BS EN 14501:2005

Blinds and shutters — Thermal and visual comfort — Performance characteristics and classification

The European Standard EN 14501:2005 has the status of a British Standard

ICS 91.060.50

British Standards

National foreword

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The UK participation in its preparation was entrusted by Technical Committee B/538, Doors, windows, shutters, hardware and curtain walling, to Subcommittee B/538/3, Domestic shutters and blinds, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

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

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Blinds and shutters - Thermal and visual comfort - Performance characteristics and classification

Fermetures et stores - Confort thermique et lumineux - Caractérisation des performances et classification

Abschlüsse - Thermischer und visueller Komfort - Leistungsanforderungen und Klassifizierung

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Contents

Foreword

This European Standard (EN 14501:2005) has been prepared by Technical Committee CEN/TC 33 “Doors, windows, shutters, building hardware and curtain walling”, the secretariat of which is held by AFNOR.

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of an identical text or by endorsement, at the latest by February 2006, and conflicting national standards shall be withdrawn at the latest by February 2006.

No existing European Standard is superseded.

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.

Introduction

This European Standard is a part of a series of standards dealing with blinds and shutters for buildings as defined in EN 12216.

The methods of characterisation are related to performance requirements required as a complement to intrinsic performances (specific requirements) that internal blinds, external blinds or shutters shall fulfil as specified in EN 13120, EN 13561 and EN 13659.

The present European Standard is mainly based on the European work performed in TC 89 relating to solar and light transmittance of solar protection devices combined with glazing and the Technical Report CIE 130.

1 Scope

This European Standard applies to the whole range of shutters, awnings and blinds defined in EN 12216, described as solar protection devices in this European Standard.

It states the properties that shall be taken into account when comparing products.

It also specifies the corresponding parameters and classifications to quantify the following properties:

- for the thermal comfort:
  - the solar factor (total solar energy transmittance);
  - the secondary heat transfer factor;
  - the direct solar transmittance;
- for the visual comfort:
  - the opacity control;
  - the night privacy;
  - the visual contact with the outside;
  - the glare control;
  - the daylight utilisation;
  - the rendering of colours.

NOTE For other purposes, more detailed methods using different parameters can be used.

Some of the characteristics (e.g. g_{tot}) are not applicable when products are not parallel to the glazing (e.g. folding-arm awnings).

This European Standard is not applicable to the products using fluorescent materials.

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 410, *Glass in building — Determination of luminous and solar characteristics of glazing*

EN 12216:2002, *Shutters, external blinds, internal blinds — Terminology, glossary and definitions*

EN 13363-1, *Solar protection devices combined with glazing — Calculation of solar and light transmittance — Part 1: Simplified method*

EN 13363-2:2005, *Solar protection devices combined with glazing — Calculation of total solar energy transmittance and light transmittance — Part 2: Detailed calculation method*

prEN 14500[1], *Blinds and shutters — Thermal and visual comfort — Test methods*

3 Terms, definitions and symbols

For the purposes of this European Standard, the terms and definitions given in EN 12216:2002 and the following apply.

3.1
transmittance τ
ratio of the transmitted flux to the incident flux (see Figure 1)

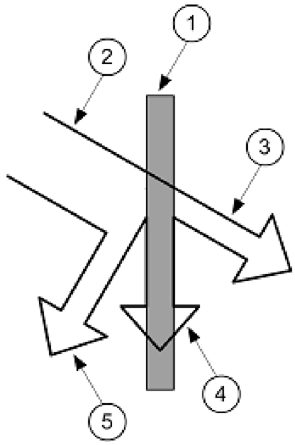
NOTE A more detailed definition is given in prEN 14500.

3.2
reflectance ρ
ratio of the reflected flux to the incident flux (see Figure 1)

NOTE A more detailed definition is given in prEN 14500.

3.3
absorptance α
ratio of the absorbed flux to the incident flux (see Figure 1)

[1] To be published.



Key

1 Solar protection device
2 Incident radiation E
3 Transmitted radiation $\tau \times E$
4 Absorbed radiation $\alpha \times E$
5 Reflected radiation $\rho \times E$

Figure 1 — Representation of the optical factors

3.4
openness coefficient
ratio between the area of the openings and the total area of the fabric

NOTE 1 For identical fabrics that differ only by the colour, the openness coefficient is considered as independent of the colour. The value of the openness coefficient should be measured for the darkest colour.

NOTE 2 The openness coefficient is determined according to prEN 14500.

