BS EN 14501:2021+A1:2025

BSI Standards Publication

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

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National foreword

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The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to CEN text carry the number of the CEN amendment. For example, text altered by CEN amendment A1 is indicated by A1 A1.

The UK participation in its preparation was entrusted to Technical Committee B/538/3, Domestic shutters and blinds.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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Published by BSI Standards Limited 2025

ISBN 978 0 539 28821 6

ICS 91.060.50

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 March 2021.

Amendments/corrigenda issued since publication

Date	Text affected
31 January 2025	Implementation of CEN amendment A1:2025

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 14501:2021+A1

January 2025

ICS 91.060.50

Supersedes EN 14501:2021

English Version

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

Stores et volets - Confort thermique et visuel - Caractéristiques de performance et classification

Abschlüsse - Thermischer und visueller Komfort - Leistungsanforderungen und Klassifizierung

This European Standard was approved by CEN on 21 October 2019 and includes Amendment 1 approved by CEN on 20 August 2024.

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Full document details: BS EN 14501:2021+A1:2025

Contents

Page

European foreword 4
Introduction 5
1 Scope 6
2 Normative references 6
3 Terms, definitions and symbols 7
4 Notations used 9
4.1 General 9
4.2 Visual or solar properties 9
4.3 Geometry of the radiation 10
4.4 Optical factors 11
5 Thermal comfort 11
5.1 General 11
5.2 Control of solar gains – Total solar energy transmittance g_{tot} 11
5.3 Secondary heat gains – Secondary heat transfer factor $q_{i,\,tot}$ 13
5.4 Protection from direct transmission – Normal/normal solar transmittance $\tau_{e,\,n\text{-}n}$ 14
6 Visual comfort 14
6.1 General 14
6.2 Darkening performance 16
6.3 Glare control 17
6.4 Night privacy 19
6.5 Visual contact with the outside 20
6.6 Daylight utilization 21
6.7 Rendering of colours 21
Annex A (normative) Reference glazing 22
A.1 General 22
A.2 Reference glazing with integrated data only 22
A.2.1 Glazing A 22
A.2.2 Glazing B 22
A.2.3 Glazing C 23
A.2.4 Glazing D 24
A.2.5 Glazing E 24
A.3 Reference glazing with spectral data 25
A.3.1 General 25
A.3.2 Glazing F 25
A.3.3 Glazing G 26
A.3.4 Glazing H 26
A.3.5 Spectral data for the panes 26
Annex B (informative) The meaning of the secondary internal heat transfer factor $q_{i,\,tot}$ 33

AVA Documents
Document Sharing Hub
Full document details: BS EN 14501:2021+A1:2025

Annex C (informative) Example of performance presentation 34
C.1 Thermal comfort 34
C.2 Visual comfort 34
Annex D (informative) Daylight Glare Probability 36
D.1 General 36
D.2 Glare 36
D.3 Daylight Glare Probability 36
D.3.1 General 36
D.3.2 Annual evaluation 37
D.3.3 Simplified annual glare evaluation 38
Annex E (normative) Opacity performance of curtain material 44
Bibliography 45

Documents
Document Sharing Hub

Full document details: BS EN 14501:2021+A1:2025

European foreword

This document (EN 14501:2021+A1:2025) 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 July 2025, and conflicting national standards shall be withdrawn at the latest by July 2025.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document includes Amendment 1 approved by CEN on 20 August 2024.

This document supersedes [A1] EN 14501:2021 [A1].

The start and finish of text introduced or altered by amendment is indicated in the text by tags [A1] [A1].

The main modifications of this project of revision are relating to:

— the revision of the performance classification for the darkening performance;

— the revision of the performance classification for the glare control. The new classification is based on DGP (Daylight Glare Probability) calculations and considers the cut-off angle of the curtain material;

— the addition of a fifth reference glazing (triple glazing);

— the addition of an informative annex giving recommendations on the class for glare control to be used depending on the location and orientation of the building, as well as on the size of the glazed area, the distance from the façade and the light transmittance of the glazing.

