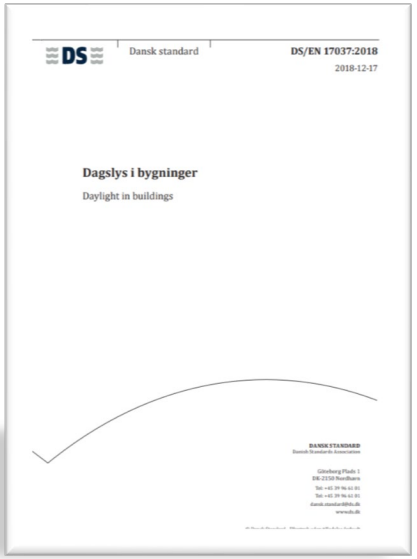
CEN European Daylight Standard (EN 17037)



EPBD 2018: Daylight must be considered

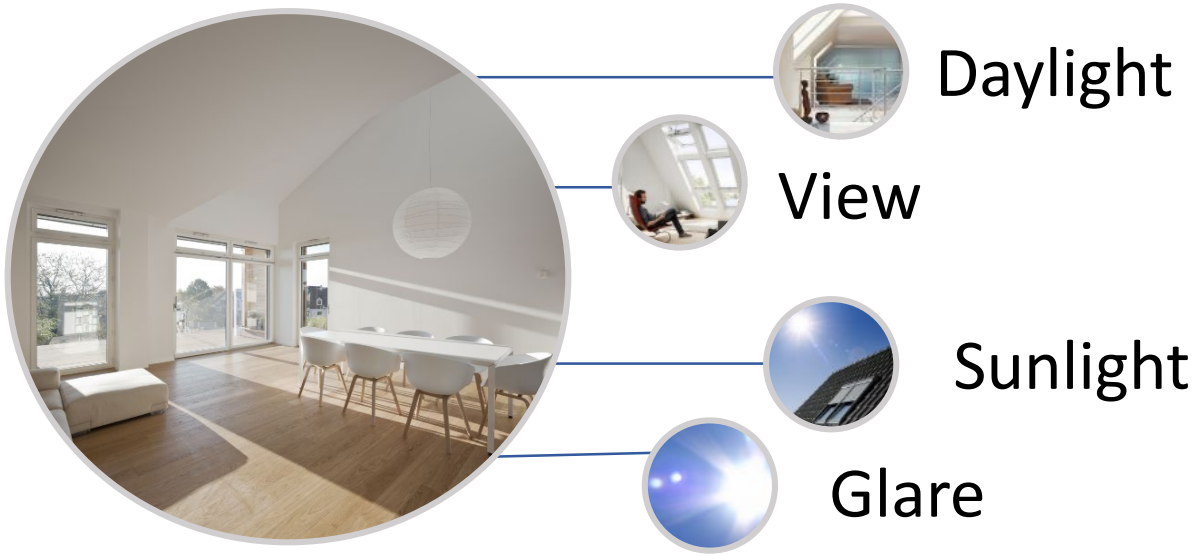
- **Recital (15)**
  - It is important to ensure that measures to improve the energy performance of buildings do not focus only on the building envelope, but include all relevant elements and technical systems in a building, such as passive elements that participate in passive techniques aiming to reduce the energy needs for heating or cooling, the energy use for lighting and for ventilation and hence improve thermal and visual comfort

- **Article 3**
  - Member States shall apply a methodology for calculating the energy performance of buildings in accordance with the common general framework set out in Annex I.

- **Annex I, Point 4.**
  - The positive influence of the following aspects shall be taken into account:
    - (a) local solar exposure conditions, active solar systems and other heating and electricity systems based on energy from renewable sources;
    - (b) electricity produced by cogeneration;
    - (c) district or block heating and cooling systems;
    - (d) natural lighting.

CEN European Daylight Standard (EN 17037)

What's included



Applies to all spaces (e.g workplaces and dwellings)

Introduction

Daylight should be a significant source of illumination for all spaces with daylight opening(s). Daylight is strongly favoured by building occupants as a way to adequately illuminate the indoor surfaces, and to save energy for electrical lighting.

- Daylight can provide significant quantities of light indoors
- Daylight openings provide views and connection to the outside
- Daylight opening provide exposure to sunlight indoors
- Shading device should be provided to reduce visual discomfort.