3.5
solar factor g (total solar energy transmittance)
ratio between the total solar energy transmitted into a room through a window and the incident solar energy on the window

g is the solar factor of the glazing alone

g_{tot} is the solar factor of the combination of glazing and solar protection device

3.6
shading factor F_c
ratio of the solar factor of the combined glazing and solar protection device g_{tot} to that of the glazing alone g

$$F_C = \frac{g_{tot}}{g}$$

NOTE In some countries, F_c is known as z

3.7
secondary internal heat transfer factor $q_{i,\,tot}$
the part of the total absorbed radiation which is flowing inwards through the glazing and the shading device combined

3.8
colour rendering index R_a
index designed to express synthetically a quantitative evaluation of the differences in colour between eight test colours lit directly by the standard illuminant D_{65} and by the same illuminant transmitted through the solar protection device

3.9
operative temperature θ_{op}
uniform temperature of a room in which an occupant would exchange the same amount of heat by radiation plus convection as in the actual non-uniform environment

NOTE For more information on the calculation of θ_{op}, it is recommended to refer to EN ISO 13791 or EN ISO 13792.

4 Notations used

4.1 General

For the purpose of this European Standard, the optical factors τ (transmittance), ρ (reflectance) and α (absorptance) are labelled with subscripts which indicate:

— visual or solar properties;

— the geometry of the incident and the transmitted or reflected radiation.

4.2 Visual or solar properties

According to the respective spectrum the following subscripts are used:

— « $_e$ » solar (energetic) characteristics, given for the total solar spectrum, (wavelengths λ from 300 nm to 2500 nm), according to EN 410;

— « $_v$ » visual characteristics, given for the standard illuminant D_{65} weighted with the sensitivity of the human eye (wavelengths λ from 380 nm to 780 nm), according to EN 410.

4.3 Geometry of the radiation

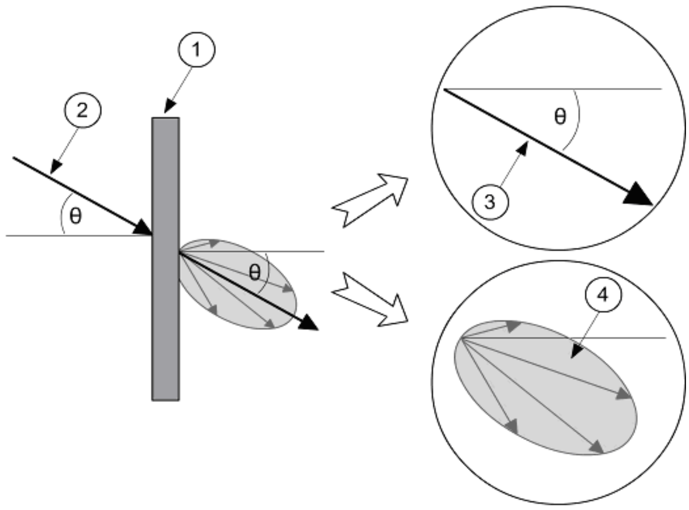
The following subscripts are used to indicate the geometry of the incident radiation and the geometry of the transmitted or reflected radiation (see Figure 2). For a more detailed definition see prEN 14500.

— « $_{dir}$ » for directional (fixed, but arbitrary direction θ);

— « $_n$ » for normal, or near normal in case of reflected radiation, the angle of incidence is $\theta = 0°$, or $\theta \leq 8°$ respectively;

— « $_h$ » for hemispherical (collected in the half space behind the sample plane);

— « $_{dif}$ » for diffuse.



Key

1 Solar protection device
2 Incident directional light or solar radiation
3 Transmitted direct component of light or solar radiation
4 Transmitted diffuse component of light or solar radiation

Figure 2 — Direct and diffuse components of transmitted radiation

4.4 Optical factors

The optical factors are designated as follows:

— $\tau_{e,\ n\text{-}n}$ normal/normal solar transmittance;

— $\tau_{v,\ n\text{-}n}$ normal/normal light transmittance;

— $\tau_{v,\ n\text{-}dif}$ normal/diffuse light transmittance;

— $\tau_{v,\ n\text{-}h}$ normal/hemispherical light transmittance;

— $\tau_{v,\ dif\text{-}h}$ diffuse/hemispherical light transmittance.

5 Thermal comfort

5.1 General

Thermal comfort is mainly governed by the operative temperature θ_{op} within the room. θ_{op} depends on the air temperature, the air velocity and the temperature of the surrounding surfaces.

Solar gains shall be controlled in order to limit the operative temperature. The classification of the total solar energy transmittance g_{tot} is given in 5.2.4.

Solar protection devices influence the thermal comfort in three aspects:

— The mean operative temperature and/or the cooling loads are influenced by the solar gains which depend on the size of the windows and the total solar energy transmittance g_{tot}.

— The solar protection device may cause higher local values of θ_{op} when irradiated by the sun due to higher temperatures on the inner surface of the glazing or solar protection device. This effect is quantified by the secondary internal heat transfer factor $q_{i, tot}$.

— The solar protection device may prevent persons and surroundings in the room from being irradiated directly. This effect is quantified by the direct-direct solar transmittance $\tau_{e, dir-dir}$.