Any feedback and questions on this document should be directed to the users’ national standards body. A complete listing of these bodies can be found on the CEN website.

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Introduction

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

The characteristics covered by this document are specific requirements that are complementary to the intrinsic requirements that internal blinds, external blinds or shutters shall fulfil in accordance with EN 13120, EN 13561 and EN 13659, respectively.

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1 Scope

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

It specifies the corresponding properties and classifications:

— relating to thermal comfort:

  — the solar factor (total solar energy transmittance);

  — the secondary heat transfer factor;

  — the direct solar transmittance;

— relating to visual comfort:

  — the darkening performance;

  — the night privacy;

  — the visual contact with the outside;

  — the glare control;

  — the daylight utilization;

  — 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 solar protection devices are not parallel to the glazing (e.g. folding-arm awnings).

This document is not applicable to the solar protection devices using fluorescent materials.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. 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, *Shutters, external blinds, internal blinds — Terminology, glossary and definitions*

EN ISO 52022-1, *Energy performance of buildings — Thermal, solar and daylight properties of building components and elements — Part 1: Simplified calculation method of the solar and daylight characteristics for solar protection devices combined with glazing (ISO 52022-1)*[1]

EN ISO 52022-3, *Energy performance of buildings — Thermal, solar and daylight properties of building components and elements — Part 3: Detailed calculation method of the solar and daylight characteristics for solar protection devices combined with glazing (ISO 52022-3)*[2]

EN 14500:2021, *Blinds and shutters — Thermal and visual comfort — Test methods*

[1] EN ISO 52022-1 supersedes EN 13363-1.

[2] EN ISO 52022-3 supersedes EN 13363-2.

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3 Terms, definitions and symbols

For the purposes of this document, the terms and definitions given in EN 12216 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp/

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

Note 1 to entry: A more detailed definition is given in EN 14500:2021.

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

Note 1 to entry: A more detailed definition is given in EN 14500:2021.

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

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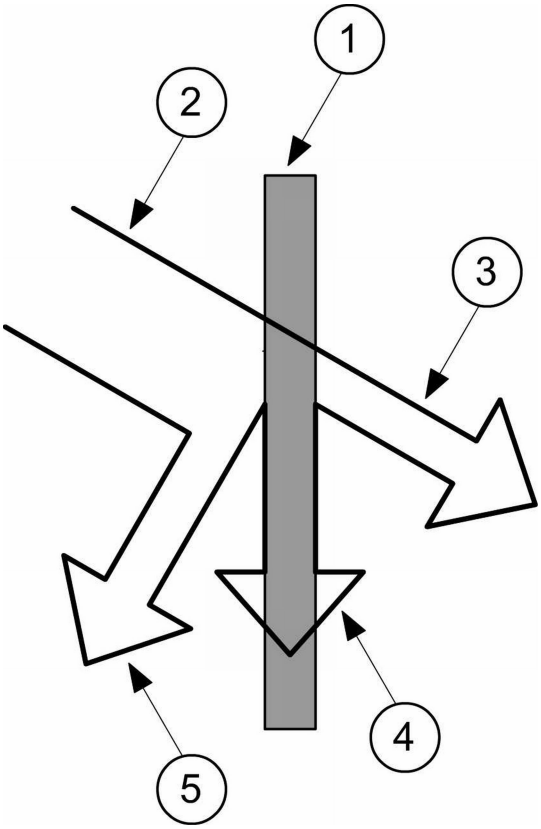

Key

1	solar protection device	4	absorbed radiation $\alpha \cdot E$
2	incident radiation E	5	reflected radiation $\rho \cdot E$
3	transmitted radiation $\tau \cdot E$		

Figure 1 — Representation of the optical factors

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

Note 1 to entry: For identical fabrics that differ only by the colour, the openness coefficient is considered as independent of the colour.

