BS EN 1013:2012+A1:2014

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BSI Standards Publication

Light transmitting single skin profiled plastic sheets for internal and external roofs, walls and ceilings — Requirements and test methods

National foreword

This British Standard is the UK implementation of EN 1013:2012+A1:2014. It supersedes BS EN 1013:2012, which is withdrawn.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to CEN text carry the number of the CEN amendment. For example, text altered by CEN amendment A1 is indicated by [A1] 〈A1〉.

The UK participation in its preparation was entrusted by Technical Committee B/542, Roofing and cladding products for discontinuous laying, to Subcommittee B/542/8, Light transmitting plastics sheeting for roofing and cladding.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

The National Annex (informative) attached to this standard provides additional guidance on the application of EN 1013.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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ICS 83.140.10; 91.060.01

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English Version

Light transmitting single skin profiled plastics sheets for internal and external roofs, walls and ceilings - Requirements and test methods

Plaques d'éclairement profilées, simple paroi, en matière plastique, pour toitures, bardages et plafonds intérieurs et extérieurs - Exigences et méthodes d'essai

Lichtdurchlässige, einschalige profilierte Platten aus Kunststoff für Innen- und Außenanwendungen an Dächern, Wänden und Decken - Anforderungen und Prüfverfahren

This European Standard was approved by CEN on 20 October 2012 and includes Amendment 1 approved by CEN on 22 August 2014.

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Foreword

This document (EN 1013:2012+A1:2014) has been prepared by Technical Committee CEN/TC 128 “Roof covering products for discontinuous laying and products for wall cladding”, the secretariat of which is held by NBN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2015, and conflicting national standards shall be withdrawn at the latest by September 2016.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes [A1] EN 1013:2012 [A1].

This document includes Amendment 1 approved by CEN on 2014-08-22.

The start and finish of text introduced or altered by amendment is indicated in the text by tags [A1] [A1].

[A1] This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of the EU Construction Products Regulation.

For relationship with EU Directive(s) and the Construction Products Regulation, see informative Annex ZA, which is an integral part of this document. [A1]

[A1] *deleted text* [A1]

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

This document describes the requirements and test methods for light transmitting single skin profiled plastics sheets.

The physical properties of light transmitting single skin profiled plastics sheets differ from bituminous, metal and fibre reinforced cement sheets, as defined in EN 534 [1], EN 506 [2], EN 508-1 [3], EN 508-2 [4], EN 508-3 [5] and EN 494 [6]. They do not necessarily have the same span capabilities and alternative fixing specifications are generally required.

Reference should be made to national regulations and the manufacturer's literature for requirements concerning design, storage and installation, including all safety aspects, according to the material.

1 Scope

This European Standard specifies the requirements for light transmitting single skin profiled plastics sheets for internal and external walls, roofs and ceilings. It is applicable to single skin sheets which are used as a single layer or when assembled to form a multiple layer construction.

It also specifies the test methods and provides for the evaluation of conformity and marking of the sheets.

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.

EN 59, *Glass reinforced plastics - Measurement of hardness by means of a Barcol impressor*

CEN/TS 1187:2012, *Test methods for external fire exposure to roofs*

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

EN 13501-5, *Fire classification of construction products and building elements — Part 5: Classification using data from external fire exposure to roofs tests*

EN 13823:2010, *Reaction to fire tests for building products - Building products excluding floorings exposed to the thermal attack by a single burning item*

EN ISO 178, *Plastics — Determination of flexural properties (ISO 178)*

EN ISO 472:2001, *Plastics — Vocabulary (ISO 472:1999)*

EN ISO 527-1, *Plastics —Determination of tensile properties — Part 1: General principles (ISO 527-1)*

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

EN ISO 527-4, *Plastics — Determination of tensile properties — Part 4: Test conditions for isotropic and orthotropic fibre-reinforced plastic composites (ISO 527-4)*

EN ISO 1043-1:2011, *Plastics - Symbols and abbreviated terms - Part 1: Basic polymers and their special characteristics (ISO 1043-1:2011)*

EN ISO 1043-2:2011, *Plastics - Symbols and abbreviated terms - Part 2: Fillers and reinforcing materials (ISO 1043-2:2011)*

EN ISO 1172:1998, *Textile-glass-reinforced plastics - Prepregs, moulding compounds and laminates - Determination of the textile-glass and mineral-filler content - Calcination methods (ISO 1172:1996)*

EN ISO 4892-2:2006, *Plastics — Methods of exposure to laboratory light sources — Part 2: Xenon-arc lamps (ISO 4892-2:2006)*

EN ISO 4892-3:2006, *Plastics — Methods of exposure to laboratory light sources — Part 3: Fluorescent UV lamps (ISO 4892-3:2006)*

EN ISO 6603-1, *Plastics — Determination of puncture impact behaviour of rigid plastics — Part 1: Non-instrumented impact testing (ISO 6603-1)*

〚A1〛 *Deleted text* 〚A1〛

EN ISO 11664-1, *Colorimetry — Part 1: CIE standard colorimetric observers (ISO 11664-1)*

EN ISO 11664-2:2011, *Colorimetry - Part 2: CIE standard illuminants (ISO 11664-2:2007)*

EN ISO 11925-2:2010, *Reaction to fire tests - Ignitability of products subjected to direct impingement of flame - Part 2: Single-flame source test (ISO 11925-2:2010)*

EN ISO 12572, *Hygrothermal performance of building materials and products — Determination of water vapour transmission properties (ISO 12572)*

EN ISO 13468-1, *Plastics — Determination of the total luminous transmittance of transparent materials — Part 1: Single-beam instrument (ISO 13468-1)*

EN ISO 13468-2, *Plastics — Determination of the total luminous transmittance of transparent materials — Part 2: Double-beam instrument (ISO 13468-2)*

EN ISO 14125, *Fibre-reinforced plastic composites — Determination of flexural properties (ISO 14125)*

ISO 11359-2, *Plastics — Thermomechanical analysis (TMA) — Part 2: Determination of coefficient of linear thermal expansion and glass transition temperature*

ETAG 010, *Self supporting translucent roof kits*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 472:2001, EN ISO 1043-1:2011, EN ISO 1043-2:2011 and Annex A and the following apply.

3.1
indirect test (IT)
test performed by the manufacturer, different from that specified for that particular characteristic, having verified its correlation with the specified test

3.2
yellowness
deviation in chroma from whiteness or water-whiteness in the dominant wavelength range from 570 nm to 580 nm

3.3
yellowness index
magnitude in yellowness relative to CIE standard illuminant D 65

3.4
radiant exposure
H
time integral of irradiance, measured in joules per square metre ($J \cdot m^{-2}$)

[SOURCE: ISO 9370:1997] [7]

4 Symbols and abbreviations

4.1 Symbols

A_n class for the exposure to artificial accelerated weathering using xenon-arc lamps

B_n class for the exposure to artificial accelerated weathering using fluorescent UV lamps

H radiant exposure

YI yellowness index of a test specimen exposed to ageing

YI_0 yellowness index of a test specimen unexposed to ageing

ΔYI change of the yellowness index after ageing

4.2 Abbreviations

FPC factory production control

GRA glass-fibre reinforced acrylic (PMMA)

GRP glass-fibre reinforced polyester

ITT initial type testing

PC polycarbonate

PET poly(ethylene terephthalate)

PMMA poly(methyl methacrylate)

PVC-U unplasticised poly(vinyl chloride)

PVF poly(vinyl fluoride)

5 Requirements

5.1 Visual appearance

Both sides of the sheets shall be of regular appearance. Visual or tactile examination shall reveal no evidence of any hole, cracking or splitting, and no cluster of bubbles greater than 1 mm in diameter, or inclusions that are likely to affect properties. For GRP sheets, any defects such as resin ribs, glass folds or glass knots shall not exceed 5 mm in diameter.

The edges of the sheet shall be straight and clean.

Further requirements concerning the visual aspects of the sheets can be agreed upon between the manufacturer and the customer.

Where required, the sheet shall be declared as “diffusing” or “non-diffusing” depending on whether the image of an object placed 1 m behind the sheet appears blurred or sharp, respectively.

5.2 Dimensional tolerances and mass per square metre

The dimensional tolerances and mass per square metre shall be assessed when subject to regulatory requirement. When measured in accordance with the test methods as specified in 6.1.1 to 6.1.3 and Table 1, the dimensional tolerances and mass per square metre of the sheets shall conform to the requirements given in Table 1.

The test methods given in Table 1 are used for initial type testing, and are the reference test methods. Any other indirect test method may be chosen provided that it is sufficiently accurate to ensure that the dimensions of the products meet the requirements of Table 1 and as far as a correlation is demonstrated with the concerned reference test method.

Table 1 — Dimensional tolerances and mass per square metre requirements

Characteristic	Test method	Requirement
Sheet thickness	6.1.4	The nominal thickness of the profiled sheet shall be declared. The mean value of the thickness of the profiled sheet shall not vary by more than ± 10 % of this value. The sheet thickness at any point of a sheet including crown, trough and sides of corrugation shall not vary by more than ± 20 % from the declared nominal thickness of the profiled sheet.
Mass per square metre	6.1.5	The mass per square metre of the material in flat form, prior to profiling, which is the reference value, shall be controlled and declared. The mean value of the mass per square metre shall not vary by more than ± 10 % of the declared nominal mass per square metre. The mass per linear metre of profiled sheet, which can be calculated from the mass per square metre of the material in flat form, may be also declared.
Cover width	6.1.6	The measured cover width shall be within ± 0,8 % of the declared nominal cover width.
Shape of the sheet profile	6.1.7	When it is intended that the profile of the sheets shall match the shape of a dissimilar material (e.g. metal or fibre cement), the shape of the profile shall match the nominal shape with a maximum tolerance (deviation) at any point of 4 mm.
Sheet length	6.1.8	The sheet length shall be within the interval from: — 0 mm to + 20 mm of the declared sheet length, for sheet length up to 2,5 m; — 0 % to + 0,8 % of the declared sheet length for sheet length greater than 2,5 m.
Sheet straightness	6.1.9	The sheet straightness shall be less than or equal to 2,0 mm/m length.
Squareness of a sheet	6.1.10	The out of squareness of a sheet shall be less than or equal to 0,5 % of the declared cover width.

5.3 Light transmission

The total luminous transmittance shall be determined by testing five samples in accordance with 6.2 and calculating the mean value. The total luminous transmittance based on the mean value shall be declared and the mean value of subsequent measurements shall be within ± 5 % of the declared value.

5.4 Flexural/tensile strength

The flexural/tensile strength shall be assessed when subject to regulatory requirement.

The flexural strength and flexural modulus or the tensile strength and Young's modulus, as applicable, of the material of the sheets shall be measured in accordance with 6.4.

The flexural strength and flexural modulus or the tensile strength and Young's modulus, as applicable, based on the mean values, shall be declared and any subsequent measurement shall be a minimum of 80 % of the declared value.

5.5 Durability

5.5.1 General

The durability shall be assessed when subject to regulatory requirement.

The durability of profiled sheets shall be demonstrated by testing the variations after artificial accelerated weathering of the yellowness index, light transmission and flexural/tensile strength and declaring the results according to 5.5.3, 5.5.4 and 5.5.5, respectively.

5.5.2 Artificial ageing performance

Artificial accelerated weathering shall be carried out:

a) by xenon-arc lamps in accordance with EN ISO 4892-2:2006, Cycle 1, with radiant exposure given in Table 2, using one or more of the classes A_0, A_1, A_2 or A_3 as defined in Table 2;

or

b) artificial accelerated weathering shall be carried out by fluorescent UV lamps in accordance with EN ISO 4892-3:2006, Type 1A (UVA 340), Cycle 1, with test duration given in Table 3, using one or more of the classes B_0, B_1, B_2 or B_3 as defined in Table 3.

CAUTION —Sheets shall be classified according to two different systems, respectively A_0, A_1, A_2 or A_3 and B_0, B_1, B_2 or B_3. Any comparison between two classes, one of each system, is not possible and shall be avoided because the two artificial accelerated weathering methods have their own test parameters which cannot be compared.

NOTE New investigations and round robin tests would be necessary to decide whether a single method for assessing the ageing behaviour is achievable. This issue will be considered during the next revision of this standard.

Table 2 — Artificial ageing classification according to EN ISO 4892-2

Radiant exposure, *H,* in the total daylight range (300 nm to 3 000 nm) GJ/m^2	**Class**
$18 \leq H$	A_0
$10 \leq H < 18$	A_1
$6 \leq H < 10$	A_2
$4 \leq H < 6$	A_3

Table 3 — Artificial ageing classification according to EN ISO 4892-3

Test duration h	Class
4 000	B_0
3 000	B_1
2 000	B_2
1 000	B_3

The dimensions of the exposed test pieces shall be sufficient to allow carrying out the light transmission test and the subsequent specific tests.

5.5.3 Variation of the yellowness index after artificial ageing

Variation of the yellowness index after artificial ageing shall be assessed when subject to regulatory requirement.

The yellowness index shall be measured in accordance with 6.3. The amount of variation in yellowness for each applied class of Table 2 or Table 3, as applicable, shall be declared. The performance at class A3, or B3, as applicable, may be declared but the performance at higher classes of exposure shall only be declared provided that the yellowness index does not change by more than 20 units at any higher class(es) declared.

5.5.4 Variation of the light transmission after artificial ageing

Variation of the light transmission after artificial ageing shall be assessed when subject to regulatory requirement.

The total luminous transmittance shall be measured in accordance with 6.2.

The variation of the total luminous transmittance, $\Delta\tau_t$, for each applied class of Table 2 or Table 3, as applicable, shall be declared, defined as the percentage reduction of the total luminous transmittance of an unaged sample as follows:

$$\Delta\tau_t = \frac{\tau t_0 - \tau t_1}{\tau t_0} \quad (1)$$

where

$\Delta\tau_{t0}$ is the total luminous transmittance, in percentage, of an unaged sample;

$\Delta\tau_{t1}$ is the total luminous transmittance, in percentage, of an aged sample.

The performance at class A_3 or B_3, as applicable, may be declared but the performance at higher classes of exposure shall only be declared provided that the variation of the total luminous transmission is not greater than 20 % at any higher class(es) declared.

5.5.5 Variation of the flexural/tensile strength after ageing

The variation of the flexural/tensile strength after ageing shall be assessed when subject to regulatory requirement.

The variation of properties after ageing shall be determined by assessing the variations of either the flexural strength and flexural modulus by a bending test, or the tensile strength and Young's modulus by a tensile test, both according to 6.4.

The percentage reductions of the flexural/tensile strength and flexural/Young's modulus between unexposed test specimens and test specimens aged at the maximum exposure declared for variation of yellowness index and variation of total luminous transmittance shall then be expressed within the ranges ≤ 10 %, > 10 % to ≤ 20 %, > 20 % to ≤ 30 %, or > 30 %.

5.6 Thermal ageing resistance (only for thermoplastic sheets)

The thermal ageing resistance of thermoplastic sheets shall be determined by assessing the variations of the total luminous transmittance, yellowness index and flexural/tensile strength, before and after exposure to dry heat according to 6.5.