The performance classes for the thermal comfort used in the following clauses are specified in Table 1.

Table 1 — Definition of classes

Class	Influence on thermal comfort				
	0	1	2	3	4
	very little effect	little effect	moderate effect	good effect	very good effect

5.2 Control of solar gains – Total solar energy transmittance g_{tot}

5.2.1 General

The limitation of solar gains is one of the most important aspects of summer thermal comfort when there is no mechanical cooling system. The solar gains are directly proportional to the total solar energy transmittance g_{tot}.

g_{tot} depends on the glazing and the solar protection device g_{tot} may be determined for the four different reference glazings given in Annex A using either the methodology given in 5.2.2 or in 5.2.3. For general product labelling (independent from the installation conditions), the calculation according to 5.2.2 and the reference glazing C, specified in Annex A, shall be used.

The solar factor g of glazing alone, needed for the calculation of $g_{tot,}$ shall be calculated according to EN 410.

NOTE 1 The influence of solar protection devices on the solar gains can also be represented by the shading factor F_C. The shading factor depends not only on the solar protection device but also on the glazing. If F_C is used for product characterisation, it should be given for the 4 different reference glazings, defined in Annex A.

For windows with slatted or louvered devices, the values of the total solar factor g_{tot} shall be specified for at least two positions:

— the fully closed position of the slats at normal incidence;

— the slats tilted at 45° and irradiation with 30° altitude angle, 0° azimuth angle.

In the case of roller shutters with light and ventilation slots, g_{tot} shall be calculated:

— in the fully extended and closed position at normal incidence;

— in the fully extended and open position at normal incidence.

NOTE 2 For slatted or louvered devices tilted at 45° the values $\tau^{corr}{}_e$ specified in EN 13363-1 can be used as the direct-hemispherical solar transmittance except for mirror-finish products and under the boundary condition that there is no direct solar transmission for the tilt angle of the slats under consideration.

NOTE 3 In the near future there will be a standard for the direct calorimetric measurement of g_{tot}.

NOTE 4 For a more detailed method for the calculation of the transmittance and the reflectance of slatted devices, see the calculation method given in EN 13363-2. The view factors given in Annex A of EN 13363-2:2005 are only applicable for venetian blinds with a ratio of d/l =1 for slat width l and slat distance d. For the cases described above see prEN 14500.

5.2.2 Determination of g_{tot} – Simplified method: installation conditions unknown

When the installation conditions are unknown, g_{tot} shall be calculated according to EN 13363-1.

The necessary data for the calculation are the following:

— τ_e solar transmittance of the product;

— ρ_e solar reflectance of the outer surface of the product;

— g solar factor of the glazing;

— U thermal transmittance of the glazing.

5.2.3 Determination of g_{tot} – Detailed method: installation conditions known

When the site installation conditions are known and/or more accurate values are required, g_{tot} shall be calculated according to EN 13363-2.

The necessary data for the calculation are the following:

— $\tau(\lambda)_{n-h}$ normal/hemispherical spectral transmittance of the product;

— $\rho(\lambda)_{n-h}$ and $\rho'(\lambda)_{n-h}$ normal/hemispherical spectral reflectances of the product for each side;

— ε, ε' emissivities of the product sides;

— C_o openness coefficient as a measure for the size of the openings (fabrics only);

— the spectral characteristics of each pane of the glazing;

— the emissivity of each surface of each pane of the glazing;

— the thickness and nature of gas space.

NOTE 1 In EN 13363-2 two different sets of boundary conditions are specified: Summer conditions and reference (mean winter) conditions. Care should be taken to choose the correct set of boundary conditions according to the project specifications and the national regulations.

NOTE 2 If spectral data for ρ(λ), ρ´(λ) and τ(λ) are not available, solar data can be used. This will reduce the accuracy of the calculations.

5.2.4 Performance classes

The classification of g_{tot} is specified in Table 2 with the classes quoted in Table 1.

Table 2 — Total solar energy transmittance g_{tot} — Classification

Class	0	1	2	3	4
g_{tot}	$g_{tot} \geq 0,50$	$0,35 \leq g_{tot} < 0,50$	$0,15 \leq g_{tot} < 0,35$	$0,10 \leq g_{tot} < 0,15$	$g_{tot} < 0,1$

5.3 Secondary heat gains – Secondary heat transfer factor $q_{i, tot}$

5.3.1 General

The total solar energy transmitted through a facade consists of two parts:

— radiation in the solar range, measured by the solar transmittance $\tau_{e, tot}$;

— heat (thermal radiation and convection), measured by the secondary heat transfer factor $q_{i,tot}$.