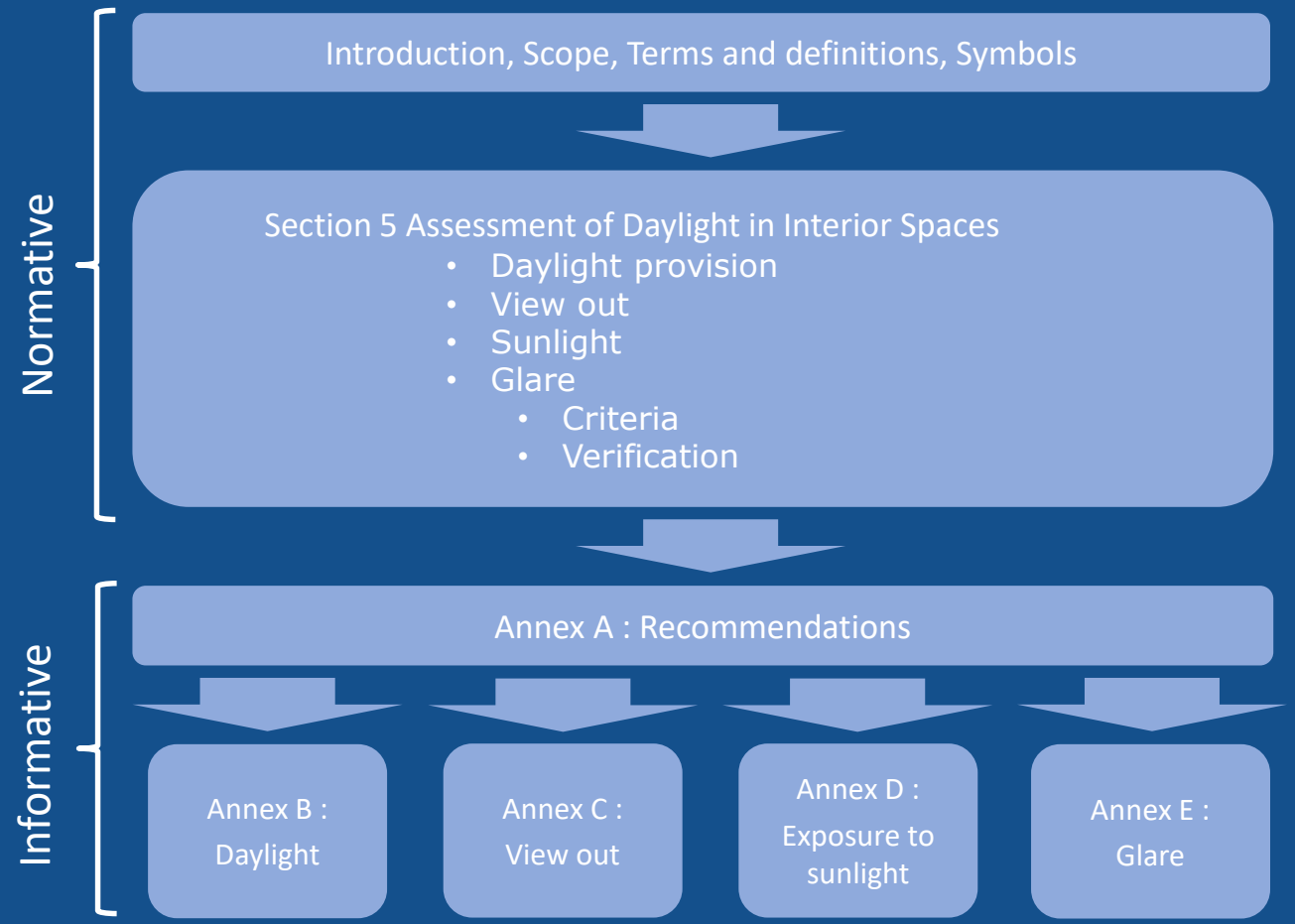
Scope

This document specifies elements for achieving an impression of lightness indoors, and for providing an adequate view out.

In addition, recommendations for the duration of sunshine exposure within occupied rooms are given, as well as how to limit glare.

It applies to all spaces that may be regularly occupied by people.

CEN Daylight Standard (EN 17037)



5 Assessment of daylight in interior spaces (Normative)

5.1 Daylight Provision

5.1.1 General

Daylight can contribute significantly to the lighting needs of any type of building. This means that daylight openings should have appropriate areas to provide sufficient daylight throughout the year.

Evaluation of daylight provision should make account:

- External obstruction
- Glazing transmittance
- Thickness of walls and roofs
- Internal partition and surface reflectance.

5 Assessment of daylight in interior spaces (Normative)

5.1.2 Criteria for daylight provision

A space is considered to provide adequate daylight if **a target illuminance level** is achieved across a **fraction of the reference plane** within a space for at least **half of the daylit hours**.

In addition, for spaces with vertical or inclined daylight openings, a **minimum target illuminance level** is also to be achieved across the reference plane.

Recommendations for daylight provision are given in Tables A.1 to A.4 and calculation methods are described in Annex B (Informative).

5 Assessment of daylight in interior spaces (Normative)

5.1.3 Daylight Provision Calculation Methods

The following methods to assess daylight provision to the interior, using validated software, are possible:

Method 1) Calculation method using daylight factors on the reference plane. Annex A gives values for target daylight factors (D_T) and minimum target daylight factors (D_{TM}) to be achieve depending on the given site.

Method 2) Calculation method of illuminance levels on the reference plane using climatic data for the given site and an adequate time step. Annex A gives values for target illuminances and minimum target illuminances to be achieve.

Annex B describes recommendations for the daylight calculations using the two methods.

Daylight recommendation for openings in the façade and roof (EN 17037)

For openings in the façade, daylight design should achieve a target daylight factor (D_T) across a fraction of the relevant floor area (i.e. 50% vertical) and the minimum target daylight factor (D_{TM}) should be achieved across 95% of the area.

For opening in a nearly horizontal roof, the target daylight factor (D_T) should be achieved across 95% of the area.

Table A.1 — Recommendations of daylight provision by daylight openings in vertical and inclined surface

Level of recommendation for vertical and inclined daylight opening	Target illuminance E_T lx	Fraction of space for target level $F_{plane,\%}$	Minimum target illuminance E_{TM} lx	Fraction of space for minimum target level $F_{plane,\%}$	Fraction of daylight hours $F_{time,\%}$
Minimum	300	50 %	100	95 %	50 %
Medium	500	50 %	300	95 %	50 %
High	750	50 %	500	95 %	50 %

NOTE — Table A.3 gives target daylight factor (D_T) and minimum target daylight factor (D_{TM}) corresponding to target illuminance level and minimum target illuminance, respectively, for the CEN capital cities.

Daylight recommendation for openings in the façade and roof (EN 17037)

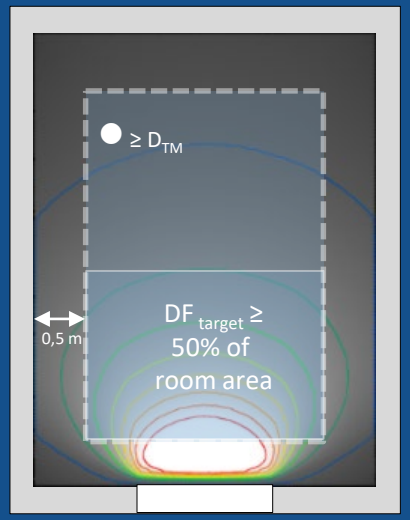
Estonia
Tallinn

$$D_T = \frac{Internal}{External} = \frac{300 \cdot 100}{13.600} = 2{,}2\%$$

$$D_{TM} = \frac{Internal}{External} = \frac{100 \cdot 100}{13.600} = 0{,}7\%$$

City	Internal lux	External lux	D_T %	D_{TM} %
Vilnius	300	15.300	2,0%	0,7%
Riga	300	13.600	2,2%	0,7%
Tallinn	300	13.600	2,2%	0,7%
Copenhagen	300	14.200	2,1%	0,7%
Paris	300	15.900	1,9%	0,6%
Rome	300	19.200	1,6%	0,5%