The variation of each property (i.e. yellowness index, light transmission, and flexural/tensile strength, measured in accordance with 6.3, 6.2 and 6.4 respectively) shall be declared, defined as the percentage reduction compared to an unaged sample.

5.7 Longitudinal reversion and profile retention (only for thermoplastic sheets)

When tested in accordance with 6.6, the mean variations in dimensions of the sheet shall not exceed ± 2 % for the longitudinal reversion and ± 3 % for the profile retention.

Where the conditions of use may lead to these figures being exceeded, the manufacturer's documentation shall give guidance.

5.8 Impact resistance

5.8.1 Small hard body impact resistance

The small hard body impact resistance shall be assessed when subject to regulatory requirement.

The small hard body impact resistance shall be measured in accordance with 6.7.

5.8.2 Large soft body impact resistance

The resistance to large soft body impact depends very heavily on the method of installation and the roof system into which the light transmitting sheet is incorporated, rather than a property of the sheet itself.

The large soft body impact resistance of the same product is likely to be different when the same product is used in different roofing systems and/or installed with different methods of installation, and therefore cannot be declared for a particular product.

In the absence of an appropriate European test method for sheets, the manufacturer may declare the method of installation for each application, which shall consider the large soft body impact resistance. The manufacturer shall assess the large soft body impact resistance separately in accordance with ETAG 010, EN 14963 or individual national safety requirements for each such application. The test report shall record the test method and the manufacturer's instructions for the installation.

NOTE At the date of publication of this document, the following national safety requirements have been identified: DS 1133:1987[8], XP P 38-505:1998[9], XP P 38-506:1999[10], XP P 38-507:2000[11] and ACR[M]001:2005[12].

The user should not assume that the large soft body impact resistance for any one application shall apply to any other application or method of installation.

5.9 Resistance to deflection (mechanical resistance)

5.9.1 Resistance to deflection

The resistance to deflection shall be assessed when subject to regulatory requirement.

The resistance to deflection shall be evaluated by determining according to 6.8 the deflection of an unfixed sheet of the declared nominal thickness as measured in 6.1.4. The bending stiffness of the sheet, $(EI)_{Test}$, after 6 min shall be declared by the manufacturer.

NOTE The performance of sheets when installed is not covered by this standard. Information can be found in manufacturers' documentation. Appropriate test methods are included in ETAG 010.

5.9.2 Material stiffness factor

The stiffness factor of the material (in N.m) shall be defined as follows:

$$E \cdot t^3 \tag{2}$$

where

E is the flexural modulus as defined in 5.4, in pascals;

t is the nominal thickness of the sheet, in metres.

The deflection of a sheet of any given profile can be assumed to be approximately proportional to the material stiffness factor.

5.10 Water vapour permeability

The water vapour permeability coefficient shall be assessed when subject to regulatory requirement.

The value of the water vapour permeability coefficient of the sheet material according to Table 4 shall be declared when a higher performance is sought for declaration, the water vapour permeability coefficient of the material used for the sheet shall be determined according to EN ISO 12572.

Table 4 — Typical values for water vapour permeability coefficient

Material	Reference value mg/(m·h·Pa)
GRA	$3{,}8 \times 10^{-5}$
GRP	$1{,}5 \times 10^{-5}$
PC	$3{,}8 \times 10^{-5}$
PVC-U	$0{,}8 \times 10^{-5}$
PMMA	$3{,}8 \times 10^{-5}$

5.11 Water/air permeability

The water/air permeability shall be assessed when subject to regulatory requirement.

All plastics sheets covered by this standard shall be deemed to satisfy the water/air permeability requirement without the need for testing provided that there are no defects in the sheets. The absence of defects shall be evaluated by examination of visual appearance according to 5.1.

5.12 Linear thermal expansion

The linear thermal expansion in the longitudinal direction shall be assessed when subject to regulatory requirement.

The value of the coefficient of linear thermal expansion in the longitudinal direction of the sheet material according to Table 5 shall be declared. When a higher performance is sought for declaration or to use another

material, the thermal expansion coefficient of the material used for the sheet shall be determined according to EN ISO 11359-2.

Table 5 — Reference values for the coefficient of linear thermal expansion

Material	Reference value (K^{-1})
GRA [a]	26×10^{-6}
GRP [a]	30×10^{-6}
PC	65×10^{-6}
PMMA	70×10^{-6}
PVC-U	67×10^{-6}
a Chopped glass-fibre laminates with a glass-fibre content of 25 % to 40 %.	

5.13 Reaction to fire

The reaction to fire performance shall be assessed when subject to regulatory requirement.

The reaction to fire performance of light transmitting profiled sheets shall be determined in accordance with 6.9 and declared according to EN 13501-1.

Test samples shall be the same weight/thickness as the final product. Where there is a range of thicknesses of product, the manufacturer can test at least two thicknesses of sample, and the poorer of the two results can be applied to all products between the two thicknesses tested. Test results shall not be assumed to apply to products thicker than the thickest sample tested, or thinner than the thinnest sample tested.

Test results on flat samples shall be applied to all profiles within the product range provided the effect of the profile does not add more than 30 % additional material.

Where the effect of the profile adds more than 30 % material, the thickness of the test sample shall be increased to ensure the difference in material mass between the test sample and profiled sheet is less than 30 %.

Where the product has no surface protection on the inner surface of the product, or where the surface protection on this surface is a co-extrusion of the same base material, or is less than 75 µm thick, then samples shall be tested either with or without this surface protection. The test results achieved can be applied both to products with or without such surface protection.

Where the product has a surface protection which is not co-extruded of a similar material and is more than 75 µm thick, it shall be present on the specimens tested, and the results shall only apply to specimens with such surface protection.

5.14 External fire performance

The external fire performance shall be assessed when subject to regulatory requirement.

The external fire performance of light transmitting profiled sheets shall be determined in accordance with 6.10 and declared according to EN 13501-5.

Test samples shall be the same weight/thickness as the final product. Where there is a range of thicknesses of product, the manufacturer can test at least two thicknesses of sample, and the poorer of the two results can be applied to all products between the two thicknesses tested. Test results shall not be assumed to apply to products thicker than the thickest sample tested, or thinner than the thinnest sample tested.

Material shall be tested as flat sheets for CEN/TS 1187:2012, Test 2, and/or profiled sheets (with cover width 1 metre, depth 30 mm to 35 mm and pitch 200 mm to 250 mm) for CEN/TS 1187:2012, Tests 1 and 3. Test results on these samples shall be applied to all profiles within the product range provided the effect of the profile does not add more than 30 % additional material.

Where the effect of the profile adds more than 30 % material, the thickness of the test sample shall be increased to ensure the difference in material mass between the test sample and profiled sheet is less than 30 % (CEN/TS 1187:2012; Test 2), or the profile tested shall be selected to ensure the difference in material mass between the test sample and profiled sheet is less than 30 % (CEN/TS 1187:2012, Tests 1 and 3).

Samples shall be tested with the same surface protection as used on the external surface of the product. However, where this surface protection is a co-extrusion of the same base material, or is less than 75 µm thick, then the test results shall be applied to products which do not have any surface protection or which incorporate alternative surface protection up to 75 µm thick.

Where the product has a surface protection which is not co-extruded of a similar material and is more than 75 µm thick, it shall be present on the specimens tested, and the results shall only apply to specimens with such surface protection.

5.15 Glass-fibre content (only for glass-fibre reinforced sheets)

When tested in accordance with 6.11 the minimum glass-fibre content shall be declared.

5.16 Barcol hardness (only for glass-fibre reinforced sheets)

When tested in accordance with 6.12 the arithmetical mean of Barcol hardness after the exposure to the dry environment shall not increase by more than 10 % of its initial value.

NOTE This test is performed only to check that the cure of the resin is correct during the production.

5.17 Presence of protective coating

5.17.1 Protective coating on GRP/GRA sheets

The presence of a protective coating on GRP/GRA sheets shall be confirmed in accordance with 6.13.1. The effects of the immersion of the specimens according to the nature of the coating are given in Table 6.

Table 6 — Surface coatings

Protective coating	Effect of the immersion
Poly(vinyl fluoride) (PVF) films	No change to surface integrity, no visible glass-fibres, original degree of gloss maintained, some discoloration may occur as a result of oxidation of UV additives.
Gel coats	Slight matt finish, no exposed glass-fibre.
Poly(ethylene terephthalate) (PET) films	White residue coating.

5.17.2 Thickness of UV protection layer on PC sheets

Either the thickness of the UV-protection layer or content of the UV protective material shall be declared.

When tested in accordance with 6.13.2, the thickness of the UV protection layer shall not be less that the declared value. Any other test method may be chosen provided that it gives the same level of accuracy.

5.17.3 UV protection on PVC-U sheets

Where a UV protection layer is provided, the thickness of that layer shall be declared.

When tested in accordance with 6.13.3.2, the thickness of the UV protection layer shall not be less that the declared value.

Where UV protection is throughout the thickness of the sheet, the content of the UV protective material shall be declared.

When tested in accordance with 6.13.3.3, the content of the UV protective material shall not be less that the declared value.

5.17.4 Durability of coating

The tests given in 5.17.2 and 5.17.3 confirm the presence of surface coatings only. The durability of such coatings shall be demonstrated by testing the variations after artificial ageing of the yellowness index and total luminous transmittance (see 5.5.3 and 5.5.4).

5.18 Adhesion of surface coating (only for glass-fibre reinforced sheets)

When tested in accordance with 6.14, the adhesion of surface coating shall be considered satisfactory when the coating cannot be pried up (raised up) or peeled on a length more than 3 mm.

5.19 Resistance to fixings

The principles of fixing of the sheets shall be declared.

The method(s) of installation shall consider resistance to wind loads, snow loads and resistance to large soft body impact which may be assessed separately, e.g. in accordance with the requirements given in EN 14963, EN 1873, ETAG 010, or individual safety national requirements.

5.20 Dangerous substances

〚A1〛 National regulations on dangerous substances may require verification and declaration on release, and sometimes content, when construction products covered by this standard are placed on those markets.

In the absence of European harmonized test methods, verification and declaration on release/content should be done taking into account national provisions in the place of use.

NOTE An informative database covering European and national provisions on dangerous substances is available at the Construction website on EUROPA accessed through: http://ec.europa.eu/enterprise/construction/cpd-ds/ 〚/A1〛

6 Test methods

6.1 Dimensional tolerances

6.1.1 General

The measurements shall be carried out either at an ambient temperature of (20 ± 5) °C or, when this is not possible, a correction factor according to 5.12 shall be applied from the test temperature to 20 °C.

In case of rolls, the measurements are carried out on 10 pitches minimum or 1,5 m and the results are used to determine the width and the shape of the profile.

The sheet is held in contact with a loading bar weighing 2,45 kg/m (30 mm loading width).

All tolerances shall apply to the declared values.

6.1.2 Apparatus

6.1.2.1 **Micrometer,** capable of measuring to an accuracy of 0,01 mm, with hemispherical anvils of 5 mm in diameter.

6.1.2.2 Three supports for the test piece.

6.1.2.3 **Rigid template,** corresponding to the shape of the sheet, given by the manufacturer, extending beyond the full width of the sheet on each side, if necessary.

6.1.2.4 **Measuring tape,** capable of measuring the full length of the test piece to an accuracy of 1,0 mm.

6.1.2.5 **Rectangular frame** with vertical side and edge perpendicular to each other, accurate to 1 mm/m width.

6.1.2.6 **Short metal ruler,** capable of measuring to an accuracy of 0,5 mm.

6.1.2.7 **Metal straight edge,** 2 m long, the straightness of which is accurate to 0,5 mm.

6.1.2.8 **Loading bar** weighing 2,45 kg/m (30 mm loading width).

6.1.3 Test pieces

The test pieces shall be complete sheets, as delivered.

6.1.4 Sheet thickness

Sheet thickness shall be checked by nine measurements taken at random in the crowns, troughs and sides of corrugation across the total sheet width at a distance of 20 mm from the one end.

The first and the last measurements shall be within 25 mm of the sheet edges.

Nine values shall be recorded and their mean value calculated to the nearest 0,01 mm.

6.1.5 Mass per square metre

The reference test method is to measure the weight of a full width sample of profiled sheet, approximately 1 m length, to the nearest gram.

The ‘extended’ width of the profiled sample shall be measured by:

— applying a piece of non-stretching tape (e.g. masking tape or glass filament tape) to the top surface of the sample, perpendicular to the corrugations, ensuring it is in direct contact with the sample surface across the whole width;

— marking the position of the edges of the sample sheet on the tape;

— removing the tape and apply to a flat surface;

— measuring the distance between the two marks.

The overall width of the sample shall be measured (between the two outer edges) to the nearest millimetre.

The length of the sample shall be measured (to the nearest millimetre) along both edges, and the mean calculated.

The reference value is the mass per square metre of the material in flat form, M_f, which shall be calculated as follows:

$$M_f = \frac{M}{W_{ext} \cdot L} \tag{3}$$

where

M is the mass, in grams, of the sample;

W_{ext} is the extended width, in metres, of the sample;

L is the length, in metres, of the sample.

Where a value of the mass per linear metre of profiled sheet, M_L, is to be declared, this shall be calculated as follows:

$$M_L = \frac{M}{L} \tag{4}$$

where

M is the mass, in grams, of the sample;

L is the length, in metres, of the sample.

Where a value of the mass per square metre of profiled sheet, M_p, is to be declared, this shall be calculated as follows:

$$M_p = \frac{M}{ow \cdot L} \tag{5}$$

where

M is the mass, in grams, of the sample;

ow is the overall width, in metres, of the sample;

L is the length, in metres, of the sample.

6.1.6 Cover width of a sheet

The covered width of a sheet shall be determined as follows:

— position the upper template over the outer corrugation only, and use this to define the centre of the crown of the corrugation; mark this on the test piece;

— repeat this operation at the other side of the sheet;

— measure the distance between the centre of the crown of the outer two corrugations.

The results shall be expressed as follows: the three values obtained at the middle and at both ends, expressed in mm, to the nearest millimetre.

6.1.7 Shape of the sheet profile

The reference test method is to check the shape of the profile using a rigid template.

The shape of the sheet profile shall be determined as follows:

— ensure the test piece is held flat using the weighting bar and bring a rigid template (the same shape as the profile) into gentle contact with the test piece;

— check the gap between the test piece and the template at all points across the width of the profile by trying to insert an appropriate diameter measuring bar between the test piece and the template;

With some processes (e.g. extrusion of thermoplastics) “rounding” or distortion of the profile does not occur, and with these processes it shall be possible to confirm the profile shape is correct simply by checking the main dimensions of the corrugation (pitch, depth and width of crown and trough).

6.1.8 Sheet length

The length of a sheet shall be determined as follows:

— measure, to the nearest millimetre, the total length of the sheet along both edges;

— record these values.

The results shall be expressed as follows: the mean of the two values, expressed in millimetres, to the nearest millimetre.

6.1.9 Sheet straightness

The straightness of a sheet shall be determined as follows: Place the long straight rule along the two edges, and measure with the small ruler to the nearest 0,5 mm, the maximum distance between the rule and the edge of the sheet; record the obtained value for each side of the test piece.

The results shall be expressed as follows: the values of both lateral edges, expressed in mm, to the nearest 0,5 mm.