Note 2 to entry: The openness coefficient is determined according to EN 14500:2021.

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

Note 1 to entry: g is the solar factor of the glazing alone; g_{tot} is the solar factor of the combination of a glazing and a solar protection device.

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3.6
secondary internal heat transfer factor
$q_{i,\,tot}$
part of the total absorbed radiation which is flowing inwards through the glazing and the combined shading device

3.7
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

3.8
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 1 to entry: For more information on the calculation of $\theta_{op,}$ it is recommended to refer to EN ISO 13791 or EN ISO 13792.

3.9
light exclusion system
part of the solar protection device intended to reduce peripheral light penetration

Note 1 to entry: A guiding system may qualify as a light exclusion system, but only if the curtain penetrates the guiding channels.

3.10
cut-off angle
first angle of incidence at which the direct light transmittance is no longer perceivable

Note 1 to entry: A more detailed definition is given in EN 14500:2021.

4 Notations used

4.1 General

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

— the 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 2 500 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.

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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):

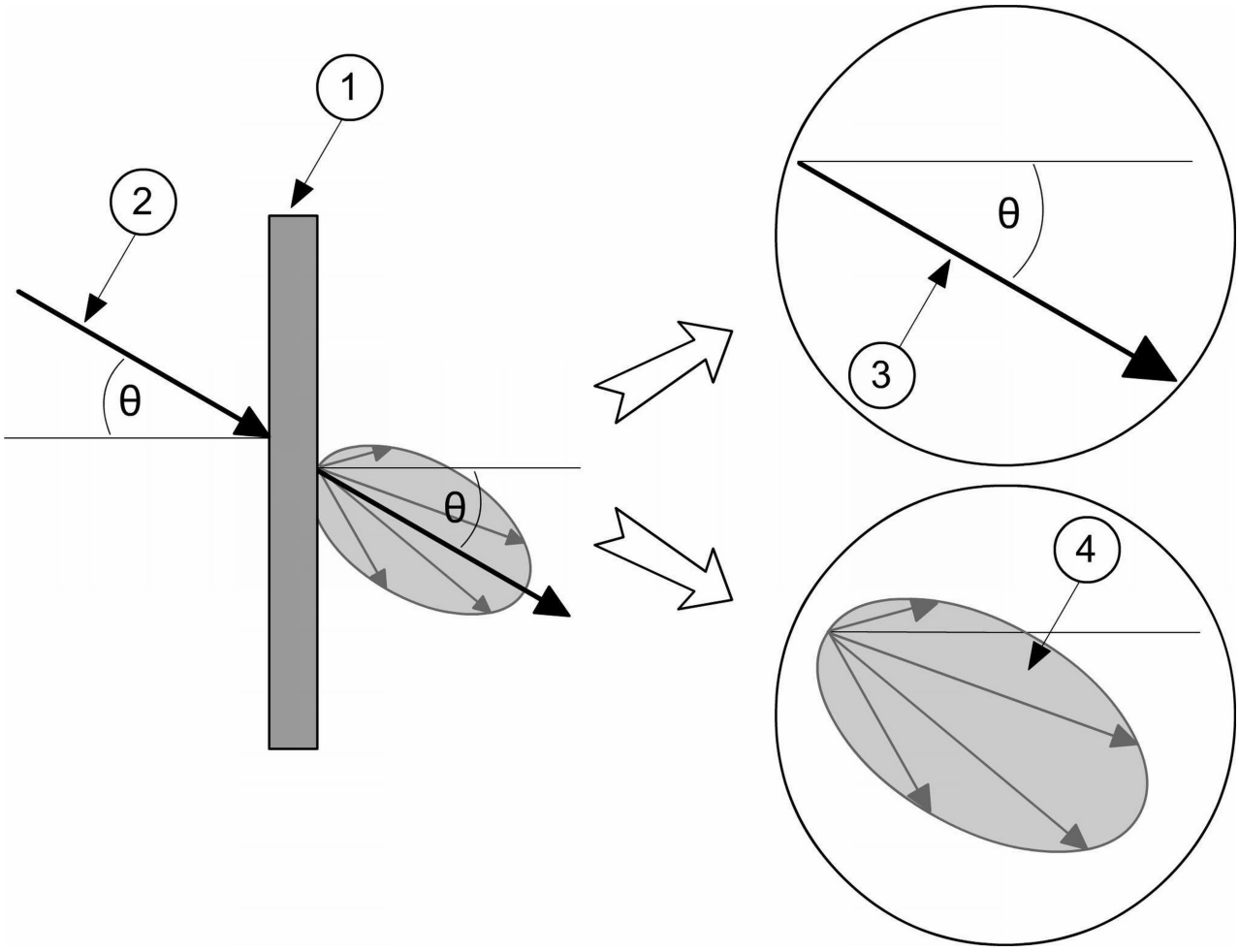
— « $_{dir}$ » for directional (fixed, but arbitrary direction θ);

