EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 1873

December 2005

ICS 91.060.20

English Version

Prefabricated accessories for roofing - Individual roof lights of plastics - Product specification and test methods

Accessoires préfabriqués pour couverture - Lanterneaux ponctuels en matière plastique - Spécifications des produits et méthodes d'essais

Vorgefertigte Zubehörteile für Dacheindeckungen - Lichtkuppeln aus Kunststoff - Produktfestlegungen und Prüfverfahren

This European Standard was approved by CEN on 4 September 2005.

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, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

Ref. No. EN 1873:2005: E

Contents

Page

Foreword

This European Standard (EN 1873:2005) 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/BIN.

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of an identical text or by endorsement, at the latest by June 2006, and conflicting national standards shall be withdrawn at the latest by June 2006.

This European Standard 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 European Standard.

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

1 Scope

This European Standard specifies requirements for roof lights made of plastic materials (e.g. GF-UP, PC, PMMA, PVC) with and without upstands made of e.g. GF-UP, PVC, steel, aluminium or wood for installation in roofs. These roof lights serve the purpose of lighting by means of daylight and of ventilating interior spaces by means of opening devices.

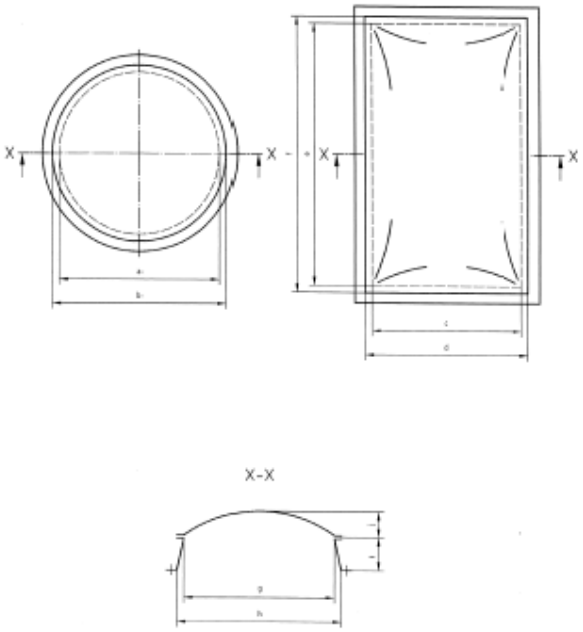
This European Standard applies to roof lights with a rectangular or circular ground plan (see Figures 1 and 2), with an opening span (width) or diameter not larger than 2,5 m and an opening length not larger than 3,0 m in roof pitches up to 25°. This document does not cover roof lights which contribute to the load-bearing or stiffness of the roof itself.

This European Standard applies to roof lights without upstand and to roof lights, where a single manufacturer provides all components of the roof light with upstand, which are bought in a single purchase.

The possible additional functions of smoke and heat ventilation in case of fire, and/or roof access, are outside the scope of this European Standard.

This European Standard does not include calculation with regard to construction, design requirements and installation techniques.

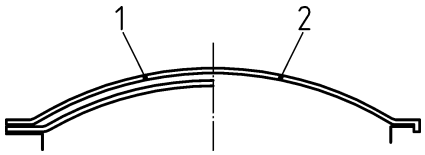
NOTE Guidelines for safety, application, use and maintenance of individual roof lights are presented in Annex A.



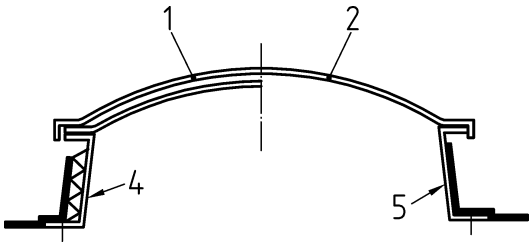
Key

a daylight diameter
b roof opening diameter
c daylight width
d roof opening width
e daylight length
f roof opening length
g daylight size
h roof opening size
i upstand height
j roof light height

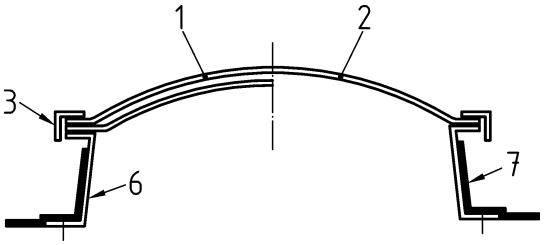
Figure 1 — Typical individual roof lights



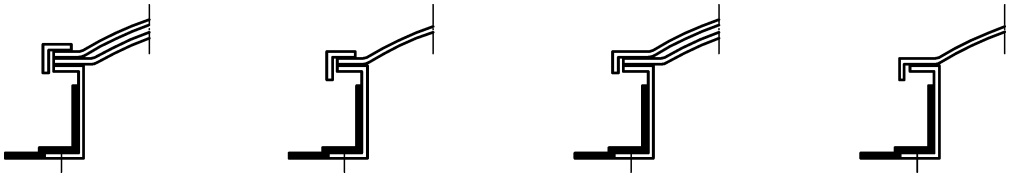
2a) Individual roof light without upstand



2b) Individual roof light with upstand



2c) Individual roof light with upstand and edge profile



with edge profile without edge profile

2d) Vertical upstands

Key

1	multi skin	4	insulated upstand	7	roof finish
2	single skin	5	non insulated upstand		
3	edge profile	6	splayed upstand		

Figure 2 — Cross sections of typical individual roof lights and upstands

2 Normative references

The following referenced documents are indispensable for the application of this European Standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 596, *Timber structures – Test methods – Soft body impact test of timber framed walls*

EN 673, *Glass in building – Determination of thermal transmittance (U value) – Calculation method*

EN 674, *Glass in building – Determination of thermal transmittance (U value) – Guarded hot plate method*

EN 675, *Glass in building – Determination of thermal transmittance (U value) – Heat flow meter method*

EN 1013-3, *Light transmitting profiled plastic sheeting for single skin roofing – Part 3: Specific requirements and test methods for sheets of polyvinyl chloride (PVC)*

EN 1013-5, *Light transmitting profiled plastic sheeting for single skin roofing – Part 5: Specific requirements, test methods and performance of polymethylmethacrylate (PMMA) sheets*

ENV 1187:2002, *Test methods for external fire exposure to roofs*

EN 12153, *Curtain walling – Air permeability – Test method*

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

EN 13501-2, *Fire classification of construction products and building elements – Part 2: Classification using data from fire resistance tests, excluding ventilation services*

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

EN ISO 140-3, *Acoustics – Measurement of sound insulation in buildings and of building elements – Part 3: Laboratory measurement of airborne sound insulation of building elements (ISO 140-3:1995)*

EN ISO 178, *Plastics – Determination of flexural properties (ISO 178:2001)*

EN ISO 527-1, *Plastics – Determination of tensile properties – Part 1: General principles (ISO 527-1:1993 including Corr 1:1994)*

EN ISO 527-2, *Plastics – Determination of tensile properties – Part 2: Test conditions for moulding and extrusion plastics (ISO 527-2:1993 including Corr 1:1994)*

EN ISO 4892-1, *Plastics – Methods of exposure to laboratory light sources – Part 1: General guidance (ISO 4892-1:1999)*

EN ISO 4892-2, *Plastics – Methods of exposure to laboratory light sources – Part 2: Xenon-arc sources (ISO 4892-2:1994)*

EN ISO 6946, *Building components and building elements – Thermal resistance and thermal transmittance – Calculation method (ISO 6946:1996)*

EN ISO 10077-2, *Thermal performance of windows, doors and shutters – Calculation of thermal transmittance – Part 2: Numerical method for frames (ISO 10077-2:2003)*

EN ISO 10211-1, *Thermal bridges in building construction – Heat flows and surface temperatures – Part 1: General calculation methods (ISO 10211-1:1995)*

EN ISO 10211-2, *Thermal bridges in building construction – Calculation of heat flows and surface temperatures – Part 2: Linear thermal bridges (ISO 10211-2:2001)*

EN ISO 10456, *Building materials and products – Procedures for determining declared and design thermal values (ISO 10456:1999)*

EN ISO 12017:1996, *Plastics – Poly(methyl methacrylate) double- and triple-skin sheets – Test methods (ISO 12017:1995)*

prEN ISO 12567-2, *Thermal performance of windows and doors – Determination of thermal transmittance by hot box method – Part 2: Roof windows and other projecting windows (ISO/DIS 12576-2:2005)*

EN ISO 13468-1, *Plastics – Determination of the total luminous transmittance of transparent materials – Part 1: Single-beam instrument (ISO 13468-1:1996)*

EN ISO 14125, *Fibre-reinforced plastic composites – Determination of flexural properties (ISO 14125:1998)*

ISO 10526, *CIE standard illuminants for colorimetry*

ISO/IEC 10527:1991, *CIE standard colorimetric observers*

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

3 Terms and definitions

For the purposes of this European Standard, the following definitions apply.