6.1.10 Squareness of a sheet

The squareness of a sheet shall be determined as follows:

— place the test piece onto the rectangular frame;

— push the test piece against the end of the frame, whilst keeping the side of the test piece aligned with the side of the frame;

— measure the maximum distance between the end of the test piece and the square end of the rectangular frame, to an accuracy of 0,5 mm. Record it in millimetres per metre of width;

— repeat this operation at the other end of the sheet.

The results shall be expressed as follows: the values of both ends, expressed in millimetres per metre, to the nearest 0,5 mm.

6.2 Light transmission

The total luminous transmittance of the sheet shall be determined in accordance with EN ISO 13468-1 or EN ISO 13468-2 using five test specimens.

Alternative test methods may be used as factory production control provided that correlation of results with EN ISO 13468-1 or EN ISO 13468-2 can be demonstrated.

6.3 Yellowness index

6.3.1 Apparatus

The apparatus shall consist of a spectrocolorimeter and an integrating sphere (hemispherical illumination and viewing the transmitting portion at an angle perpendicular to the test specimen surface or illumination perpendicular to the specimen surface and viewing the transmitted portion with an integrating sphere).

6.3.2 Test specimens

The same test specimens as used for the change in the light transmission shall be used.

6.3.3 Procedure

The spectrocolorimeter and other instruments shall be calibrated and operated according to instructions supplied by their manufacturers.

The spectral transmittance data of illuminant D65 relative to air in the wave length range of 380 nm to 780 nm shall be obtained.

6.3.4 Expression of results

The change of yellowness index after ageing shall be calculated as follows:

Calculate the tristimulus values, *X*, *Y* and *Z*, for CIE standard illuminant D65 as given by EN ISO 11664-2 and CIE standard observer 2 as given by EN ISO 11664-1 by numerical integration from recorded spectral data or by automatic integration during spectrocolorimeter operation.

Calculate the magnitude and sign of the yellowness index, in absolute value (or unit) from the following formula:

$$YI = \frac{100\,(1,2985\,X - 1,1335Z)}{Y} \tag{6}$$

where

X, *Y* and *Z* are the tristimulus values for CIE illuminant D65.

Calculate the magnitude and direction of change of the yellowness index after ageing, in absolute value (or unit), from the following formula:

$$\Delta YI = YI - YI_0 \tag{7}$$

where

YI is the yellowness index, in absolute value (or unit), of the test specimen exposed to ageing;

YI_0 is the yellowness index, in absolute value (or unit), of the test specimen unexposed to ageing.

6.4 Flexural/tensile strength

Measure the flexural strength and the corresponding flexural modulus of the material of the sheets according to either EN ISO 178 for thermoplastics sheets or EN ISO 14125 for fibre-reinforced sheets, for unexposed test specimens (used for 5.4 and 5.5.5) and specimens exposed to level A_0 (to A_3) or B_0 (to B_3), as applicable (see 5.5).

If the bending test cannot be performed, measure the tensile strength and the corresponding Young's modulus of the material of the sheets according to either EN ISO 527-1 and EN ISO 527-2 for thermoplastics sheets or EN ISO 527-1 and EN ISO 527-4 for fibre-reinforced sheets, for unexposed test specimens (used for 5.4 and 5.5.5) and test specimens exposed to level A_0 (to A_3) or B_0 (to B_3), as applicable (see 5.5).

Four test specimens shall be used for the evaluation, two unexposed and two aged.

The procedure shall be conducted at a room temperature of (23 ± 4) °C before and after ageing. The test specimens for these tests shall not be thicker than the manufacturer's normal production.

6.5 Thermal ageing resistance

6.5.1 Principle

Test specimens cut from the sheet shall be placed in a dry air oven at a specified temperature (60 °C) for a specified time period (3 000 h). The variations of the total luminous transmittance and the yellowness index shall be calculated as a percentage in relation to the initial values, respectively.

6.5.2 Apparatus

6.5.2.1 Air oven, thermostatically controlled, capable of maintaining a temperature of (60 ± 2) °C.

6.5.2.2 Apparatus capable of determining the total luminous transmittance, according to EN ISO 13468-1 or EN ISO 13468-2.

6.5.2.3 Apparatus for the determination of the yellowness index, according to 6.3.1.

6.5.3 Test specimens

Ten test specimens shall be cut from the profiled sheet so as to yield approximately flat specimens of sufficient dimensions to enable the appropriate measurements to be carried out.

Five test specimens shall be retained as the reference specimens and shall be stored in a dark place at (23 ± 2) °C.

The test specimens, exposed to heat, shall be supplied with a hole at one end to allow vertical suspension in the air oven.

6.5.4 Procedure and calculation

The resistance to thermal ageing shall be determined as follows:

— suspend the test specimens in the air oven so that they neither touch each other nor the walls of the air oven;

— maintain the air oven temperature at (60 ± 2) °C for 3 000 h;

— remove the test specimens from the air oven and allow to cool, when the specified time period has been completed;

NOTE Cooling of the test specimens may be carried out between polished stainless steel plates, under a load of approximately 100 N, in order to preserve flatness.

When test specimens need to be stored, e.g. if the light transmission measuring apparatus is not available, the storage should be carried out by fulfilling the same conditions that for the reference test specimens (see 6.5.3).

— carry out the measurements of the total luminous transmittance according to 6.2 and the yellowness index according to 6.3 on all the test pieces.

Calculate the variations of the total luminous transmittance and the yellowness index as a percentage in relation to the initial values, respectively.

6.6 Longitudinal reversion and profile retention

6.6.1 Principle

Test specimens of a given length and width shall be placed in an air oven at a specified temperature (60 °C) for a specified time period (60 min). Two marked lengths, one parallel to the corrugations, the other at right angle of the corrugations, shall be measured under identical conditions before and after heating. The longitudinal reversion shall be calculated as a percentage of the change in length, parallel to the corrugations to the initial length. The profile retention shall be calculated as a percentage of the change in the pitch, at right angle to the corrugations.

6.6.2 Apparatus

6.6.2.1 **Air oven,** thermostatically controlled, capable of maintaining a temperature of (60 ± 2) °C.

6.6.2.2 Suitable means of measuring test specimen dimensions to an accuracy of 0,25 mm.

6.6.2.3 **Suitable means of applying a minimum load to the test specimens, as necessary,** to ensure that the horizontal undersides of the trough are in contact with the flat surface immediately prior to making measurements.

6.6.3 Test specimens

Five rectangular test specimens shall be not less than 250 mm in length. The width of test specimens shall be such that one of the following conditions is fulfilled (see Figure 1):

a) for pitches greater or equal to 200 mm: one pitch plus adjacent troughs on both sides;

b) for pitches less than 200 mm: the minimum number of pitches which gives a distance greater or equal to 200 mm between outer crowns with adjacent troughs on both sides;

c) complete width of the sheet if neither a) or b) can be met.

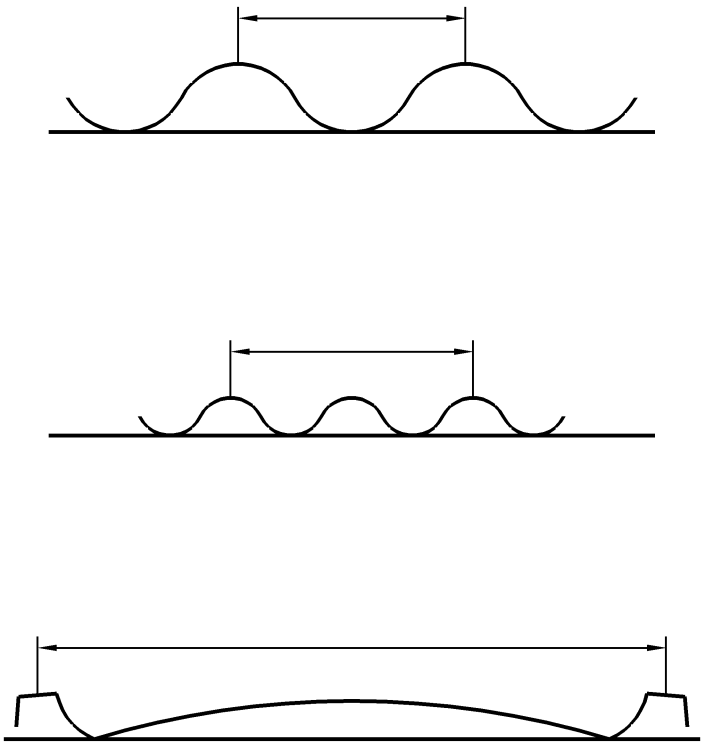


Figure 1 — Test specimens for determination of the profile retention

6.6.4 Procedure

Carry out the test in a room maintained at a temperature of (23 ± 2) °C.

Carry out two pairs of reference marks on each test specimen as follows:

a) For the longitudinal reversion, the line joining the two marks shall be parallel to the axis of the corrugations and the distance between the marks shall be not less than 200 mm.

b) For the profile retention, the marks shall be on the crown of two corrugations. The line joining the two marks shall be at right angles to the direction of the corrugations and the distance between the marks shall be not less than 200 mm.

If the horizontal undersides of the troughs are not in contact with the flat surface, apply load(s) to the sheet just sufficient to obtain contact between the horizontal undersides of the troughs and the flat surface before conducting any measurements.

Measure the distances between the two marks of each set of reference marks.

Place the test specimens in the air oven that is at (60 ± 2) °C in such a way that they are under no stress.

After a time period of 60 min, beginning after the re-establishment of the temperature (60 ± 2) °C, remove the test specimens and allow cooling on a flat surface for 10 min.

If the horizontal undersides of the troughs are not in contact with the flat surface, apply load(s) to the sheet just sufficient to obtain contact between the horizontal undersides of the troughs and the flat surface before conducting repeat measurements.

Repeat the measurement of the distances between the marks on each test specimen and calculate the individual and mean variations in length and in the pitch of the corrugations.

6.7 Small hard body impact resistance

6.7.1 Principle

Conditioned test pieces shall be subjected to an impact from a 250 g mass solid steel ball falling freely from 1 m high on five successive test pieces.

6.7.2 Apparatus

The apparatus shall be as defined in Figure 2.

6.7.3 Conditioning apparatus and test pieces

The test specimens and the apparatus shall be conditioned by keeping them at an ambient temperature of (23 ± 4) °C for a minimum of 24 h.

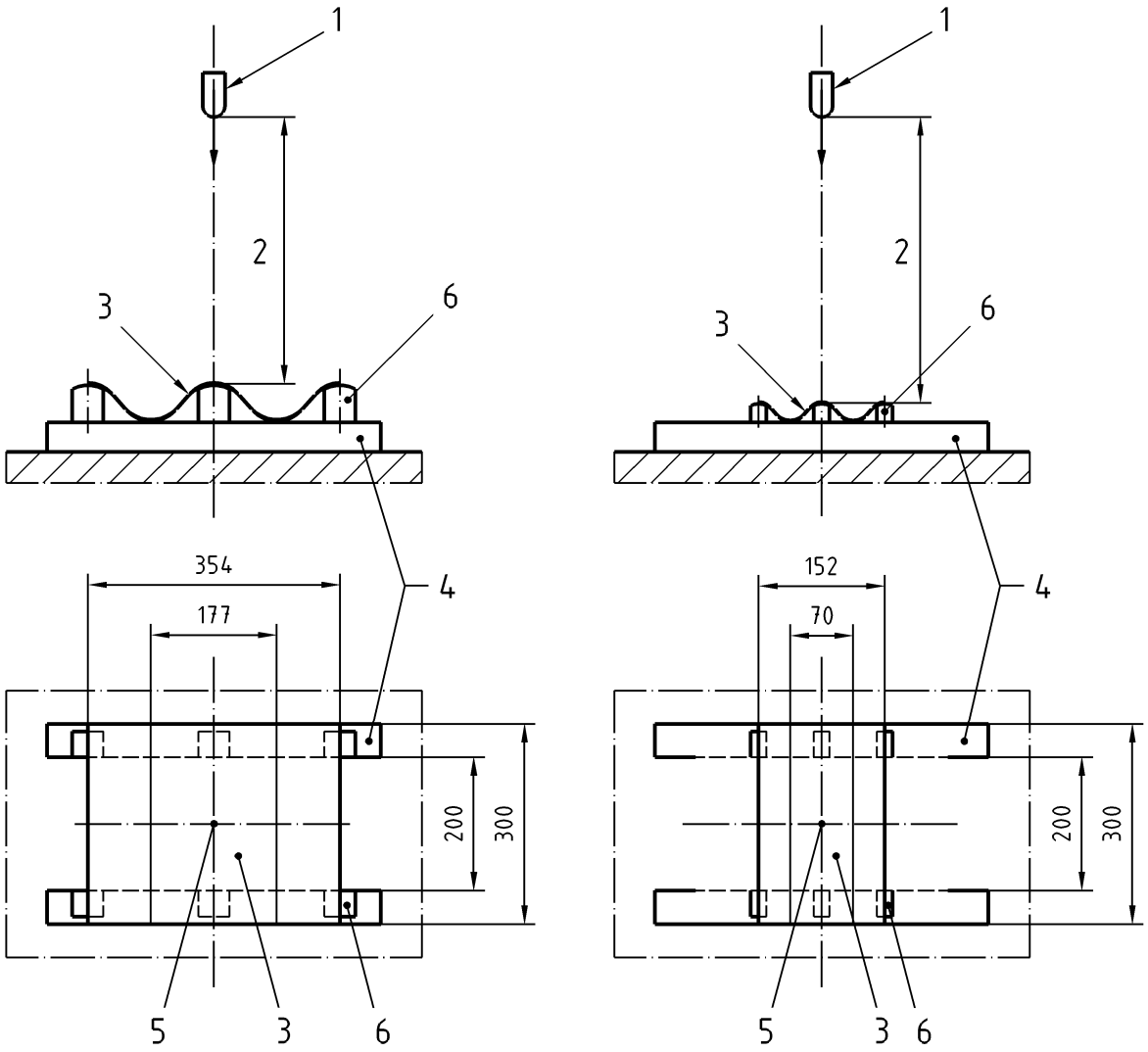
6.7.4 Test specimens

The test specimens shall be in the form of sinusoidal corrugated sheets of one of the following types:

— a 354 mm x 300 mm sheet with a 177 mm pitch of corrugation and 51 mm depth, as shown in Figure 3 for testing with the apparatus defined as in Figure 2a), or

— a 152 mm x 300 mm sheet with a 76 mm pitch of corrugation and 18 mm depth, as shown in Figure 3 for testing with the apparatus defined as in Figure 2b).

