



**International
Standard**

ISO 22578-2

**Graphical symbols — Safety colours
and safety signs —**

Part 2:

**Measurement of photopic
luminance of phosphorescent
components used in a natural
disaster safety way guidance system**

**First edition
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 145, *Graphical symbols*, Subcommittee SC 2, *Safety identification, signs, shapes, symbols and colours*.

A list of all parts in the ISO 22578 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Graphical symbols — Safety colours and safety signs —

Part 2:

Measurement of photopic luminance of phosphorescent components used in a natural disaster safety way guidance system

1 Scope

This document specifies the laboratory test method for the measurement of photopic luminance of phosphorescent materials classified in accordance with ISO 22578.

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.

ISO 16069, *Graphical symbols — Safety signs — Safety way guidance systems (SWGS)*

ISO/CIE 19476, *Characterization of the performance of illuminance meters and luminance meters*

ISO 22578:2022, *Graphical symbols — Safety colours and safety signs — Part 2: Measurement of photopic luminance of phosphorescent components used in a natural disaster safety way guidance system*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1

phosphorescent material

material incorporating phosphors that, if excited by UV or visible radiation, store energy, which is emitted as light over a period of time

Note 1 to entry: A phosphorescent sign is the same as “photoluminescent”, commonly used in the literature of the photoluminescent safety sign industry.

[SOURCE: ISO 16069:2017, 3.15]

4 Test specification

4.1 Test specimens

Three specimens shall be tested. Each test specimen shall have an area of phosphorescent material at least 35 mm in diameter, sufficient for the proper operation of the luminance meter used.

The test specimens shall be final products complete with UV protection and moisture protection where applicable and specified.

Either:

- a) the graphical symbols shall be sufficiently large to provide the minimum test diameter; or
- b) a test specimen shall be taken from a production batch without printing of the graphical symbols but with any UV protection applied.

Samples shall be representative of the production batch. They shall be coded and identified to correspond to manufacturers' production batch codes, and shall be numbered consecutively. Paints shall be applied in accordance to the manufacturer's application instructions.

4.2 Conditioning

All test specimens shall be pre-conditioned by being placed in a completely dark enclosure for at least 48 h. The specimens shall not be removed from the dark enclosure until immediately prior to the tests.

4.3 Ambient conditions

The ambient temperature during preconditioning of test specimens, excitation and luminance testing shall be $23\text{ °C} \pm 2\text{ °C}$ and the relative humidity shall be $(50 \pm 10)\%$ in accordance with ISO 16069. All luminance testing shall be performed in a room or chamber whose ambient light level is at least one order of magnitude lower than the lowest luminance measurement to be made.

4.4 Irradiance, illuminance and luminance instrumentation

4.4.1 Irradiance instrumentation

An irradiance meter shall be provided, calibrated to measure irradiance. Calibration shall be confirmed by a certificate, traceable to a certified reference measure. The irradiance meter shall have the following features:

- wavelength range: 360 nm to 490 nm;
- linearity error: $f_3 \leq 5\%$ (where f_3 shall be as defined in ISO/CIE 19476);
- measuring range: $1\text{ mW/cm}^2 \leq \text{range} \leq 5\,000\text{ mW/cm}^2$;
- light entry diameter of the irradiance measurement head: $\leq 5\text{ cm}$.

4.4.2 Illuminance instrumentation

A cosine photopic $V(\lambda)$ corrected illuminance meter shall be provided, calibrated to measure illuminance in lux (lx). Calibration shall be confirmed by a certificate, traceable to a certified reference measure. The illuminance meter shall have the following features:

- spectral error: $f_1' \leq 5\%$ (where f_1' shall be as defined in ISO/CIE 19476);
- UV response: $u \leq 0,5\%$ (where u shall be as defined in ISO/CIE 19476);
- resolution: 1,0 lx;
- linearity error: $f_3 \leq 0,5\%$ (where f_3 shall be as defined in ISO/CIE 19476);
- measuring range: $10\text{ lx} \leq \text{range} \leq 10\text{ klx}$;
- light entry diameter of the photometer-head: $\leq 1\text{ cm}$.

4.4.3 Luminance instrumentation

A luminance meter shall be provided, calibrated to measure photopic luminance. Calibration shall be confirmed by a certificate, traceable to a certified reference measure. The luminance meter shall be either a telephotometer or a contact luminance meter, depending on whether the telephotometer method (see 4.6.2) or the contact method (see 4.6.3) is used. It shall have the following minimum features:

- spectral error: $f_1' \leq 5\%$ (where f_1' shall be as defined in ISO/CIE 19476);
- UV response: $u \leq 0,5\%$ (where u shall be as defined in ISO/CIE 19476);
- resolution: at least $0,01 \text{ mcd/m}^2$;
- linearity error: $f_3 \leq 0,5\%$ (where f_3 shall be as defined in ISO/CIE 19476);
- signal-to-noise ratio: at least 10:1 for all measurements;
- measuring range: $10^{-5} \text{ cd/m}^2 \leq \text{range} \leq 10 \text{ cd/m}^2$;
- display: $\geq 3,5$ digits, range: $0,001 \times 10^{-2} \text{ cd/m}^2 \leq \text{range} \leq 19,99 \text{ cd/m}^2$.

