SOC1.4

Visual comfort

Objective

Our objective is to ensure sufficient, uninterrupted supply of daylight and artificial light in all interior areas which are in constant use. Visual comfort forms the basis of general well-being and efficient, productive work. Natural light has a positive effect on the mental and physical health of humans. In addition, efficient use of daylight provides a great deal of potential energy savings in terms of artificial lighting and cooling.

Benefits

User satisfaction is closely linked to feelings of comfort and well-being. Forecasts providing users with information regarding daylight hours, their surroundings, weather conditions, etc. are highly important in this regard. Visual comfort strongly affects user productivity and satisfaction.

Contribution to overriding sustainability goals

	CONTRIBUTION TO SUSTAINABLE DEVELOPMENT GOALS (SDGS) OF UNITED NATIONS (UN)		CONTRIBUTION TO GERMAN SUSTAINABILITY STRATEGY	
	7.3	Double the improvement in energy efficiency	7.1.a/b	Resource conservation

Low

Outlook

There are currently no plans to make any of the requirements stricter.

Share of total score

	SHARE	WEIGHTING FACTOR
Office **Assembly buildings**	**3.1%**	**3**
Education	**2.7%**	**3**
Residential	**3.2%**	**3**
Hotel	**2.0%**	**2**
Consumer market **Shopping centre** **Department stores**	**3.4%**	**3**
Logistics **Production**	**3.2%**	**3**

EVALUATION

In order to ensure sufficient and uninterrupted supply of daylight and artificial light, visual comfort is evaluated on the basis of seven indicators, depending on the specific use of the building. The availability of daylight in the entire building and at permanent workstations is assessed via indicators 1 and 2. Availability of direct view to the outside is acknowledged via indicator 3. Indicator 4 evaluates the solar radiation/glare protection system in place. The artificial light conditions, the colour rendering index of the daylight and the duration of exposure to daylight are assessed in indicators 5 to 7. In this criterion, a maximum of 100 points can be awarded.

NO.	INDICATOR		POINTS
1	**Availability of daylight for the entire building**		
1.1	**Daylight factor (DF)**		
	Office **Education** **Assembly buildings**		**10–18**
	Residential		**20–40**
	Hotel		**16–34**
	50% of the usable area (UA) has a daylight factor (DF) of		
	■ ≥ 1.0% (with documentation via simulation or calculation with detailed documentation of the obstruction index I_{VJ})	**Office** **Education** **Assembly buildings**	10
		Residential	20
		Hotel	16
	■ ≥ 1.5% (with documentation via simulation or calculation with detailed documentation of the obstruction index I_{VJ})	**Office** **Education** **Assembly buildings**	14
		Residential	30
		Hotel	25
	■ ≥ 2.0% (with documentation via simulation or calculation with detailed documentation of the obstruction index I_{VJ})	**Office** **Education** **Assembly buildings**	18
		Residential	40
		Hotel	34
	Consumer market		
	Areas illuminated via side windows have a daylight factor of at least 1.0% and areas illuminated via skylights have a daylight factor of at least 2.0%. The area illuminated with daylight is determined by superimposing all areas illuminated with daylight (combined area).		**Max. 45**
	■ The combined area features the following proportion of the usable area (UA:		**+ 15–35**
	■ A ≥ 15% of UA		15
	■ A ≥ 25% of UA		25
	■ A ≥ 50% of UA		35
	■ Uniformity of the daylight supply in the area illuminated by the skylights:		**+ 10**

The distance between the midpoints of the skylights is not greater than the clear room height. Alternatively, uniformity ($g_1 = D_{min}/D_{average}$) of the area illuminated via skylights of more than 0.5 can be documented via a daylight simulation.

Shopping centre

Daylight factors of at least 2.0% **10–30**

- A ≥ 15% of UA 10
- A ≥ 25% of UA 20
- A ≥ 50% of UA 30

Department stores

Areas illuminated via side windows have a daylight factor of at least 1.0% and areas illuminated via skylights have a daylight factor of at least 2.0%. **10–40**
The area illuminated with daylight is determined by superimposing all areas illuminated with daylight (combined area).

The combined area features the following proportion of the usable area (UA:

- A ≥ 5% of the UA 10
- A ≥ 10% of the UA 25
- A ≥ 15% of the UA 40

Production buildings

50% of the usable area (UA has a daylight factor (DF) of **15–30**

- ≥ 0.5% (with documentation via simulation or calculation with detailed documentation of the obstruction index I_{VJ}) 15
- ≥ 0.75% (with documentation via simulation or calculation with detailed documentation of the obstruction index I_{VJ}) 20
- ≥ 1.0% (with documentation via simulation or calculation with detailed documentation of the obstruction index I_{VJ}) 30

Not applicable for **Logistics**

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2 Availability of daylight at permanent workstations

2.1 Annual relative motive exposure

Office **Education** **Logistics** office part **Assembly buildings** area Type I **8–16**

Annual relative useful exposure

- ≥ 45% (with documentation via simulation or calculation with detailed documentation of the obstruction index I_{VJ}) 8
- ≥ 60% (with documentation via simulation or calculation with detailed documentation of the obstruction index I_{VJ}) 12
- ≥ 75% (with documentation via simulation or calculation with detailed documentation of the obstruction index I_{VJ}) 16

Logistics industrial part **6–12**

Assembly buildings area Type II **8–16**

Proportion of the roof surface area represented by translucent skylights (proportion of industrial work)

■ ≥ 0.5%	**Logistics**	6
	Assembly buildings	8
■ ≥ 2.0%	**Logistics**	9
	Assembly buildings	12
■ ≥ 4.0%	**Logistics**	12
	Assembly buildings	16

Not applicable for **Residential** **Hotel** **Consumer market** **Shopping centre** **Department stores** **Production buildings**

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3 Visual contact with the outside

3.1 Availability of line of sight to the outside

Shopping centre **Department stores** **Max. 30**

Consumer market **Max. 18**

■ Direct visual link to the outside for all office rooms Direct visual link to the outside for 80% of all break and social rooms	**Shopping centre** **Department stores**	+5
	Consumer market	+9
■ Proportion of the total net sales area represented by the open façade area (not including the shop façades in the mall) 0% to 5%	**Shopping centre** **Department stores**	+ 0–15
■ There are shop areas with direct lines of sight to the outside	**Shopping centre** **Department stores**	+5
■ 0% to 50% of the façade area of the shop areas has a direct line of sight to the outside	**Shopping centre** **Department stores**	+ 0–5
■ A direct visual link to the outside is possible from all checkout workstations.	**Consumer market**	+9

Office **Education** **Hotel** **Logistics** **Max. 16**

Assembly buildings area Type I and II

Residential **Max. 20**

(If the building has both a solar radiation protection system and a glare protection system at the same time with different classifications, the evaluation will be carried out on the basis of the better classification.)

■ Visual contact to the outside is possible	**Residential**	10
Assembly buildings area Type II	**Office** **Education**	8
■ Daylight is available from the lounge areas (e.g. event room, foyer).	**Hotel** **Logistics** **Assembly buildings**	
Visual contact to the outside in direct field of vision from the workstation, the living area or hotel room is possible	**Residential**	15
	Office **Education**	12

Assembly buildings area Type II — **Hotel** **Logistics** **Assembly buildings**

- Visual contact from the lounge areas (e.g. event room, foyer) to the outside area is possible.

Visual contact to the outside in the direct field of vision from the workstation, the living area or hotel room is possible, even when the glare protection system or solar radiation protection system is down — **Residential** 20; **Office** **Education** 16; **Hotel** **Logistics** **Assembly buildings**

Assembly buildings area Type II

- Visual contact to the outside in the direct field of vision from the common areas (e.g. event room, foyer) possible.

Not applicable for **Production buildings**

4 Absence of glare in daylight

4.1 Absence of glare due to solar radiation/glare protection system

Office **Education** — **Max. 16**

Assembly buildings area Type I

Assembly buildings area Type II **(Variable)**

(If the building has both a solar radiation protection system and a glare protection system at the same time with different classifications, the evaluation will be carried out on the basis of the better classification.