Dimensions in millimetres

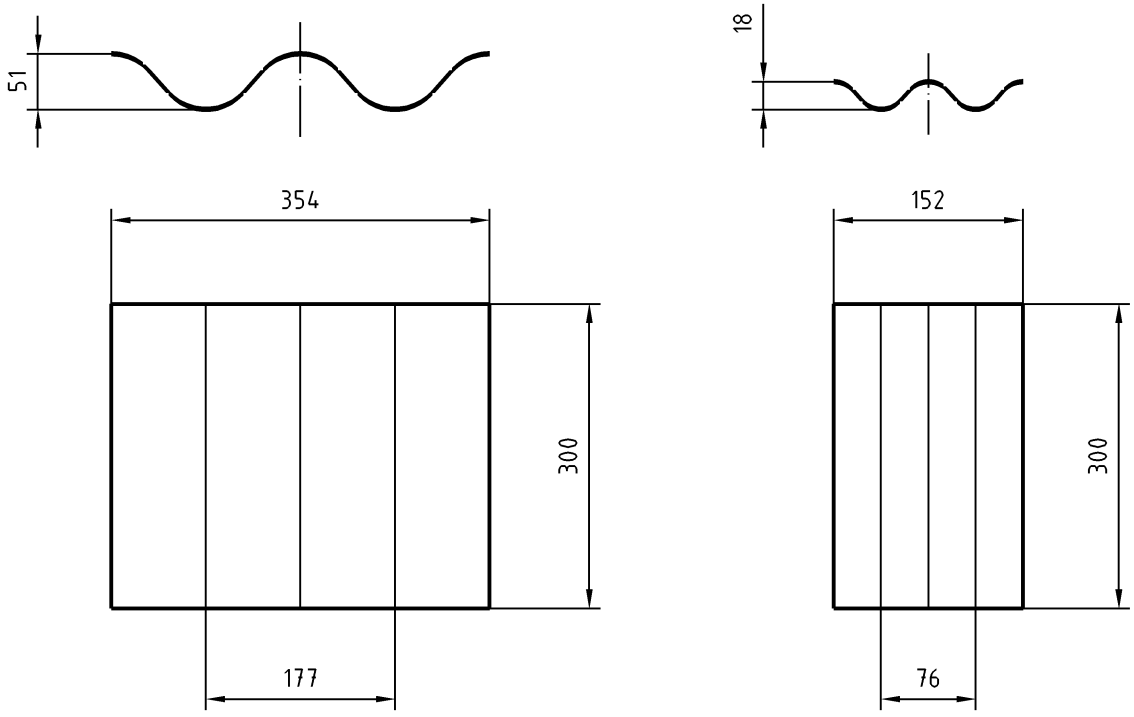


Key

1 projectile
2 fall height = 1 m
3 test specimen
4 support
5 drop point
6 distance piece

Figure 2 — Apparatus for the determination of small hard impact resistance

Dimensions in millimetres



a) b)

Figure 3 — Test specimens for small hard impact resistance tests

6.7.5 Test procedure

Place the test specimen in the corresponding apparatus as shown in Figure 2. Then carry out the test according to EN ISO 6603-1.

6.7.6 Test results

Failure is the development of a through crack, hole and/or the exposure of the glass fibres.

Bruising is not regarded as failure.

6.8 Resistance to deflection

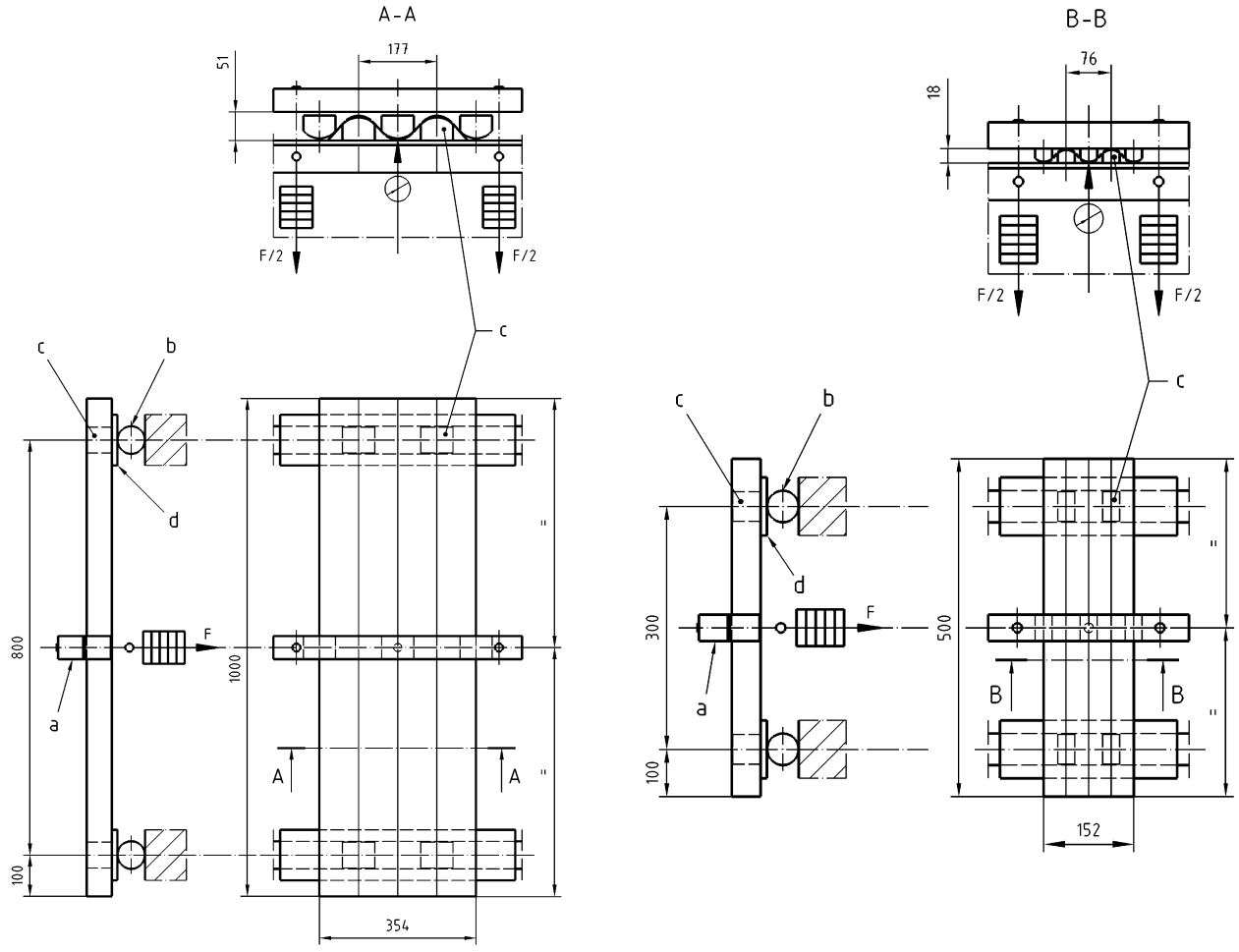
6.8.1 Principle

The resistance to deflection (mechanical resistance) shall be evaluated by determining the deflection of an unfixed sheet, with a sinusoidal corrugated profile [177 mm (51 mm or 76 mm) 18 mm] with a span of 800 mm or 300 mm, respectively. The failure load shall be determined (where failure is defined by either a breakage or a deflection such that the sheet falls between the supports). Then, the test shall be repeated with a load equal to 30 % of this failure load, and the deflection after 6 min shall be used to calculate $(EI)_{test}$ according to [A1] 6.8.4 [A1], which shall be declared.

6.8.2 Apparatus

Apparatus shall be as defined in Figure 4.

Dimensions in millimetres



a) b)

Key

a aluminium structural hollow sections

b steel tubes

c distance pieces

d aluminium strips

F load

Figure 4 — Apparatus for the determination of resistance to deflection

6.8.3 Test specimens

The test specimens shall be in the form of sinusoidal corrugated sheets of one of the following types:

— a 354 mm x 1 000 mm sheet with a 177 mm pitch of corrugation and 51 mm depth, as shown in Figure 5 for testing with the apparatus defined as in Figure 4a), or

— a 152 mm x 500 mm sheet with a 76 mm pitch of corrugation and 18 mm depth, as shown in Figure 5 for testing with the apparatus defined as in Figure 4b).

Dimensions in millimetres

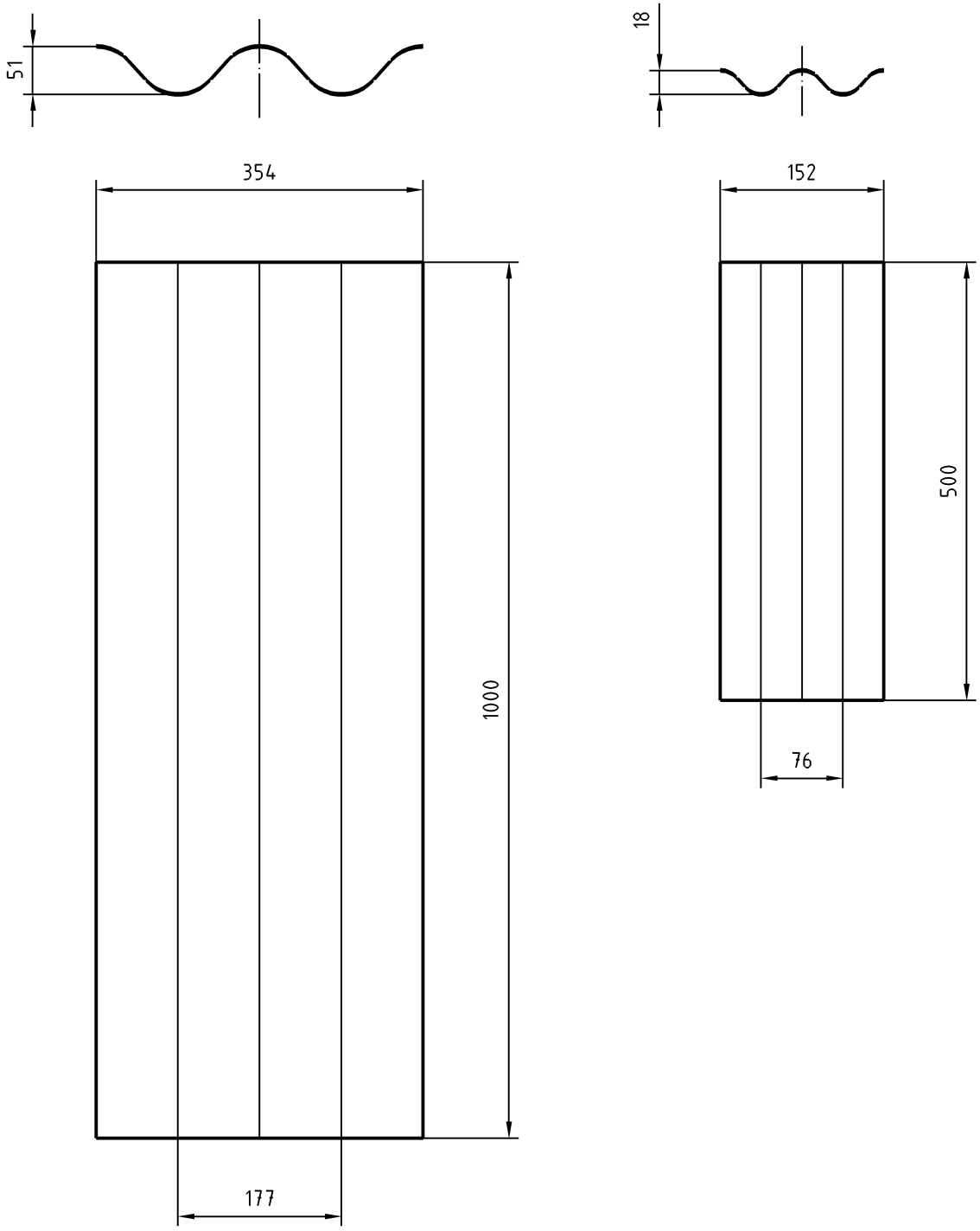


Figure 5 — Test specimens for deflection resistance tests

6.8.4 Procedure

Position the test piece on the test rig. Apply the test load gently across the centre of the sheet, leave the load for a time of 6 min, then measure the deflection.

Calculate the bending stiffness $(EI)_{Test}$ of the sheet using the following formula:

$$(EI)_{Test} = \frac{W \cdot L^3}{48d} \quad (8)$$

where

$(EI)_{Test}$ is the bending stiffness, in newtons square metres (Nm2),

W is the test load, in newtons,

L is the span, in metres,

D is the deflection, in metres.

6.9 Reaction to fire

6.9.1 Principle

The product shall be tested in accordance with EN ISO 11925-2 and EN 13823, and classified in accordance with EN 13501-1.

6.9.2 Test specimens

Specimens in flat sheet form of the following sizes shall be tested according to EN 13823:

— short wing: (495 ± 5) mm x (1 500 ± 5) mm;

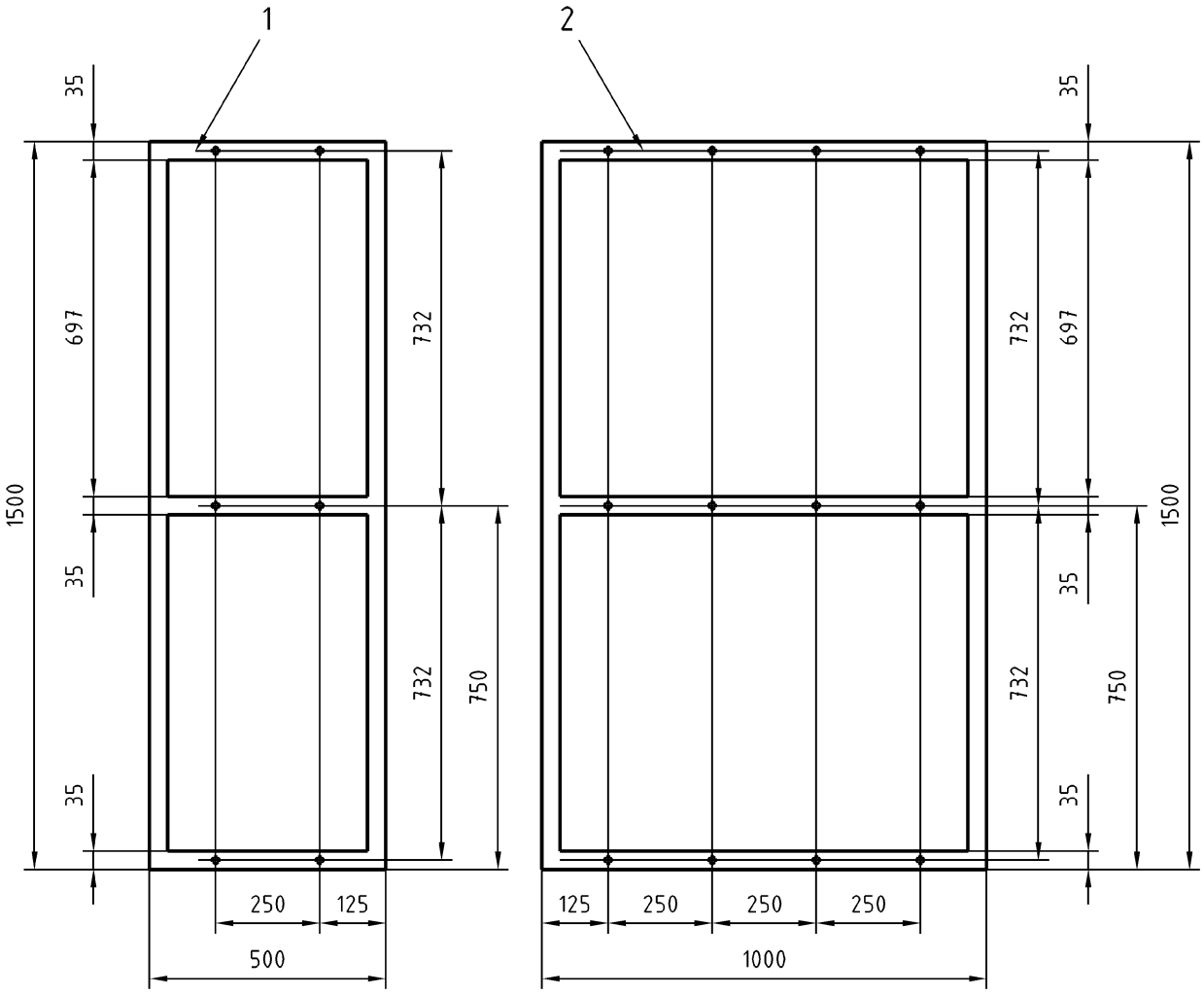
— long wing: (1 000 ± 5) mm x (1 500 ± 5) mm.