4.5 Excitation light conditions

Excitation of the phosphorescent test specimens shall be by a xenon-arc source of light providing a mean irradiance of 400 mW/cm^2 on the surface of the test specimen or by $3\,000 \text{ lx}$ from a D_{65} lamp. The irradiance shall be measured using the irradiance meter specified in 4.4.1. Where used, the illuminance shall be measured using the illuminance meter specified in 4.4.2. The excitation duration shall be 60 min. No ambient or stray light shall be present during excitation.

Test patches for measurement of irradiance shall be positioned in the centre of the radiated area of the test specimen and at each of the four 90° points on the outer rim of the surface of the test specimen. The mean irradiance on the five test patches shall be 400 mW/cm^2 . The maximum irradiance divided by the minimum irradiance of the test patches shall be less than 1,1.

When applicable, test patches for measurement of illuminance shall be positioned in the centre of the radiated area of the test specimen and at each of the four 90° points on the outer rim of the surface of the test specimen. The mean illuminance on the five test patches shall be $3\,000 \text{ lx}$. The maximum illuminance divided by the minimum illuminance of the test patches shall be less than 1,1.

4.6 Luminance measurements

4.6.1 General

The luminance measurements shall be carried out using the luminance meter specified in 4.4.3, using either the telephotometer method given in 4.6.2 or the contact method given in 4.6.3.

4.6.2 Telephotometer method

The distance between the luminance meter and the measured test specimen, and also the aperture of the luminance meter, shall be chosen in such a way that the area of the test specimen to be evaluated shall be sufficient for the luminance meter to give a luminance reading at low luminance levels.

Where possible, an area of the test specimen at least 30 mm in diameter should be evaluated.

4.6.3 Contact method

The measurement head of the luminance meter shall be placed on the surface of the test specimen. The influence of ambient light shall be avoided by covering the test specimen's surface outside or around the luminance measurement head with a light protecting material. The area of the test specimen to be evaluated shall be sufficient for the luminance meter to give a luminance reading at low luminance levels.

Where possible, an area of the test specimen at least 30 mm in diameter should be evaluated.

The luminance shall be determined by measuring illuminance and converting to luminance, according to [Formula \(1\)](#):

$$\bar{L} = E / \Omega_p \quad (1)$$

where

- $\bar{L}$ is the average luminance of the test specimen measured, in cd/m²;
- E is the illuminance of the place determined on the light incidence area of the photometer head used, in lx;
- Ω_p is the projected solid angle which the tested surface of the measuring object takes viewed from the middle of the light incidence area of the photometer head, in sr.

The projected solid angle, Ω_p , follows [Formula \(2\)](#):

$$\Omega_p = \pi \left[1 + (r/R)^2 \right]^{-1} \Omega_0 \quad (2)$$

where

- Ω_0 is the unit solid angle, $\Omega_0 = 1$ sr;
- r is the distance between the light incidence area of the photometer head and the measuring object, in mm;
- R is the radius of the plane of the tested surface of the measuring object, in mm.

4.6.4 Luminance recordings

The luminance meter shall be zeroed prior to the start of measurement, then checked immediately after the final measurement. A measurement shall be rejected if the zero has drifted by more than 5 % of the measured value.

The luminance shall be measured at least every 2 min after the excitation light is removed. In all cases, the measurements shall include the time period up to 720 min after the excitation light is removed and shall include measurements (which shall be recorded in mcd/m²) at 60 min ± 10 s, 120 min ± 10 s, 360 min and 720 min ± 10 s for each of the three test specimens.

The luminance performance shall be based on the mean values of the three test specimens.

4.7 Test report

The test report shall include the following information:

- a) a reference to this document, i.e. ISO 22578-2:2024;
- b) manufacturer of the tested phosphorescent product (name, address, telephone number, fax);
- c) specimen description (clear item identification to make specimens traceable to manufacturer's production batch code);
- d) beginning and end of conditioning (day and time);
- e) date of measurement;
- f) instrument parameters, photometer serial number and the expiry date of calibration;

- g) excitation (fill in minutes, type of excitation light source, irradiance in mW/cm^2 or illuminance lx);
- h) ambient temperature, surface temperature of the specimen and relative humidity;
- i) photometric luminance measurements results; luminance in mcd/m^2 at 60 min, 120 min, 360 min and 720 min after excitation has ceased; list separately for all test specimens and list mean values;
- j) test performed by (person's name and title);
- k) signature;
- l) test location;
- m) company performing test (full name, address, telephone number, fax);
- n) any deviations from the procedure and any unusual features observed.

4.8 Marking of phosphorescent materials

Phosphorescent materials shall be marked by the following aspects:

- a) the number and publication date of this document;
- b) the luminance in mcd/m^2 at 60 min, 120 min, 360 min and 720 min after excitation;
- c) classification according to ISO 22578:2022, Table 3.

According to ISO 22578, phosphorescent materials are classified as either I or II when the minimum luminance at 720 minutes decay time is $3 \text{ mcd}/\text{m}^2$ or $10 \text{ mcd}/\text{m}^2$.

EXAMPLE 1 Marking, based on the number of this document (ISO 22578-2:2024), based on value at 60 min (70), 120 min (29), 360 min (7,3) and 720 min (3,0):

ISO 22578-2:2024-70-29-7,3-3,0 (Class I)

EXAMPLE 2 Marking, based on the number of this document (ISO 22578-2:2024), based on value at 60 min (213), 120 min (95), 360 min (26) and 720 min (11,2):

ISO 22578-2:2024-213-95-26-11,2 (Class II)