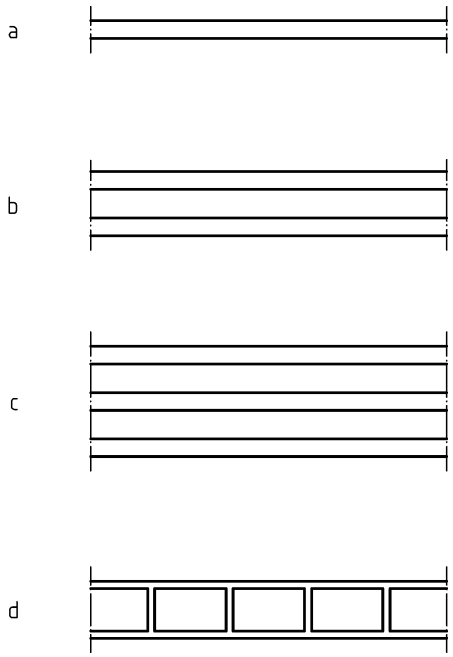
3.1
plastic roof light
building element which consists of one or several light transmitting (translucent or transparent) skins. The translucent part of the roof light is one single element (see Figure 3)

3.2
upstand
element which is single- or multi-walled or composite with vertical and/or pitched walls; with or without thermal insulation and having the two-fold purpose of providing an area for the fixture of plastic roof lights and for connection to the substructure, the roof covering or the roof sealing. The upstand transmits into the substructure the loads acting upon the plastic roof lights. Upstands may include ventilation devices

3.3
accessories
connections, opening and locking devices and seals for the assembly of the elements according to 3.1 and 3.2

3.4
plastic rooflight with upstand
building element which consists of at least the separate elements in accordance with 3.1, 3.2 and 3.3

3.5
batch
quantity of material made in a single operation, or in the case of continuous production for a defined quantity which shall be demonstrated by the producer to have a uniform composition



Key

a single skin, solid sheet
b double skin, solid sheet
c triple skin, solid sheet
d structured sheet

Figure 3 — Cross sections of typical plastic sheets

4 Symbols and abbreviations

C_c	Change in light transmission in %
ΔYI	Change in the yellowness index
H_c	Energy applied during ageing procedure
L_s	Light transmission of a test piece
L_{sn}	Light transmission of the *n*th test piece
τ_{D65}	Total luminous transmittance for the CIE-standard illuminant D_{65} in %
M_s	Average (see B.5.1) of R_1 and R_3
M_v	Light transmission of the sample
R	Thermal resistance in $m^2 \cdot K/W$
R_1 and R_3	Reading of galvanometer without any test piece
R_2	Reading of galvanometer with the test piece
R_w	Airborne sound index in dB

U	Heat transmittance in W/(m²·K)
YI	Value of the yellowness index of aged test piece
YI_0	Value of the yellowness index of unaged test piece
ΔE	Variation of E-modulus in %
$\Delta\sigma$	Variation of strength in %
$X_{CIE,}$ $Y_{CIE,}$ Z_{CIE}	Colourimetric coordinates

5 Requirements

5.1 Degree of total luminous transmittance (τ_{D65})

This characteristic shall be assessed when subject to regulatory requirements and may be assessed otherwise. The degree of total luminous transmittance of each skin and possible combinations of skins in new plastic roof lights shall be stated by the manufacturer when measured with a spectrophotometer according to 6.1 either on a flat specimen and/or a finished product. The recorded τ_{D65} value of the total luminous transmittance shall be within ± 5 % of the stated value.

NOTE Annex C presents information regarding the calculation of radiation related to energy consumption.

5.2 Durability

5.2.1 General

Durability of the product is evaluated by measuring the variation of total luminous transmittance, yellowness index and mechanical properties after ageing procedure of the roof light material with the same energy level for the three following characteristics either on flat sheets and/or finished product. The ageing procedure shall be conducted in accordance with 6.2.

5.2.2 Variation of total luminous transmittance τ_{D65} and yellowness index YI (ΔYI)

Plastic roof lights are classified in 9 types as given in Table 1.

Table 1 — Material classification according to the change of the total luminous transmittance τ_{D65} and yellowness index *YI* (ΔYI)

Type	H_C GJ/m^2	Change of τ_{D65} %	ΔYI %
ΔA	18	≤ 5	≤ 10
ΔB	18	≤ 5	≤ 20
ΔC	18	≤ 10	≤ 10
ΔD	18	≤ 10	≤ 20
ΔE	10	≤ 10	≤ 10
ΔF	10	≤ 10	≤ 20
ΔG	10	≤ 15	≤ 20
ΔH	6	≤ 15	≤ 20
ΔI	4	≤ 15	≤ 20

The figures indicated for the change of total luminous transmittance τ_{D65} refer to variation in percentage of the initial value.

5.2.3 Variation of mechanical properties with ageing

The tensile strength and Young's Modulus are properties of a material which can vary with age.

Where required, the variation of the properties shall be determined by a bending test (or a tensile test) as defined in 6.2.4.

The percentage reduction in Young's Modulus, E, and tensile strength, σ, between new samples and samples aged to energy exposures (H_c) as described in Table 1, shall then be expressed in accordance with Tables 2 and 3.

Table 2 — Material classification according to change of E-Modulus after ageing procedure at the same energy level H_c selected from Table 1

Type	ΔE %
Cu 0	0
Cu 1	0 > ΔE ≥ -10
Cu 2	-10 > ΔE ≥ -20
Cu 3	-20 > ΔE ≥ -30

Table 3 — Material classification according to change of σ after ageing procedure at the same energy level H_c selected from Table 1

Type	$\Delta\sigma$ %
Ku 0	≥ 0
Ku 1	$0 > \Delta\sigma \geq -10$
Ku 2	$-10 > \Delta\sigma \geq -20$
Ku 3	$-20 > \Delta\sigma \geq -30$

5.3 Water tightness

5.3.1 Roof lights with upstand

This characteristic shall be assessed when subject to regulatory requirements and may be assessed otherwise. The plastic roof light in the closed condition shall be tested in accordance with 6.3. No water shall drop from the internal surface. The design of the roof light shall ensure that water drains away.

5.3.2 Roof lights without upstand

This characteristic shall be assessed when subject to regulatory requirements and may be assessed otherwise. The products covered by this European Standard are water impermeable provided that they are free of defects such as holes. The absence of such defects shall be checked by visual inspection of the finished product.

5.4 Mechanical performances

5.4.1 Resistance to upward loads

This characteristic shall be assessed when subject to regulatory requirements and may be assessed otherwise. According to their resistance to upward loads, plastic roof lights are classified into one of the three types as given in Table 4.

Table 4 — Types of upward loads

Type	Load N/m^2
UL 1500	1 500
UL 3000	3 000
UL A [a]	A [a]
[a] The value of A can be selected to meet specific requirements.	

The designations UL 1500, UL 3000 and UL A are representing the test upward load in N/m^2 applied, when the roof light is tested in accordance with 6.4.1. When tested in accordance with 6.4.1, the plastic roof light shall be capable of resisting the test load.

A successful test is achieved if neither damage nor permanent deformation occurs which would affect the performance in use (e.g. watertightness, opening).

5.4.2 Resistance to downward loads

This characteristic shall be assessed when subject to regulatory requirements and may be assessed otherwise. According to their resistance to downward loads, plastic roof lights are classified into one of the five types as given in Table 5.

Table 5 — Types of downward loads

Type	Load N/m^2
DL 750	750
DL 1125	1 125
DL 1750	1 750
DL 2500	2 500
DL A [a]	A [a]
[a] The value of A can be selected to meet specific requirements.	

The designations DL 750, DL 1175, DL 1750, DL 2500 and DL A are representing the test downward load in N/m² applied, when the rooflight is tested in accordance with 6.4.1. When tested in accordance with 6.4.1, the plastic roof light shall be capable of resisting the test load.

A successful test is achieved if neither damage nor permanent deformation occurs which would affect the performance in use (e.g. watertightness, opening).

5.4.3 Impact load

5.4.3.1 Small, hard body

This characteristic shall be assessed when subject to regulatory requirements and may be assessed otherwise. The product shall be tested in accordance with 6.4.2.1. Plastic roof lights shall be resistant to the impact of a small hard body. The products shall always be tested with the manufacturer's corresponding or specified upstand.

NOTE The identification of the tested assembly (the roof light and the upstand) is part of the information accompanying the declared performance.

5.4.3.2 Large, soft body

This characteristic shall be assessed when subject to regulatory requirements and may be assessed otherwise. The product shall be tested in accordance with 6.4.2.2. Plastic roof lights with upstands shall be classified according to Table 6. The products shall always be tested with the manufacturer's corresponding or specified upstand.

NOTE The identification of the tested assembly (the roof light and the upstand) is part of the information accompanying the declared performance.