6.9.3 Mounting of test specimens according to EN 13823

A specimen of each size shall be mounted in a right-angled test frame made from 35 mm x 5 mm steel strip as shown in Figure 6. In addition, the test frame shall have horizontal intermediate bars, 35 mm x 5 mm, at 750 mm centres. The specimen sheets (see Figure 7) shall be fixed to top, bottom and intermediate horizontal bars with nuts and bolts or screws (typically 6 mm diameter) fitted with washers (minimum 29 mm diameter) at 250 mm centres.

The test assembly shall be positioned immediately behind the drip trays of the test unit. A spacer frame and a 12 mm thick calcium silicate backing board shall be positioned behind each wing of the test assembly to give an air gap of 200 mm between the rear surface of the specimen and the backing board. The lower half of the two side panels farthest away from the corner shall be removed in accordance with EN 13823:2010, 5.2.2a and 4.4.11.

Dimensions in millimetres



a) b)

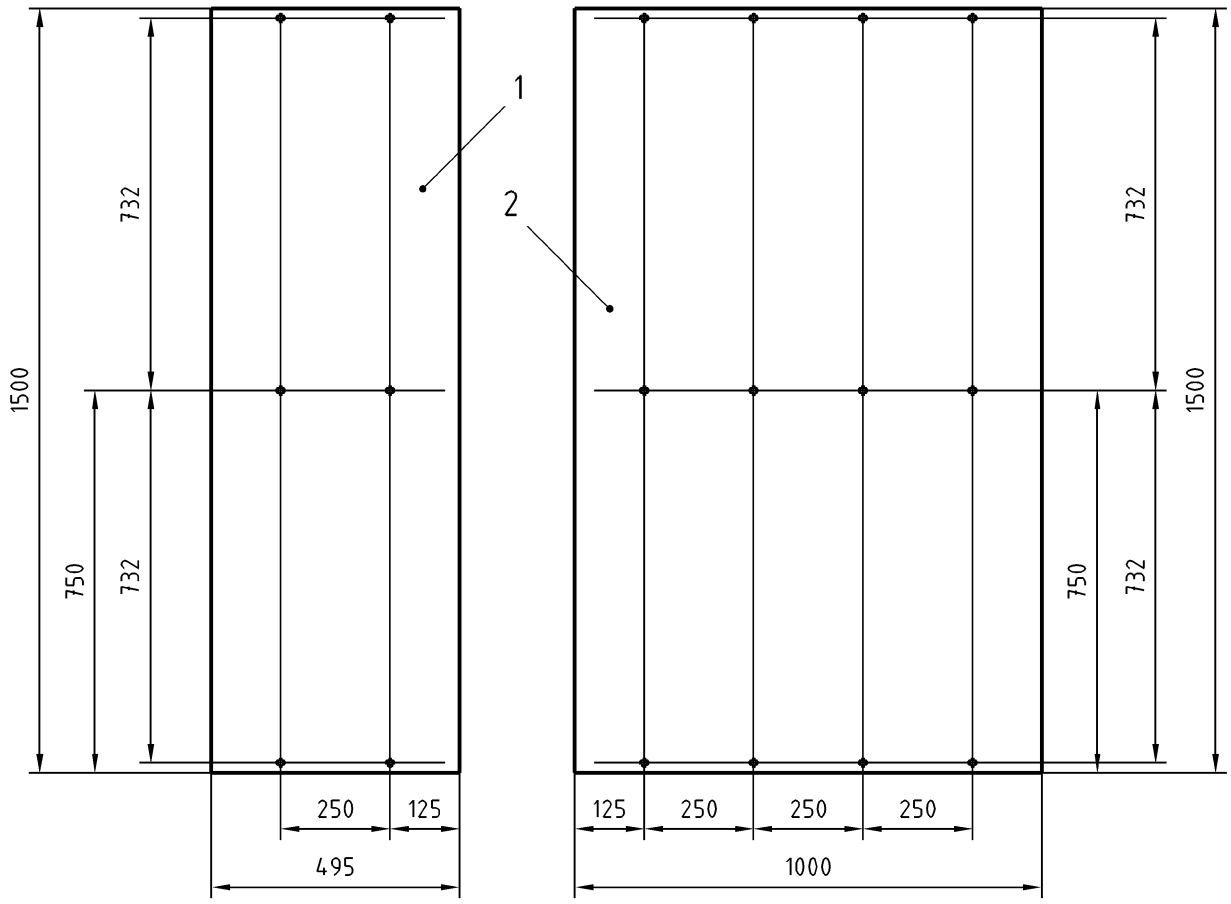
Key

1 steel-based frame for short wing

2 steel-based frame for long wing

Figure 6 — Steel-based frame for fixing of specimens in the SBI apparatus

Dimensions in millimetres



a) b)

Key

1 sheet specimen for short wing

2 sheet specimen for long wing

Figure 7 — Details of sheet specimen sizes and positions of fixing points

6.10 External fire performance

6.10.1 Principle

The products shall be tested in accordance with CEN/TS 1187 and classified in accordance with EN 13501-5.

6.10.2 Test specimens

For CEN/TS 1187:2012, Tests 1 and 3, the specimens shall be profiled sheets; the specimen shall have a cover width of 1 m, depth 30 mm to 35 mm and pitch 200 mm to 250 mm.

For CEN/TS 1187, Test 2, the specimen shall be flat sheet.

The weather (i.e. upper) side of the product shall be the exposed surface of the test specimen.

6.10.3 Mounting of test pieces

The specimens shall be fixed with nuts and bolts or screws (typically 6 mm diameter) fitted with washers (minimum 29 mm diameter) at 200 mm centres.

6.11 Glass-fibre content

The glass-fibre content of the sheet shall be determined according to EN ISO 1172:1998, Method A (when no mineral fillers are present) or Method B (when mineral fillers are present), as applicable, using 50 mm x 40 mm test specimens.

When the density of the resin can be easily established, the glass-fibre content may be determined by using the method of the laminate density given in Annex B as part of factory production control.

6.12 Barcol hardness

6.12.1 Principle

The Barcol hardness shall be determined in accordance with EN 59 by using two 150 mm x 150 mm test specimens.

6.12.2 Procedure

Measure the Barcol hardness according to EN 59 at six measuring points on each specimen and calculate the mean value of the twelve measured values.

Expose the test specimens to a dry environment at a temperature of (80 ± 2) °C during (16 ± 1) h.

Allow specimens to cool at the room temperature.

Measure again the Barcol hardness according to EN 59 at six measuring points close to each of the six first measuring points on each specimen and calculate the arithmetical mean of the twelve measured values.

For routine factory production control testing, the duration of exposure to dry environment may be reduced provided the temperature of exposure is increased up to a maximum of 100 °C and the correlation with the results obtain by the referenced test method is demonstrated.

6.12.3 Expression of results

Calculate the change of the arithmetical mean of Barcol hardness after the exposure to dry environment as a percentage of the mean value before the exposure.

6.13 Presence of protective coating

6.13.1 GRP/GRA sheets

6.13.1.1 Reagent

A solution of 98 % concentrated sulphuric acid shall be prepared.

The solution shall not be exposed to the air for more than 20 min and a fresh solution shall be used for each test specimen.

WARNING — Sulphuric acid is highly corrosive and it has to be handled with extreme care.

6.13.1.2 Test specimens

Three test specimens, each approximately 25 mm wide and 100 mm long shall be cut from across the sheet width with a fine tooth saw.

6.13.1.3 Procedure

Immerse the test specimen into a solution of 98 % concentrated sulphuric acid, maintained at a temperature of (20 ± 2) °C, to a minimum depth of 50 mm.

After the duration as specified in Table 7, remove the test specimen from the solution and wash it with running water.

Record the effects of the immersion on the test specimen.

Table 7 — Immersion duration

Protective coating	Immersion duration min
Poly(vinyl fluoride) (PVF) films	30
Gel coats	7,5
Poly(ethylene terephthalate) films	1

6.13.2 Thickness of UV protection layer on PC sheets

6.13.2.1 Principle

Thin sheet sections cut by a microtome are immersed in a fluorescing dyestuff solution, which is absorbed by the UV protection layer, to highlight the thickness of the layer when illuminated by a suitable UV light source, and enable measurement of that layer thickness using a microscope.

6.13.2.2 Test specimens

Five test specimens, approximately 6 mm x 12 mm, shall be cut from a full width sample of a profiled sheet, at equidistant spacing.

6.13.2.3 Procedure

Mount each test specimen, longitudinal (extrusion) direction vertical, in a microtome sample holder.

With the microtome cutter, remove slices from the section end until consistent test pieces of thickness 25 microns are obtained.

Take a representative cut slice and place on a film of UV-fluorescing dye solution on a glass microscope slide, and cover with a second slide to secure.

6.13.2.4 Measurement of the layer thickness

Place the prepared slide on the microscope table, illuminate with the appropriate UV light source, and adjust focus and position to locate the edges of the fluorescing UV-protection layer.

The distance between these locations is the thickness of the UV-protection layer; it shall be expressed in microns, to an accuracy of ± 5 microns.

6.13.3 UV protection layer on PVC-U sheets

6.13.3.1 General

The measurement of PVC-U sheets ultra-violet (UV) protection shall be carried out either by the measurement of the thickness of the UV protection layer (microtomic cut method) where it is physically possible or otherwise by the determination of the content of UV protective material (dilution method).

NOTE These methods make it possible to measure or calculate the thicknesses of the protective layers, but they do not make it possible to measure the quality of the UV protection.

6.13.3.2 Visualisation of the thickness of UV protection layer

6.13.3.2.1 Principle

The co-extruded layer becomes visible to the naked eye by virtue of the enlightening the sample with a UV lamp and so can be measured microscopically.

This test method shall be used for the direct measurement of the UV protective layer thickness of a sample of sheet.

6.13.3.2.2 Test specimens

Seven test specimens shall be cut from a full width sample of a profiled sheet.

6.13.3.2.3 Procedure

Mount each test specimen in the microtome sample holder so that it is vertical and that the slice cut by the microtome is across the sheet.

Take preliminary slices, either by hand or on slow speed, to ensure that the cut is vertical and to establish the cutting window.

Move a fresh knife edge into position and cut automatically the test pieces, each slice being drawn off the knife with tweezers or a brush until a satisfactory section is obtained. This section is laid on a slide before being covered with a cover glass.

6.13.3.2.4 Measurement

Measurement shall be carried out using the graticule in the microscope. A test piece on a slide shall be moved, using the slide carrier movement controls, so that the edge of the layer to be measured shall be on the zero of the built-in graticule which is turned to be at right angles to the layer. The thickness shall then be read off on the graticule and the reading converted to microns according to the magnification factor of the lens in use.

The traditional microscope can be replaced by an electronic microscope. After calibration, the reading thickness of the layer of protection anti UV shall be read directly on the screen by displacement of cursors.

6.13.3.3 Determination of anti UV content (dilution method)

6.13.3.3.1 Principle

The quantity of UV protective material shall be determined by UV spectrophotometry of the absorbance of the solution of a test piece in a pure solvent.

This test method shall be used for the indirect measurement of the quantity of UV protective material located either inside the PVC-U material of a sheet or the material of the co-extruded layer of a sheet.

6.13.3.3.2 Test pieces

Seven test specimens shall be cut from a full width sample of a profiled sheet.

Determined and record the dimensions of each test piece.

6.13.3.3.3 Procedure

Dissolve under agitation each test specimen in a known and constant volume of pure solvent.

6.13.3.3.4 Measurement

6.13.3.3.4.1 PVC-U sheet treated in the mass

Measure by UV spectrophotometry the absorbance of each solution.

Calculate the concentration of anti UV material according to the weight of the test specimen and measure the value of UV absorbance.

6.13.3.3.4.2 PVC-U sheet with one anti UV co-extruded side

Measure by UV spectrophotometry the absorbance of the solution of the co-extruded test specimen.

Determine by calculation the thickness of the protective layer, in so far as the concentration in the co-extruded section material is known.

If the raw material of the sheet contains crushed resulting ones from a co-extruded manufacture it shall be necessary to deduce from the calculation of the thickness of the protective layer the theoretical thickness corresponding to the recycled material. The measurement of the absorbance corresponding to the recycled material shall be carried out on a sample whose layer of protection was removed before dilution in solvent.

6.13.3.3.4.3 PVC-U sheet with two anti UV co-extruded sides

The elimination of the protective layer on one side makes it possible to measure and calculate the layer of protection on the other side; the method of measurement for a PVC-U sheet with one co-extruded layer side applies.

6.14 Adhesion of surface coating

6.14.1 Test specimens

Three test specimens in flat sheet form, 25 mm wide and 50 mm long, shall be used.

6.14.2 Procedure

Carry out two parallel cuts in the surface coating of the sheet with a scalpel, 2 mm apart and 15 mm long.

Pry up (raise up) the surface coating with the scalpel point.

6.14.3 Expression of results

If the coating strip cannot be pried up, the adhesion shall be considered as satisfactory.

If the coating can be lifted, insert the scalpel point below it and twist attempting to pry the coating from the sheet using the blunt edge of the scalpel.

If the film breaks but does not peel on a length by more than 3 mm the adhesion shall be considered satisfactory.

A1

7 Assessment and verification of constancy of performance – AVCP

7.1 General

The compliance of light transmitting single skin profiled plastics sheets with the requirements of this document and with the stated values (including classes) shall be demonstrated by:

— product type determination,

— factory production control by the manufacturer, including product assessment.

For the purposes of testing, the manufacturer's products may be grouped into families, where it is considered that the results for one or more characteristics from any one product within the family are representative for that same characteristics for all products within that same family (a product may be in different families for different characteristics).

7.2 Product type determination

Product type determination (PTD) shall be performed to show conformity with this document. Tests previously performed in accordance with the provisions of this document (same product, same characteristic(s), test method, sampling procedure, system of attestation of conformity, etc.) may be taken into account.

The characteristics subjected to PTD are listed in Table 8.

Whenever a change occurs in the product design, the raw material or supplier of the components, or the production process (subject to the definition of a family), which would change significantly one or more of the characteristics, the type tests shall be repeated for the appropriate characteristic(s).