Annual relative useful exposure).

- Solar radiation/glare protection system available (with no additional documentation of the quality in accordance with DIN EN 14501) — 8
- Solar radiation/glare protection system = class 1 — 12
- Solar radiation/glare protection system ≥ class 2 — 16

Additionally for **Assembly buildings** area Type II **(Variable)**

- Light-directing systems in combination with glare protection with direct light suppression available.
  or:
  Use of skylights with a high proportion of diffuse northern light (e.g. shed roof) — 16

Consumer market — **12**

- Requirements in accordance with workplace regulation A3.4 Section 4.2 have been complied with

Logistics — **Max. 13**

- Solar radiation/glare protection system < class 1 — 6
- Solar radiation/glare protection system = class 1 — 9
- Solar radiation/glare protection system ≥ class 2 — 13

Production — **24**

- Light-diverting systems in combination with glare protection with direct light filtering available.

or:

Use of skylights with high percentage of diffusion of northern light (e.g. saw-tooth roof)

Not applicable for **Residential** **Shopping centre** **Department stores** **Hotel**

5 Artificial lighting

5.1 Minimum requirements for artificial lighting

Office **Education** **Hotel** **Consumer market** **Department stores** **Assembly buildings**

- The requirements for lighting in accordance with DIN EN 12464-1 have been complied with.

Office **Education**	**16**
Assembly buildings **Hotel**	**12**
Consumer market	**15**
Department stores	**20**

Logistics **Max. 20**

Production **Max. 30**

- Numerical criteria in accordance with DIN EN 12464-1 have been complied with for artificial lighting:
  $\bar{E}_m$: Maintained illuminance value
  U_o: Uniformity of illuminance
  UGR_L: Glare limitation
  R_a: Colour rendering

Logistics	+20
Production	+30

Shopping centre (does not apply for tenant areas) **+ Max. 10**

- Numerical criteria in accordance with DIN EN 12464-1 have been complied with for artificial lighting:
  $\bar{E}_m$: Maintained illuminance value
  UGR_L: Glare limitation
  R_a: Colour rendering — +5
- Automatic adjustment of the artificial light in areas supplied with daylight via dimmable lights or incremental light control — +5

Not applicable for **Residential**

5.2 Artificial lighting over-fulfilment

Office **Education** **Hotel** **Consumer market** **Department stores**

Possible over-fulfilment features:

- Colour rendering $R_a \geq 90$
- Illuminance on the walls $Ev_{Wall} \geq 150$ lx
- Automatic or individual adjustment of the illuminance via artificial lighting (> 800 lx)
- Automatic or individual adjustment of the light colour via artificial lighting in the range of warm white (3000 K) to daylight white (6500 K) (for new **Hotel**: 6000 K)

Additionally for **Education**

- Light management with brightness and presence detection depending on daylight
- In classrooms: Additional lighting for the blackboard that can be

switched on and off separately

Additionally for **Consumer market** **Department stores**

- Artificial light planning takes into account the results of a daylight analysis (e.g. via suitable zoning and management)

Office **Education** **Consumer market** **Department stores** **Max. 10**
Hotel **Max. 8**

Number of features implemented:

- 1 3
- 2 6
  Hotel 5
- ≥ 3 10
  Hotel 8

Shopping centre (does not apply for tenant areas) **Max. 20**

Possible over-fulfilment features:

- Increased colour rendering Ra ≥ 90
- Cylindrical illuminance E cyl ≥ 150 lx
- Automatic adjustment of the illuminance via artificial light (> 800 lx) is possible
- Automatic adjustment of the light colour via artificial light at least in the range of warm white (3000 K) to daylight white (6000 K)
- Artificial lighting concept that encourages ambiance (e.g. zoning, pools of light)
- A concept for preventing light pollution at night is planned and implemented
- All mall entrances and transition areas are designed as adaptation zones for dark adaptation.
- Artificial light planning takes into account the results of a daylight analysis (e.g. via suitable zoning and management)

Number of features implemented:

- 1 5
- 2 10
- 3 15
- ≥ 4 20

Logistics **Production buildings** **Max. 8**

Possible over-fulfilment features:

- Increased colour rendering Ra ≥ 90
- Automatic or individual adjustment of the illuminance via artificial light (> 800 lx)
- Automatic or individual adjustment of the light colour via artificial light in the range of warm white (3000 K) to daylight white (6000 K)

Number of features implemented:

- 1 4

- 2 — 6
- 3 — 8

Assembly buildings — **Max. 12**

- Artificial light plan from a specialist/expert is available
- Colour rendering Ra ≥ 90
- A lighting control with daylight-dependent brightness control has been implemented
- Automatic adjustment of the light colour via artificial light at least in the range of warm white (3000 K) to daylight white (6000 K)
- Artificial lighting concept that creates the mood (e.g. zoning, islands of light)

Number of features implemented:

- 1 — 4
- 2 — 8
- ≥ 3 — 12

Not applicable for **Residential**

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6 Daylight colour rendering

6.1 Colour rendering index R_a

Office **Education** **Production buildings** — **4–8**
Residential — **15–20**
Hotel **Logistics** — **8–15**
Shopping centre **Assembly buildings** — **5–10**

Colour rendering index R_a for the combination of glazing and solar radiation/glare protection, all daylit areas in constant use

- Ra ≥ 80 — 4
  - **Residential** — 15
  - **Hotel** **Logistics** — 8
  - **Shopping centre** — 5
- Ra ≥ 90 — 8
  - **Residential** — 20
  - **Hotel** **Logistics** — 15
  - **Shopping centre** — 10

Not applicable for **Consumer market** **Department stores**

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7 Exposure to daylight

7.1 Duration of exposure to daylight

Residential — **5–20**
Hotel — **8–15**

- Duration of exposure to daylight on 17th January ≥ 1 h and duration of exposure to daylight at the equinox ≥ 4 h, achieved for at least 40% of the living spaces (at least one living space per residential unit)/guest rental unit (hotel)
  - **Residential** — 5
  - **Hotel** — 8

■ Duration of exposure to daylight on 17th January ≥ 1 h and duration of exposure to daylight at the equinox ≥ 4 h, achieved for at least 60% of the living spaces (at least one living space per residential unit)/guest rental unit (hotel)		10
■ Duration of exposure to daylight on 17th January ≥ 1 h and duration of exposure to daylight at the equinox ≥ 4 h, achieved for at least 80% of the living spaces (at least one living space per residential unit)/guest rental unit (hotel)	**Residential** **Hotel**	15 13
■ Duration of exposure to daylight on 17th January ≥ 1 h and duration of exposure to daylight at the equinox ≥ 4 h, achieved for 100% of the living spaces/guest rental units (hotel)	**Residential** **Hotel**	20 15

Not applicable for **Office** **Education** **Consumer market** **Shopping centre** **Department stores** **Logistics** **Production buildings** **Assembly buildings**

SUSTAINABILITY REPORTING AND SYNERGIES

Sustainability reporting

Appropriate key performance indicators (KPIs) include communicating indicators regarding daylight, direct visual links to the outside, artificial light qualities and glazing qualities, as well as durations of exposure to daylight.

NO.	KEY PERFORMANCE INDICATORS (KPIS)	UNIT
KPI 1	Daylight factor (DF) for 50% of the usable area	[%]
KPI 2	Relative annual useful exposure	[%]
KPI 3	Proportion of the roof surface area represented by translucent skylights	[%]
KPI 4	Proportion of the rooms with direct visual link to the outside	[%]
KPI 5	Artificial light qualities: Colour rendering index, illuminance and rate of adjustment, light colour	[-]
KPI 6	Colour rendering index of the glazing	[%]
KPI 7	Durations of exposure to daylight (17th January and at the equinox) and proportion of rooms to which this information applies	[h]

Synergies with DGNB system applications

- **DGNB OPERATION:** Achieving high levels of quality in this criterion provides great potential for achieving high satisfaction rates during ongoing operation for criterion 9.1 of the Buildings in use (BIU) scheme (user satisfaction).
- **DGNB RENOVATED BUILDINGS:** Large similarities with criterion SOC1.4 in the REN scheme.
- **DGNB INTERIORS:** Large similarities with criterion SOC1.4 in the IR scheme.

