensional tolerance requirements are specified in Table 2.</td><td></td><td>-</td></tr>
<tr><td></td><td>
Table 2 — Dimensional tolerance requirements
<table>
<tr><th rowspan="2">Property</th><th rowspan="2">Test method (EN 438-2:2016, Clause no.)</th><th colspan="2">Requirement</th></tr>
<tr><th>thickness</th><th>maximum variation</th></tr>
<tr><td>Thickness</td><td>5</td><td>2,0 ≤ t < 3,0 mm:
3,0 ≤ t < 5,0 mm:
5,0 ≤ t < 8,0 mm:
8,0 ≤ t < 12,0 mm:
12,0 ≤ t < 16,0 mm:
16,0 ≤ t < 20,0 mm:
20,0 ≤ t < 25,0 mm:
25,0 ≤ t</td><td>± 0,20 mm
± 0,30 mm
± 0,40 mm
± 0,50 mm
± 0,60 mm
± 0,70 mm
± 0,80 mm
to be agreed between supplier and customer</td></tr>
<tr><td>Length and width [b]</td><td>6</td><td colspan="2">+ 10 mm/ − 0 mm</td></tr>
<tr><td>Edges straightness [b]</td><td>7</td><td colspan="2">1,5 mm/m maximum deviation</td></tr>
<tr><td>Edges squareness [b]</td><td>8</td><td colspan="2">1,5 mm/m maximum deviation</td></tr>
<tr><td>Flatness [a]</td><td>9</td><td>maximum deviation
2,0 ≤ t < 6,0 mm:
6,0 ≤ t < 10,0 mm:
10,0 ≤ t :</td><td>
8,0 mm/m
5,0 mm/m
3,0 mm/m</td></tr>
<tr><td colspan="4">[a] Provided that the laminates are stored in the manner and conditions recommended by the manufacturer they shall comply with the flatness requirements specified in Table 2 when measured in accordance with EN 438-2:2016, Clause 9. The flatness values specified in Table 2 apply to laminates with two decorative faces. Limits for laminates with one Face sanded shall be agreed between supplier and customer.
[b] Tolerances for cut-to-size panels shall be agreed between supplier and purchaser.</td></tr>
</table>
</td><td></td><td>P</td></tr>
<tr><td>6.4</td><td>Test requirements</td><td></td><td>-</td></tr>
<tr><td>6.4.1</td><td>General requirements</td><td></td><td>-</td></tr>
<tr><td></td><td>General requirements are specified in Table 3</td><td></td><td>P</td></tr>
</table>

Table 3 — General requirements

Property	Test method (EN 438-2:2016, Clause no. Unless otherwise stated)	Property or attribute	Unit (max. or min.)	Laminate grade	
				CGS	CGF
Resistance to surface wear	10	Wear resistance	Revolutions (min) Initial point	 150	 150
Resistance to immersion in boiling water	12	Mass increase Thickness increase Appearance	% (max) 2 mm ≤ t < 5 mm t ≥ 5 mm % (max) 2 mm ≤ t < 5 mm t ≥ 5 mm Surface rating (min) Gloss finish other finishes Edge rating (min)	5,0 2,0 6,0 2,0 3 4 3	7,0 3,0 9,0 6,0 3 4 3
Resistance to water vapour	14	Appearance	Rating (min) Gloss finish Other finishes	 3 4	 3 4
Resistance to dry heat (160 °C)	16	Appearance	Rating (min) gloss finish other finishes	 3 4	 3 4
Dimensional stability at elevated temperature	17	Cumulative Dimensional Change	% (max) 2 mm ≤ t < 5 mm L [b] T [c] t ≥ 5 mm L [b] T [c]	 0,40 0,80 0,30 0,60	 0,40 0,80 0,30 0,60
Resistance to wet heat (100 °C)	18	Appearance	Rating (min) gloss finish other finishes	 3 4	 3 4
Resistance to impact by large diameter ball	21	Drop height [a]	mm (min) 2 ≤ t < 6 6 ≤ t	1400 1800	1400 1800
Resistance to crazing	24	Appearance	Grade (min)	4	4
Resistance to scratching	25	Force	Rating (min) smooth finishes textured finishes	 2 3	 2 3
Resistance to staining	26	Appearance	Rating (min) Groups 1 & 2 Group 3	 5 4	 5 4
Light fastness (xenon arc)	27	Contrast	Grey scale rating	4 to 5	4 to 5
Flexural modulus [e]	EN ISO 178 [d]	Stress	MPa (min) L [b] and T [c]	9000	9000
Flexural strength [e]	EN ISO 178 [d]	Stress	MPa (min) L [b] and T [c]	80	80
Density	EN ISO 1183-1	Density	g/cm^3 (min)	1,35	1,35

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

[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] Machine crosshead speed 10 mm/min

[e] The test results can be affected by the sample handling and by the humidity absorption from the air during the step previous to the conditioning

P

6.4.2	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		P

	material is to be used. The reaction-to-fire of construction products is classified in accordance with EN 13501-1. For applications other than construction, fire test methods and performance requirements may vary from one country to another, and at present it is not possible, with any test, to predict compliance with all national and other requirements. No fire performance test is therefore included in this specification, however Annex A gives examples of how Compact laminates relate to EN 13501-1 and some of the more common European fire test methods		
6.5	Supplemental properties		-
	For certain applications, information on some of the properties listed in Table 4 may be required. On request, this information shall be supplied by the laminate manufacturer and in this case shall have been derived using the test methods listed in Table 4		P
	Table 4 — Supplemental properties and test methods		P