Vertical façade windows

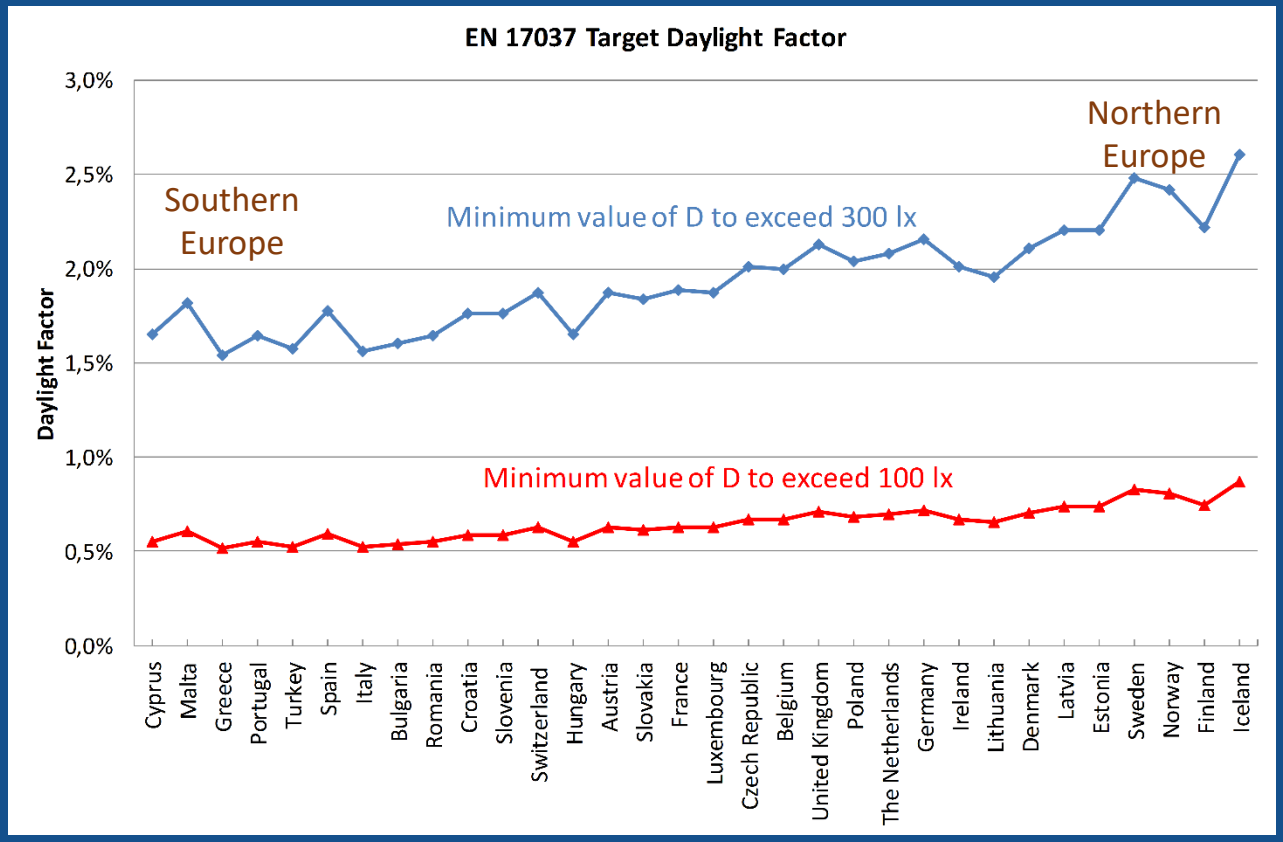


PLAN

The target Daylight Factor (D_T) is based on internal illuminance of 300 lux and the external diffuse horizontal illuminance at the location of interest.

For openings in the façade, daylight design should achieve a target daylight factor (D_T) across a fraction of the relevant floor area (i.e. 50% vertical) and the minimum target daylight factor (D_{TM}) should be achieved across 95% of the area. For opening in a nearly horizontal roof, the target daylight factor (D_T) should be achieved across 95% of the area.

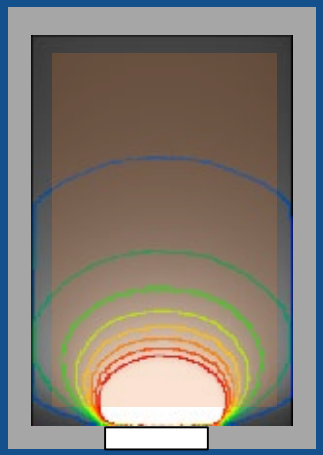
Daylight recommendation for openings in the façade and roof (EN 17037)



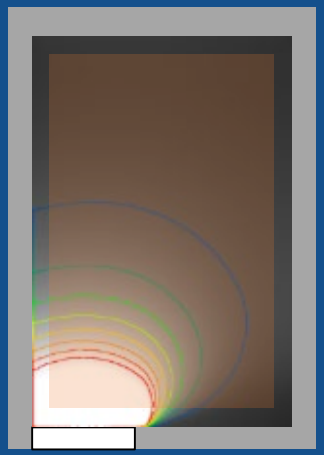
The proposed methodology for daylight provision require only a modest enhancement to existing practice.