The secondary heat transfer factor $q_{i, tot}$ of the combination of glazing and solar protection device shall be calculated with the following equation:

$$q_{i, tot} = g_{tot} - \tau_{e, tot}$$

$q_{i,tot}$ may be determined for the four different reference glazings given in Annex A using either the methodology given in 5.3.2 or in 5.3.3. For general product labelling (independent from the installation conditions) the calculation for $q_{i,tot}$ according to 5.3.2 and the reference glazing C, specified in Annex A, shall be used.

NOTE An example explaining the meaning of $q_{i, tot}$ is given in Annex B.

5.3.2 Determination of $q_{i, tot}$ – Simplified method

The direct solar transmittance $\tau_{e, tot}$ and the total solar transmittance g_{tot} of the combination of a glazing and a solar protection device shall be calculated according to EN 13363-1.

5.3.3 Determination of $q_{i, tot}$ – Detailed method

The direct solar transmittance $\tau_{e, tot}$ and the total solar transmittance g_{tot} of the combination of a glazing and a solar protection device shall be calculated according to EN 13363-2.

NOTE In EN 13363-2 two different sets of boundary conditions are specified: Summer conditions and reference (mean winter) conditions. Care should be taken to choose the correct set of boundary conditions according to the project specifications and the national regulations.

5.3.4 Performance classes

The classification of $q_{i, tot}$ is specified in Table 3 with the classes quoted in Table 1.

Table 3 — Secondary Heat transfer factor $q_{i, tot}$ — Classification

Class	0	1	2	3	4
$q_{i, tot}$	$q_{i, tot} \geq 0{,}30$	$0{,}20 \leq q_{i, tot} < 0{,}30$	$0{,}10 \leq q_{i, tot} < 0{,}20$	$0{,}03 \leq q_{i, tot} < 0{,}10$	$q_{i, tot} < 0{,}03$

5.4 Protection from direct transmission – Normal/normal solar transmittance $\tau_{e, n-n}$

5.4.1 General

The ability of a solar protection device to protect persons and surroundings from direct irradiation is measured by the direct/direct solar transmittance $\tau_{e, dir-dir}$ of the device in combination with a glazing. For the sake of simplicity, the normal-normal solar transmittance $\tau_{e, n-n}$ is used as a measure for this property.

5.4.2 Determination

The normal/normal solar transmittance $\tau_{e, n-n}$ shall be determined according to prEN 14500.

5.4.3 Performance classes

The classification of $\tau_{e,\ n\text{-}n}$ is specified in Table 4 with the classes quoted in Table 1.

Table 4 — Normal/normal solar transmittance $\tau_{e,\ n\text{-}n}$ — Classification

Class	0	1	2	3	4
$\tau_{e,\ n\text{-}n}$	$\tau_{e,\ n\text{-}n} \geq 0{,}20$	$0{,}15 \leq \tau_{e,\ n\text{-}n} < 0{,}20$	$0{,}10 \leq \tau_{e,\ n\text{-}n} < 0{,}15$	$0{,}05 \leq \tau_{e,\ n\text{-}n} < 0{,}10$	$\tau_{e,\ n\text{-}n} < 0{,}05$

NOTE Slatted or louvered devices with non-perforated slats are class 4 when the slats are tilted in a way that there is no direct penetration of the sun.

6 Visual comfort

6.1 General

Depending on the geometry of the incident and the transmitted radiation, the components of the light transmission concern different aspects of visual comfort.

When the opening is directly lit by the sun:

— the incident radiation is mainly directional;

— the transmitted radiation is partially directional ($\tau_{v,\ dir\text{-}dir}$), partially diffuse ($\tau_{v,\ dir\text{-}dif}$);

— the total transmitted light flow is the sum of these two components.

$$\tau_{v,\ dir\text{-}h} = \tau_{v,\ dir\text{-}dir} + \tau_{v,\ dir\text{-}dif}$$

These characteristics depend on the incidence angle θ.

The value $\tau_{v,\ dir\text{-}h}$ is representative of the global reduction of natural light by the solar protection device when the light is coming from one specific direction. If an average value is required, $\tau_{v,\ dif\text{-}h}$ is representative.

The direct part of transmitted radiation $\tau_{v,\ dir\text{-}dir}$ represents the light passing through the holes in the solar protection device under incidence θ. It allows recognition of shapes, and has a favourable influence on vision to the outside, but is unfavourable for night privacy.

It may also be the basis of two factors of visual discomfort:

— direct vision of the solar disc;

— solar spots on the floor or the office furniture.

The diffused part $\tau_{v,\ dir\text{-}dif}$ of transmitted radiation results in an own luminance of the solar protection device, which appears as a light source.

This may constitute a discomfort factor, either from an excessive value of the luminance in itself, or from the contrast between the luminance of the solar protection device and that of its surrounding.

Solar protection devices shall be classified, with regard to the following criteria:

— opacity control;

— glare control;

- night privacy;
- visual contact with the outside;
- daylight utilisation;
- rendering of colours.