Property	Test method
Electrostatic properties: - point to point resistance - vertical resistance	 EN 61340-4-1 EN 61340-4-1
Microscratch resistance	EN 438-2:2016, Clause 30 "Determination of microscratch resistance"

Annex A	Addendum to sub-clause 6.4.2, relating to fire performance		-
	In Europe, laminate panels intended for construction applications are tested in accordance with EN 13823 [1] (SBI test) and EN ISO 11925-2 [2] (Small-burner test), and the resulting reaction-to-fire performance is expressed in accordance with EN 13501-1.		P
	Table A.1 — Typical EN 13501-1 classifications of Compact laminates in the field of building construction		P

Product type	EN 13501-1 classification
CGF ≥ 6mm thick	B-s2,d0
CGF < 6mm thick	C-s2,d0 or better
CGS	D-s2,d0 or better
NOTE It is advised to contact the laminate manufacturer for details of fire test reports and certifications held, and for information on fire test methods and specifications.	

	Table A.2 — Examples of typical fire performance of compact laminates not in the field of building construction		P

Test method	Test standard	Typical performance levels	
		CGF	CGS
Smoke density and toxicity	NF F 16-101 [3]	F2 or better	F2 or better
Railways applications [a]	EN 45545-2 [4]	-	-
Transport applications	Directive 95/28/EC	-	-
NOTE Fire test performance will depend on laminate thickness and construction, substrate type and thickness, and adhesive used. It is advised to contact the laminate manufacturer for details of test reports and classification held, and for information on fire test methods and specifications.			
[a] Depending on the application and on the vehicle category			

Type of equipment, model: COMPACT LAMINATE,
8MM 10MM 12MM

Details of:

View:

[X] general

[ ] front

[ ] rear

[ ] right

[ ] left

[ ] top

[ ] bottom



Details of:

View:

[X] general

[ ] front

[ ] rear

[ ] right

[ ] left

[ ] top

[ ] bottom



Details of:

View:

[X] general

[ ] front

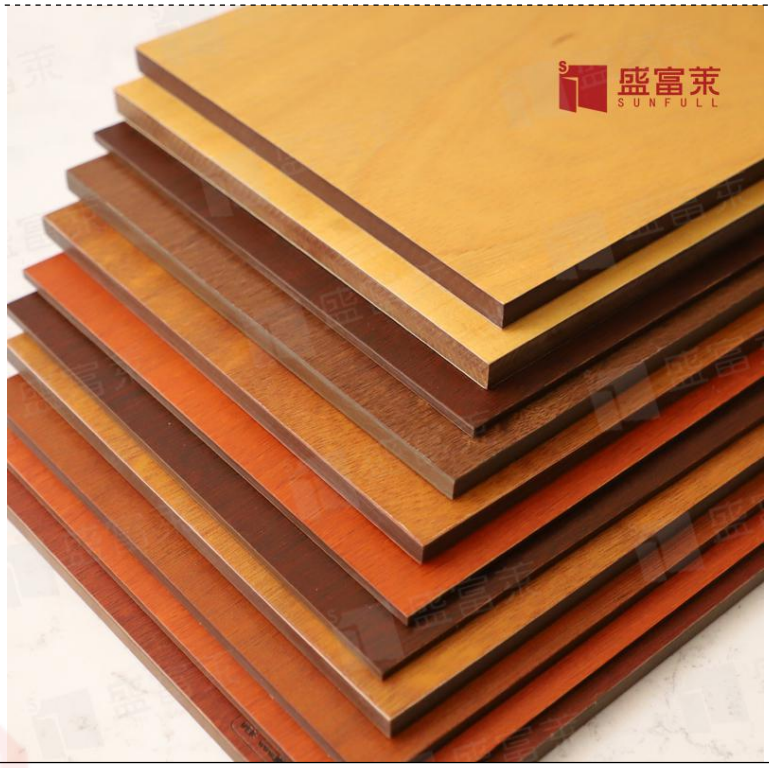
[ ] rear

[ ] right

[ ] left

[ ] top

[ ] bottom



Details of:

View:

[X] general

[ ] front

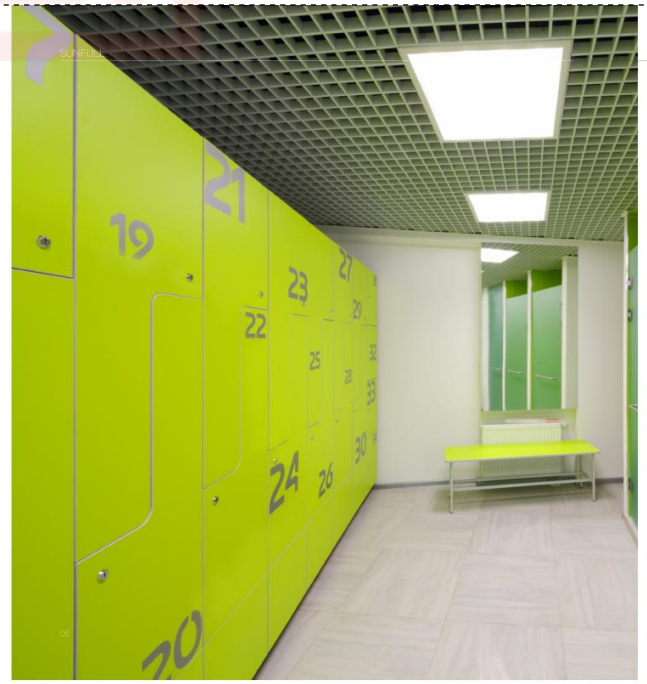
[ ] rear

[ ] right

[ ] left

[ ] top

[ ] bottom





- End of Annex I -