CEN Daylight Standard (EN 17037): $D_T \geq 2.0\%$

- Daylight recommendation for façade windows (and VRW)

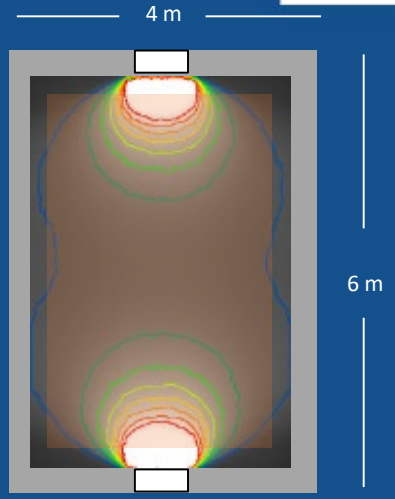


Daylit area ≥ 41%
Window 1,73x1,73
W/floor = 1:8



Daylit area ≥ 23%
Window 1,73x1,73
W/floor = 1:8

Daylit area ≥ **21%**
Window 1,07x2,8
W/floor = 1:8

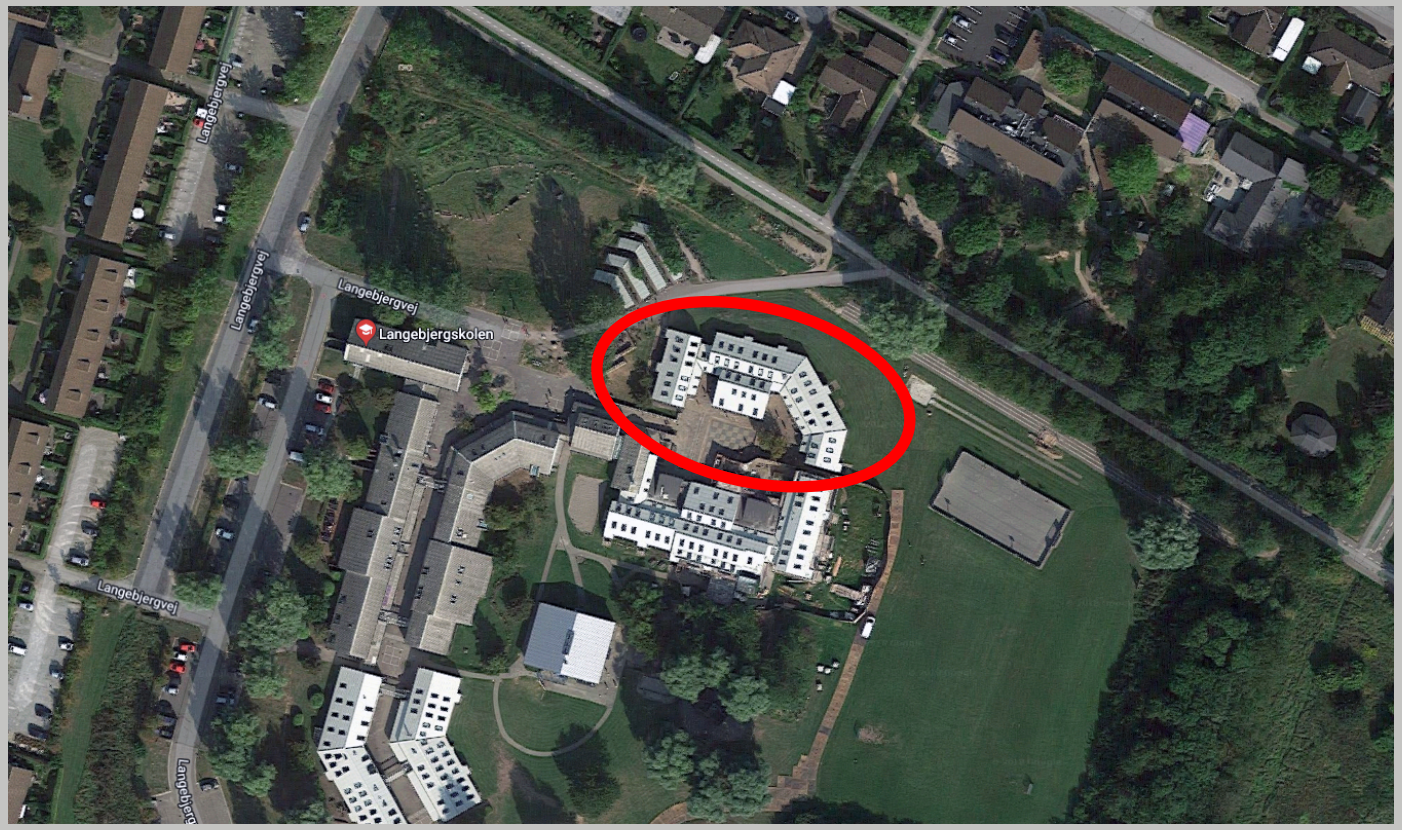


Daylit area ≥ 38%
Windows(2) 1,0x1,5
W/floor = 1:8

The examples shows that daylight performance for the same window-to-floor ratio (1:8) can vary significantly, giving a percentage daylit area [DF ≥ 2.0%] from 21% to 41%.

And in this case; the window need to be increase ! (or the location of the space is more southern)