APPENDIX A – DETAILED DESCRIPTION

I. Relevance

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II. Additional explanation

Visual comfort is achieved by means of balanced lighting, with no significant interferences such as direct and/or reflected glare, as well as by means of sufficient level of illumination and individual adjustment to suit the needs of specific users. Here, user satisfaction is closely linked to feelings of comfort and well-being. Forecasts providing users with information regarding daylight hours, their surroundings, weather conditions, etc. are essential in this regard. Additional criteria include absence of glare, light distribution and the light colour in the room. These requirements apply in principle to use of daylight and artificial light, where the evaluation of the daylight supply in the interior plays a particularly important role. For this reason, sufficient, disturbance-free supply of daylight and artificial light must be available for all interior areas in constant use.

III. Method

Indicator 1: Availability of daylight for the entire building
The daylight factor (DF) and the corresponding portion of the usable area (UA), area definition according to the chapter “Terms and definitions” [T&D_04]. Documentation can be carried out either via simulation or in accordance with DIN V 18599, with detailed documentation of the obstruction index I_{VJ} (or, in the case of hotels, with a lump sum approach for the obstruction index I_{VJ}).

Indicator 2: Availability of daylight at permanent workstations
The relative annual useful exposure and the corresponding portion of the permanent workstations must be determined. Documentation can be carried out either via simulation or in accordance with DIN V 18599, with detailed documentation of the obstruction index I_{VJ} (or, in the case of hotels, with a lump sum approach for the obstruction index I_{VJ}).

Indicator 3: Visual contact with the outside
Visual contact with the outside must be determined qualitatively via the floor plan and the type of solar radiation/glare protection used.

Indicator 4: Absence of glare in daylight
The solar radiation/glare protection must be classified with regard to its glare protection function in accordance with DIN 14501, Section 6.3. For **Consumer markets**, compliance with the occupational health and safety guidelines (ASR) A3.4, Section 4.2 must be documented. For **Production buildings**, if skylights are used, the proportion of the lit areas must be stated, and the glare protection system, if used, must be described.

Indicator 5: Artificial light

The evaluation of the indicator is divided into minimum requirements and possible over-fulfilments. Points for an over-fulfilment can only be awarded if the minimum requirements for the area under assessment are met. The evaluation can be carried out on an area-weighted basis for partial areas.

The reference values for lighting requirements are summarised in DIN EN 12464-1, separated by use. The following values must be considered:

- $\bar{E}_m$ Maintained illuminance value [lx]
- UGR_L Glare limitation [-]
- U_o Uniformity of illuminance [-]
- R_a Colour rendering [-]
- $E_{V\ Wall}$ Illuminance on the walls [lx]
- L Luminance limits for lights at workstations with monitors [cd·m−2]

Indicator 6: Daylight colour rendering

The colour rendering index Ra for the combination of glazing and solar radiation/glare protection, all daylit areas in constant use must be determined.

Indicator 7: Exposure to daylight

The duration of exposure to daylight of building windows must be established on 17th January and 21st March/21st September (equinox) using suitable calculations for shading. When doing so, in accordance with DIN 5034, all external shading, e.g. due to adjacent buildings, topography, the courtyard/atrium, plants/trees, etc., must be taken into account.

IV. Usage-specific description

Education

Indicator 2: Availability of daylight at permanent workstations

The areas under evaluation are not just restricted to the workstations in the administration offices, usable area (UA 2 – Office work in accordance with DIN 277-1 [T&D_04]). The affected areas in usable area (UA 5 – Education, teaching and culture in accordance with DIN 277-1 [T&D_04] must also be taken into account.

Consumer market **Shopping centre** **Department stores**

The issue of lighting plays a significant role in retail buildings. Firstly, the energy demand for artificial lighting is generally very high, meaning that optimisation involving increased use of daylight provides substantial potential savings. Secondly, retail buildings are, for example, generally subject to different requirements than offices in terms of lighting, as both permanent and short stays play a role. Daylighting is currently hardly utilised in retail buildings. However, the acceptability of the indoor climate is closely linked to comfort at the workplace, which naturally also includes employees in retail buildings. In addition, studies have clearly shown that using daylight can positively affect purchasing behaviour, including in retail buildings. As the two groups under consideration – employees and customers – are fundamentally different from one another, the reference to each of the group under consideration is established separately and, if necessary, treated differently.

*Employees**

For employees, visual comfort forms the basis of efficient, productive work. In addition, good use of daylight provides a great deal of potential energy savings in terms of artificial light and cooling. The acceptability of the indoor climate (thermal comfort, air quality, noise and lighting), particularly the lighting conditions, is closely linked to satisfaction. For this reason, sufficient, disturbance-free lighting must be available in all interior areas which are in constant use. For psychological and physiological reasons, daylight is always preferable to artificial light, and a suitable visual connection to the outside world should be established.

*Employees are all persons working in continuously occupied areas. Continuously occupied areas include: sales rooms, office rooms, kitchens, checkouts, customer service points, etc.

Customers

For customers, visual comfort is equally vital for ensuring well-being, and thereby also affects their length of stay. Studies have determined that purchasing activity is higher in retail buildings lit with daylight and have thereby established a positive monetary impact as well. Adjusting the interior lighting to suit the daylight situation also provides potential energy savings. In addition, accent lighting provides customers with important guidance to find their way through the building/store. Appropriate light planning, taking into account daylight and artificial light, must be ensured and must incorporate energy aspects, physiological aspects and functional aspects.

Indicator 3: Visual contact with the outside

Direct sight to outside from the checkout workstations.

Visual contact with the outside must be established via graphical entries in the floor plan. This applies to all checkout workstations where the line of sight to a window or glazed door is not blocked by permanent installations. Transparent internal walls or open staircases (e.g. escalators) are not classified as blocking elements for the purposes of this indicator. The windows or doors that provide a view to the outside must be designed to be transparent at a height of 1 m to 2.2 m.

Definition

Mall spaces: All publicly accessible areas (i.e. areas that are not lockable) of the shopping street must be taken into account, including food areas, open sales areas, open staircases, etc. Ancillary areas, etc. can be ignored by the auditor with proper justification.

Definition of rental space: The rental space must be considered to comprise all rentable floor areas listed in Appendix 1. Tenant fit outs, including light separating walls, may be ignored.

Logistics

The requirements for visual comfort vary for office and industrial areas.

For offices with UA (in accordance with DIN 277-1 [T&D_04]) of ≥ 400 m² or ≥ 20 permanent workstations, the visual comfort for both office and industrial areas must be analysed.

1. Number of office workstations ≥ 15% of the total workstations or ≥ 20 permanent office workstations:

Evaluation of proportion of office area and proportion of industrial area:

For the evaluation, the proportion of office area and the proportion of industrial area must be analysed in the individual indicators.

$$\text{Points}_{\text{total}} = \text{points}_{\text{office portion}} \times (\text{number of office workstations} / \text{number of total workstations}) + \text{Points}_{\text{industrial work portion}} \times (\text{number of industrial workstations} / \text{number of total workstations})$$

2. Number of office workstations < 15% of the total workstations and < 20 permanent office workstations:

Evaluation of proportion of industrial area:

For the evaluation, the proportion of industrial area must be analysed in the individual indicators.

$$\text{Points}_{\text{total}} = \text{points}_{\text{industrial work portion}}$$

Indicator 2: Availability of daylight at permanent workstations:

The availability of daylight, via the external walls, in the hall area of logistics buildings is limited due to the wide expanse of the halls. For this reason, the halls are supplied with daylight, if at all, via skylights. The low area proportion is balanced out by the fact that the light output of skylights is higher than vertical windows (approx. four times higher). The problem of stored goods being exposed to unwanted heat and UV radiation can be balanced out by not situating the skylights in shelving areas, where there are no permanent workstations, and instead concentrating them in the order picking area and other similar permanent workstations.