These criteria depend on three main optical factors:

- $\tau_{v,\ n\text{-}n}$ normal/normal light transmittance;
- $\tau_{v,\ n\text{-}dif}$ diffused part of light transmission;
- $\tau_{v,\ dif\text{-}h}$ diffuse/hemispherical light transmittance.

The performance classes for glare control, night privacy, visual contact with the outside, daylight utilisation are quoted in Table 5.

Table 5 — Definition of Classes

Class	Influence on visual comfort				
	0	1	2	3	4
	very little effect	little effect	moderate effect	good effect	very good effect

NOTE 1 The real light transmittance of the solar protection device may be much greater than that of the curtain, due to the lateral gaps and the guiding system. It is difficult to establish, either by calculation or direct measurement.

NOTE 2 The residual light transmittance of the solar protection device in its fully extended and closed position can be evaluated, according to the type of solar protection device, from the light transmittance of the constitutive materials. To some extent, the light transmittance of a completely closed or partially opened slatted or louvered device (e.g. venetian blind) can be evaluated using the calculation method given in EN 13363-2 from the light characteristics and geometry of the slats or laths.

NOTE 3 When the window is not directly exposed to the sun it receives diffuse radiation, which may be disturbing enough to require that the solar protection device remains in the extended position.

NOTE 4 Health and safety regulations require that the workplace receives as much natural light as is reasonably practical (see EU Directive ED 89/654 EEC).

NOTE 5 All retractable products provide a certain degree of adjustment of natural light (see EU Directive ED 89/654 EEC).

NOTE 6 Adjustable slatted products provide optimal light control.

NOTE 7 In the case of a venetian blind with unperforated slats, $\tau_{v,\ n\text{-}n}$ can be considered as 0 when the blind is fully closed. If the slats can be tilted horizontally, $\tau_{v,\ n\text{-}n}$ can be considered to be greater than 0,5 in that position. This means, that $\tau_{v,\ n\text{-}n}$ of a venetian blind with unperforated slats can be adjusted to a large extent.

NOTE 8 In the case of a venetian blind with fully perforated slats, the minimum value of $\tau_{v,\ n\text{-}n}$ can be considered to be the measured value of $\tau_{v,\ n\text{-}n}$ of the perforated area of an individual slat.

NOTE 9 In the case of a venetian blind with partially perforated slats, the minimum value of $\tau_{v,\ n\text{-}n}$ can be considered to be 0, when the perforated area can be protected with the unperforated area of the upper slat. If this is not the case, $\tau_{v,\ n\text{-}n}$ can be considered to be the measured value of $\tau_{v,\ n\text{-}n}$ of the perforated area of an individual slat.

6.2 Opacity control

6.2.1 General

Opacity control represents the capacity of an internal blind, external blind or a shutter in the fully extended and closed position to preclude the vision of outside light.

6.2.2 Determination

The performance of dim-out and black-out products is expressed by the level of illuminance under which no light is perceivable behind the device. It shall be determined according to prEN 14500.

6.2.3 Performance classes

The opacity performance is specified according to the classification of fabrics given in Table 6 and the classification of products given in Table 7.

Table 6 — Opacity of fabrics — Classification

Opacity control of fabric	Classification of fabric
No light perceived when tested under 1 000 Lux	Dim out
No light perceived when tested under 100 000 Lux	Black out

Table 7 — Opacity control of products — Classification

Product performance	Product classification	Class
No light perceived when tested under more than 10 Lux	Dim out	1
No light perceived when tested under more than 1 000 Lux		2
No light perceived when tested under more than 75 000 Lux	Black out	3

NOTE 1 Dim out is needed for viewing screens with back projected slide, cinema or video images, viewing reflective screens with front projected images, stage entertainment and presentation with lighting effects, aid to sleep in domestic bedrooms, low gradable laboratory work, optics, etc., medical examination including optometry.

NOTE 2 Black-out is needed for example, for art and furnishing conservation (reducing light dosage), X-ray work (not film handling), high grade laboratory work, advanced optics, photochemicals, plant research etc., photography: studio work, low speed emulsions, printing high speed emulsions, exposed colour film, etc., handling highly light sensitive material.

6.3 Glare control

6.3.1 General

The glare control is characterised by:

— The capacity of the solar protection device to control the luminance level of openings and to reduce the luminance contrasts between different zones within the field of vision due to:

  — the solar spot on the work surface and its immediate surrounding;

- the part of the sky seen through a window;
- the direct vision of solar disk through the solar protection device;
- the luminance of the solar protection device, contrast with its surroundings (in the case of diffusing products).

— The capacity of the solar protection device to prevent disturbing reflection on visual display due to the luminance of the window and the surrounding surfaces.