VELUX®


Langebjergvej
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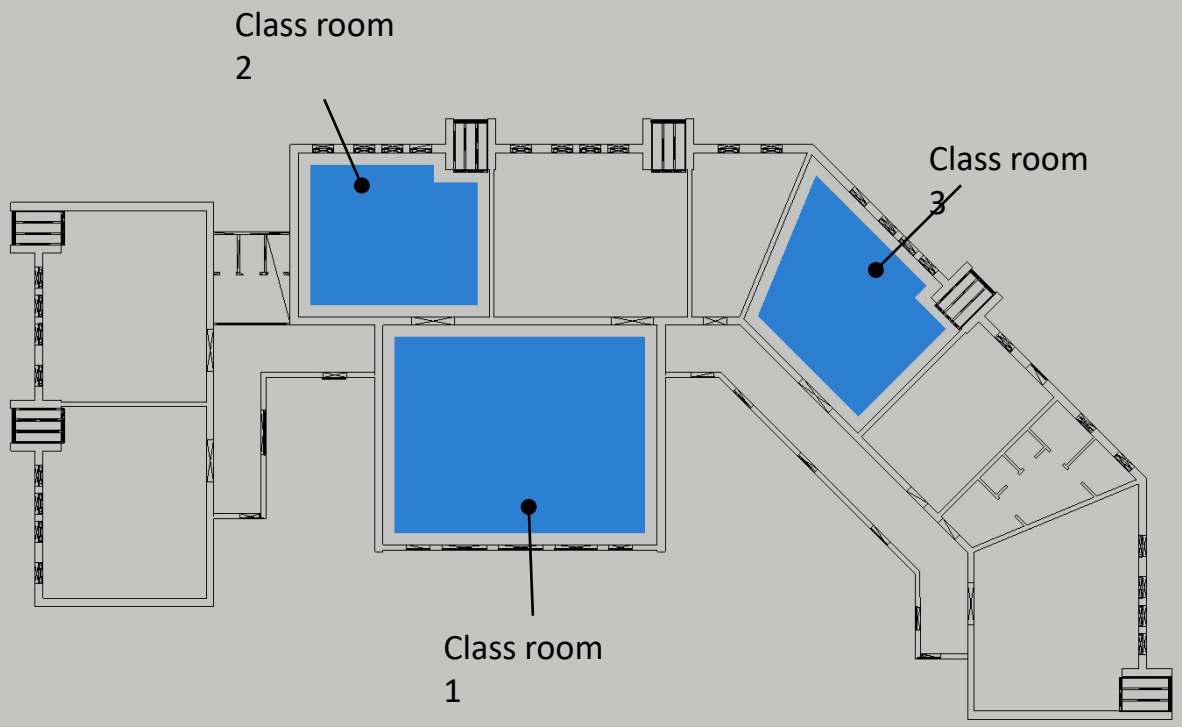
Langebjergskolen
Langebjergvej

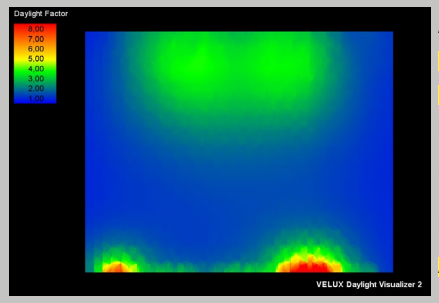

Class room
2
Class room
3
Class room
1

Before renovation

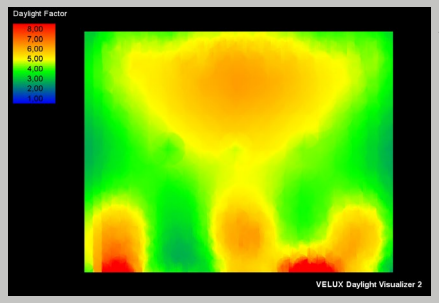
After renovation

VELUX®

Class room 1

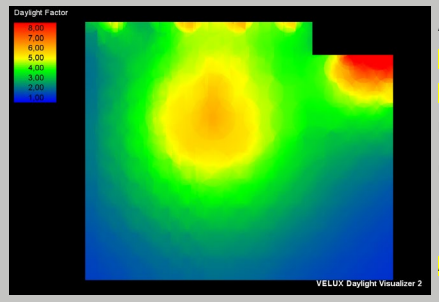


Average daylight factor	Dav	1.50
Median daylight factor	Dm	1.11
Minimum daylight factor	Dmin	0.47
Maximum daylight factor	Dmax	10.54
Uniformity 1	Dmin/Dav	1 : 3.19 (0.31)
Uniformity 2	Dmin/Dmax	1 : 22.38 (0.04)
Above 0.7%		87%

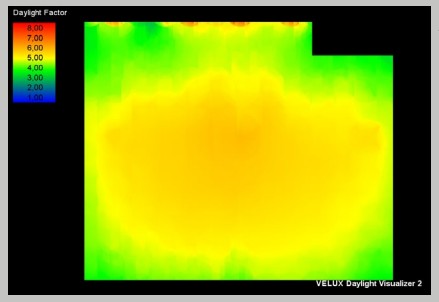


Average daylight factor	Dav	4.20
Median daylight factor	Dm	4.19
Minimum daylight factor	Dmin	1.94
Maximum daylight factor	Dmax	11.66
Uniformity 1	Dmin/Dav	1 : 2.16 (0.46)
Uniformity 2	Dmin/Dmax	1 : 6.00 (0.17)

Class room 2

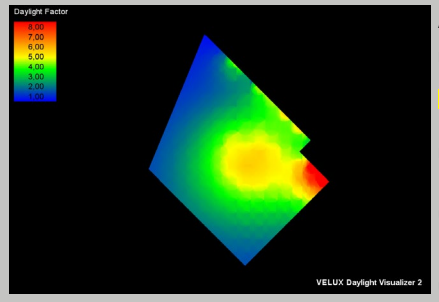


Average daylight factor	Dav	2.77
Median daylight factor	Dm	2.57
Minimum daylight factor	Dmin	0.59
Maximum daylight factor	Dmax	10.27
Uniformity 1	Dmin/Dav	1 : 4.68 (0.21)
Uniformity 2	Dmin/Dmax	1 : 17.34 (0.06)
Above 0.7%		99%

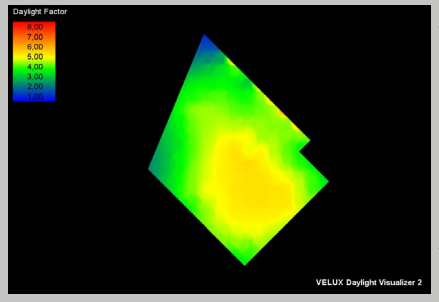


Average daylight factor	Dav	4.41
Median daylight factor	Dm	4.46
Minimum daylight factor	Dmin	2.41
Maximum daylight factor	Dmax	6.92
Uniformity 1	Dmin/Dav	1 : 1.83 (0.55)
Uniformity 2	Dmin/Dmax	1 : 2.88 (0.35)

Class room 3



Average daylight factor	Dav	2.76
Median daylight factor	Dm	2.49
Minimum daylight factor	Dmin	0.17
Maximum daylight factor	Dmax	10.52
Uniformity 1	Dmin/Dav	1 : 15.85 (0.06)
Uniformity 2	Dmin/Dmax	1 : 60.42 (0.02)
Above 0.7%		97%



Average daylight factor	Dav	3.80
Median daylight factor	Dm	3.91
Minimum daylight factor	Dmin	0.52
Maximum daylight factor	Dmax	5.87
Uniformity 1	Dmin/Dav	1 : 7.28 (0.14)
Uniformity 2	Dmin/Dmax	1 : 11.23 (0.09)
Above 0.7%		99%

5 Assessment of daylight in interior spaces (Normative)

5.2 Assessment for view out

5.2.1 General

View to the outside provides visual connection with the surroundings to supply information about the local environment, weather changes and the time of day. This information can relieve the fatigue associated with long periods of being indoors.