Table 6 — Types of large soft body impact loads

Types	Impact energy J
SB 1200	1 200
SB 800	800
SB 600	600
SB 300	300
SB A [a]	A [a]
SB 0	no requirement
[a] The value of A can be selected to meet specific requirements.	

The designations SB 1200, SB 800, SB 600, SB 300 and SB A are representing the test impact energy in Joules applied, when the roof light is tested in accordance with 6.4.2.2.

A successful test is achieved if neither the bag nor the gauge can pass through the specimen.

5.5 Reaction to fire

This characteristic shall be assessed when subject to regulatory requirements and may be assessed otherwise. The product shall be tested using the test method(s) as referred to in and classified in accordance with EN 13501-1.

Where required by a particular test method, and in addition to any specific requirements in that test method, the product shall be mounted and fixed for testing in a manner representative of its intended end use.

5.6 Resistance to fire

This characteristic shall be assessed when subject to regulatory requirements and may be assessed otherwise. The product shall be tested using the test method(s) as referred to in and classified in accordance with EN 13501-2.

Where required by a particular test method, and in addition to any specific requirements in that test method, the product shall be mounted and fixed for testing in a manner representative of its intended end use.

5.7 External fire performance

This characteristic shall be assessed when subject to regulatory requirements and may be assessed otherwise. The product shall be tested using the test method(s) as referred to in and classified in accordance with prEN 13501-5. The products to be tested shall be installed, in addition to the general provisions given in the relevant test method, in a manner representative of their intended end use. When tested in accordance with ENV 1187:2002, test method 2, the materials shall be tested flat.

NOTE This requirement is not applicable until prEN 13501-5 (or EN 13501-5) becomes available. The text is written like this to avoid the need for it to be changed after UAP.

5.8 Air permeability

5.8.1 Roof lights with upstand

This characteristic shall be assessed when subject to regulatory requirements and may be assessed otherwise. The test method is given in EN 12153.

5.8.2 Roof lights without upstand

The products covered by this European Standard are air impermeable provided that they are free of defects such as holes. Where required, the absence of such defects shall be checked by visual inspection of the finished product.

5.9 Thermal resistance

5.9.1 Roof lights with upstands

The calculated or measured value of the thermal transmittance, U value, in W/(m²·K) shall be determined.

Calculations shall be performed on the basis of the thermal properties of component products (see 5.9.2) in accordance with EN ISO 6946. The effect of any areas of thermal bridging shall be included as a weighted area resultant for the total product based on its thermal resistance, R-value, determined in accordance with EN ISO 10211-1, EN ISO 10211-2 and/or EN ISO 14653.

Alternatively, measurements in accordance with prEN ISO 12567-2 shall be performed.

5.9.2 Roof light components

5.9.2.1 Translucent sheet material

The thermal transmittance, *U*-value, in W/(m²·K) of the translucent sheet material may be assumed to have the appropriate value specified in Table 7 without the need for testing. The values of Table 7 do not apply to light transmitting elements made of structured (hollow-chamber) materials (see Figure 3). In case Table 7 does not apply or if the manufacturer claims better performance, the thermal transmittance shall be determined in accordance with EN ISO 10456, based on test results in accordance with EN 674 or EN 675, or calculated in accordance with EN 673 (for flat sheets). The values relate to the translucent area of the plastic roof light made of one or more skins of solid sheet material, without edge effects.

5.9.2.2 Upstand, edge profiles and accessories

For calculation purposes for the roof light with upstand (see 5.9.1), the thermal transmittance of upstands, edge profiles and accessories shall be determined in accordance with EN ISO 10077-2.

Table 7 — Thermal resistance

Type of roof light	Heat transmittance (*U*-value) W/(m^2 x K)
single skin	5,6
double skin	3,0
triple skin	2,2

5.10 Airborne sound insulation

In the absence of measurements as specified below, it is deemed that the values given in Table 8 apply for the airborne sound insulation index R_w of plastic roof lights.

If the values specified in Table 8 are not used, the proof of airborne sound insulation index R_w for plastic rooflights with upstands shall be provided in compliance with EN ISO 140-3.

Table 8 — Airborne sound indexes

Type of roof light	Airborne sound index R_w dB
single skin	12
double skin	20
triple skin	22

6 Testing

6.1 Light transmission

The light transmission of the roof light material is determined as luminous transmittance τ_{D65} using a spectrophotometer according to EN ISO 13468-1 or ISO 13468-2. The light transmission of structured sheets is determined as luminous transmittance τ_A according to EN ISO 12017:1996, Annex A.

If the reference test method specified above is not used for factory production control testing, the alternative method given in Annex B shall be followed.

6.2 Durability

6.2.1 Conditions for accelerated ageing

The testing is carried out in accordance with EN ISO 4892-1. The spectral distribution of the filtered Xenon-arc-radiation shall be in accordance with EN ISO 4892-2.

The following test conditions shall be observed:

— black-panel-temperature (45 ± 3) °C;

— black-standard-temperature (65 ± 3) °C.

Either the black panel temperature or the black standard temperature may be used according to the details of the apparatus:

— air-temperature in the test chamber: +30 °C to +35 °C;

— relative humidity in the dry period: (65 ± 5) %;

— spray cycle: 120 min = 18 min rain + 102 min dry;

or where those facilities are not available, times of 9 min and 51 min, respectively, are allowed.

The dimensions of the test samples shall be sufficient to be subsequently tested for light transmittance (see 6.2.2), yellowness index (see 6.2.3) and mechanical properties (see 6.2.4).

Test specimens for these tests shall be representative of and not thicker than the sheets used in practice.

6.2.2 Variation of light transmittance

6.2.2.1 Apparatus

Determine the light transmittance using a spectrophotometer as described in 6.1 before and after the ageing procedure.

6.2.2.2 Test pieces

Use ten test pieces chosen at random so as to be representative.

6.2.2.3 Procedure

Calibrate and operate the spectrophotometer and other instruments in accordance with instructions supplied by the manufacturer.

Obtain spectral transmittance data relative to air in the wave length range of 380 nm to 780 nm.

6.2.2.4 Expression of results

The change of light transmission is expressed as the average of the variation of total luminous transmittance of each test piece. These figures are evaluated in percentage of the initial value.

6.2.3 Variation in yellowness index

6.2.3.1 Apparatus

Determine the yellowness index using a spectrophotometer as described in 6.1 before and after the ageing procedure.

6.2.3.2 Test pieces

The same test pieces as already used for change in light transmittance shall be used.

6.2.3.3 Procedure

Calibrate and operate the spectrophotometer and other instruments in accordance with instructions supplied by the manufacturer.

Obtain spectral transmittance data relative to air in the wave length range of 380 nm to 780 nm.

6.2.3.4 Expression of results

Calculate the tristimulus values for CIE standard illluminant D 65 according to ISO 10526 and CIE standard observer 2° according to ISO/CIE 10527 by numerical integration from recorded spectral data or by automatic integration during spectrometer operation.

Calculate the magnitude and sign of the yellowness index from the following equation:

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

Calculate the magnitude and direction of change in yellowness index from the following equation:

$$\Delta YI = YI - YI_0 \quad (2)$$

6.2.4 Variation of mechanical properties with ageing

Measure the bending strength and the corresponding E-modulus of the material of the sheets according to EN ISO 14125 or EN ISO 178 for new samples and samples aged to energy exposures (H_c) as described in Table 1.

If a bending test cannot be performed, measure the tensile strength and the corresponding *E*-modulus according to EN ISO 527-1 and EN ISO 527-2.

Four test pieces are used for evaluation, two new samples and two aged samples.

Bending or tensile and light transmitting tests shall be carried out on the same sample ensuring the aged surface is in tension.

6.3 Watertightness

6.3.1 Principle

This test simulates the effect of rainwater or melting snow which can run across the external surface of the plastic roof light.