6.3.2 Determination

Glare control is quantified by the parameters $\tau_{v,\ n\text{-}dif}$ and $\tau_{v,\ n\text{-}n}$. $\tau_{v,\ n\text{-}dif}$ and $\tau_{v,\ n\text{-}n}$ shall be determined according to prEN 14500.

NOTE For slatted or louvered devices with non-perforated slats $\tau_{v,\ dir\text{-}dif}$ should be taken in case of oblique angles of incidence.

6.3.3 Performance classes

The solar protection device shall be classified according to Table 8. The classes are quoted in Table 5.

Table 8 — Glare control — Classification

$\tau_{v,\ n\text{-}n}$	$\tau_{v,\ n\text{-}dif}$			
	$\tau_{v,\ n\text{-}dif} < 0,02$	$0,02 \leq \tau_{v,\ n\text{-}dif} < 0,04$	$0,04 \leq \tau_{v,\ n\text{-}dif} < 0,08$	$\tau_{v,\ n\text{-}dif} \geq 0,08$
$\tau_{v,\ n\text{-}n} > 0,10$	0	0	0	0
$0,05 < \tau_{v,\ n\text{-}n} \leq 0,10$	1	1	0	0
$\tau_{v,\ n\text{-}n} \leq 0,05$	3	2	1	1
$\tau_{v,\ n\text{-}n} = 0,00$	4	3	2	2

NOTE 1 $\tau_{v,\ n\text{-}n} = 0,00$ means that the openness factor is equal to zero.

NOTE 2 Using a fabric or a foil with $C_o = \tau_{v,\ n\text{-}n} = 0$ and $\tau_{v,\ n\text{-}dif} < 2$ %, 4 % or 8 %, the mean luminance values on the inner surface of the fabric will be probably lower than 1 000 cd/m², 2 000 cd/m² or 4 000 cd/m² respectively under the following conditions:

– light transmittance of the glazing : 79 %;

– illuminance level on the outside : 80 000 Lux.

NOTE 3 For slatted or louvered devices with non-perforated slats $\tau_{v,\ dir\text{-}dif}$ should be taken in case of oblique angles of incidence.

NOTE 4 Glare control of non-perforated venetian blinds depends on two aspects:

- reflectance of the slats;
- closure of the slats.

With the blind fully extended and closed, luminances lower than 1000 cd/m² will be achieved except in the case of poor closure and/or light coloured or mirror finish slats, where a test according to prEN 14500 may be necessary.

6.4 Night privacy

6.4.1 General

Night privacy is the capacity of an internal or external blind or a shutter in the fully extended position or fully extended and closed position to protect persons, at night in normal light conditions from external view. Normal light conditions are defined by a cylindrical illuminance level at the position of the person/object less or equal to 300 Lux. External view means the ability of an external observer located 5 m from the fully extended or fully extended and closed product, to distinguish a person or object standing 1 m behind the protection device in the room.

6.4.2 Determination

Night privacy is quantified by the parameters $\tau_{v,\ n\text{-}dif}$ and $\tau_{v,\ n\text{-}n}$. $\tau_{v,\ n\text{-}dif}$ and $\tau_{v,\ n\text{-}n}$ shall be determined according to prEN 14500.

6.4.3 Performance classes

The performance of the product shall be classified according to Table 9. The classes are quoted in Table 5.

Table 9 — Privacy night — Classification

$\tau_{v,\ n\text{-}n}$	$\tau_{v,\ n\text{-}dif}$		
	$0 < \tau_{v,\ n\text{-}dif} \leq 0{,}04$	$0{,}04 < \tau_{v,\ n\text{-}dif} \leq 0{,}15$	$\tau_{v,\ n\text{-}dif} > 0{,}15$
$\tau_{v,\ n\text{-}n} > 0{,}10$	0	0	0
$0{,}05 < \tau_{v,\ n\text{-}n} \leq 0{,}10$	1	1	1
$\tau_{v,\ n\text{-}n} \leq 0{,}05$	2	2	2
$\tau_{v,\ n\text{-}n} = 0{,}00$	4	3	2

NOTE This table can be used for venetian blinds with fully perforated and closed slats assuming $\tau_{v,\ n\text{-}dif} = 0$.

6.5 Visual contact with the outside

6.5.1 General

Visual contact with the outside is the capacity of the solar protection device to allow an exterior view when it is fully extended. This function is affected by different light conditions during the day.

It is characterised by two parameters:

— the normal/normal transmittance $\tau_{v,n\text{-}n}$;

— the diffuse part of light transmittance $\tau_{v,n\text{-}dif}$.

NOTE 1 Visual contact with the outside may represent in daylight conditions, the ability for an observer, standing on the inside, 1 m from the fully extended product to distinguish a person or an object 5 m away from the blind or shutter on the outside.

NOTE 2 High values of $\tau_{v,\ n\text{-}n}$ are favourable because they allow for shape recognition.