A view is considered to comprise three distinct layers:

- a layer of sky;

- a layer of landscape;

- a layer of ground.

5 Assessment of daylight in interior spaces (Normative)

5.2.2 Criteria for view out

The criteria for view out concern the utilized area. In order to ensure an adequate view out, the following criteria should be met:

- the glazing material of the view opening should provide a view that is perceived to be clear, undistorted and neutrally coloured;
- in the utilized area, view opening(s) as seen from the reference point of the view should have a total horizontal sight angle higher than a minimum value;
- the distance to the outside view should be larger than a minimum value;
- in the utilized area a minimum number of layers should be seen.

Recommendation for view out is given in Tables A.5 and calculation methods are described in Annex C (Informative).

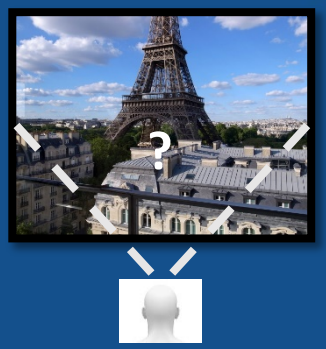
CEN Daylight Standard (EN 17037)

- View out (table method)

Table A.5 — Assessment of the view outwards from a given position

	Parameter [a]		
Level of recommendation for view out	**Horizontal sight angle**	**Outside distance of the view**	**Number of layers to be seen from at least 75 % of utilized area:** **- sky** **- landscape (urban and/or nature)** **- ground**
Minimum	≥ 14°	≥ 6,0 m	At least landscape layer is included
Medium	≥ 28°	≥ 20,0 m	Landscape layer and one additional layer is included in the same view opening
High	≥ 54°	≥ 50,0 m	all layers are included in the same view opening

[a] For a space with room depth more than 4 m, it is recommended that the respective sum of the view opening(s) dimensions is at least 1,0 m × 1,25 m (width × height).



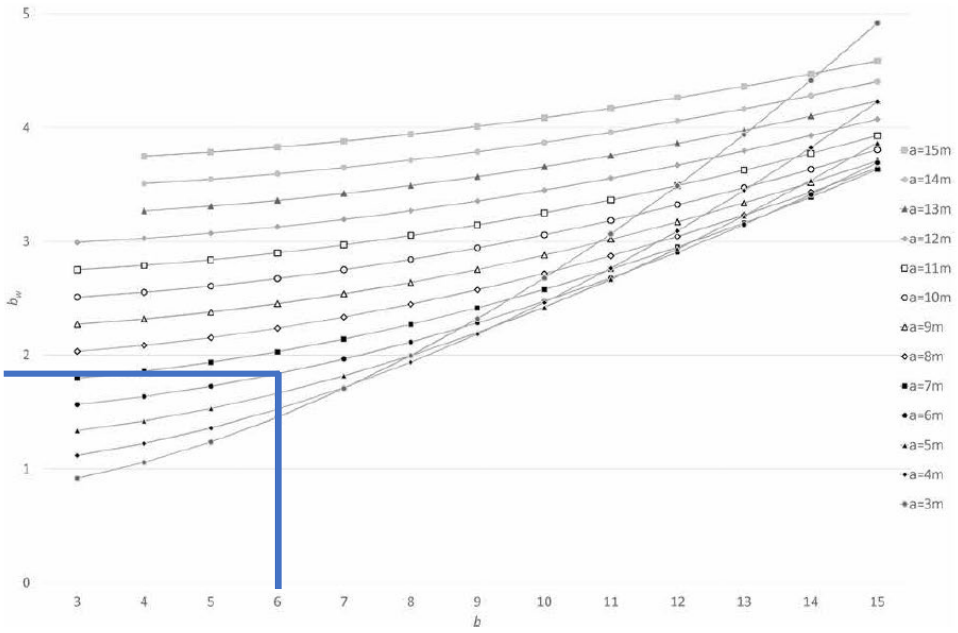
Horizontal sight angle

Outside distance of view

Amount of layers seen from inside

CEN Daylight Standard (EN 17037)

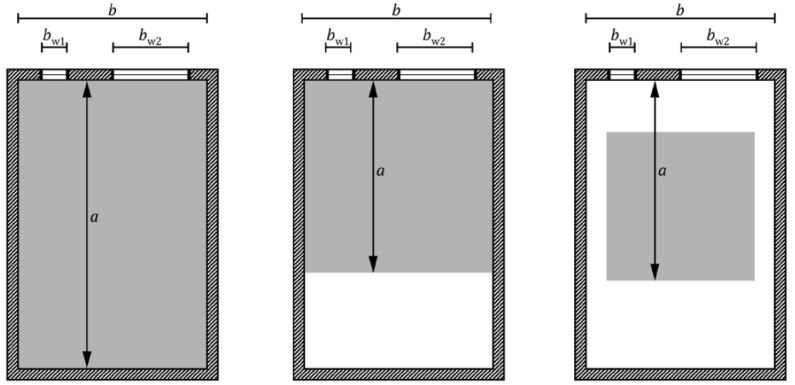
- View out (table method)



Key

a	distance between the façade and the most remote part of the utilized area
b_w	width of the view opening(s) (m)
b	width of the room (m)

Figure C.2 — Rating of width of view opening(s) as a function of depth of the utilized area for a horizontal sight angle of ≥ 14 degrees



Key

a	distance between the façade and the most remote part of the utilized area
b	width of façade between interior walls
b_{w1}	width view opening 1
b_{w2}	width view opening 2

Figure C.1 — The view opening(s) in the same façade

Example:

Distance a is 6m and the space has a width b of 6 m. The width of the view window is about 1.8m.

