
**Prosojna profilirana polimerna plošča za enoslojno strešno kritino - 5. del:
Posebne zahteve, preskusne metode in lastnosti plošč iz polimetilmetakrilata
(PMMA)**

Light transmitting profiled plastic sheeting for single skin roofing - Part 5: Specific requirements, test methods and performance of polymethylmethacrylate (PMMA) sheets

Profilierte lichtdurchlässige Platten aus Kunststoff für einschalige Dacheindeckungen - Teil 5: Besondere Anforderungen, Prüfverfahren und -verhalten für Platten aus Polymethylmethacrylat (PMMA)

Plaques profilées éclairantes en matière plastique pour couverture en simple paroi - Partie 5: Exigences spécifiques, méthodes d'essai et performance pour plaques en polyméthylméthacrylate (PMMA)

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Light transmitting profiled plastic sheeting for single skin roofing
- Part 5: Specific requirements, test methods and performance
of polymethylmethacrylate (PMMA) sheets

Plaques profilées éclairantes en matière plastique pour
couverture en simple paroi - Partie 5: Exigences
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Profilierte lichtdurchlässige Platten aus Kunststoff für
einschalige Dacheindeckungen - Teil 5: Besondere
Anforderungen, Prüfverfahren und -verhalten für Platten
aus Polymethylmethacrylat (PMMA)

This European Standard was approved by CEN on 7 November 1999.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

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 Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.



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Foreword

This European Standard 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 IBN.

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 July 2000, and conflicting national standards shall be withdrawn at the latest by July 2000.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

This standard is one of a series dealing with profiled plastics sheeting for single skin roofing.

EN 1013-1:1997	Light transmitting profiled plastic sheeting for single skin roofing - Part 1: General requirements and test methods
EN 1013-2:1998	Light transmitting profiled plastic sheeting for single skin roofing - Part 2: Specific requirements and test methods for sheets of glass fibre reinforced polyester resin (GRP)
EN 1013-3:1997	Light transmitting profiled plastic sheeting for single skin roofing - Part 3: Specific requirements and test methods for sheets of polyvinyl chloride (PVC)
EN 1013-4:1999	Light transmitting profiled plastic sheeting for single skin roofing - Part 4: Specific requirements, test methods and performance of polycarbonate (PC) sheets
EN 1013-5:1999	Light transmitting profiled plastic sheeting for single skin roofing - Part 5: Specific requirements, test methods and performance of polymethylmethacrylate (PMMA) sheets

1 Scope

1.1 This part of EN 1013 specifies requirements for materials, methods of testing and performance of light transmitting profiled sheets of polymethylmethacrylate (PMMA) produced to the desired profile by extrusion and/or forming for single skin application. It is applicable in conjunction with the general requirements contained in EN 1013-1:1997.

1.2 Requirements are specified relative to:

- Sheet thickness
- Width of the sheet
- Visual characteristics
- Longitudinal reversion
- Retention of profile

- Variation of impact strength after ageing
- Thermal ageing

Test procedures are indicated as appropriate.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 1013-1:1997	Light transmitting profiled plastic sheeting for single skin roofing - Part 1: General requirements and test methods
ISO 179:1993	Plastics - Determination of Charpy impact strength
ISO 527-1:1993	Plastics - Determination of tensile properties - Part 1 : General principles
ISO 527-2:1993	Plastics - Determination of tensile properties - Part 2 : Test conditions for moulding and extrusion plastics
ISO 8257-1:1998	Plastics - Poly(methyl methacrylate) (PMMA) moulding and extrusion materials - Part 1: Designation system and basis for specifications

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3 Material

SIST.EN 1013-5:2000

The materials from which standard PMMA sheets are made shall consist substantially of polymethylmethacrylate according to ISO 8257-1:1998. They comprise both unmodified materials and materials containing lubricants, processing aids, UV-absorbers, pigments and colorants. The materials for impact modified sheets shall consist of polymethylmethacrylate according to ISO 8257-1:1998 and additionally an impact modifier.

4 Classification

Sheets shall be classified according to EN 1013-1:1997 for each of the following:

- Light transmission
- Impact resistance
- Variation of yellowness index and light transmission after ageing procedure

5 Dimensions

5.1 General

The value for the nominal sheet thickness shall be quoted by the manufacturer.

5.2 Tolerances for nominal sheet thickness (Quality control test)

When tested in accordance with 11.1 the values of sheet thickness obtained from crown and valley shall be the nominal thickness quoted $\pm 10\%$.

On the flanks the tolerance shall be the nominal thickness quoted $\pm 20\%$.

5.3 Tolerance for cover width (Quality control test)

In addition to the requirements quoted in 5.5.4 of EN 1013-1:1997 the values of cover width shall be within an interval from 0 - + 3 mm of the width stated, when measured as described in EN 1013-1:1997.

6 Visual characteristics

(Quality control test)

Visual or tactile examination shall reveal no evidence of any hole, cracking, splitting or cluster of bubbles greater than 1 mm in diameter or inclusions that are likely to affect properties. The edges shall be straight and clean. Further requirements concerning the visual aspect of the sheets can be agreed upon between the manufacturer and the customer.

7 Longitudinal reversion and profile retention

(Type test)

When the sheet is tested by the method described in 11.2 at a temperature of 80 °C for 60 min, the average percentage change in dimensions shall not exceed the following:

- Longitudinal reversion ±2 %
- Profile retention ±3 %

Manufacturer's literature shall give guidance where conditions of use may lead to these figures being exceeded.

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8 *E*-modulus and tensile strength

(Type test)

When the sheet is tested according to ISO 527-1:1993 and ISO 527-2:1993, the *E*-modulus has to be at least 3000 MPa and the tensile strength has to be at least 60 MPa for standard PMMA.

For impact modified materials the lower limits have to be declared by the manufacturer.

9 Variation of impact strength after ageing

(Type test)

When the sheet is tested according to method 1fU in ISO 179:1993 the minimum Charpy impact strength levels a_{cU} of unnotched specimens are:

Table 1: Minimal impact strength levels

Material	Unaged samples a_{cU} kJ/m ²	Aged samples a_{cU} kJ/m ²
Standard	≥ 10	≥ 10

For impact modified materials the impact strength levels before and after ageing have to be declared by the manufacturer.

Ageing shall be carried out in accordance with 7.1 of EN 1013-1:1997 using a Xenon arc lamp.

The duration of ageing shall be chosen so that an exposure ≥ 18 GJ/m² according to class A₀ in EN 1013-1:1997 results.

10 Thermal ageing

(Type test)

When the sheet is exposed to dry heat for 3000 h at 80 °C by the method described in 11.3, property levels, with respect to unexposed sheet, shall be maintained at:

- | | |
|------------------------------|------------------------------|
| - Light transmission | ≥ 90 % of its original value |
| - Change in yellowness index | ≤ 10 points |

11 Test methods**11.1 Sheet thickness**

The sheet thickness shall be determined at any point by using a micrometer screw with hemispherical tips of 5 mm in diameter and with an accuracy of $\pm 0,01$ mm.

The values as mentioned under 5.2 shall be the result of 5 measurements of which the average will be within the defined tolerance. The 5 measurements will be made at regular distances over the full sheet width.

11.2 Longitudinal reversion and profile retention**11.2.1 Principle**

During a given period of time, the test pieces are submitted to a determined temperature. Next, the percentage changes in length and in the pitch of corrugations are determined.

11.2.2 Apparatus

- Air circulation oven capable of maintaining a temperature of (80 ± 2) °C.
- Suitable means of measuring test pieces to an accuracy of $\pm 0,25$ mm.
- Suitable means of applying a minimum load to the test piece shall be provided as necessary to ensure that the horizontal undersides of the valleys are in contact with the flat surface immediately prior to making measurements.

11.2.3 Test pieces

Five rectangular test pieces are required which shall be not less than 250 mm in length. The width of test pieces shall be such that one of the following conditions is satisfied (see also Figure 1):

- a) for pitches greater or equal to 200 mm : one pitch plus adjacent valleys 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 valleys on both sides.
- c) complete width of the sheet if neither a) and b) can be met.

11.2.4 Test procedure

Carry out the test in a room maintained at a temperature of (23 ± 2) °C and (50 ± 5) % relative humidity.

Scribe two pairs of reference marks on each test piece as follows:

a) 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) 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.

to
obtain contact between the horizontal undersides of the valleys and the flat surface before conducting any measurements.

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

Place the test pieces in the air circulation oven which is at (80 ± 2) °C in such a way that they are under no stress.

After a period of 60 min, which shall commence when the temperature of the oven regains (80 ± 2) °C, remove the test pieces and allow to cool on a flat surface for 10 min.

to
obtain contact between the horizontal undersides of the valleys and the flat surface before conducting measurements.

Repeat the measurement of the distances between the marks on each test piece and calculate the individual and average percentage changes in length and in the pitch of the corrugations.

11.3 Thermal ageing

11.3.1 Principle

Light transmission and yellowness index measurements are made on test pieces which have been subjected to dry heat in a ventilated oven at 80 °C. Changes in the values of these properties are determined by comparison with the unexposed sheet.

11.3.2 Apparatus

- Air circulation oven capable of maintaining a temperature of (80 ± 2) °C.
- Light transmission and yellowness index are measured with a spectrophotometer as specified in 7.2.1 and 7.3.1 of EN 1013-1:1997.

11.3.3 Test pieces

Ten test pieces are required which shall be cut from the profiled sheet so as to yield approximately flat specimens of sufficient dimensions to enable the appropriate measurements to be made.

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

Test pieces which will be exposed to heat shall be supplied with a hole at one end to allow vertical suspension in the oven.

11.3.4 Test procedure

Suspend the test pieces in the oven so that they neither touch each other nor the walls of the oven.

Maintain the oven temperature at (80 ± 2) °C for $(3\ 000 \pm 50)$ h.

When the specified period has been completed remove the test pieces from the oven and allow to cool. Cooling of the test pieces can be carried out between polished stainless steel plates, under a load sufficient to preserve flatness.

be done in a similar manner to that for reference test pieces (see 11.3.3).

Make light transmission measurements in accordance with 7.2.3 of EN 1013-1:1997, and yellowness index measurements in accordance with 7.3.3 of EN 1013-1:1997, on all the test pieces.

Determine the changes in property levels for light transmission and yellowness index in accordance with 7.2.4 and 7.3.4 of EN 1013-1:1997, respectively.