NOTE 3 A high value of $\tau_{v,\ n\text{-}dif}$ is unfavourable because it distorts the direct vision and generates a parasitic luminance on the fabric when illuminated by the sun.

6.5.2 Determination

Visual contact with the outside is quantified by the parameters $\tau_{v,\ n\text{-}dif}$ and $\tau_{v,\ n\text{-}n}$. $\tau_{v,\ n\text{-}dif}$ and $\tau_{v,\ n\text{-}n}$ shall be determined according to prEN 14500.

6.5.3 Performance classes

The performances of the product shall be classified according to Table 10. The classes are quoted in Table 5.

Table 10 — Visual contact with the outside — Classification

$\tau_{v,n\text{-}n}$	$\tau_{v,n\text{-}dif}$		
	$0 < \tau_{v,n\text{-}dif} \leq 0{,}04$	$0{,}04 < \tau_{v,n\text{-}dif} \leq 0{,}15$	$\tau_{v,n\text{-}dif} > 0{,}15$
$\tau_{v,n\text{-}n} > 0{,}10$	4	3	2
$0{,}05 < \tau_{v,n\text{-}n} \leq 0{,}10$	3	2	1
$\tau_{v,n\text{-}n} \leq 0{,}05$	2	1	0
$\tau_{v,n\text{-}n} = 0{,}00$	0	0	0

NOTE For slatted or louvered devices with non-perforated slats $\tau_{v,\ n\text{-}n}$ and $\tau_{v,\ dir\text{-}dif}$ should be taken in case of oblique angles of incidence.

6.6 Daylight utilisation

6.6.1 General

Daylight utilisation is characterised by:

- the capacity of the solar protection device to reduce the time period during the artificial light is required;
- the capacity of the solar protection device to optimise the daylight which is available.

NOTE The capacity of the solar protection device to provide daylight does not only depend on the device itself but also on the environment conditions (e.g size and shape of room, size and type of window, reflectance of internal surface, façade orientation).

6.6.2 Determination

Daylight utilisation is quantified by the parameter $\tau_{v,\ dif\text{-}h}$. This parameter shall be determined according to prEN 14500.

6.6.3 Performance classes

The performances of the product shall be classified according to Table 11.

Table 11 — Daylight utilisation — Classification

Class	0	1	2	3	4
$\tau_{v, dif-h}$	$\tau_{v, dif-h} < 0{,}02$	$0{,}02 \leq \tau_{v, dif-h} < 0{,}10$	$0{,}10 \leq \tau_{v, dif-h} < 0{,}25$	$0{,}25 \leq \tau_{v, dif-h} < 0{,}40$	$\tau_{v, dif-h} \geq 0{,}40$

6.7 Rendering of colours

6.7.1 Solar protection device without glazing

The procedure given in EN 410 shall be used to determine the general colour rendering index R_a of a solar protection device without glazing.

The following modification shall be applied: the spectral transmittance of the glazing $\tau(\lambda)$ shall be substituted by that of the solar protection device $\tau(\lambda)_{n-h}$.

6.7.2 Solar protection device with glazing

The procedure given in EN 410 shall be used to determine the general colour rendering index R_a of a combination of glazing and solar protection device.

The following modification shall be applied: the spectral transmittance of the glazing $\tau(\lambda)$ shall be substituted by that of the combination of glazing and solar protection device $\tau(\lambda)_{n-h, tot}$.

$\tau(\lambda)_{n-h, tot}$ shall be calculated according to EN 13363-2.

Annex A
(normative)

Reference glazings

A.1 General

For global product comparisons (glazing unknown) of shutters, external and internal blinds the following reference glazings shall be used:

A.2 Glazing A

Clear single glazing (4 mm Float)

Table A.1 — Glazing A — Thermal properties

U W/(m² K)	g	τ_e	ρ_e	ρ'_e
5,8	0,85	0,83	0,08	0,08

Characteristics of components:

Table A.2 — Glazing A — Optical properties of the single glass pane

	Single pane
τ_e	0,83
ρ_e	0,08
ρ'_e	0,08
ε	0,84
ε'	0,84

A.3 Glazing B

Clear double glazing (4 mm Float + 12 mm space + 4 mm Float), space filled with air as specified in Table A.3 and Table A.4.

Table A.3 — Glazing B — Thermal properties

U W/(m² K)	g	τ_e	ρ_e	ρ'_e
2,9	0,76	0,69	0,14	0,14

Characteristics of components:

Table A.4 — Glazing B — Optical properties of the individual panes

	Ext. pane	Int. pane
τ_e	0,83	0,83
ρ_e	0,08	0,08
ρ'_e	0,08	0,08
ε	0,84	0,84
ε'	0,84	0,84

A.4 Glazing C

Double glazing (4 mm Float + 16 mm space + 4 mm Float), with low emissivity coating in position 3 (outer surface of the inner pane), space filled with argon as specified in Table A.5 and Table A.6.