6.3.2 Procedure

The plastic roof light with upstand – in closed position if an openable type - as installed on the roof shall be sprayed with water as follows:

— water is sprayed over the entire test area, the nozzles being in horizontal position;

— flow volume on the test area is 2 l/(m²·min) to 3 l/(m²·min);

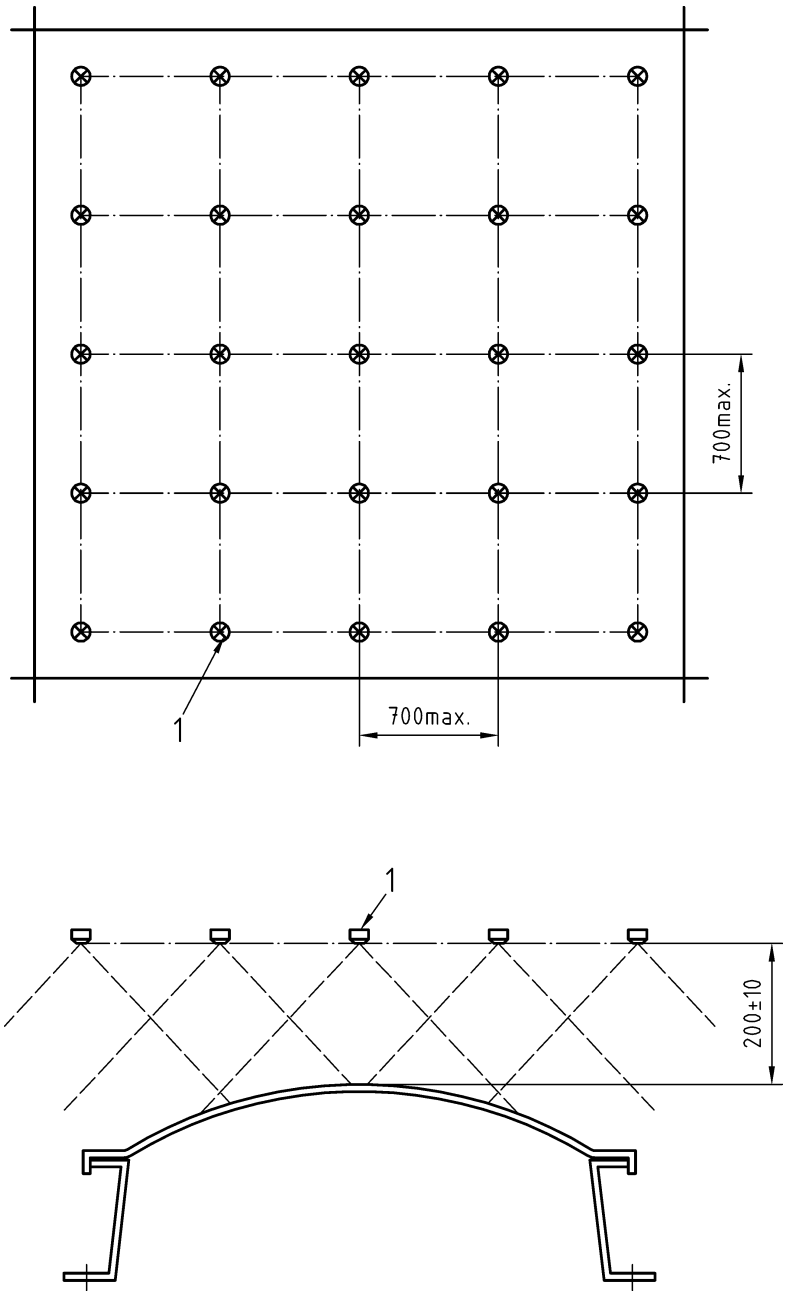
— test duration is 60 min.

The test report shall indicate the degree of inclination at which the test was undertaken.

6.3.3 Apparatus

The apparatus used shall conform to Figure 4, which allows the water used to emanate from a rectangular grid system of nozzles. The nozzles together shall cover the whole of the square area relative to the horizontal plane as shown in Figure 4. The vertical position of the nozzle grid shall be fixed at (200 ± 5) mm above the highest point of the plastic roof light.

Dimensions in millimetres



Key

1 nozzle

Figure 4 — Test apparatus for water tightness

6.4 Mechanical performances

6.4.1 Resistance to upward and downward loads

6.4.1.1 General

This test procedure serves the purpose of judging the behaviour of plastic roof lights with upstands under varying loads.

6.4.1.2 Test apparatus and procedure

The test shall be carried out as follows:

a) carry out the tests on a new plastic roof light with upstand at a temperature of (23 ± 4) °C;

b) secure the upstand on rigid supports in accordance with the manufacturer's instructions for regular use (number and position of supports, fixings, etc.);

c) connect the plastic roof light (or opening frame if applicable) with the upstand by means of the fixings normally used by the manufacturer and in accordance with the manufacturer's instructions;

d) if an openable type – carry out the test with the roof light closed. Apply the weight on the outer skin of the roof light (i.e. any inner skin(s) shall be cut off);

e) for testing, air pressure can be used to simulate either positive or negative loads. The roof opening size (see Figure 1) shall be subject to the test. If weights are used for downward loads the overall size shall be used, for upward loads the daylight size shall be used referring to Figure 1;

f) equivalent loads (i.e. using weights instead of air pressure) may be used;

g) maintain the load for 6 min at the required value accurate to $^{+2}_{0}$ %;

h) if air pressure is used as load, measure the pressure as a function of time recorded on a diagram.

NOTE As a result of the vacuum or excess pressure test method, the forces will be normal to the surface of the roof light, whereas actual forces can be normal to the horizontal. The differences are considered negligible, taken into account in the estimation of national safety factors, if any.

6.4.2 Impact load

6.4.2.1 Small hard body

6.4.2.1.1 General

This test procedure serves the purpose of judging the behaviour of plastic roof lights with upstands towards the impact of a steel ball falling from a height of 1,0 m above the impact point in a laboratory environment.

6.4.2.1.2 Equipment and procedure

The equipment and procedures for the test are as follows:

— test specimens and equipment shall be at (23 ± 4) °C;

— secure the upstand on a rigid horizontal support in accordance with the manufacturer's instructions for regular use (number and position of fixings etc.);

— connect the plastic roof light (or opening frame, if applicable) with the upstand by means of the fixings normally used by the manufacturer and in accordance with the manufacturer's instructions;

— if an openable type - carry out the test with the roof light closed;

— use a steel ball with a mass of 250 g ± 1 %;

— test the impact strength at three points, located in the daylight area of the roof light, at the centre, at a corner, or edge for circular types, and at the most unfavourable position.

The test is satisfactory if the steel ball does not pass through the product in either of the three positions.

NOTE If no visible damages occur the test specimen can be used for the soft body test according to 6.4.2.2.

6.4.2.2 Large soft body

6.4.2.2.1 General

This test procedure serves the purpose of judging the behaviour of a plastic roof light with upstand by the impact of a sphero-conic bag of 50 kg mass falling from a given height in a laboratory environment.

6.4.2.2.2 Equipment and procedure

The equipment and procedures for the test are as follows:

a) test specimens and equipment shall be at (23 ± 4) °C;

b) secure the upstand on a rigid horizontal support in accordance with the manufacturer's instructions for regular use (number and position of fixings etc.). Carry out the fixing to the substructure or to the ground in such a way that no supporting air pressure below the rooflight occurs;

c) connect the plastic roof light (or opening frame, if applicable) with the upstand by means of the fixings normally used by the manufacturer and in accordance with the manufacturer's instructions;

d) carry out the test with the roof light closed;

e) suspend the bag defined in EN 596 at a height (distance between lowest point of bag and prospective impact point) of:

2,40 m	± 1%	for type SB 1200,
1,60 m	± 1%	for type SB 800,
1,20 m	± 1%	for type SB 600,
0,60 m	± 1%	for type SB 300, and
(A x 0,002) m	± 1%	for type SB A

above the impact point and drop the bag without initial velocity;

f) test the impact strength at a point, which is determined as the most unfavourable point, located in an area between 0,5 m and 1,0 m from the outer edge of the roof light. If one size of the roof light is smaller than 1,0 m, carry out the test at the centre line;

g) only one test shall be carried out on each roof light sample;

h) examine the test specimen without changing the position of the bag one minute after the impact to check whether a 300 mm diameter spherical gauge can pass through.

6.5 Number and dimensions of test specimens

6.5.1 Plastic roof lights with upstands which consist of the same materials and are provided with the same construction features form a model series manufactured in various sizes.

6.5.2 The validity of the results for each test on one roof light described in this European Standard may be extended by calculation and/or correlation to all roof lights of a model series and also other model series of roof lights provided that the selection of tested roof lights is made in accordance with 6.5.3 to 6.5.9.

6.5.3 For total luminous transmittance tests, one test per material type, colour type, thickness and manufacturer of plastic/resin.

6.5.4 For durability, one test per material type, colour type, type of surface protection, thickness and manufacturer of plastic/resin.

6.5.5 For watertightness, one test on the most unfavourable roof light dimension (usually the greatest dimension in area or perimeter of the roof light), connection dome/upstand and installation pitch.

6.5.6 For resistance to upward loads, one test on the most unfavourable roof light and upstand dimension, material type, thinnest outer skin, type of connection dome/upstand.

6.5.7 For resistance to downward loads, one test on the most unfavourable rooflight and upstand dimension, material type, thickness of skin(s) and type of connection dome/upstand. This test shall be conducted in real configuration of supports. The roof light may be tested with all skins, this shall, however, be indicated in the test report.

6.5.8 For impact test, small hard body, one test on the most unfavourable roof light dimension (usually the smallest dimension in area or perimeter of the roof light), material type, thickness of outer skin and type of connection dome/upstand.

6.5.9 For impact test – large soft body, one test on the most unfavourable roof light dimension (usually the smallest dimension in area or perimeter of the rooflight), material type, thickness of skin(s) and type of connection dome/upstand.