Assembly buildings

Area assignments:

For the scheme **Assembly buildings**, different areas to be weighted and evaluated according to the different typology of areas defined in Appendix 1:

Areas under the Type I:

- Workplaces in administrative offices (UA 2 – office work [T&D_04]);
- Event rooms or workplace rooms with the visual requirements similar to offices, which, however, are assigned to UA 5 – rooms for education, teaching and culture, in accordance with DIN 277-1 [T&D_04] (e.g. in lecture halls, seminar rooms, work rooms, library rooms, reading rooms). Foyer areas that are also used as event areas are to be assigned to this type;

Areas under the Type II:

- Event rooms, such as exhibition rooms (in museums, galleries, etc.), exhibition halls which, due to their main use (purpose), do not allow any or only a small amount of daylight, as well as due to their special purpose, have large volumes of space (hall character) where daylight is only available and useful to a small extent via the external walls. Rooms that do not require daylight due to the special requirements (such as cinemas) do not have to be considered.

Evaluation:

- Areas type I: application of the method according to the **Education** based on the "annual relative useful exposure";
- Areas type II: application of the method according to **Logistics** based on the "translucent skylight portion of the roof area";
- If no assignment to the type I or type II is given, all areas must be considered in accordance with the Appendix 1 of this criterion;

Indicator 1: Availability of daylight for the entire building

This indicator assesses the daylight availability for the entire building. The following areas are assessed in accordance with the Appendix 1: Usable areas (UA) 1-7 according to DIN 277-2 (chapter 4 “Terms and definitions” [T&D_04]) excluding those areas that do not require daylight due to their special typological requirements for operation e.g. cinema halls.

Indicator 3: Visual contact with the outside

The visual connection to the outside of all surfaces represents an optimum for the visual comfort of the “Assembly buildings”. In the areas in which a visual connection to the outside is not possible, availability of a daylight reference e.g. daylight created by the ribbon windows, so that the times of day and lighting conditions can be identified, will be assessed positively. For “Assembly buildings” with special requirements e.g. concert halls and cinema buildings where no permanent daylight availability is required, a positive evaluation will be still granted if a temporary daylight reference will be possible, e.g. in foyers, this will highlight the flexibility of area usage. For “Assembly buildings”, the areas to be assigned to the relevant types (according to indicator 2) and to be assessed on an area-weighted basis. For area type I, evidence of the minimum proportion of window areas in accordance with DIN 5034 must be provided. The determination of the class (0 to 4) of the sun / glare protection with regard to the visual contact to the outside is based according to DIN 14501, Table 10, the assessment of the class (0 to 4) of the solar radiation/glare protection with regard to visual contact with the outside is based on the vertical-vertical light transmittance $\tau_{v,n\text{-}n}$ and the proportion of the light transmittance that is diffused $\tau_{v,n\text{-}dif}$ (s. Appendix 2).

Indicator 4: Absence of glare in daylight

For “Assembly buildings”, areas to be assigned to the certain use types (according to indicator 2 and to be assessed on an area-weighted basis:

- For type I areas, compliance with the occupational safety guideline (ASR) A3.4 chapter 4.2 must be proven. The sun / glare protection is with regard to the glare protection function according to DIN14501, chap. 6.3 to be classified.
- For areas assigned to the type II usage, the presence of light-directing systems in combination with glare protection and direct light suppression or in the case of roof skylights with a high proportion of diffuse northern lights will be assessed positively.
- Variable: indicator can be set to “not relevant” for buildings that can be assumed to be glare-free due to their use.

Appendix 1

APPENDIX 1 AREAS OF THE SCHEMES TO BE TAKEN INTO ACCOUNT

Office

SCHEME	USE GROUP	FLOOR AREA AND ROOMS	INDICATOR						
			1	2	3	4	5	6	7
NEW OFFICE BUILDINGS	1_Residential and recreation (Portion of rooms for socialisation)	Common rooms Break rooms Waiting rooms Dining rooms	x		x		x		
	2_Office work	Office rooms Open-plan offices Meeting rooms Design rooms Ticket offices Control rooms Surveillance rooms	x	x	x	x	x	x	

Education

NEW BUILDINGS EDUCATIONAL BUILDINGS	1_Residential and recreation (Portion of rooms for socialisation)	Common rooms Break rooms Waiting rooms Dining rooms	x		x		x	x	
	2_Office work (Portion of admin-istrative work)	Office rooms Open-plan offices Meeting rooms Design rooms Ticket offices Control rooms Surveillance rooms	x	x	x	x	x	x	

	3_Production, manual and machine work, experiment (Portion of industrial work)	Workshops (where these are permanent workstations) Technological laboratories Physics, engineering physics and electrical engineering laboratories Chemistry, bacteriology and morphology laboratories			x	x	x	x	
	5_Education, teaching and culture	Classrooms with fixed seating (lecture halls, including experimental lecture halls; auditoriums) General classrooms and practice rooms without fixed seating (classrooms and group rooms, seminar rooms, student workspaces) Special classrooms and practice rooms without fixed seating (work and craft rooms, training rooms, language rooms, special drawing classrooms, rooms for graphic design, painting and sculpture, rooms and practice booths for singing, language and instrumental training, rooms for home economics lessons)	x	x	x	x	x	x	

Residential

NEW BUILDINGS RESIDENTIAL BUILDINGS	1_Residential and recreation	Living spaces Common rooms Break rooms Waiting rooms Dining rooms	x		x			x	x

Consumer market

NEW BUILDINGS RETAIL	1_Residential and recreation (Portion of rooms for socialisation)	Common rooms Break rooms Waiting rooms Dining rooms	x		x				

	2_Office work	Office rooms Open-plan offices Meeting rooms Design rooms Ticket offices Control rooms Surveillance rooms	x	x	x	x	x	x	
	1_Residential and recreation (Portion of rooms for socialisation)	Common rooms Break rooms Waiting rooms Dining rooms	x		x		x		
	2_Office work (Portion of administrative work)	Office rooms Open-plan offices Meeting rooms Design rooms Ticket offices Control rooms Surveillance rooms	x		x	x	x		
	4_Distribution and sales	Sales rooms Showrooms For NSC, indicators 4 and 5 are not taken into consideration	x		x	x	x		

Shopping centre

	1_Residential and recreation (Portion of rooms for socialisation)	Common rooms Break rooms Waiting rooms Dining rooms	x		x		x		
NEW BUILDINGS RETAIL BUILDINGS	2_Office work (Portion of administrative work)	Office rooms Open-plan offices Meeting rooms Design rooms Ticket offices Control rooms Surveillance rooms	x		x	x	x		

	4_Distribution and sales	Sales rooms Showrooms For NSC, indicators 4 and 5 are not taken into consideration	x		x	x	x		
	Mall	All publicly accessible areas (i.e. areas that are not lockable) of the shopping street must be taken into account, including food areas, open sales areas, open staircases, etc. Ancillary areas, etc. can be ignored by the auditor with proper justification.	x					x	

Department stores

NEW BUILDINGS RETAIL BUILDINGS	1_Residential and recreation (Portion of rooms for socialisation)	Common rooms Break rooms Waiting rooms Dining rooms	x		x		x		
	2_Office work (Portion of administrative work)	Office rooms Open-plan offices Meeting rooms Design rooms Ticket offices Control rooms Surveillance rooms	x		x	x	x		
	4_Distribution and sales	Sales rooms (Checkout workstations) Showrooms (Workstations)	x		x		x		

Production buildings

NEW BUILDINGS INDUSTRIAL BUILDINGS	1_Residential and recreation (Portion of rooms for socialisation)	Common rooms Break rooms Waiting rooms Dining rooms			x				