5 Assessment of daylight in interior spaces (Normative)

5.3 Exposure to sunlight

5.3.1 General

Exposure to sunlight is an important quality criterion of an interior space and can contribute to human well-being.

Minimum exposure to sunlight should be provided in patient rooms in hospitals, play rooms in nurseries and at least one habitable space in dwellings

5.3.2 Criteria for exposure to sunlight

For a given reference day, a space should receive sunlight for at least a predefined number of hours.

Recommendations for sunlight exposure is given in Table A.6 and calculation methods are described in Annex D (Informative).

CEN Daylight Standard (EN 17037)

- Sunlight (Hand calculation, algorithms …)

A.4 Recommendation for exposure to sunlight

The recommendation is that a space should receive possible sunlight for a duration according to Table A.6 (supposed to be cloudless) on a selected date between February 1st and March 21. Table A.6 proposes three levels for sunlight exposure. See Annex D for further details.

When applying the recommendation to a whole dwelling, the proposal is that at least one habitable room in the dwelling should have at least exposure to sunlight after Table A.6.

Table A.6 — Recommendation for daily sunlight exposure

Level of recommendation for exposure to sunlight	Sunlight exposure
Minimum	1,5 h
Medium	3,0 h
High	4,0 h

5 Assessment of daylight in interior spaces (Normative)

5.4 Protection from glare

5.4.1 General

Direct sunlight or high luminance differences between bright and dark areas within the field of view can cause risk of glare.

For any space with daylight openings, it is recommended to use shading devices to reduce risk of glare, and direct view to the sun or a reflection of it should be avoided.

5 Assessment of daylight in interior spaces (Normative)

5.4.2 Criteria for protection from glare

Daylight Glare Probability (DGP) is used to assess protection from glare for spaces where the activities are comparable to reading, writing or using display devices and the occupants are not able to choose position and viewing direction.

The DGP-assessment can be applied to a space with vertical or inclined daylight openings, but is not applicable for a space with horizontal daylight openings. DGP-threshold values should not exceed a certain fraction of the reference usage time.

Recommendations for glare protection is given in Table A.7 and calculation methods and pre-calculated tables are described in Annex E (Informative). The shading material properties and glare protection classes are according to prEN 14501 Blinds and shutters - Thermal and Visual comfort - Performance characteristics and classification.

CEN Daylight Standard (EN 17037)

- Annual glare evaluations (tables)

A.5 Recommendation for glare protection

The Daylight Glare Probability (*DGP*) should not exceed a maximum value for more than the fraction $F_{DGP,exceed}$ = 5 % of the usage time of the space.

In Table A.7, $DGP_{e<5\,\%}$ -threshold values for different levels of glare protection are proposed.

The minimum recommendation for glare protection is that the *DGP* for the occupied space does not exceed a value of 0,45 in more than 5 % of the occupation time of the relevant space.

Table A.7 — Proposed different levels of threshold $DGP_{e<5\,\%}$ for glare protection

Level of recommendation for glare protection	$DGP_{e<5\,\%}$
Minimum	0,45
Medium	0,40
High	0,35

CEN Daylight Standard (EN 17037)

- Annual glare evaluation (tables)

Table E.2 — The marerial porperties and glare protection classes

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

Table E.3 — Glare control classification given in EN 14501 according to the visual transmittance properties $\tau_{v,n\text{-}n}$ and $\tau_{v,\,n\text{-}diff}$

$\tau_{v,\,n\text{-}dif}$ [b]	$\tau_{v,\,n\text{-}n}$ [a]					
	$\tau_{v,\,n\text{-}n} = 0{,}00$	$0{,}00 < \tau_{v,\,n\text{-}n} \leq 0{,}01$	$0{,}01 < \tau_{v,\,n\text{-}n} \leq 0{,}02$	$0{,}02 < \tau_{v,\,n\text{-}n} \leq 0{,}03$	$0{,}03 < \tau_{v,\,n\text{-}n} \leq 0{,}05$	$\tau_{v,\,n\text{-}n} > 0{,}05$
$\tau_{v,\,n\text{-}dif} \leq 0{,}03$	4	4	3	3	1	0
$0{,}03 < \tau_{v,\,n\text{-}dif} \leq 0{,}06$	4	3	2	2	1	0
$0{,}06 < \tau_{v,\,n\text{-}dif} \leq 0{,}10$	4	3	2	1	0	0
$0{,}10 < \tau_{v,\,n\text{-}dif} \leq 0{,}15$	3	2	1	1	0	0
$0{,}15 < \tau_{v,\,n\text{-}dif} \leq 0{,}20$	2	2	1	1	0	0
$0{,}20 < \tau_{v,\,n\text{-}dif} \leq 0{,}25$	1	1	0	0	0	0
$0{,}25 < \tau_{v,\,n\text{-}dif}$	0	0	0	0	0	0

[a] $\tau_{v,\,n\text{-}n}$ is the normal/normal light transmittance

[b] $\tau_{v,n\text{-}dif}$ is the normal/diffuse light transmittance

Solar protection device where the curtain is made of textile, film or perforated opaque material

CEN Daylight Standard (EN 17037)

- Minimum recommendation for Annual Glare evaluation

Towards North (e.g. DK) ↓ Towards South ↓

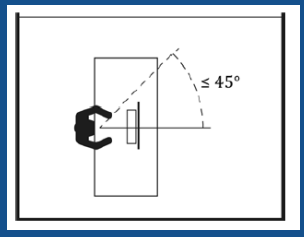
Table E.4 — Recommended glare classes according to EN 14501 to fulfil the glare criteria of $DGP_{e<5\%} \leq 0{,}45$