6.6 Test report

The test report shall include at least the following items:

a) name of manufacturer;

b) sampling method;

c) testing conditions (e.g. substructure);

d) date of test;

e) individual results of the test;

f) description and drawing of the plastic rooflight with upstand in accordance with 3.4 including specification of the construction material used;

g) indication on restrictions of use.

7 Evaluation of conformity

7.1 General

The compliance of a roof light with the requirements of this European Standard and with the stated values (including types and classes) shall be demonstrated by:

— initial type testing;

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

For the purposes of testing, roof lights may be grouped into families (model series), where it is considered that the results for a given characteristic from any one product within a family are representative for all other products within the same family.

7.2 Initial type testing

Initial type testing shall be performed on first application of this European Standard. Tests previously performed in accordance with the provisions of this European Standard (same product, same characteristic(s), test method, sampling procedure, system of attestation of conformity, etc.) may be taken into account. In addition, initial type testing shall be performed at the beginning of the production of a new roof light type (unless a member of the same family) or at the beginning of a new method of production where this may affect the stated properties.

Where characteristics have been determined on the basis of conformity with this European Standard, these characteristics need not be reassessed provided that the manufacturer ensures the validity of the results. Products CE marked in accordance with appropriate harmonised European specifications may be presumed to have the performances stated of them, although this does not replace the responsibility of the roof light manufacturer to ensure that the roof light as a whole is correctly designed and its component products have the necessary performance values.

Whenever a change occurs in the roof light 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).

The results of all type tests shall be recorded and held by the manufacturer for at least 5 years.

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.

An FPC system conforming with the requirements of the relevant clauses of EN ISO 9001, and made specific to the requirements of this European Standard, is considered to satisfy the above requirements.

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.

7.3.2 Equipment

All weighing, measuring and testing equipment shall be calibrated and regularly inspected according to documented procedures, frequencies and criteria.

7.3.3 Raw materials and components

The specifications of all incoming raw materials and components shall be documented, as shall the inspection scheme for ensuring their conformity.

7.3.4 Design process

The factory production control system shall document the various stages in the design of products, identify the checking procedure and those individuals responsible for all stages of design.

During the design process itself, a record shall be kept of all checks, their results, and any corrective actions taken. This record shall be sufficiently detailed and accurate to demonstrate that all stages of the design phase, and all checks, have been carried out satisfactorily.

7.3.5 Product testing and evaluation

The manufacturer shall establish procedures to ensure that the stated values of all characteristics are maintained. The characteristics, and the means and frequency of control, are presented in Table 9.

Table 9 - Verifications in the framework of factory production control

Characteristics	Verification method [a]	Minimum frequency
For light transmitting sheets, upstands, accessories, etc.		
Material properties of upstand material, insulation products, accessories, etc.	Compliance with supplier's declaration	Every delivery
Geometry (all declared parameters, e.g. length, width, height)	Manufacturer's methods	Every unit light transmitting sheet and upstand (if relevant)
For light transmitting sheets only		
Composition	Manufacturer's methods	Continuously or every production batch
Density		Every production batch
Bending or tensile strength (initial)	EN 1873:2005, 6.2.4	
Impact resistance (hard body)	EN 1873:2005, 6.4.2.1	
Heat resistance [b]	EN 1013-3	
Glass content [c]	EN 1013-5	
Curing [c]	EN 1013-5	
Luminous transmittance	EN 1873:2005, 6.1 (or Annex B)	Every 1 000 light transmitting sheets

[a] The test methods should correspond to those included in the technical specification referred to, but different equipment may be used by the manufacturer, as long as correlation with ITT results can be established (where applicable).

[b] Only applicable for PVC light transmitting sheets.

[c] Only applicable for GRP sheet material.

8 Designation

Plastic roof lights with and without upstands shall be designated at least by the following items:

a) wording "plastic roof light with upstand" or “plastic roof light without upstand” (as relevant);

b) reference to this European Standard (EN 1873);

c) size (roof opening diameter or roof opening width x roof opening length);

d) height of the upstand (if applicable);

e) material classification according to change of total luminous transmittance τ_{D65} and yellowness index *YI (ΔYI)*;

f) material classification according to change of E-modulus after ageing procedure;

g) material classification according to change of σ after ageing procedure;

h) mechanical performances (types of upward, downward and impact loads).

EXAMPLE OF DESIGNATION

Plastic roof light with upstand, EN 1873, ∅ 1,2 m, 0,3 m; ΔA, Cu 0, Ku 0, UL 1500, DL 750, SB 300

Plastic roof light without upstand, EN 1873, ∅ 1,2 m; ΔA, Cu 0, Ku 0, UL 1500, DL 750, SB 300

9 Marking

Plastic roof lights with and without upstands shall be marked with the following items (coding is acceptable):

NOTE 1 It is recommended to repeat the same details on any wrapping supplied with the consignment units.

a) name or trademark of the manufacturer or responsible supplier;

b) type and model;

c) month and year of manufacture;

d) designation (see Clause 8);

e) maximum inclination;

f) luminous transmittance.

NOTE 2 Where ZA.3 covers the same information as this clause, the requirements of this clause are met.

Annex A
(informative)

Guidelines for safety, application, use and maintenance

A.1 General

Plastic roof lights with upstands should be suitable for use. The construction materials should be mutually compatible and suitable for their respective purposes.

A.2 Guidelines for safety

A.2.1 Plastic roof lights according to this European Standard are not intended to be walked on. Roof lights should only be opened according to the manufacturer's instruction.

A.2.2 Plastic roof lights, upstands, opening frames and accessories should be designed to minimise risk to personnel when used in compliance with the specification. In particular, there should be no possibility of falling debris which can cause bodily injuries, except under extraordinary climatic conditions (i.e. fire conditions).

A.2.3 Plastic roof lights with upstands should be equipped with fixing elements which cannot be removed from the outside without tools. Opening roof lights should be secure in the closed position.

A.3 Guidelines for application and use

A.3.1 Where not otherwise defined in this European Standard, European and/or national regulations and codes of practice applicable to the design and installation of roofing systems should be followed. Where relevant, the methods of application laid down by suppliers of special roofing materials should be always considered. The manufacturer should specify the installation conditions.

A.3.2 The connection of the separate roof light unit to the supporting substructure should be executed in such a way that the loads acting upon the connection are transferred to the substructure.

A.3.3 The storage, transportation, erection and installation of the plastic roof lights, upstands, opening frames and accessories should be performed in accordance with the manufacturer’s instructions.

A.3.4 The manufacturer’s instructions should be adhered to with respect to the temperature and environmental compatibility such as the effect of cleaning agents, fluids, gaseous and solid substances (particularly organic solvents).

A.3.5 Roof lights made of plastic materials are vapour permeable. For this reason, in the case of multi-skinned roof lights the formation of water condensate between the skins may occur temporarily, which, however, should not affect the function of the roof light.

A.3.6 Opening roof lights should be closed at wind speeds of over 10 m/s.

A.3.7 The minimum height of the upstand should be at least 150 mm above the finished roof level.

A.3.8 Where wind loads corresponding to higher test loads than those indicated in Table 4 are specified, the plastic roof light should be tested using the method described in 5.4 but with the higher test load.

A.3.9 Where higher loads than those indicated in Table 5 are required (i.e. in regions of regular high snow falls), the plastic roof light should either be fitted substantially higher than the roof surface or subjected to a special test load.

A.4 Maintenance

Plastic roof lights with upstands should be subjected to periodic maintenance according to the manufacturer's instructions. The maintenance should include:

— cleaning of structural elements;

— checking and possible replacement of seals;

— checking, maintenance and possible replacement of accessories;

— maintenance of the opening mechanism (if any).

The maintenance measures should be safely and easily implemented without the need to dismantle the plastic roof lights with upstands. Failure to comply with these maintenance requirements may affect the performance and life expectancy of the product.

Annex B
(normative)

Alternative test method for the determination of light transmission

B.1 General

The described test method may be used for quality control purposes provided that the manufacturer can demonstrate correlation with the method described in 6.1. In this case the manufacturer shall use as reference the light transmission figure relative to the box method equivalent to the stated value. The tolerance of ± 5 % applies to this reference.

B.2 Apparatus

The apparatus consists of:

— open box, square in plan, painted matt white[1] inside with internal dimensions of $600\ ^{+5}_{0}$ mm and $900\ ^{+5}_{0}$ mm high. An internal flange $25\ ^{+5}_{0}$ mm wide and $25\ ^{+5}_{0}$ mm deep has to be provided at a distance (from the top of the box) of 100 mm, or the maximum depth of the profile to be tested plus 5 mm, whichever is the greater;

— 40 mm colour and cosine-corrected selenium photocell is mounted, facing downwards, at the centre of the aperture formed by the flange but $600\ ^{+5}_{0}$ mm below it. The spectral response of this photocell is such as to give a maximum reading between 380 nm to 780 nm. The photocell is connected to a galvanometer;

— light source designed to have a colour temperature of about 6 500 K is fitted to the top of the box. It consists of an optically neutral opal acrylic plastics diffuser (opal polymerised methyl methacrylate or equivalent may be used[1]) mounted flush with the top of the box with eight tubes, 600 mm long, 20 W fluorescent "cold white" above it and control apparatus mounted outside;

— regulator circuit, if necessary, to maintain a constant voltage supply to the lamps;

— suitable devices to measure temperature:

a) in the centre of and on the surface of the diffuser;

b) immediately above the photocell.