	2_Office work (Portion of administrative work)	Office rooms Open-plan offices Meeting rooms Design rooms Ticket offices Control rooms Surveillance rooms		x	x	x	x	x	
	3_Production, manual and machine work, experiment (Portion of industrial work)	Factory halls (where these are permanent workstations) Workshops (where these are permanent workstations) Technological laboratories Physics, engineering physics and electrical engineering laboratories Chemistry, bacteriology and morphology laboratories		x	x	x	x	x	
	4_Logistics halls (Portion of industrial work)	Logistics halls (where these are permanent workstations)		x	x	x	x	x	
Logistics									
NEW BUILDINGS INDUSTRIAL BUILDINGS	1_Residential and recreation (Portion of rooms for socialisation)	Common rooms Break rooms Waiting rooms Dining rooms	x		x				
	2_Office work (Portion of administrative work)	Office rooms Open-plan offices Meeting rooms Design rooms Ticket offices Control rooms Surveillance rooms	x	x	x	x	x	x	

	3_Production, manual and machine work, experiment (Portion of industrial work)	Factory halls (where these are permanent workstations) Workshops (where these are permanent workstations) Technological laboratories Physics, engineering physics and electrical engineering laboratories Chemistry, bacteriology and morphology laboratories	x	x	x	x	x	x	
	4_Logistics halls (Portion of industrial work)	Logistics halls (where these are permanent workstations)		x	x	x	x	x	

Hotel

NEW BUILDINGS HOTEL BUILDINGS	1_Residential and recreation	Living spaces (guest rooms) Common rooms Break rooms Waiting rooms Dining rooms	x		x			x	x
	2_Office work (Portion of administrative work)	Office rooms Open-plan offices Meeting rooms Design rooms Ticket offices Control rooms Surveillance rooms	x		x		x	x	

Assembly buildings

NEW BUILDINGS ASSEMBLY BUILDINGS	1_Residential and recreation (UA 1)	Living rooms, bedrooms, accommodation rooms, Kitchens in apartments, common rooms, lounges, ready rooms, break rooms, tea kitchens, rest rooms, waiting rooms, dining rooms, detention rooms	x		x	x	x	x	

2_Office work (UA 2)	Office space, Open plan offices, meeting rooms, construction rooms, design rooms, Counter rooms, Supervision rooms, office equipment rooms	x	x	x	x	x	x	
3_Production, manual and machine work, experiment (UA 3)	Factory halls (where these are permanent workstations) Workshops (where these are permanent workstations) Laboratories, Rooms for keeping animals, Rooms for plant cultivation, commercial kitchens, special work rooms	x	x	x	x	x	x	
4_Storage, distribution, sales (UA 4)	Storage and pantry rooms, warehouses, vaults, silo rooms, archives, collection rooms, registries, cold rooms, reception and distribution rooms, packing rooms, sales rooms, exhibition rooms	x	x	x	x	x	x	
5_Education, teaching and culture (UA 5)	Classrooms and practice rooms, lecture halls, seminar rooms, work rooms, internship rooms, library rooms, reading rooms, sports rooms, gymnastics rooms, auditoriums (in cinemas, theatres, sports halls, etc.), stage rooms, studio rooms, rehearsal rooms, exhibition rooms (in museums, galleries, etc.), sacred rooms	x	x	x	x	x	x	

	7_Other uses (UA 7)	Storage rooms, bicycle rooms, garbage collection rooms, vehicle parking areas, passenger lounge areas, technical systems for the operation of usage-specific facilities, technical systems for the supply and disposal of other structures, Shelters, Sanitary rooms, changing rooms (cupboards, artists' dressing rooms, etc.), cleaning locks	x		x				
NEW BUILDINGS ASSEMBLY BUILDINGS	All usable areas 1-7 according to the DIN 277-2 [T&D_04] excluding those areas that do not require daylight due to the typological requirements for the operation of the rooms. Note: circulation areas within rooms, in accordance with DIN 277-1: 2016-01; 4.7.4 do not belong to the circulation spaces (CS), but to the usable area (UA).		x		x	x		x	

Areas to be taken into account:

Indicator 1. Availability of daylight for the entire building

This indicator assesses the supply of daylight for the entire building. For this reason, the following area is evaluated:

Office **Education** **Consumer market** **Shopping centre** **Department stores** **Production**

Usable floor area in accordance with DIN 277-2 [see. T&D_04] includes corridors in open-plan offices, group offices or combi-offices that are in open-air contact with the workstations (classification of the specified areas as circulation areas is not possible as a result).

Residential **Hotel**

Permanently used/occupied rooms

Assembly buildings

Usable areas (UA) 1-7 in accordance with DIN 277-2 [see. T&D_04] excluding areas that do not require daylight due to the typological requirements for the use (e.g. cinema halls). A list of areas with the corresponding allocation and explanations must be enclosed with the verification.

2. Availability of daylight at permanent workstations

Office **Education** **Logistics** **Assembly buildings**

Corridors in open-plan offices, group offices or combi-offices that cannot be converted into workstations – contrary to DIN 277-2 and DIN V 18599, as well as indicator 1 – must not be allocated to the usable floor area that is taken into account, but are instead considered to be circulation areas and are therefore not taken into account.
This applies if the corridors
a) have a ceiling height lower than the surrounding offices (panelling for supply ducts) and
b) have a different source of artificial light (corridor lighting instead of office lighting)
In both cases, clear verification documentation must be compiled.

3. Visual contact with the outside

Office **Education** **Residential** **Hotel** **Logistics** **Consumer market** **Shopping centre** **Department stores**

Permanently used/occupied rooms

4. Absence of glare in daylight

Office **Education** **Logistics** **Production** **Consumer market** **Assembly buildings**

Permanent workstations

5. Artificial light

Office **Education** **Logistics** **Production** **Shopping centre** **Department stores**

Permanently used/occupied rooms

Logistics **Production** **Hotel**

Permanent workstations

Consumer market

Min. 80% of the total usable area to be verified and at least 80% of the permanent workstations.

6. Daylight colour rendering

Permanently used/occupied rooms

Consumer market

5. Artificial light

At least 80% of the total usable areas and at least 80% of the permanent workstations should be documented

Logistics Production **Hotel**

5. Artificial light

Permanent workstations

6. Colour rendering

Office **Education** **Residential** **Consumer market** **Shopping centre** **Department stores**

Permanently used/occupied rooms

Logistics **Production** **Hotel**

Permanent workstations

7. Exposure to daylight

Residential **Hotel**

Living areas

Appendix 2

Indicator 1: Availability of daylight for the entire building

The availability of daylight for the entire building is documented using UA, which should achieve a certain daylight factor (0.5 to 2.0%) at minimum. When calculating the daylight factors, the following effects must be taken into account in accordance with DIN 5034, regardless of the selected documentation process:

- All external shading, e.g. due to adjacent buildings, topography, the courtyard/atrium, plants/trees, etc.
- Reduction as the daylight shines through the façade (light transmittance of the glazing, frames/sash bars, dirt, unusual angle of incidence of sunlight).

In general, the methods listed below are permitted for assessment of the portion of UA to be evaluated.
As DIN V 18599-4 does not in principle take into account shading due to trees/plants, but these do still reduce the amount of daylight that reaches the building, if shading due to trees/plants is expected or already exists, daylight simulations must be used as a documentation method when possible. If the simplified method in accordance with DIN V 18599-4 is used, plants must be assessed as obstructions to be on the safe side (estimation of the maximum height and width of the plants as building dimensions). Alternative to DIN 18599-4 the ISO 52000-1, module 9 (M9) can be used or the calculation method from the local energy performance certificate - EPC if this comply with the boundary conditions described in the criterion ENV1.1 “Building life cycle assessment”.