Table A.5 — Glazing C — Thermal properties

U W/(m² K)	**g**	τ_e	ρ_e	ρ'_e
1,2	0,59	0,49	0,29	0,27

Characteristics of components:

Table A.6 — Glazing C — Optical properties of the individual panes

	Ext. pane	**Int. pane**
τ_e	0,83	0,58
ρ_e	0,08	0,30
ρ'_e	0,08	0,24
ε	0,84	0,05
ε'	0,84	0,84

A.5 Glazing D

Reflective double glazing 4 + 16 + 4 with a low emissivity soft coating in position 2, (inner surface of the outer pane), space filled with Argon as specified in Table A.7 and Table A.8.

TableA.7 — Glazing D — Thermal properties

U W/(m² K)	**g**	τ_e	ρ_e	ρ'_e
1,1	0,32	0,27	0,29	0,38

Characteristics of components:

Table A.8 — Glazing D — Optical properties of the individual panes

	Ext. Pane	**Int. pane**
τ_e	0,32	0,83
ρ_e	0,28	0,08
ρ'_e	0,42 (coated)	0,08
ε	0,84	0,84
ε'	0,04	0,84

Annex B
(informative)

The meaning of the secondary internal heat transfer factor $q_{i, tot}$

The surface temperature of the inner surface of the facade is determined by the irradiance level, the external temperature, the internal temperature, the U-value of the glazing, the secondary heat transfer factor $q_{i, tot}$ and the internal radiative and convective heat transfer coefficients.

Case study

Boundary conditions:

- High irradiance level of 800 W/m²;
- External temperature of 32 °C;
- Internal temperature of 26 °C;
- and standard heat transfer conditions according to EN 410 on the inner surface (correct for external or interpane sun-shading systems).

For this case, the surface temperatures given in Table B.1, are calculated depending on the U-value of the glazing and the secondary heat transfer factor $q_{i,tot}$ of the combination of glazing and solar protection device.

Table B.1 — Case study on inner surface temperatures

Temperature [°C] of the inner surface		U- Value of the combination (glazing + solar protection device)				
		0	1,1	1,9	2,9	5,8
$q_{i,,tot}$	0	26,0	26,8	27,4	28,2	30,4
	0,03	29,0	29,8	30,4	31,2	33,4
	0,05	31,0	31,8	32,4	33,2	35,4
	0,06	32,0	32,8	33,4	34,2	36,4
	0,10	36,0	36,8	37,4	38,2	40,4
	0,15	41,0	41,8	42,4	43,2	45,4
	0,20	46,0	46,8	47,4	48,2	50,4
	0,30	56,0	56,8	57,4	58,2	60,4
	0,40	66,0	66,8	67,4	68,2	70,4
	0,50	76,0	76,8	77,4	78,2	80,4

$q_{i, tot}$ has a big impact on the thermal comfort.

Annex C
(informative)

Example of performance presentation

C.1 Thermal comfort

Control of solar gains – Total solar energy transmittance g_{tot}

		Reference glazings			
		Glazing A Clear single glass pane (g = 0,85)	Glazing B Clear double glazed unit (g = 0,76)	Glazing C Heat control double glazing (g = 0,59)	Glazing D Solar control double glazing (g = 0,32)
g_{tot}	Conditions of installation unknown				

Calculation method used: ☐ Simplified Method (EN 13363-1)

☐ Detailed Method (EN 13363-2)

Secondary heat gains – Secondary heat transfer factor $q_{i, tot}$

	Reference glazings			
	Glazing A Clear single glass pane (g = 0,85)	Glazing B Clear double glazed unit (g = 0,76)	Glazing C Heat control double glazing (g = 0,59)	Glazing D Solar control double glazing (g = 0,32)
$q_{i, tot}$				

Calculation method used: ☐ Simplified Method (EN 13363-1)

☐ Detailed Method (EN 13363-2)

Protection from direct transmission – Normal/normal solar transmittance $\tau_{e, n\text{-}n}$

$\tau_{e, n\text{-}n}$	

C.2 Visual comfort

Opacity control

Fabrics: ☐ Dim out

☐ Black out

Products: Class obtained: ________________

Glare control

$\tau_{v,\ n\text{-}n}$: ________________

$\tau_{v,\ n\text{-}dif}$: ________________

Class obtained: ________________

Night privacy

$\tau_{v,\ n\text{-}n}$: ________________

$\tau_{v,\ n\text{-}dif}$: ________________

Class obtained: ________________

Visual contact with the outside

$\tau_{v,\ n\text{-}n}$: ________________

$\tau_{v,\ n\text{-}dif}$: ________________

Class obtained: ________________

Daylight utilisation

$\tau_{v,\ dif\text{-}h}$: ________________

Class obtained: ________________

Rendering of colours

R_a: ________________

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