All products tested shall be representative of the manufacturer's normal production.

Where raw materials are used whose characteristics have already been determined, by the raw material manufacturer, on the basis of conformity with this or other product standards, these characteristics need not be reassessed provided that the raw materials' performance or method of assessment remain the same, that the characteristics of the raw material are suitable for the intended end use of the finished product, and insofar as the manufacturing process does not have a detrimental effect on the determined characteristics.

Table 8 — Product type determination of single skin profiled plastics sheets

Characteristic	Requirement clause	Assessment method
Visual appearance	5.1	–
Dimensional tolerances and mass per square metre [a]	5.2	6.1
Light transmission	5.3	6.2
Flexural/tensile strength [a]	5.4	6.4
Durability:		
variation of yellowness index after ageing [a]	5.5.3	6.3
variation of light transmission after ageing [a]	5.5.4	6.2
variation of flexural/tensile strength after ageing [a]	5.5.5	6.4
Thermal ageing resistance	5.6	6.5
Longitudinal reversion and profile retention	5.7	6.6
Small hard body impact resistance [a]	5.8.1	6.7
Large soft body impact resistance [a]	5.8.2	See 5.8.2
Resistance to deflection [a]	5.9	6.8
Water vapour permeability [a]	5.10	EN ISO 12572
Water/air permeability [a]	5.11	–
Linear thermal expansion [a]	5.12	EN ISO 11359-2
Reaction to fire [a]	5.13	6.9
External fire performance [a]	5.14	6.10
Glass-fibre content [b]	5.15	6.11
Presence of protective coating [b]	5.17	6.13
Adhesion for surface coating [b]	5.18	6.14
Resistance to fixings [c]	5.19	See 5.19

a Only where required.

b If relevant.

c Appropriate method(s) of fixing to be declared at PTD according to the design of assembly.

When a sheet requires a new PTD as a result of an enforced raw material change by the supplier, and that change affects the raw material composition or grade, the sheet manufacturer may, at his own risk, benefit from a presumption of conformity to the existing PTD for defined characteristic(s). These shall be durability, variation of yellowness index and light transmission, because these are the subject of long term testing procedures. The presumption of conformity shall be subject to the following:

a) the raw material supplier's written confirmation that the new composition or grade is no less durable than the previous grade or composition (only if this information is available);

   or

   if the new material is considered less durable, the manufacturer shall estimate the new durability based upon relevant information from the material supplier (only if this information is available);

b) the new PTD is commenced at the earliest practical time;

c) if the new PTD indicates a reduced performance than that declared by the manufacturer, the manufacturer shall have suitable traceability procedures and advise the purchaser accordingly;

d) the presumption of conformity shall cease when the period of time has elapsed that would permit the test to provide comparable results with the PTD.

7.3 Factory production control (FPC)

7.3.1 General

The manufacturer shall establish, document and maintain an FPC system to ensure that the products placed on the market conform with the stated performance characteristics. The FPC system shall consist of procedures, regular inspections and tests and/or assessments and the use of the results to control raw and other incoming materials or components, equipment, the production process and the product.

All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures. This production control system documentation shall ensure a common understanding of conformity evaluation and enable the achievement of the required component characteristics and the effective operation of the production control system to be checked.

Factory production control therefore brings together operational techniques and all measures allowing maintenance and control of the conformity of the component with its technical specifications. Its implementation may be achieved by controls and tests on measuring equipment, raw materials and constituents, processes, machines and manufacturing equipment and finished components, including material properties in components, and by making use of the results thus obtained.

7.3.2 General requirements

Manufacturers having an FPC system, which complies with EN ISO 9001 [13] and which addresses the requirements of this European Standard are recognized as satisfying the FPC requirements.

7.3.3 FPC requirements for all manufacturers

7.3.3.1 Product specific requirements

The FPC system shall:

— address this document; and

— ensure that the products placed on the market conform to the stated performance characteristics.

The results of inspections, tests or assessments requiring action shall be recorded, as shall any action taken. The action to be taken when control values or criteria are not met shall be recorded and retained for the period specified in the manufacturer’s FPC procedures.

7.3.3.2 Raw materials and components

The specifications of all incoming raw materials and components shall be documented, and the inspection scheme for ensuring their conformity shall be in accordance with Table 9.

Table 9 — Inspection scheme for raw materials and components

Material/component	Control	Method	Frequency
Raw material and component	Conformity of supplier's declaration with manufacturer's requirement [a]	Document examination	Each delivery
[a] This also applies where the manufacturer of the sheets is also the producer of the raw materials.			

7.3.3.3 Product testing and evaluation

The manufacturer shall establish procedures to ensure that the stated values of all of the characteristics are maintained. The characteristics, and the means of control, shall be as given in Table 10.

Table 10 — Characteristics and minimum sampling frequencies for FPC testing

Characteristic [a]	Requirement clause	Factory production control [b]	Minimum frequency of testing [c]	Compliance criteria
Visual appearance	5.1	Visual inspection	Continuous	As defined in 5.1
Water/air permeability	5.10	Visual inspection	Continuous	No holes
Dimensional tolerances and mass per square metre	5.2	Measurement according to 6.1	Once per 2 h	Within the tolerances as defined in Table 1
Light transmission	5.3	Measurement according to 6.2	Once per day	Within the tolerances as defined in 5.3
Durability (after ageing):		Raw material and process control	See Table 9 for raw material and continuous process control	Within manufacturer's specification
– variation of yellowness index	5.5.3			
– variation of light transmission	5.5.4			
– variation of flexural/tensile strength	5.5.5			
Flexural/tensile strength	5.4			
Thermal ageing resistance d	5.6			
Longitudinal reversion and profile retention [d]	5.7			
Small hard body impact resistance	5.8.1			
Large soft body impact resistance	5.8.2			
Resistance to deflection	5.9			
Water vapour permeability	5.10	+ see Footnote [e]		
Linear thermal expansion	5.12	+ see Footnote [f]		
Reaction to fire	5.13			
External fire performance	5.14			
Glass-fibre content [g]	5.15			

Presence of protective coating [h]	5.17	+ see Footnote [i]		
Adhesion for surface coating [g]	5.18			
Barcol hardness [g]	5.16	Measurement according to 6.12	Once per 2 h	Within the tolerances defined in 5.16
Resistance to fixing	5.19	–	+ see Footnote [j]	

[a] FPC is performed only if the characteristic is being declared.

[b] Indirect methods of measurement (e.g. process control) are allowed provided that they give the same degree of confidence as if the specified minimum sampling frequency had been followed.

[c] Hourly frequencies relate to production time.

[d] Only applicable for thermoplastic sheets.

[e] No control necessary if using reference values from Table 4.

[f] No control necessary if using reference values from Table 5.

[g] Only applicable for glass-fibre reinforced sheets.

[h] Not necessary for any uncoated product.

[i] Raw material control is required only where raw material is purchased with protective coating already applied.

[j] When the design of the installed assembly/kit is changed.

7.4 Initial inspection of factory and of FPC

Initial inspection of FPC shall be carried out when the production process has been finalized and in operation. The factory and FPC documentation shall be assessed to verify that the requirements of 7.3.2 and 7.3.3 are fulfilled.

During the inspection it shall be verified:

a) that all resources necessary for the achievement of the product characteristics required by this European Standard are in place and correctly implemented, and

b) that the FPC-procedures in accordance with the FPC documentation are followed in practice, and

c) that the product complies with the initial type testing/type testing samples, for which compliance with this European Standard has been verified.

All locations where final assembly or at least final testing of the relevant product is performed, shall be assessed to verify that the above conditions a) to c) are in place and implemented. If the FPC system covers more than one product, production line or production process, and it is verified that the general requirements are fulfilled when assessing one product, production line or production process, then the assessment of the general requirements does not need to be repeated when assessing the FPC for another product, production line or production process.

All assessments and their results shall be documented in the initial inspection report.

7.5 Continuous surveillance of FPC

Surveillance of the FPC shall be undertaken. The surveillance of the FPC shall include a review of the FPC test plan(s) and production processes(s) for each product to determine if any changes have been made since the last assessment or surveillance. The significance of any changes shall be assessed.

Checks shall be made to ensure that the test plans are still correctly implemented and that the production equipment is still correctly maintained and calibrated.

The records of tests and measurement made during the production process and to finished products shall be reviewed to ensure that the values obtained still correspond with those values for the samples submitted to type testing and that the correct actions have been taken for non-compliant devices. 〈A1〉

8 Marking and labelling

Sheets complying with this European Standard shall be durably marked with the name or trade mark of the manufacturer, and a means of traceability to documentation showing the classes according to this European standard.

When the sheets are protected by a coating/treatment on one side only, this side shall be identified.

The following information shall be clearly indicated on the delivery note, invoice or supplier' declaration, supplied with the delivery of light transmitting single skin profiled plastics sheets:

a) name, trade mark or other means of identification of the manufacturer,

b) reference to EN 1013,

c) identification of the profile, colour of the sheets,

d) type of material,

e) identification symbol of any third party, if relevant,

f) nominal sheet thickness (see 〈A1〉 5.2 〈A1〉),

g) nominal mass per square metre of material in flat form (see 〈A1〉 5.2 〈A1〉),

h) total luminous transmittance (see 5.3),

i) flexural/tensile strength (see 5.4), if relevant,

j) class for the artificial ageing performance (see 5.5.2), if relevant,

k) variation of the yellowness index after thermal ageing (see 5.5.3), if relevant,

l) variation of the total luminous transmittance after artificial ageing (see 5.5.4), if relevant,

m) variation of the flexural/tensile strength after artificial ageing (see 5.5.5), if relevant,

n) variation of the total luminous transmittance after thermal ageing (see 5.5), if relevant,

o) variations of total luminous transmittance and the yellowness index after exposure to dry heat (see 5.6), if relevant,

p) impact resistance (see 5.8.1 and 5.8.2), if relevant,

q) deflection of the sheet (see 5.9), if relevant,

r) water vapour permeability (see 5.10), if relevant,

s) linear thermal expansion (see 5.12), if relevant,

t) class for the reaction to fire (see 5.13), if relevant,

u) the class for the external fire performance (see 5.14), if relevant.

NOTE Where ZA.3 covers the same requirements as this clause, the requirements of this clause are met.

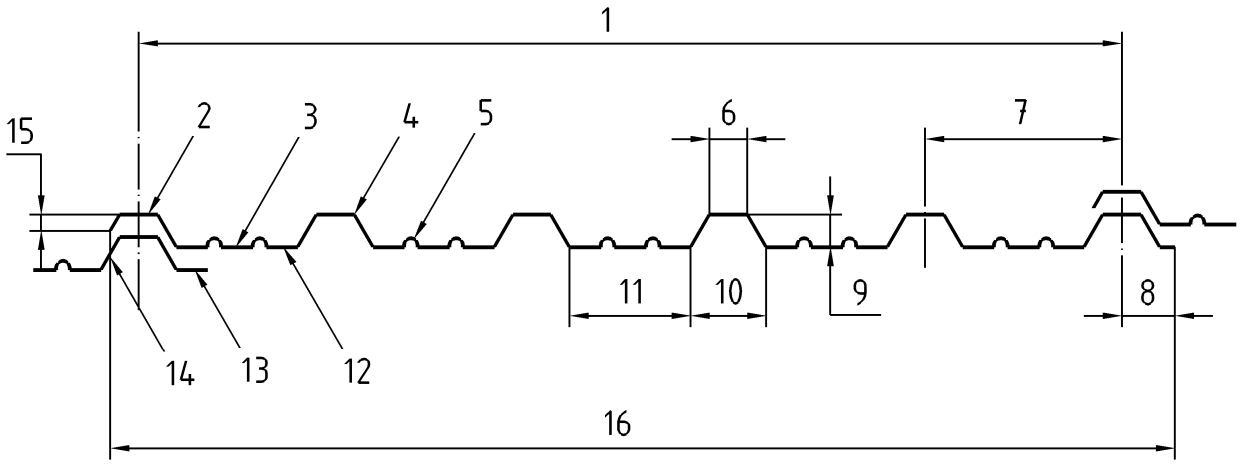
Annex A
(normative)

Profile terminology

A.1 Non-sinusoidal profiles

Figure A.1 gives an example of a non-sinusoidal profile including the corresponding terminology which shall be used by the manufacturer.

NOTE All the items given in Figure A.1 may not be present on all the profiled sheets.



Key

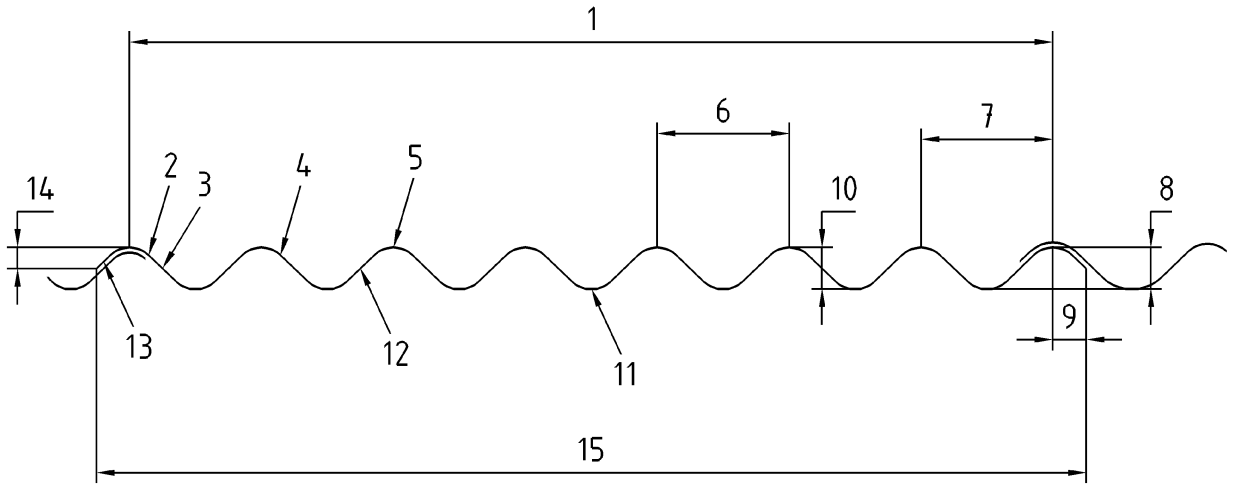
1 cover width (cw)
2 overlap
3 external face
4 primary corrugation
5 secondary corrugation
6 crown (c)
7 pitch of corrugation (p)
8 width of edges
9 depth (d)
10 base of corrugation (b)
11 trough (t)
12 internal face
13 purlin bearing leg (pbl)
14 underlap
15 height of edges
16 overall width (ow)

Figure A.1 — Example of a non-sinusoidal profile

A.2 Sinusoidal profile

Figure A.2 gives an example of a sinusoidal profile including the corresponding terminology which shall be used by the manufacturer.

NOTE All the items given in Figure A.2 may not be present on all the profiled sheets.