(1) Calculation using the simplified method of DIN V 18599-4

I. Breakdown of the rooms (zones) that are to be allocated to UA into

a) Area supplied with daylight A_{DL}

b) Area not supplied with daylight A_{NDL}

The following applies to all rooms in the usable area (UA) (see below): $A_{tot} = A_{DL} + A_{NDL}$

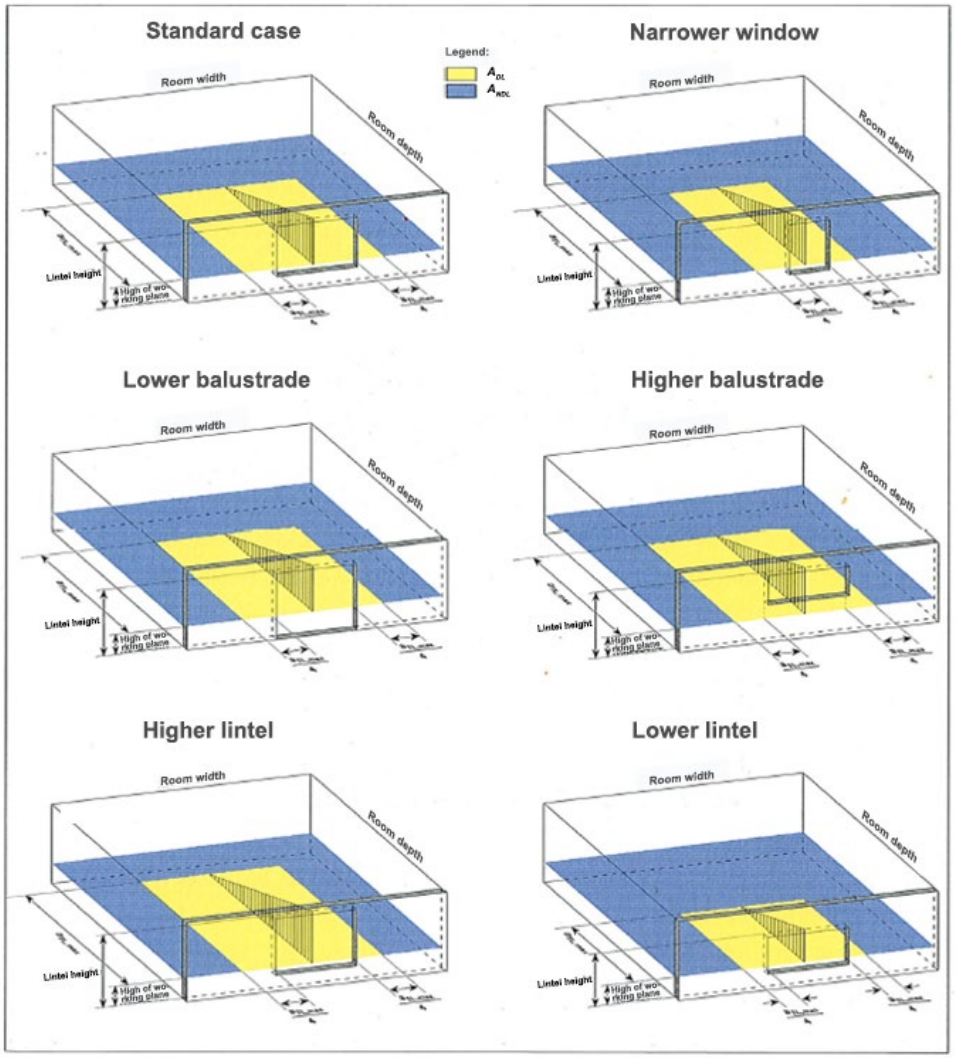


Fig. 4–21: Illustration of the effect of the window width and the lintel/ balustrade height on the area supplied with daylight

II. Reduction of the daylight factor D_{Rb} from the DIN V 18599-calculation

c) Adoption of the daylight factor D_{Rb} from the DIN V 18599 calculation, which only applies for the opening in the structural work.

d) Adoption of the approximated effective light transmittance $\tau_{eff,SNA}$ from the DIN V 18599 calculation.

e) Assessment of the actual effective daylight factor D_{eff}, taking into account reduction due to glazing, frames/sash bars, dirt, and non-vertical angle of incidence of sunlight, via the following equation:
$D_{eff} = D_{Rb} \cdot \tau_{eff,SNA}$

f) The obstruction index I_{Vj} must be determined in detail in accordance with DIN V 18599-4 (at least by storey or appropriate façade sections) and is incorporated into the assessment of D_{Rb}.
The lump sum approach to the obstruction index I_{Vj} = 0.9 – permitted in accordance with the EPC (e.g. *EnEV*, German energy saving ordnance, details under [T&D_03]) – does not sufficiently portray the actual shading in most cases and is therefore not permitted for the documentation of this indicator.

This effective daylight factor D_{eff} applies in accordance with the country specific EPC (e.g. DIN V 18599-4, [T&D_03]) as an average value over the axis at half of the depth of the area supplied with daylight in parallel to the façade area under consideration (see below):

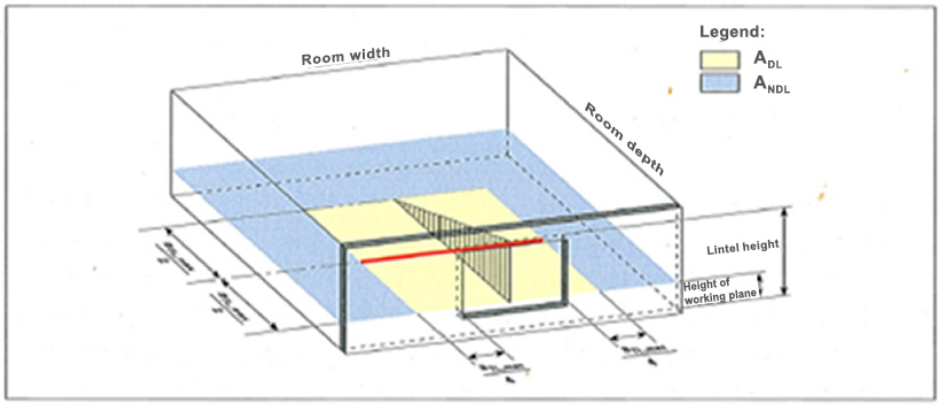


Fig. 4–28: Diagram of the check location for determining the daylight factor

© *Heizen, Kühlen, Belüften & Beleuchten* – Bilanzierungsgrundlagen zur DIN V 18599 [Heating, cooling, ventilating and lighting – Fundamentals of balancing for DIN V 18599]; David, de Boer, Erhorn, Reiß, Rouvel, Schiller, Weiß, Wenning, published by Fraunhofer IRB Verlag, 2006, ISBN-13: 9-783-8167-7024-4

I. Assessment of the portion $A_{1.0\%/1.5\%/2.0\%,j}$ of the area supplied with daylight A_{DL} in the room j that has a daylight factor of at least 1.0%/1.5%/2.0%, via linear **interpolation** of the depth of the area supplied with daylight $a_{1.0\%/1.5\%/2.0\%,j}$ that has a daylight factor of at least 1.0%/1.5%/2.0%:

$$a_{1,0\%,j} = \frac{a_{TL}}{2} + \frac{a_{TL}}{2} \cdot \left(\frac{D_{eff} - 1{,}0\%}{D_{eff}} \right)$$

$$a_{1,5\%,j} = \frac{a_{TL}}{2} + \frac{a_{TL}}{2} \cdot \left(\frac{D_{eff} - 1{,}5\%}{D_{eff}} \right)$$

$$a_{2,0\%,j} = \frac{a_{TL}}{2} + \frac{a_{TL}}{2} \cdot \left(\frac{D_{eff} - 2{,}0\%}{D_{eff}} \right)$$

II. The relevant depth of the area supplied with daylight $a_{1.0\%/1.5\%/2.0\%,j}$, which has a daylight factor of at least 1.0%/1.5%/2.0%, can be used together with the width of the area supplied with daylight $b_{DL,j}$ to derive the area in the room j with this daylight factor at minimum:

$$A_{1.0\%,j} = a_{1.0\%,j} \cdot b_{DL,j}$$

$$A_{1.5\%,j} = a_{1.5\%,j} \cdot b_{DL,j}$$

$$A_{2.0\%,j} = a_{2.0\%,j} \cdot b_{DL,j}$$

III. Assessment of the portion of the total UA in the building that has a daylight factor of at least 1.0%/1.5%/2.0% by simply determining the sum of the relevant partial areas $A_{1.0\%/1.5\%/2.0\%,j}$ across all n rooms in the building that must be allocated to UA, that is to be taken into account, meaning that the following equations apply:

$$A_{UA,1.0\%}=\sum_{j=1}^{n} A_{1.0\%,j}$$
$$A_{UA,1.5\%}=\sum_{j=1}^{n} A_{1.5\%,j}$$
$$A_{UA,2.0\%}=\sum_{j=1}^{n} A_{2.0\%,j}$$

The relevant partial area with a daylight factor of at least 1.0%/1.5%/2.0% is then compared to 50% of the usable area of the building, and the result can be classified in accordance with the evaluation table.

(1) Assessment via daylight simulations

When using daylight simulations to assess the daylight factor, it is not necessary to simulate all rooms within UA; it is sufficient to simulate a few representative rooms and apply the results to the remaining rooms in UA via appropriate interpolation.

(1) Assessment via daylight measurements

In accordance with DIN 5034, the daylight factors must in principle be measured with a completely overcast sky. Similar to the daylight simulations, it is not necessary to measure all rooms within UA; it is sufficient to measure the daylight factors in a few representative rooms and apply the results to the remaining rooms in UA via appropriate interpolation.

Indicator 2: Availability of daylight at permanent workstations

In general, the methods listed below are permitted for assessment of the relative annual useful exposure.
As DIN V 18599-4 does not in principle take into account shading due to trees/plants, but these do still reduce the amount of daylight that reaches the building, if shading due to trees/plants is expected or already exists, daylight simulations must be used as a documentation method, if possible. If the simplified method in accordance with DIN V 18599-4 is used, plants must be assessed as obstructions to be on the safe side (estimation of the maximum height and width of the plants as building dimensions).

Calculation using the simplified method of DIN V 18599-4

If the relative annual useful exposure is documented using DIN V 18599-4, the daylight supply factor $C_{DL,supp}$ must first be calculated. To do so, the obstruction index I_{Vj} must be determined in detail in accordance with DIN V 18599-4 and incorporated into the assessment of the daylight supply factor $C_{DL,supp}$ or the daylight factor of the opening in the structural work DRb.
The lump sum approach to the obstruction index I_{Vj} = 0.9 – permitted in accordance with EPC (e.g. EnEV, T&D_03) – does not sufficiently portray the actual shading in most cases and therefore results in a significant points penalty for documentation of this indicator.
If partial areas exist in the rooms with the permanent workstations that are not supplied with daylight in accordance with DIN V 18599-4[1] (i.e. the area supplied with daylight is smaller than the floor area of the rooms), the area in the rooms that is not supplied with daylight must be taken into account with an annual relative useful exposure of 0% in the area-weighted averaging of the daylight supply factor.
As the daylight supply factor $C_{DL,supp}$ in accordance with DIN V 18599-4 refers solely to the daylight hours (= use time while there is daylight) but the relative annual useful exposure in accordance with DIN 5034 nevertheless covers the entire use time (regardless of whether there is daylight), the daylight supply factor $C_{DL,supp}$ averaged over the area must then be corrected using the daytime and night-time hours in accordance with DIN V 18599-10, Annex A, as follows:

$$H_{use,rel} = C_{DL,sup} \frac{t(day)}{t(day)+t(night)}$$

[1] Alternative: ISO 52000-1 module 9 (M9) or the local EPC may be applied

where:
$H_{use,rel}$ = relative annual useful exposure according to the DIN 5034
$C_{DL,sup}$ = daylight supply factor according to the DIN 18599-4
t(day) = annual daytime use hours according to the DIN 18599-4
t(night) = annual nighttime use hours according to the DIN 18599-4

For this correction, the annual hours of use for daytime and night-time in accordance with DIN V 18599-10, Annex A, must be used, which is calculated for the site of the project as well as for the expected use times (= normal working hours, e.g. office work days from 7 am–6 pm) in accordance with DIN V 18599-10, Annex A. The annual relative useful exposure $H_{Mot,rel}$ determined in this way forms the basis for evaluation of this indicator.

Daylight simulation
When using daylight simulations to assess the relative annual useful exposure, it is not necessary to simulate all rooms within UA; it is sufficient to simulate a few representative rooms and apply the results to the remaining rooms in UA via appropriate interpolation.

Indicator 3: Visual contact with the outside
Proof of the minimum window area proportions in accordance with DIN 5034 must be documented using suitable plans and descriptions.
In accordance with DIN EN 14501, Table 10, the assessment of the class (0 to 4) of the solar radiation/glare protection with regard to visual contact with the outside is based on the vertical-vertical light transmittance $\tau_{v,n\text{-}n}$ and the proportion of the light transmittance that is diffused $\tau_{v,n\text{-}dif}$:

DIN EN 14501 Table 10 Visual contact with the outside – Classification			
$\tau_{v,\ n\text{-}n}$	$\tau_{v,\ n\text{-}dif}$		
	$0 < \tau_{v,n\text{-}dif} \leq 0.04$	$0.04 < \tau_{v,n\text{-}dif} \leq 0.15$	$\tau_{v,n\text{-}dif} \leq 0.15$
$\tau_{v,n\text{-}n} > 0.10$	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

If the solar radiation/glare protection is implemented with horizontal slats, the following angles must be used as a basis for the assessment of light transmittances:

- Normal angle of incidence of sunlight (same as for screens)
- Angle of inclination of moveable slats: max. opening angle (horizontal)
- Angle of inclination of fixed slats: as installed

If the solar radiation/glare protection is implemented with vertical slats, the following angles must be used as a basis for assessment of the light transmittances:

- Normal angle of incidence of sunlight (same as for screens)
- Angle of rotation of rotatable slats: max. opening angle (vertical)
- Angle of rotation of fixed slats: as installed

Indicator 4: Absence of glare in daylight
In accordance with DIN EN 14501, Table 8, the assessment of the class (0 to 4) of the solar radiation/glare protection with regard to absence of glare in daylight is based on the vertical-vertical light transmittance $\tau_{v,n\text{-}n}$ and the proportion of the light transmittance that is diffused $\tau_{v,n\text{-}dif}$:

DIN EN 14501 Table 8 – Glare control – Classification

$\tau_{v,n\text{-}n}$	$\tau_{v,n\text{-}dif}$			
	$\tau_{v,n\text{-}dif} \leq 0.02$	$0.02 < \tau_{v,n\text{-}dif} \leq 0.04$	$0.04 < \tau_{v,n\text{-}dif} \leq 0.08$	$\tau_{v,n\text{-}dif} > 0.08$
$\tau_{v,n\text{-}n} > 0.10$	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

If the solar radiation/glare protection is implemented in the form of horizontal slats, the following angles must be used as a basis for assessment of the light transmittances:

- Normal angle of incidence of sunlight (same as for screens)
- Angle of inclination of moveable slats: max. closing angle (approx. 70° to 75°)
- Angle of inclination of fixed slats: as installed

If the solar radiation/glare protection is implemented in the form of vertical slats, the following angles must be used as a basis for assessment of the light transmittances:

- Normal angle of incidence of sunlight (same as for screens)
- Angle of rotation of rotatable slats: max. closing angle

- Angle of rotation of fixed slats: as installed

Indicator 5: Absence of glare in artificial light

The following methods are permitted for documenting the colour rendering:

(2) Artificial light simulation

The UGR value must be calculated using artificial light simulations and evaluated in accordance with DIN EN 12464-1 for selected, representative rooms.

(3) Product data sheets with UGR values

Documentation of the glare limitation in accordance with DIN EN 12464-1 via product data sheets with UGR values

Indicator 6: Colour rendering

The following methods are permitted for documenting the colour rendering:

(4) Daylight

The colour rendering in daylight must always be evaluated for the combination of glazing and solar radiation/glare protection in accordance with DIN EN 14501. To do so, the general colour rendering index Ra for the combination of glazing and solar radiation/glare protection must be determined using spectral calculations in accordance with the method provided in DIN EN 410 and used as a basis for the evaluation.

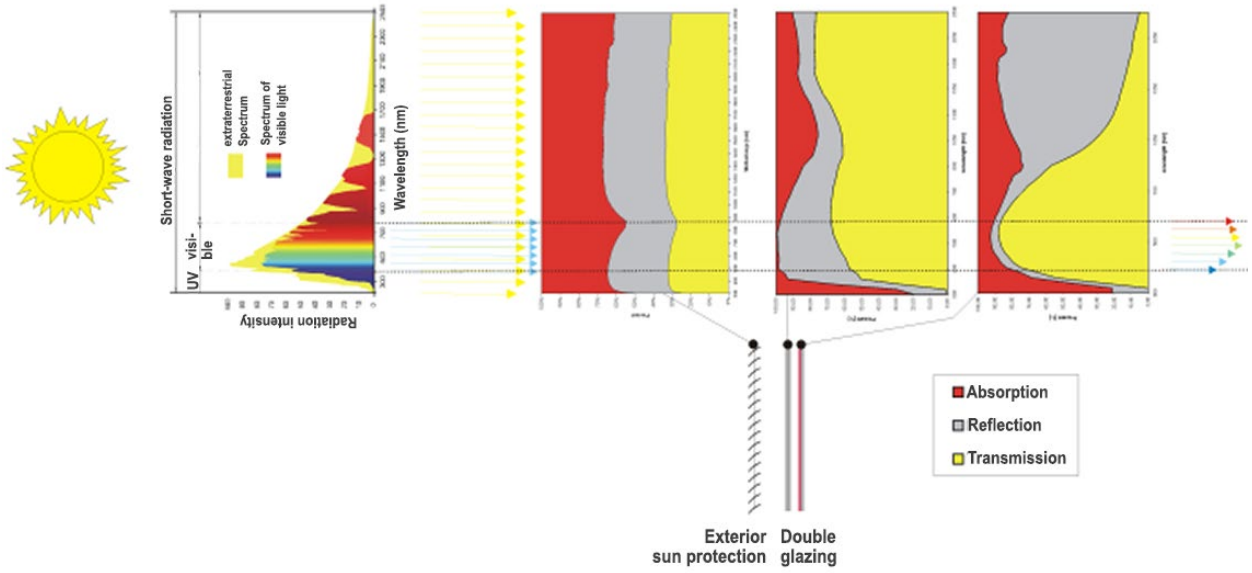
The following points must be taken into account in the spectral calculations:

I. If the solar radiation protection also acts as the glare protection function when operated, it is sufficient to just determine and evaluate the colour rendering index Ra for the combination of the glazing and the solar radiation protection.

II. If there is no solar radiation protection in place but glare protection is installed, the colour rendering index Ra for the combination of the glazing and the glare protection must be determined and evaluated.

III. If the solar radiation protection does not act as the glare protection function when operated (e.g. if perforated slats are used), the colour rendering index Ra must be determined and evaluated for the combination of glazing, solar radiation protection and glare protection (if installed).

Colour rendering for multi-pane glazing



Spectral filtering of the light as it passes through the façade:
Higher transmission of the green/yellow portion of the daylight results in colour distortion into green/yellow light → reduction in the R_a.

(5) Artificial light

The colour rendering of artificial light must be verified using the manufacturer specifications for lighting.

APPENDIX B – DOCUMENTATION

I. Required documentation

Examples of possible documentation include the following items. The documentation submitted for the evaluation of individual indicators should comprehensively and clearly demonstrate compliance with the relevant requirements In accordance with Appendix 2: "Permitted documentation processes"

Indicator 1: Availability of daylight for the entire building

- Basis and results of the completed daylight simulation.
- Measurement report for the completed daylight measurements.
- Calculation using the simplified method of DIN V 18599-4 additionally for **Assembly buildings:**
- List of areas (usage areas 1-7 according to DIN 277-1, 2016-01) with allocation and explanation of any areas not considered
- Alternative to DIN 18599-4: ISO 52000-1 M9 or the local EPC calculation

Indicator 2: Availability of daylight at permanent workstations

- Basis and results of the completed daylight simulation.
- Calculation using the simplified method of DIN V 18599-4.
- Alternative: ISO 52000-1 M9 or the local EPC calculation
- In the case of corridors with panelling and different artificial lighting that renders it unable to be converted into workstations, clear and comprehensive documentation must be compiled, e.g. using photos, detailed plans and lighting concepts, additionally for **Assembly buildings:**
- List of areas including area allocations for type I and II incl. the area-weighted assessment explanation or clarification of areas that may not be considered.

Indicator 3: Visual contact with the outside

- Documentation of the visual contact with the outside (where applicable in accordance with DIN 5034-1, Section 4.2.3 or 4.2.2) using suitable plans and calculations.
- Data sheets for the installed solar radiation/glare protection systems.
- Photo documentation.

Indicator 4: Absence of glare in daylight

- Classification of the installed solar radiation/glare protection.
- Data sheets for the installed solar radiation/glare protection additionally for **Assembly buildings:**
- Area list including area allocation type I and II and presentation of the area-weighted assessment

Indicator 5: Artificial light

- Basis and results of the completed artificial light calculation.
- Product data sheets with colour rendering.

- Spectral measurement of the light composition.
- Area configuration for area-weighted evaluation.

Indicator 6: Daylight colour rendering

- Basis and results of the spectral calculation in accordance with DIN EN 410 or DIN EN 13363-2.
- MaUAacturer specifications for the glazing and solar radiation/glare protection system used, e.g. in the form of data sheets or calculation results.
- Data in accordance with DIN EN 14501, maUAacturer specifications or calculation (e.g. via software).

Indicator 7: Exposure to daylight

- Documentation of at least one guest room/living space.
- Floor plans, cross-sections, site plan.
- Sun progression chart.
- Calculation of the duration of exposure to daylight.

APPENDIX C – LITERATURE

I. Version

Change log based on version 2018

PAGE	EXPLANATION	DATE
all	General, Evaluation and Usage specific explanation: scheme “Assembly buildings” has been added	16.09.2021
all	Editorial amendments for more clarification.	16.09.2021
all	Appendix 1: relevant UAs for the scheme “Assembly buildings” has been added	16.09.2021

II. Literature

- DIN V 18599 Part 4. Energy efficiency of buildings. Berlin: Beuth Verlag. December 2012
- DIN 5034 Part 1. Daylight in interiors. Berlin: Beuth Verlag. July 2011
- DIN 5034 Part 2. Daylight in interiors. Berlin: Beuth Verlag. February 1985
- DIN 5034 Part 3. Daylight in interiors. Berlin: Beuth Verlag. February 2007
- DIN EN 12464 Part 1. Lighting of work places. Berlin: Beuth Verlag. August 2008
- DIN EN 13363 Part 2: Solar protection devices combined with glazing – Calculation of total solar energy transmittance and light transmittance – Part 2: Detailed calculation method; German version EN 13363-2:2005. Berlin: Beuth Verlag. June 2005 incl. DIN EN 13363-2 Corrigendum 1 published April 2007
- German workplace regulation (ArbStättV). 12.08.2004; last changed 19th July 2010
- VDI 6011: Optimisation of daylight use and artificial lighting. Düsseldorf: Verein Deutscher Ingenieure e.V.
- DIN 6169: Colour rendering. Berlin: Beuth Verlag. February 1976