B.3 Test pieces

Cut five test pieces from the sheet which are square in shape, each side being 575 mm in length.

---

[1] Colour RAL 9003 matt can be used.

[1] For example, "Perspex", grade 040, is a suitable product available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by CEN of this product.

B.4 Procedure

B.4.1 Before testing, fit the top to the box, switch on the lamps and leave to stabilise for a minimum period of 30 min.

B.4.2 The temperature levels from each device has to be monitored. Tests shall be discontinued if the temperatures recorded in the centre and on the surface of the diffuser exceed 35 °C and/or the temperature recorded immediately above the photocell exceeds 30 °C.

B.4.3 Note the reading R_1 of the galvanometer without any test piece in position.

B.4.4 Remove the top from the box and place the test piece on the internal flange. Refit the top to the box and note the reading R_2 of the galvanometer with the sample in position.

B.4.5 Remove the top from the box, remove the test piece. Refit the top to the box and note the reading R_3 of the galvanometer.

B.4.6 Compare R_1 and R_3, and if the difference is not greater than 5 % relative to the greater value, accept the results. If the difference is more than 5 %, repeat the test until satisfactory results are obtained.

B.4.7 Repeat B.4.3 to B.4.6 four times with different test pieces.

B.5 Expression of results

B.5.1 Determine the mean value M_s of R_1 and R_3 for each test piece as:

$$M_s = \frac{R_1 + R_3}{2} \tag{B.1}$$

B.5.2 Express the light transmission L_s of each test piece as:

$$L_s = \frac{R_2}{M_s} \times 100 \text{ in \%} \tag{B.2}$$

B.5.3 Determine the mean value of the light transmission of the test pieces as:

$$M_v = \frac{1}{5} \times \sum_{n-1}^{n=5} L_{sn} \tag{B.3}$$

Annex C
(informative)

Information regarding luminous transmittance

C.1 General

All definitions in this annex are in accordance with CIE 38 [1].

C.2 Material characteristics

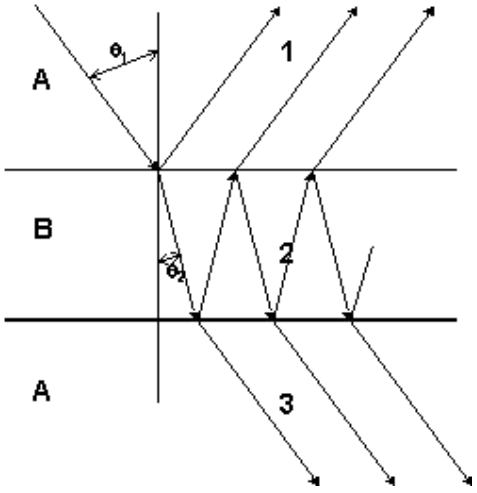
Material characteristics are affected by the spectral distribution of radiation, its state of polarisation, the angles of incidence and observation, the angular extent of the incident radiation and the viewing beam, the thickness of the sample, the temperature and the state of the surface.

Radiation can be absorbed, reflected or transmitted by a sample.

Refraction occurs when the radiation propagates in different optical media. The refractive indices n_1 and n_2 determine the new direction of propagation θ_2 if the radiation incidence is under the angle θ_1:

$$n_1 \times \sin(\theta_1) = n_2 \times \sin(\theta_2) \quad \text{(C.1)}$$

As shown in Figure C.1, all rays are within one plane. The angles θ_1 and θ_2 are the plane angles between the rays and a line normal to the surface.



Key

A air (n_1 = 1,0)
B transparent material (n_2)
1 Reflected
2 Absorbed
3 Transmitted

Figure C.1 — Propagation of radiation through two media with different refractive indices

C.3 Transmission

The passage of radiation through a medium without change of wavelength is called transmission. The spectral transmittance $\tau(\lambda)$ is the ratio of the transmitted radiant flux $\Phi_{e\lambda\tau}$ to the incident flux $\Phi_{e\lambda}$ at a given wavelength λ:

$$\tau(\lambda) = \frac{\Phi_{e\lambda\lambda}(\lambda)}{\Phi_{e\lambda}(\lambda)} \tag{C.2}$$

This factor is also called transmission factor.

For double glazing the spectral transmittance can be computed by the spectral transmittances and reflectance of each glazing (index 1 refers to the outer glazing; index 2 refers to the inner glazing):

$$\tau(\lambda) = \frac{\tau_1(\lambda) \times \tau_2(\lambda)}{1 - \rho'_1(\lambda) \times \rho_2(\lambda)} \tag{C.3}$$

$\rho'_1(\lambda)$ is the spectral reflectance of the outer glazing measured against the direction of incident radiation. $\rho_2(\lambda)$ is the spectral reflectance measured parallel to the incident radiation.

Accordingly, the spectral transmittance of triple glazing can be obtained by the equation:

$$\tau(\lambda) = \frac{\tau_1(\lambda) \times \tau_2(\lambda) \times \tau_3(\lambda)}{[1 - \rho'_1(\lambda) \times \rho_2(\lambda)] \times [1 - \rho'_2(\lambda) \times \rho_3(\lambda)] \times \tau_2^2(\lambda) \times \rho'_1(\lambda) \times \rho_3(\lambda)} \tag{C.4}$$

Regular transmittance can be calculated by the spectral transmittance for a given relative spectral power distribution $S_\lambda(\lambda)$ and a weighting function $s_{rel}(\lambda)$:

$$\tau = \frac{\int_0^\infty S_\lambda(\lambda) \times \tau(\lambda) \times s_{\mathrm{rel}}(\lambda)\, d\lambda}{\int_0^\infty S_\lambda(\lambda) \times s_{rel}(\lambda)\, d\lambda} \tag{C.5}$$

For radiant characteristics, the weighting function is independent of wavelength; $s_{rel}(\lambda) = 1$. For photometric characteristics, the weighting function is $V(\lambda)$. The luminous transmittance is given for a defined illuminant $S_\lambda(\lambda)$. In daylight applications the standard illuminant *D65* is usually used.

C.4 Reflectance factor

The reflectance factor *R* is the ratio of radiant flux reflected in the direction delimited by the cone to that reflected in the same direction by a perfect reflecting diffuser identically irradiated.

C.5 Absorptance

The spectral absorptance $\alpha(\lambda)$ is the ratio of absorbed spectral radiant flux $\Phi_{e\lambda\alpha}$ to the incident flux $\Phi_{e\lambda}$:

$$\alpha(\lambda) = \frac{\Phi_{e\lambda\lambda}(\lambda)}{\Phi_{e\lambda}(\lambda)} \tag{C.6}$$

Luminous absorptance for a given illuminant can be calculated by weighting the absorbed and the incident flux with the $V(\lambda)$-function.

C.6 Solar gain

C.6.1 General information

Direct solar radiation and diffuse sky radiation entering a building can be used for illumination purposes. In addition to that, the radiation may lead to a heat gain. The luminous, radiant and energetic characteristics of the materials used affect the inner situation of a building. Colour-related quantities of the light entering the building also depend on the spectral characteristics of the materials.

While in winter the energy for heating can be decreased by solar heat gain, this effect should be prevented in summer, because the cooling loads will be increased.

C.6.2 Illuminance

The illuminance is the ratio of the differential luminous flux $d\Phi$ hitting the differential area dA_2:

$$E = \frac{d\Phi}{dA_2} \tag{C.7}$$

The index 2 indicates that the area receives light. The unit of illuminance is lux (lx).

C.6.3 Solar factor

The total solar energy transmittance (solar factor) g is the sum of the direct radiant transmittance τ_e for global radiation and the secondary internal heat transfer factor q_i.

$$g = \tau_e + q_i$$

The secondary internal heat transfer factor is a measure for secondary effects of heat transfer such as convection and infrared radiation of longer wavelengths.

The direct transmittance for global radiation (300 nm to 2 500 nm) can be obtained by:

$$\tau_e = \frac{\sum_{\lambda=300\text{nm}}^{2500\text{nm}} S_\lambda(\lambda) \times \tau(\lambda) \times \Delta\lambda}{\sum_{\lambda=300\text{nm}}^{2500\text{nm}} S_\lambda(\lambda) \div \Delta\lambda} \tag{C.8}$$

$$\rho_e = \frac{\sum_{\lambda=300\text{nm}}^{2500\text{nm}} S_\lambda \rho(\lambda) \Delta\lambda}{\sum_{\lambda=300\text{nm}}^{2500\text{nm}} S_\lambda \Delta\lambda} \tag{C.9}$$

where

ρ_e is the direct solar energy reflection energy;
S_λ is the relative spectral distribution of solar radiation;
$\rho(\lambda)$ is the reflection spectral factor;
$\Delta\lambda$ is the wavelength interval;

α_e is the solar absorptance and can be obtained indirectly by the solar reflectance and solar transmittance:

$$\alpha_e = 1 - (\rho_e + \tau_e) \quad \text{(C.10)}$$

EN 410 gives equations to determine the secondary internal heat transfer factor for single, double and triple glazing. The solar factor depends, as all other material characteristics, on the angle of incidence. The angle of incidence should be taken into account for different sun positions.