		Sunshine Zone L				Sunshine Zone H			
		orientation S, S-E, S-W		orientation E, W, N-E, N-W		orientation S, S-E, S-W		orientation E, W, N-E, N-W	
		$\tau_{glazing}$		$\tau_{glazing}$		$\tau_{glazing}$		$\tau_{glazing}$	
	d_w	≤ 0,60 VD_p/VD_f	> 0,60 VD_p/VD_f	≤ 0,60 VD_p/VD_f	> 0,60 VD_p/VD_f	≤ 0,50 VD_p/VD_f	> 0,50 VD_p/VD_f	≤ 0,50 VD_p/VD_f	> 0,50 VD_p/VD_f
small opening	1 m	1 / 3	2 / 3	1 / 3	1 / 3	1 / 3	1 / 4	1 / 3	1 / 3
	2 m	1 / 1	1 / 1	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2
	3 m	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1	1 / 1
large opening	1 m	1 / 3	2 / 4	1 / 3	2 / 3	1 / 3	2 / 4	1 / 3	2 / 3
	2 m	1 / 2	1 / 3	1 / 2	1 / 3	1 / 3	1 / 3	1 / 3	1 / 3
	3 m	1 / 1	1 / 1	1 / 1	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2

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

Solar protection device where the curtain is made of textile, film or perforated opaque material

VD_P is View Direction parallel with facade
VD_f is View Direction 45° towards facade



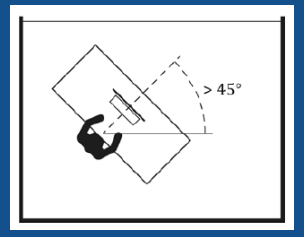
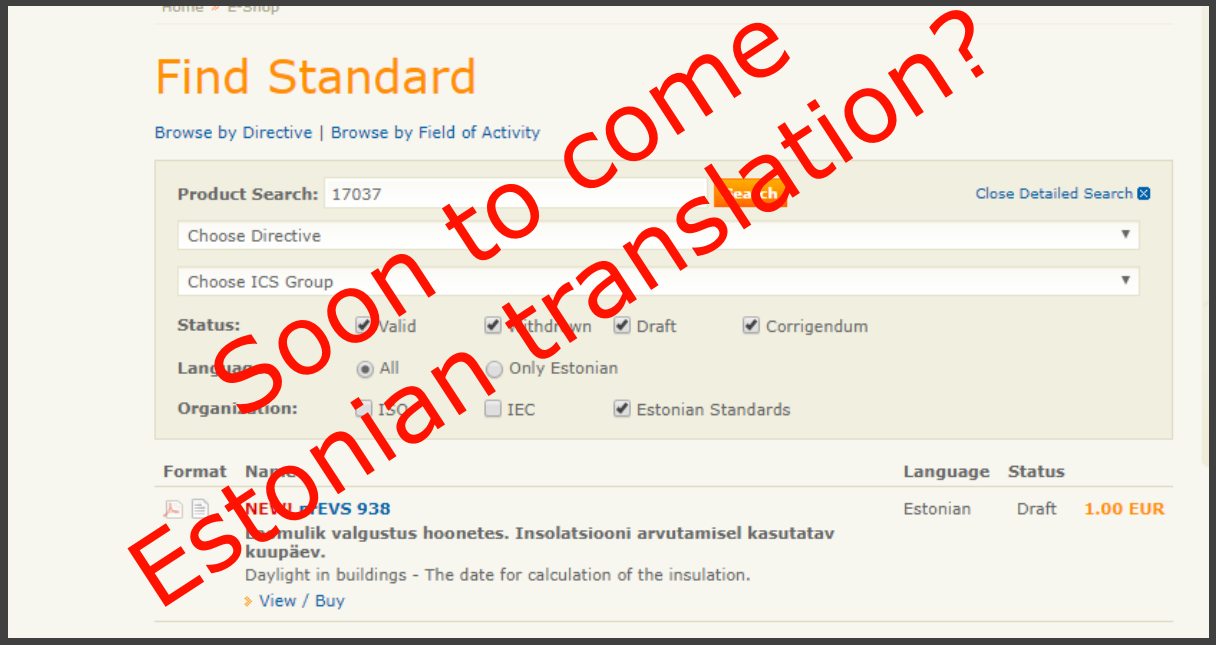


Table E.3 — Glare control classification given in EN 14501 according to the visual transmittance properties $\tau_{v,n\text{-}n}$ and $\tau_{v,\ n\text{-}diff}$

$\tau_{v,\ n\text{-}dif}$ b	$\tau_{v,\ n\text{-}n}$ a					
	$\tau_{v,\ n\text{-}n} = 0{,}00$	$0{,}00 < \tau_{v,\ n\text{-}n} \leq 0{,}01$	$0{,}01 < \tau_{v,\ n\text{-}n} \leq 0{,}02$	$0{,}02 < \tau_{v,\ n\text{-}n} \leq 0{,}03$	$0{,}03 < \tau_{v,\ n\text{-}n} \leq 0{,}05$	$\tau_{v,\ n\text{-}n} > 0{,}05$
$\tau_{v,\ n\text{-}dif} \leq 0{,}03$	4	4	3	3	1	0
$0{,}03 < \tau_{v,\ n\text{-}dif} \leq 0{,}06$	4	3	2	2	1	0
$0{,}06 < \tau_{v,\ n\text{-}dif} \leq 0{,}10$	4	3	2	1	0	0
$0{,}10 < \tau_{v,\ n\text{-}dif} \leq 0{,}15$	3	2	1	1	0	0
$0{,}15 < \tau_{v,\ n\text{-}dif} \leq 0{,}20$	2	2	1	1	0	0
$0{,}20 < \tau_{v,\ n\text{-}dif} \leq 0{,}25$	1	1	0	0	0	0
$0{,}25 < \tau_{v,\ n\text{-}dif}$	0	0	0	0	0	0

a $\tau_{v,\ n\text{-}n}$ is the normal/normal light transmittance
b $\tau_{v,n\text{-}dif}$ is the normal/diffuse light transmittance

Where to get EN 17037 ?



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Technical committee representatives: