SLOVENSKI STANDARD
SIST EN 1013:2013

01-marec-2013

Nadomešča:
SIST EN 1013-1:1998
SIST EN 1013-2:2000
SIST EN 1013-3:1998
SIST EN 1013-4:2000
SIST EN 1013-5:2000

Prosojne enoslojne profilirane polimerne plošče za notranje in zunanje strehe, stene in stropove - Zahteve in preskusne metode

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

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

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

Ta slovenski standard je istoveten z: **EN 1013:2012**

ICS:

83.140.10	Filmi in folije	Films and sheets
91.060.10	Stene. Predelne stene. Fasade	Walls. Partitions. Facades
91.060.20	Strehe	Roofs
91.060.30	Stropi. Tla. Stopnice	Ceilings. Floors. Stairs

SIST EN 1013:2013 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 1013

December 2012

ICS 83.140.10; 91.060.01

Supersedes EN 1013-1:1997, EN 1013-2:1998, EN 1013-3:1997, EN 1013-4:2000, EN 1013-5:2000

English Version

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

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This European Standard was approved by CEN on 20 October 2012.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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Ref. No. EN 1013:2012: E

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Foreword

This document (EN 1013:2012) 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of an identical text or by endorsement, at the latest by June 2013, and conflicting national standards shall be withdrawn at the latest by June 2013.

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 EN 1013-1:1997, EN 1013-2:1998, EN 1013-3:1997, EN 1013-4:2000 and EN 1013-5:2000.

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 EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

This revision is a merger of EN 1013-1:1997, EN 1013-2:1998, EN 1013-3:1997, EN 1013-4:2000 and EN 1013-5:2000. The main changes are as follows:

— a complete technical review of requirements and test methods, based on the essential characteristics given in Mandates M/121 and M/122;

— a technical review of the artificial ageing procedure based on the current test methods, with the possibility to use either the exposition to arc-xenon lamps or to fluorescence UV lamps;

— a technical review of the impact resistance of the sheets: in addition to the existing small hard body impact resistance, test methods for assessing the large soft body impact resistance have been added;

— introduction of new subclauses for the reaction to fire and external fire performance;

— a review of the flexural/tensile strength and the resistance to deflection;

— deletion of the hail resistance;

— introduction of a new clause dealing with evaluation of conformity;

— introduction of an informative Annex ZA giving the clauses of this European Standard addressing the provisions of the EU Construction Products Directives.

According to the CEN/CENELEC Internal Regulations, the national standards organisations 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)*

EN ISO 9001:2008, *Quality management systems — Requirements (ISO 9001:2008)*

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:

$$\Delta\tau_t = \frac{\tau_{t0} - \tau_{t1}}{\tau_{t0}} \quad (1)$$

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.