Annex ZA
(informative)

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

ZA.1 Scope and relevant characteristics

This European Standard has been prepared under mandate M/122 "Roof coverings, roof lights, roof windows and ancillary products" given to CEN by the European Commission and the European Free Trade Association

The clauses of this European Standard shown in this annex meet the requirements of the mandate given under the EU Construction Products Directive (89/106/EEC).

Compliance with these clauses confers a presumption of fitness of the roof lights covered by this annex for the intended uses indicated herein; reference shall be made to the information accompanying the CE marking.

WARNING: Other requirements and other EU Directives, not affecting the fitness for intended uses, may be applicable to the roof lights falling within the scope of this European Standard.

NOTE In addition to any specific clauses relating to dangerous substances contained in this standard, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the EU Construction Products Directive, these requirements need also to be complied with when and where they apply. An informative database of European and national provisions on dangerous substances is available at the Construction web site on EUROPA (accessed through http://europa.eu.int/comm/enterprise/construction/internal/dangsub/dangmain.htm).

This annex establishes the conditions for the CE marking of the roof lights intended for the use indicated in Table ZA.1.1 and ZA.1.2 and shows the relevant clauses applicable.

The scope of this annex is defined by Tables ZA.1.1 and ZA.1.2, and is the same as Clause 1 of this standard.

Table ZA.1.1 — Relevant clauses for individual roof lights with upstand

Product: Individual roof lights of plastic with upstands **Intended use:** Light transmission for use in flat and inclined roofs of buildings			
Essential Characteristics	**Requirement clauses in this European Standard**	**Levels and/or classes**	**Notes**
Mechanical resistance	5.4.1, 5.4.2	–	Type
Reaction to fire	5.5	Classes A1 to F	-
Resistance to fire	5.6	See EN 13501-2	-
External fire performance	5.7	See prEN 13501-5	-
Water tightness	5.3.1 and 5.3.2	–	Pass / Fail (twice)
Impact resistance	5.4.3	–	Pass / Fail and Type
Direct airborne sound insulation	5.10	-	R_w index
Thermal resistance	5.9.1 and 5.9.2.1	–	*U*-values
Luminous transmittance	5.1	–	τ_{D65}-value
Air permeability	5.8.1 and 5.8.2	–	Type and Pass / Fail
Durability:			
- variation of total luminous transmittance	5.2.2	–	Type
- variation of yellowness index	5.2.2	–	Type
- variation of mechanical properties	5.2.3	–	Type

Table ZA.1.2 — Relevant clauses for individual roof lights without upstand

Product: Individual roof lights of plastic without upstands **Intended use:** Light transmission for use in flat and inclined roofs of buildings			
Essential Characteristics	**Requirement clauses in this European Standard**	**Levels and/or classes**	**Notes**
Reaction to fire	5.5	Classes A1 to F	-
Water tightness	5.3.2	–	Pass / Fail
Impact resistance (hard body)	5.4.3.1	–	Pass / Fail
Thermal resistance	5.9.2.1	–	*U*-value
Luminous transmittance	5.1	–	τ_{D65}-value
Air permeability	5.8.2	–	Pass / Fail
Durability:			
- variation of total luminous transmittance	5.2.2	–	Type
- variation of yellowness index	5.2.2	–	Type
- variation of mechanical properties	5.2.3	–	Type

The requirement on a certain characteristic is not applicable in those Member States (MSs) where there are no regulatory requirements on that characteristic for the intended use of the product. In this case, manufacturers placing their products on the market of these MSs are not obliged to determine nor declare the performance of their products with regard to this characteristic and the option “No performance determined” (NPD) in the information accompanying the CE marking (see ZA.3) may be used. The NPD option may not be used, however, where the characteristic is subject to a threshold level.

ZA.2 Procedure(s) for attestation of conformity of roof lights

ZA.2.1 Systems of attestation of conformity

The systems of attestation of conformity of the construction products indicated in Tables ZA.1.1 and ZA.1.2, in accordance with the Decision of the Commission 98/436/EC of 1998-07-10 (L194) as given in Annex III of the mandate M/122 is shown in Table ZA.2 for the indicated intended uses and relevant levels or classes.

Table ZA.2 — Systems of attestation of conformity

Products	Intended use(s)	Classes	Attestation of conformity systems
Individual roof lights	For uses subject to reaction to fire regulations	A1 [a], A2 [a], B [a] and C [a]	1
		A1 [b], A2 [b], B [b], C [b], D and E	3
		F	4
	For uses subject to external fire performance regulations	Any (see prEN 13501-5)	3
		F_{roof}	4
	For uses subject to resistance to fire regulations	See EN 13501-2	3
	For uses subject to regulations on dangerous substances	-	3
	For other uses than those above mentioned	–	3

[a] 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).

[b] Products/materials not covered by footnote [a]

System 1: See Directive 89/106/EEC (CPD) Annex III.2.(i), without audit testing of samples.

System 3: See Directive 89/106/EEC (CPD) Annex III.2.(ii), second possibility.

System 4: See Directive 89/106/EEC (CPD) Annex III.2.(ii), third possibility.

The attestation of conformity of the roof lights in Tables ZA.1.1 and ZA.1.2 shall be in accordance with the evaluation of conformity procedures indicated in Tables ZA.3.1, ZA.3.2 or ZA.3.3 resulting from application of the clauses of this European Standard indicated therein.

Table ZA.3.1 — Assignment of evaluation of conformity tasks for roof lights under system 1

Tasks		Content of the task	Evaluation of conformity clauses to apply
Tasks under the responsibility of the manufacturer	Factory production control (F.P.C)	Parameters related to all relevant characteristics of Table ZA.1.1 or ZA.1.2	7.3
	Further testing of samples taken at factory[b]	All relevant characteristics of Table ZA.1.1 or ZA.1.2	7.3
	Initial type testing by a notified laboratory	All relevant characteristics of Table ZA.1.1 or ZA.1.2 except reaction to fire in the classes below	7.2
Tasks under the responsibility of the product certification body	Initial type testing	Reaction to fire (Classes A1 [a], A2 [a], B [a] and C [a])	7.2
	Initial inspection of factory and of F.P.C	Parameters related to all relevant characteristics of Table ZA.1.1 or ZA.1.2, in particular to reaction to fire	7.3
	Continuous surveillance, assessment and approval of F.P.C.	Parameters related to all relevant characteristics of Table ZA.1 or ZA.1.2, in particular to reaction to fire	7.3

[a] 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).

[b] For some characteristics, FPC may be by indirect control, such as checking raw materials and the production process.

Table ZA.3.2 — Assignment of evaluation of conformity tasks for roof lights under system 3

Tasks		Content of the task	Evaluation of conformity clauses to apply
Tasks under the responsibility of the manufacturer	Factory production control (F.P.C)	Parameters related to all relevant characteristics of Table ZA.1.1 or ZA.1.2	7.3
	Initial type testing by a notified test laboratory	All relevant characteristics of Table ZA.1.1 or ZA.1.2, namely: Mechanical resistance Reaction to fire (A1 [c], A2 [c], B [c], C [c], D and E) Resistance to fire External fire performance (products requiring testing) Dangerous substances Watertightness [d] Impact resistance Direct airborne sound insulation [d] Thermal resistance [d] Luminous transmittance Air permeability [d] Durability	7.2

[c] Products/materials not covered by footnote [a] (see Table ZA.3.1).

[d] Only for products requiring testing.

Table ZA.3.3 — Assignment of evaluation of conformity tasks for roof lights under system 4

Tasks		Content of the task	Evaluation of conformity clauses to apply
Tasks under the responsibility of the manufacturer	Factory production control (F.P.C)	See [e]	7.3
	Initial type testing by the manufacturer	Thermal resistance and airborne sound insulation (when using values from Tables 7 and 8). Watertightness and air permeability of rooflights without upstand, assessment without testing. See [e]	7.2

[e] All characteristics of Tables ZA.1.1 and ZA.1.2, when tested, are subject to attestation system 3. Attestation system 4 therefore applies only to products for which no performance is declared for all characteristics except those shown in this table, and the characteristics in this table are assessed either by using tabulated values from Tables 7 and/or 8, or by visual assessment (in the case of watertightness and/or air permeability) for rooflights without upstand. In this case, FPC will concentrate on those characteristics subject to visual inspection.