— « $_{n}$ » for normal, or near normal in case of reflected radiation, the angle of incidence is θ = 0°, or θ ≤ 8° respectively;

— « $_{h}$ » for hemispherical (collected in the half space behind the sample plane);

— « $_{dif}$ » for diffuse.

NOTE A more detailed definition is given in EN 14500:2021.



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

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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 mainly 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 $\tau_{e, dir\text{-}dir}$.

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. It also strongly reduces the energy consumption of cooling systems. 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 using either the methodology given in 5.2.2 or in 5.2.3. When the glazing specifications are unknown, any one of the eight different reference glazing given in Annex A may be used.

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The method and the glazing used for the determination of the g_{tot} value shall be specified in all reported g_{tot} values.

For a declaration of performance (independent from the installation conditions), the calculation according to 5.2.2 and the reference glazing C, specified in Annex A, shall be used. For cases not covered by 5.2.2, the method defined in 5.2.3 shall be used, assuming that:

— for external solar protection devices, the space between the solar protection device and the glazing is unventilated;

— summer conditions are used.

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

For venetian blinds, 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 1 For slatted or louvered devices tilted at 45° the values τ^{corr}_{e} specified in EN ISO 52022-1 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 at the tilt angle of the slats under consideration.

NOTE 2 A direct calorimetric measurement of g_{tot} is given by ISO 19467.

NOTE 3 For a more detailed method for the calculation of the transmittance and the reflectance of slatted devices, see the calculation method given in EN ISO 52022-3. The view factors given in Annex D of EN ISO 52022-3:2017 are only applicable for venetian blinds with a ratio of d/l = 1 for slat width l and slat distance d. EN 14500:2021 and ISO TR 52022-2 provide additional view factors for other configurations.

5.2.2 Determination of g_{tot} – Simplified method

The simplified method to be applied for the determination of g_{tot} is EN ISO 52022-1.

The necessary data for the calculation are the following:

— τ_e solar transmittance of the solar protection device;

— ρ_e solar reflectance of the outer surface of the solar protection device;

— g solar factor of the glazing;

— U thermal transmittance of the glazing.

5.2.3 Determination of g_{tot} – Detailed method

The detailed method to be applied for the determination of g_{tot} is EN ISO 52022-3.

The necessary data for the calculation are the following:

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

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

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— ε, ε' emissivities of the solar protection device surfaces;

— 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.

In EN ISO 52022-3, 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.

If spectral data for ρ(λ), ρ´(λ) and τ(λ) are not available, integrated data may 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.

The method and the glazing used for the determination of the g_{tot} value shall be specified for all reported classes.

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

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

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 formula:

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

$q_{i,tot}$ may be determined for the eight different reference glazing 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.

The method and the glazing used for the determination of the $q_{i,tot}$ value shall be specified in all reported $q_{i,tot}$ values.

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 ISO 52022-1.

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