Key

1 cover width (cw)
2 overlap
3 external face
4 corrugation
5 crown (c)
6 pitch of corrugation (p)
7 underlap pitch (if applicable)
8 depth of underlap corrugation (if applicable)
9 width of edges
10 depth (d)
11 trough (t)
12 internal face
13 underlap
14 height of edges
15 overall width (ow)

Figure A.2 — Example of a sinusoidal profile

A.3 Minimum information to be declared

Minimum information to be declared shall be as follows:

a) the cover width (cw),

b) the pitch of corrugation (p),

c) the depth (d).

Other profile information, as shown in Figure A.1 or Figure A.2, may also be declared, if relevant.

Annex B
(normative)

Glass content by density of laminate

B.1 Determination of density of laminate constituents

B.1.1 Resins

Prepare a 6 mm diameter x 12 mm long resin casting in a glass tube using the catalyser resin mix to be used in production.

Cure the casting in an oven for 10 min at 120 °C.

Allow the cured casting to cool for 60 min at a room temperature of 20 °C to 25 °C.

Determine the density by loss of weight in water.

B.1.2 Glass-fibre

The density of glass-fibre shall be taken as 2,53 g/cm^3.

B.2 Test specimens

Two test specimens 50 mm x 40 mm are required.

B.3 Procedure

The test specimens of laminate are individually weighed first in air and then while immersed in water at 20 °C to 25 °C in order to determine laminate density (= mass in air/apparent loss of mass in water).

To obtain the corresponding glass contents, the relationship shall be established between glass-fibre content and laminate density for the particular resin system used.

EXAMPLE Consider 100 g of laminate made from a cured resin of density 1,25 g/cm^3, containing 25 % of glass-fibre, density 2,53 g/cm^3.

The density of laminate, D_L, is given by Formula B.1:

$$\frac{100}{D_L} = \frac{75}{1,25} + \frac{25}{2,53} \qquad \text{(B.1)}$$

Then D_L = 1,431.

With a 30 % glass content, the density D_L is 1,474.

A graph may be drawn of the glass percentage against laminate density, from which the glass content may be read off for any laminate density determined.

Alternatively, the formula of the straight line graph may be established.

If G is the glass-fibre content by mass, M the line gradient and C a constant, the following three formulae are established:

$$G = M \times D_L + C \quad \text{(B.2)}$$

$$30 = M \times 1,474 + C \quad \text{(B.3)}$$

$$25 = M \times 1,431 + C \quad \text{(B.4)}$$

For *M* = 116,28 and *C* = -141,4, then Formula (B.2)

$$G = 116,28 \times D_L - 141,4 \quad \text{(B.5)}$$

applies to this particular resin system. The method is applicable to both resins with or without fillers provided that the density of the appropriate cured casting is first determined and the glass-fibre content relationship established.

From the glass-fibre content and laminate mass per extended area, the glass-fibre mass laydown per unit area, MGF, in grams per square metres, shall be calculated:

$$M_{GF} = \frac{M_d \cdot fc}{100\,S} \quad \text{(B.6)}$$

where

M_d is the mass, in grams, of the specimen,

fc is the glass-fibre content, in percentage,

S is the area, in square metres, of the specimen.

A1

Annex ZA
(informative)

Clauses of this European Standard addressing the provisions of the EU Construction Products Regulation

ZA.1 Scope and relevant characteristics

This European Standard has been prepared under Mandate M/121 “Internal and external wall and ceiling finishes” as amended and Mandate M/122 “Roof coverings, rooflights, roof windows and ancillary products” as amended and given to CEN by the European Commission and the European Free Trade Association.

If this European Standard is cited in the Official Journal of the European Union (OJEU), the clauses of this standard, shown in this annex, are considered to meet the provisions of the relevant mandate, under the Regulation (EU) No. 305/2011.

This annex deals with the CE marking of the light transmitting single skin profiled plastics sheets for internal and external use in roofs, walls and ceilings intended for the uses indicated in Tables ZA.1.1 to ZA.1.2 and shows the relevant clauses applicable.

This annex has the same scope as Clause 1 of this standard related to the aspects covered by the mandate and is defined by Tables ZA.1.1 to ZA.1.2.

Table ZA.1.1 — Relevant clauses for light transmitting single skin profiled plastics sheets intended for roof coverings for buildings

Products: Light transmitting single skin profiled plastics sheets **Intended use:** Discontinuously laid roof covering for buildings			
Essential characteristics	**Clauses in this and other European Standard(s) related to essential characteristics**	**Regulatory classes**	**Notes**
Impact resistance	5.8.1	–	“Pass” or “Fail”
	5.8.2	–	See Footnote [a]
Mechanical resistance	5.9	–	Bending stiffness $(EI)_{test}$
External fire performance	5.14	–	Declared class
Reaction to fire	5.13	Classes A1 to F	Declared class
Water vapour permeability	5.10	–	coefficient from Table 3 or according to EN ISO 12572
Water/air tightness	5.11	–	“Pass” or “Fail”
Dimensional tolerances	5.2	–	“Pass” or “Fail”
Durability, as:			
- variation of yellowness index	5.5.3	–	Class A_0, A_1, A_2 or A_3 according to

			Table 2 or Class B_0, B_1, B_2 or B_3 according to Table 3
- variation of light transmittance	5.5.4	–	- declared value of the variation of the total luminous transmission or - alternatively, as class A_3 or class B_3 (see 5.5.4, last paragraph)
- variation of flexural/tensile strength	5.5.5	–	- declared reduction values of the flex./ tensile strength and flex. modulus and - variation of total luminous transmittance within certain range (see 5.5.5, last paragraph)
Release of dangerous substances	5.20	–	
[a] Large soft body impact resistance depends highly on the method of installation. Large soft body impact resistance of a fully installed assembly/kits shall be declared separately by the manufacturer or designer of assembly/kits as stated in 5.8.2 where subject to regulation, otherwise “NPD” may be declared. The test method and configuration of the roof assembly/kits shall be declared.			

Table ZA.1.2 — Relevant clauses for light transmitting single skin profiled plastics sheets intended for internal external wall and ceiling finishes

Products: Light transmitting single skin profiled plastics sheets **Intended use:** Internal and external wall and ceiling finishes			
Essential characteristics	**Clauses in this and other European Standard(s) related to essential characteristics**	**Regulatory classes**	**Notes**
Reaction to fire	5.13	Classes A1 to F	Declared class
Water vapour permeability	5.10	–	coefficient from Table 3 or determined according to EN ISO 12572
Water/air tightness	5.11	–	“Pass” or “Fail”
Release of dangerous substances	5.20	–	
Shatter properties (safe breakability), as:			
- impact resistance	5.8.1	-	“Pass” or “Fail”
Flexural tensile strength, as:		-	
- flexural/tensile strength	5.4	-	- flexural strength and flexural modulus or - tens. strength and Young’s mod., as applicable
- resistance to deflection	5.9	-	Bending stiffness $(EI)_{test}$
Resistance to fixings [a]	5.19	-	Declaration of method of fixing
Durability, as:			

- variation of yellowness index	5.5.3	-	Class A_0, A_1, A_2 *or* A_3 according to Table 2 or Class B_0, B_1, B_2 or B_3 according to Table 3
- variation of light transmission	5.5.4	-	- declared value of the variation of the total luminous transmission or - alternatively, as class A_3 or class B_3 (see 5.5.4, last paragraph)
- variation of flexural/tensile strength	5.5.5	-	- declared reduction values of the flex./tensile strength and flex. modulus and - variation of total luminous transmittance within certain range (see 5.5.5, last paragraph)
[a] When used for external wall finishes subject to requirements against accidental fall of objects on to transit areas.			

The declaration of the product performance related to certain essential characteristics is not required in those Member States (MS) where there are no regulatory requirements on these essential characteristics for the intended use of the product.

In this case, manufacturers placing their products on the market of these MS are not obliged to determine nor declare the performance of their products with regard to these essential characteristics and the option “No performance determined” (NPD) in the information accompanying the CE marking and in the declaration of performance (see ZA.3) may be used for those essential characteristics.

ZA.2 Procedure for AVCP of light transmitting single skin profiled plastics sheets

ZA.2.1 Systems of AVCP

The AVCP systems of light transmitting single skin profiled plastics sheets indicated in Tables ZA.1.1 and ZA.1.2, established by EC Decisions:

— the Decision of the Commission 98/436/EC of 1998-06-22 (published the 10.07.98 under L194) amended by the Decision 01/596/EC (published the 2.08.01 under L209) as given in Annex III of the mandate for “Roof coverings, roof lights, roof windows and ancillary products”,

— the Decision of the Commission 98/437/EC of 1998-06-30 (published the 10.07.98 under L194) amended by the Decision 01/596/EC (published the 2.08.01 under L209) as given in Annex III of the mandate for “Internal and external wall and ceiling finishes”,

are shown in Table ZA.2 for the indicated intended use(s) and relevant level(s) or class(es) of performance.

Table ZA.2 — Systems of AVCP

Products	Intended uses	Level(s) or class(es) of performance	AVCP systems
Flat and profile sheets	As roofing coverings subject to reaction to fire regulations	A1*, A2*, B* and C* A1**, A2**, B**, C**, D and E (A1 to E)***, F	1 3 4
	As roof coverings subject to external fire performance regulations	Products requiring testing Products 'deemed to satisfy' without testing	3 4
	As roof coverings subject to regulations on dangerous substances	–	3
	As roof coverings for all other uses	–	4
Panels	As internal or external finishes in walls or ceilings subject to reaction to fire regulations	A1*, A2*, B* and C* (A1, A2, B, C)**, D and E (A1 to E)***, F	1 3 4
	As internal or external finishes in walls or ceilings, as relevant, subject to regulations on dangerous substances	–	3
	As internal or external finishes in walls or ceilings for all other uses mentioned in the mandate [a]	–	4

* Products/materials for which a clearly identifiable stage in the production process results in an improvement of the reaction to fire classification (e.g. an addition of fire retardants or a limiting of organic material). Fire retardant products are under conformity system 1.

** Products for which there is no clearly identifiable stage in the production process results in an improvement of the reaction to fire classification (e.g. an addition of fire retardant or limiting of organic material).

*** Products/materials that do not require to be tested for reaction to fire (e.g. products/materials of Class A1 according to Commission Decision 96/603/EC).

System 1: See Regulation (EU) No. 305/2011 (CPR) Annex V, 1.2

System 3: See Regulation (EU) No. 305/2011 (CPR) Annex V, 1.4

System 4: See Regulation (EU) No. 305/2011 (CPR) Annex V, 1.5

[a] Other intended uses covered by the mandate are: for vapour control, for water penetration control, for acoustic control and for thermal control.

The AVCP of the light transmitting single skin profiled plastics sheets in Tables ZA.1.1 and ZA.1.2 shall be according to the AVCP procedures indicated in Tables ZA.3.1 to ZA.3.3 resulting from application of the clauses of this or other European Standard indicated therein. The content of tasks of the notified body shall be limited to those essential characteristics as provided for, if any, in Annex III of the relevant mandate and to those that the manufacturer intends to declare.

Table ZA.3.1 — Assignment of AVCP tasks for light transmitting single skin profiled plastics sheets under system 1 (for reaction to fire classes A1*, A2*, B*, C*) with system 3 (for external fire performance subject to testing and dangerous substances for internal or external wall finishes)

Tasks		Content of the task	AVCP clauses to apply
Tasks for the manufacturer	Factory production control (FPC)	Parameters related to essential characteristics of Table ZA.1.1 and/or Table ZA.1.2 relevant for the intended use which are declared	7.3
	Determination of the product-type on the basis of type testing, type calculation, tabulated values or descriptive documentation of the product	Essential characteristics of Table ZA.1.1 and/or Table ZA.1.2 relevant for the intended use which are declared except external fire performance (subject to testing) reaction to fire and dangerous substances (for internal or external finishes)	7.2
	Further testing of samples taken at factory according to the prescribed test plan	Essential characteristics of Table ZA.1.1 and/or Table ZA.1.2 relevant for the intended use which are declared	7.3
Tasks for a notified testing laboratory	Determination of the product-type on the basis of type testing (based on sampling carried out by the manufacturer), type calculation, tabulated values or descriptive documentation of the product	Release of dangerous substance (only for internal or external wall finishes) and external fire performance, if relevant.	7.2
Tasks for the notified product certification body	determination of the product type on the basis of type testing (including sampling), type calculation, tabulated values or descriptive documentation of the product	Reaction to fire (Classes A1*, A2*, B*, C*)	7.2
	Initial inspection of manufacturing plant and of FPC	Parameters related to essential characteristics of Table ZA.1.1 and/or Table ZA.1.2 relevant for the intended use which are declared, namely reaction to fire. Documentation of the FPC.	7.3, 7.4
	Continuous surveillance, assessment and evaluation of FPC	Parameters related to essential characteristics of Table ZA.1.1 and/or Table ZA.1.2 relevant for the intended use which are declared, namely reaction to fire Documentation of FPC	7.3, 7.5

Table ZA.3.2 — Assignment of AVCP tasks for light transmitting single skin profiled plastics sheets under system 3 (for reaction to fire classes A1, A2**, B**, C**, D and E) (and for external fire subject to testing)**

Tasks		Content of the task	AVCP clauses to apply
Tasks for the manufacturer	Factory production control (FPC)	Parameters related to essential characteristics of Table ZA.1.1 and/or Table ZA.1.2 relevant for the intended use which are declared	7.3
	Determination of the product-type on the basis of type testing, type calculation, tabulated values or descriptive documentation of the product	Essential characteristics of Table ZA.1.1 and/or Table ZA.1.2 relevant for the intended use which are declared except reaction to fire, external fire subject to testing and dangerous substances (for internal or external wall finishes)	7.2
Tasks for a notified testing laboratory	Determination of the product-type on the basis of type testing (based on sampling carried out by the manufacturer), type calculation, tabulated values or descriptive documentation of the product	Reaction to fire (Classes A1**, A2**,B**, C**, D and E), external fire performance and release of dangerous substances (only for internal or external wall finishes), if relevant	7.2
** See footnote to Table ZA.2.			

Table ZA.3.3 — Assignment of AVCP tasks for light transmitting single skin profiled plastics sheets under system 4

Tasks		Content of the task	AVCP clauses to apply
Tasks for the manufacturer	Factory production control (FPC)	Parameters related to essential characteristics of Table ZA.1.1 and/or Table ZA.1.2 relevant for the intended use	7.3
	Determination of the product-type on the basis of type testing, type calculation, tabulated values or descriptive documentation of the product	Essential characteristics of Table ZA.1.1 and/or Table ZA.1.2 relevant for the intended use which are declared	7.2

ZA.2.2 Declaration of performance (DoP)

ZA.2.2.1 General

The manufacturer draws up the DoP and affixes the CE marking on the basis of the different AVCP systems set out in Annex V of the Regulation (EU) No 305/2011:

In case of products under system 1:

— the factory production control and further testing of samples taken at the factory according to the prescribed test plan, carried out by the manufacturer; and

— the certificate of constancy of performance issued by the notified product certification body on the basis of determination of the product type on the basis of type testing (including sampling), type calculation, tabulated values or descriptive documentation of the product; initial inspection of the manufacturing plant and of factory production control and continuous surveillance, assessment and evaluation of factory production control.

In case of products under system 3:

— the factory production control carried out by the manufacturer; and

— the determination of the product-type on the basis of type testing (based on sampling carried out by the manufacturer), type calculation, tabulated values or descriptive documentation of the product, carried out by the notified testing laboratory.