NOTE Any product for which at least one characteristic of Tables ZA.1.1 or ZA.1.2 has to be tested, falls under either attestation system 3 or 1, depending on its reaction to fire performance.

ZA.2.2 EC Certificate and Declaration of conformity

In case of products under system 1:

When compliance with the conditions of this annex is achieved, the certification body shall draw up a certificate of conformity (EC Certificate of conformity), which entitles the manufacturer to affix of the CE marking. The certificate shall include:

— name, address and identification number of the certification body;

— name and address of the manufacturer, or his authorised representative established in the EEA, and place of production;

— description of the product (type, identification, use, ...);

NOTE Where some of the information required for the Declaration is already given in the CE marking information, it does not need to be repeated.

— provisions to which the product conforms (i.e. Annex ZA of this EN), and a reference to the ITT report(s) and factory production control records, as appropriate;

— particular conditions applicable to the use of the product (e.g. provisions for use under certain conditions);

— number of the certificate;

— conditions and period of validity of the certificate, where applicable;

— name of, and position held by the person empowered to sign the certificate.

In addition, the manufacturer shall draw up a declaration of conformity (EC Declaration of conformity) including the following:

— name and address of the manufacturer, or his authorised representative established in the EEA;

— name and address of the certification body;

— description of the product (type, identification, use, ...), and a copy of the information accompanying the CE marking;

NOTE Where some of the information required for the Declaration is already given in the CE marking information, it does not need to be repeated.

— provisions to which the product conforms (i.e. Annex ZA of this EN), and a reference to the ITT report(s) and factory production control records, as appropriate;

— particular conditions applicable to the use of the product (e.g. provisions for use under certain conditions);

— number of the accompanying EC Certificate of conformity;

— name of, and position held by the person empowered to sign the declaration on behalf of the manufacturer or his authorised representative.

In case of products under system 3:

When compliance with the conditions of this annex is achieved, the manufacturer or his agent established in the EEA shall prepare and retain a declaration of conformity (EC Declaration of conformity), which authorises affixing of the CE marking. This declaration shall include:

— name and address of the manufacturer, or his authorised representative established in the EEA, and place of production;

— description of the product (type, identification, use,...), and a copy of the information accompanying the CE marking;

NOTE Where some of the information required for the Declaration is already given in the CE marking information, it does not need to be repeated.

— provisions to which the product conforms (i.e. Annex ZA of this EN), and a reference to the ITT report(s) and factory production control records, as appropriate;

— particular conditions applicable to the use of the product, (e.g. provisions for use under certain conditions);

— name and address of the notified laboratory(ies);

— name of, and position held by, the person empowered to sign the declaration on behalf of the manufacturer or his authorised representative.

In case of products under system 4:

When compliance with this annex is achieved, the manufacturer or his agent established in the EEA shall prepare and retain a declaration of conformity (EC Declaration of conformity), which authorises the affixing of CE marking. This declaration shall include:

— name and address of the manufacturer, or his authorised representative established in the EEA, and place of production;

— description of the product (type, identification, use,...), and a copy of the information accompanying the CE marking;

— provisions to which the product conforms (i.e. Annex ZA of this EN);

— particular conditions applicable to the use of the product (e.g. provisions for use under certain conditions);

— name of, and position held by, the person empowered to sign the declaration on behalf of the manufacturer or of his authorised representative.

The above mentioned declaration and certificate shall be presented in the language or languages accepted in the Member State in which the product is to be used.

ZA.3 CE marking and labelling

The manufacturer or his authorised representative established within the EEA is responsible for the affixing of the CE marking. The CE marking symbol to affix shall be in accordance with Directive 93/68/EC and shall be shown on the roof light upstand (for roof lights with upstand) or on the product or packaging (for roof lights without upstand) or on the accompanying commercial documents. If only part of the information is presented on the roof light upstand, product or packaging, then this information shall also be part of the information presented on the accompanying commercial document(s). The following information on the product and its essential characteristics shall accompany the CE marking symbol:

— identification number of the certification body (only for products under system 1);

— name or identifying mark and registered address of the producer;

— last two digits of the year in which the marking is affixed;

— number of the EC Certificate of conformity (only for products under system 1);

— reference to this European Standard (EN 1873);

— description of the product (generic name, material, dimensions etc.) and intended use;

— information on the relevant essential characteristics in Table ZA.1.1 or ZA.1.2 (information indicated by (*) does not apply to rooflights without upstand):

  — Resistance to upward load(*): type (e.g. UL 1500) or NPD;

  — Resistance to downward loads(*): type (e.g. DL 750) or NPD;

  — Reaction to fire: class (e.g. B-s3,d0) or class F;

  — Resistance to fire(*): class (e.g. EI30) or NPD;

  — External fire performance(*): class (e.g. B_{ROOF}(t2)) or class F_{ROOF};

  — Water tightness:

    — for the roof light with upstand(*): pass or NPD; and

    — for the light transmitting sheet material: pass or NPD;

  — Impact resistance:

    — small hard body: pass and the identification of the tested assembly (the roof light and the upstand) or NPD; and

    — large, soft body(*): type (e.g. SB 1200) and the identification of the tested assembly (the roof light and the upstand) or NPD;

  — Thermal transmittance:

- roof light with upstand(*): *U*-value or NPD; and
- light transmitting sheet material: *U*-value or NPD;

— Direct airborne sound insulation(*): R_w-value or NPD;

— Luminous transmittance: τ_{D65}-value or NPD;

— Air permeability:

- rooflight with upstand(*): type (e.g. A3) or NPD; and
- light transmitting sheet material: pass, fail or NPD;

— Durability: types (e.g. ΔA, Cu 0, Ku 0).

The “No performance determined” (NPD) option may not be used where the characteristic is subject to a threshold level. Otherwise, the NPD option may be used when and where the characteristic, for a given intended use, is not subject to regulatory requirements.

Figures ZA1.1 and ZA.2 are examples of the information to accompany the CE Symbol for roof lights with and without upstand.

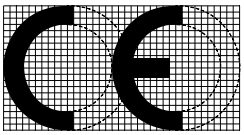
 01234	*CE conformity marking, consisting of the "CE"-symbol given in Directive 93/68/EEC.* *Identification number of the certification body (where relevant)*
Any Co Ltd. PO Box 21, B 1050 06 01234-CPD-00234	*Name or identifying mark and registered address of the producer* *Last two digits of the year in which the marking was affixed* *Certificate number (where relevant)*
EN 1873 Roof light with upstand, intended to be used for light transmittance for flat and/or inclined roofs Resistance to upward load: UL 1500 Resistance to downward loads: DL 750 Reaction to fire: B-s3,d0 Resistance to fire: EI30 External fire performance: F_{ROOF} Water tightness: – Roof light with upstand: Pass – Light transmitting sheet material: Pass Impact resistance: – Small hard body: Pass – Large, soft body: SB 1200 Thermal transmittance: – Roof light with upstand: 2,6 – Light transmitting sheet material: 2,2 Direct airborne sound insulation: 20 Luminous transmittance: 55 % Air permeability: – Roof light with upstand: A3 – Light transmitting sheet material: Pass Durability: ΔA, Cu 0, Ku 0	*No. of European Standard* *Description of the product and intended use* *and* *Information on regulated characteristics*

Figure ZA.1 — Example for CE marking information for roof lights with upstand

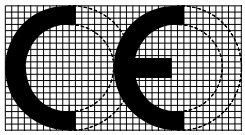
 01234	*CE conformity marking, consisting of the "CE"-symbol given in Directive 93/68/EEC.* *Identification number of the certification body (where relevant)*
Any Co Ltd. PO Box 21, B 1050 06 01234-CPD-00234	*Name or identifying mark and registered address of the producer* *Last two digits of the year in which the marking was affixed* *Certificate number (where relevant)*
EN 1873 Roof light without upstand, intended to be used for light transmittance for flat and/or inclined roofs Reaction to fire: B-s3,d0 Water tightness: Pass Impact resistance: Pass Thermal resistance: 2,2 Luminous transmittance: 55 % Air permeability: Pass Durability: ΔA, Cu 0, Ku 0	*No. of European Standard* *Description of the product and intended use* *and* *Information on regulated characteristics*

Figure ZA.2 — Example for CE marking information for roof lights without upstand

In addition to any specific information relating to dangerous substances shown above, the product should also be accompanied, when and where required and in the appropriate form, by documentation listing any other legislation on dangerous substances for which compliance is claimed, together with any information required by that legislation.

NOTE European legislation without national derogations need not be mentioned.

Bibliography

[1] CIE 38:1977, *Radiometric and photometric characteristics of materials and their measurement*

[2] EN 410, *Glass in building – Determination of luminous and solar characteristics of glazing*

[3] EN ISO 9001, *Quality management systems – Requirements (ISO 9001:2000)*

[4] EN ISO 14683, *Thermal bridges in building construction - Linear thermal transmittance - Simplified methods and default values (ISO 14683:1999)*