In case of products under system 4:

— the factory production control carried out by the manufacturer

— the determination by the manufacturer of the product-type on the basis of type testing, type calculation, tabulated values or descriptive documentation of the product.

ZA.2.2.2 Content

The model of the DoP is provided in Annex III of the Regulation (EU) No 305/2011.

According to this Regulation, the DoP shall contain, in particular, the following information:

— unique identification of the product-type for which the declaration of performance has been drawn up;

— the AVCP system or systems of the construction product, as set out in Annex V of the CPR;

— the reference number and date of issue of the harmonized standard which has been used for the assessment of each essential characteristic;

— where applicable, the reference number of the Specific Technical Documentation used and the requirements with which the manufacturer claims the product complies.

The DoP shall in addition contain:

a) the intended use or uses for the construction product, in accordance with the applicable harmonized Technical Specification;

b) the list of essential characteristics, as determined in the harmonized Technical Specification for the declared intended use or uses;

c) the performance of at least one of the essential characteristics of the construction product, relevant for the declared intended use or uses;

d) where applicable, the performance of the construction product, by levels or classes, or in a description, if necessary based on a calculation in relation to its essential characteristics determined in accordance with the Commission determination regarding those essential characteristics for which the manufacturer shall declare the performance of the product when it is placed on the market or the Commission determination regarding threshold levels for the performance in relation to the essential characteristics to be declared;

e) the performance of those essential characteristics of the construction product which are related to the intended use or uses, taking into consideration the provisions in relation to the intended use or uses where the manufacturer intends the product to be made available on the market;

f) for the listed essential characteristics for which no performance is declared, the letters “NPD” (No Performance Determined).

Regarding the supply of the DoP, article 7 of the Regulation (EU) No 305/2011 applies.

The information referred to in Article 31 or, as the case may be, in Article 33 of Regulation (EC) No 1907/2006, (REACH) shall be provided together with the DoP.

ZA.2.2.3 Example of DoP

The following gives an example of a filled-in DoP for light transmitting single skin profiled plastics sheets:

DECLARATION OF PERFORMANCE

No. 001CPR2013-07-14 (To be stated by the manufacturer)

1. Unique identification code of the product-type:

Light transmitting single skin profiled plastics sheets

GRP 130/30

2 Type, batch or serial number or any other element allowing identification of the construction product as required under Article 11(4):

Light transmitting single skin profiled plastics sheets

GRP 130/30

3. Intended use or uses of the construction product, in accordance with the applicable harmonized Technical Specification, as foreseen by the manufacturer:

For discontinuously laid roof covering for buildings

4. Name, registered trade name or registered trade mark and contact address of the manufacturer as required under Article 11(5):

AnyCo SA,

PO Box 21

B-1050 Brussels, Belgium

Tel. +32987654321

Fax: +32123456789

Email: anyco.sa@provider.be

5. Where applicable, name and contact address of the authorized representative whose mandate covers the tasks specified in Article 12(2):

Anyone Ltd

Flower Str. 24

West Hamfordshire

UK-589645 United Kingdom

Tel. +44987654321

Fax: +44123456789

e-mail: anyone.ltd@provider.uk

6. System or systems of assessment and verification of constancy of performance of the construction product as set out in CPR, Annex V:

System 1

7. In case of the declaration of performance concerning a construction product covered by a harmonized standard:

Notified factory production control certification body No. 0123 performed the determination of the product type (for reaction to fire) the initial inspection of the manufacturing plant and of factory production control and the continuous surveillance, assessment and evaluation of factory production control and issued the certificate of constancy of performance of the product.

8. Declared performance

Essential characteristics	Performance	Harmonized Technical Specification
External fire performance	F_{ROOF} (NPD)	EN 1013:2012+A1:2014
Reaction to fire	F (NPD)	
Water vapour permeability	$0{,}8 \cdot 10^{-5}$ mg/m·h·Pa	
Water/air permeability	Pass	
Release of dangerous substances	NPD	
Dimensional tolerances	Pass	
- Small hard body impact resistance	Pass	
- Large soft body impact resistance (assembly)	Pass	
Mechanical resistance (deformation behaviour)	$(EI)_{test}$ = 50 Nm^2	
Durability, as variation (after ageing):		
- of yellowness index	14 (B_1), 18 (B_o)	
- of the light transmittance	10 % (B_1)	
- on flexural strength for: > flexural strength, and > flexural modulus	> 10 % to ≤ 20 % (B_o) > 10 % to ≤ 20 % (B_o)	

9. The performance of the product identified in points 1 and 2 is in conformity with the declared performance in point 8.

This declaration of performance is issued under the sole responsibility of the manufacturer identified in point 4.

Signed for and on behalf of the manufacturer by:

.....
.....

(name and function)

....

(place and date of issue) (signature)

ZA.3 CE marking and labelling

The CE marking symbol shall be in accordance with the general principles set out in Article 30 of Regulation (EC) No 765/2008 and shall be affixed visibly, legibly and indelibly:

— to the light transmitting single skin profiled plastics sheets for internal and external use in roofs, walls and ceilings

or

— to a label attached to it.

Where this is not possible or not warranted on account of the nature of the product, it shall be affixed:

— to the packaging

or

— to the accompanying documents.

The CE marking shall be followed by:

— the last two digits of the year in which it was first affixed;

— the name and the registered address of the manufacturer, or the identifying mark allowing identification of the name and address of the manufacturer easily and without any ambiguity;

— the unique identification code of the product-type;

— the reference number of the declaration of performance *[see example of DoP]*;

— the level or class of the performance declared;

— the dated reference to the harmonized Technical Specification applied;

— the identification number of the notified body, *[only for products under systems 1, and 3]*;

— the intended use as laid down in the harmonized Technical Specification applied.

The CE marking shall be affixed before the construction product is placed on the market. It may be followed by a pictogram or any other mark notably indicating a special risk or use.

Figures ZA 1 gives an example of the information related to products subject to AVCP under each of the different systems to be given.

CE 0123	*CE marking, consisting of the "CE"-symbol* *Identification number of the product certification body*
AnyCo Ltd, PO Box 21, B-1050, Brussels, Belgium 14 001CPR2013–07–14	*name and the registered address of the manufacturer, or identifying mark* *Last two digits of the year in which the marking was first affixed* *Reference number of the DoP*
EN 1013:2012+A1:2014	*No. of European Standard applied, as referenced in OJEU*
Light transmitting single skin profiled plastics sheets – GRP 125	*Unique identification code of the product-type*
– for discontinuously laid roof covering for buildings – profile: 130/30, GRP sheets	*Intended use of the product as laid down in the European Standard applied*
External fire performance: F_{ROOF} (NPD) Reaction to fire: F (NPD) Water vapour permeability: $0{,}8 \cdot 10^{-5}$ mg/m·h·Pa Water/air permeability: Pass Release of dangerous substances: NPD Small hard body impact resistance: Pass Large body impact resistance(assembly): Pass Mechanical resistance (deformation behaviour): $(EI)_{test}$ = 50 Nm^2 Durability as variation (after ageing) – of yellowness index: 14 (B_1), 18 (B_o) – of the light transmittance: 10 % (B_1) – on flexural strength for: > flexural strength: > 10 % to ≤ 20 % (B_o) And > flexural modulus: > 10 % to ≤ 20 % (B_o)	*Level or class of the performance declared*

Figure ZA.1 — Example of CE marking information of products under AVCP system 1 A1

Bibliography

[1] EN 534, *Corrugated bitumen sheets — Product specification and test methods*

[2] EN 506, *Roofing products from metal sheet — Specification for self-supporting products of copper or zinc sheet*

[3] EN 508-1, *Roofing products from metal sheet — Specification for self-supporting products of steel, aluminium or stainless steel sheet — Part 1: Steel*

[4] EN 508-2, *Roofing products from metal sheet - Specification for self-supporting products of steel, aluminium or stainless steel sheet - Part 2: Aluminium*

[5] EN 508-3, *Roofing products from metal sheet - Specification for self-supporting products of steel, aluminium or stainless steel sheet - Part 3: Stainless steel*

[6] EN 494, *Fibre-cement profiled sheets and fittings - Product specification and test methods*

[7] ISO 9370:2009, *Plastics — Instrumental determination of radiant exposure in weathering tests — General guidance and basic test method*

[8] DS 1133:1987, *Roof components — Resistance to impact from a soft body*

[9] XP P 38-505:1998, *Building roofing — Light transmitting glass fibre reinforced polyester profiled sheets — Resistance to passing through of a large dimensions soft body — Testing and classification*

[10] XP P 38-506:1999, *Building roofing — Light transmitting polyvinyl chloride (PVC) profiled sheets — Resistance to passing through of a large dimensions soft body — Testing and specification*

[11] XP P 38-507:2000, *Building roofing — Light transmitting (PC) profiled sheets — Resistance to passing through of a large dimensions soft body — Testing and specifications*

[12] ACR[M]001:2005, *Test for Non-Fragility of Profiled Sheeted Roof Assemblies*, Advisory Committee for Roofwork [ACR]

[13] ▌A1⟩ EN ISO 9001:2008, *Quality management systems - Requirements (ISO 9001:2008)* ⟨A1▐

National Annex
(informative)

Classification method for GRP profiled sheets in accordance with BS EN 1013

Introduction

This National Annex has been prepared by BSI Subcommittee B/542/8. In the UK it is to be used in conjunction with BS EN 1013.

NA.1 Scope

(a) This National Annex provides a classification method for GRP profiled sheets based on values defined in the following subclauses of BS EN 1013:

— 5.2
— 5.5
— 5.5.3
— 5.5.4
— 5.5.5
— 5.15
— 5.17
— 5.18

(b) BS EN 1013 subclause 5.8.2 states that "The resistance to large soft body impact depends very heavily on the method of installation and the roof system into which the light transmitting sheet is incorporated, rather than a property of the sheet itself." and that "the manufacturer may declare the method of installation for each application, …[and] shall assess the large soft body impact resistance separately in accordance with… individual national safety requirements for each such application."

In the UK the appropriate national safety requirement is ACR[M]001 "Test For Non-Fragility of Profiled Sheeted and Large Element Roofing Assemblies".

The range of classifications provided within this National Annex can be used to define the minimum requirements for GRP profiled sheets which are considered necessary to achieve non-fragility to ACR[M]001, for a range of different installation methods and non-fragility performances.

Further information on the industry guidance on classifications for different methods of installation are provided separately in NARM Guidance Note 2013/1 "Application of ACR[M]001 "Test For Non-Fragility of Profiled Sheeted and Large Element Roofing Assemblies" to GRP Profiled Rooflight Sheeting".

Some profiled GRP sheets are produced which do not meet the classification defined in this National Annex, and these may pass one-off soft body impact tests but there is concern that it cannot be expected that they will do so reliably. GRP sheets which do not meet the appropriate classifications defined in this National Annex should not be considered as non-fragile to ACR[M]001, and should not be used in applications where non-fragility classifications are required.

Some GRP profiled sheets are produced that exceed the highest classifications defined in this National Annex, and exceed the minimum requirements for non-fragility classifications to ACR[M]001. Whilst

achieving the highest classification defined in the National Annex, the additional performance of these sheets can be defined using the appropriate subclauses of BS EN 1013 without reference to this National Annex.

NA.2 Classification of profiled GRP sheets

NA.2.1 General

This National Annex defines sheet classifications of CE18, CE18E, CE24, CE24E, CE30, CE30E, CE36 and CE36E as shown in clauses NA2.1 to NA 2.3.

NA.2.2 Mass per square metre and glass fibre content

To achieve classification CE18, sheets should have a minimum mass per square metre (in flat form prior to profiling) of 1.5 kg/m^2 as defined in BS EN 1013 subclause 5.2, and minimum glass fibre content of 33% as defined in BS EN 1013 subclause 5.15

To achieve classification CE24, sheets should have a minimum mass per square metre (in flat form prior to profiling) of 2.0 kg/m^2 as defined in BS EN 1013 subclause 5.2, and minimum glass fibre content of 33% as defined in BS EN 1013 subclause 5.15

To achieve classification CE30, sheets should have a minimum mass per square metre (in flat form prior to profiling) of 2.5 kg/m^2 as defined in BS EN 1013 subclause 5.2, and minimum glass fibre content of 33% as defined in BS EN 1013 subclause 5.15

To achieve classification CE36, sheets should have a minimum mass per square metre (in flat form prior to profiling) of 3.0 kg/m^2 as defined in BS EN 1013 subclause 5.2, and minimum glass fibre content of 33% as defined in BS EN 1013 subclause 5.15

NA 2.3 External sheets and durability

For sheets intended for external use, exposed to the weather, a suffix E to the classification is defined (giving classifications of CE18E, CE24E, CE 30E and CE36E)

To achieve classification a suffix E, sheets should be shown to have;

a) a PET (polyethylene terephthalate) film surface coating as defined in BS EN 1013 subclause 5.17.1

b) with satisfactory adhesion as defined in BS EN 1013 subclause 5.18, and

c) durability demonstrated after artificial ageing to Classes B2 and B0 as defined in BS EN 1013 subclause 5.5.2 by

   i. a maximum variation in yellowness index of 10 units at Class B2, and 15 units at Class B0 as defined in BS EN 1013 subclause 5.5.3

   ii. a maximum variation in total luminous transmission of 10% at Class B2, and 15% at Class B0 as defined in BS EN 1013 subclause 5.5.4

   iii. a maximum variation in tensile/flexural strength of 10% at Class B0 as defined in BS EN 1013 subclause 5.5.5

NA 2.4 Summary requirements

The minimum requirements for a sheet to meet each of these classifications as defined in NA2.1 and NA2.2 is summarized in Table 1. Sheets should achieve the defined performance for all of the relevant subclauses shown to be given the designation defined in this table.

Table 1 Minimum requirement for sheet classifications

Classification		CE18	CE18E	CE24	CE24E	CE30	CE30E	CE36	CE36E
Requirement	Subclause BS EN 1013								
Mass per square metre (in flat form prior to profiling)	5.2	1.5	1.5	2.0	2.0	2.5	2.5	3.0	3.0
Glass fibre content	5.15	33%	33%	33%	33%	33%	33%	33%	33%
Durability, as variation (after ageing) of:	5.5								
yellowness index	5.5.3	None	<10(B_2), <15(B_0)	None	<10(B_2), <15(B_0)	None	<10(B_2), <15(B_0)	None	<10(B_2), <15(B_0)
total luminous transmission	5.5.4	None	<10%(B_2), <15%(B_0)	None	<10%(B_2), <15%(B_0)	None	<10%(B_2), <15%(B_0)	None	<10%(B_2), <15%(B_0)
flexural/tensile strength	5.5.5	None	≤10%(B_0)	None	≤10%(B_0)	None	≤10%(B_0)	None	≤10%(B_0)
presence of surface coating	5.17.1	None	PET (white residue)	None	PET (white residue)	None	PET (white residue)	None	PET (white residue)
adhesion of surface coating	5.18	None	satisfactory (3mm)	None	satisfactory (3mm)	None	satisfactory (3mm)	None	satisfactory (3mm)

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