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**Ceramic tiles —**

Part 18:

**Determination of light reflectance  
value (LRV)**

*Carreaux et dalles céramiques —*

*Partie 18: Détermination de la valeur de réflectance lumineuse (LRV)*

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Published in Switzerland

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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 documents 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](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 189, *Ceramic tile*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 67, *Ceramic tiles*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

A list of all parts in the ISO 10545 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](http://www.iso.org/members.html).

# Ceramic tiles —

## Part 18:

## Determination of light reflectance value (LRV)

### 1 Scope

The objective of this document is to define a test method to determine the light reflectance value (LRV) of ceramic tiles, including mosaic tiles.

It is applicable to solid-coloured, multicoloured and non-uniform shade tile surfaces including tile with flame effects, speckled or textured with different types of finishing.

### 2 Normative references

There are no normative references in this document.

### 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

##### **solid coloured surface**

surface with colour uniformity and same shade value

#### 3.2

##### **multi-coloured surface**

surface formed by distinct areas of different colour, which when viewed from a distance of 3 m, remain distinct, or surface formed from small colour specks, which when viewed from a distance of 1 m, assume the appearance of one colour

#### 3.3

##### **non-uniform shade surface**

surface with a certain shade variability

#### 3.4

##### **speckled surface**

surface or covered with small marks, spots, or shake

#### 3.5

##### **textured surface**

surface that causes extreme angular dependences of reflected light and that has a superficial texture with maximum peak-valley distance <2 mm

### 3.6 light reflectance value LRV

value equivalent to the CIE tristimulus value Y, also known as the luminance factor

Note 1 to entry: LRV is expressed as a percent and should include reference to the associated CIE observer angle, CIE illuminant and measurement conditions used to determine the value.

## 4 Principle

The test in question is the determination of the amount of visible light reflected by the surface product in each direction; the measurement of this reflected light at different wavelengths in visible range, weighted for the sensitivity of light of the human eye, is the light reflectance value.

## 5 Apparatus

### 5.1 Type of instrument

Any reflectance-type spectrophotometer or tristimulus colorimeter capable of colour measurements and data colour transformation into CIE tristimulus value, X, Y and Z.

This instrument shall have a reproducibility of 1 unit  $\Delta E$  CIE  $L^*a^*b^*$ , and repeatability of  $\sigma = \pm 0,2$  based on five independent measurements.

Moreover, the instrument shall have a measurement area at least 8 mm diameter, compatible with the aperture of the spectrophotometers available on the market.

### 5.2 Instrument setup

The LRV measurements can be taken as follows:

- with specular component included (SCI), a 10° visual field and illuminant CIE D65 (standard conditions);
- with specular component included (SCI), a 10° visual field and illuminant CIE F2 (fluorescent);
- with specular component included (SCI), a 10° visual field and illuminant CIE A (incandescent);
- with specular component included (SCI), a 2° visual field and illuminant CIE D65 (daylight);
- with specular component included (SCI), a 2° visual field and illuminant CIE F2 (fluorescent);
- with specular component included (SCI), a 2° visual field and illuminant CIE A (incandescent).

NOTE The illuminant CIE D65 is generally representative of a phase of daylight with a correlated colour temperature of approximately 6 500 K.

### 5.3 Instrument calibration and standards

Before measurement, the instrument shall be calibrated according to the instructions provided by the manufacturer.

The primary standard for reflectance measurement is a layer of freshly prepared barium sulfate.

Because of the difficulty of preparing a primary standard each time and its variability, calibrated pieces of white opaque glass, porcelain enamel plaques, or glazed ceramic tile are used as working standards and are usually supplied by the manufacturer of the instrument. The manufacturer of each type of instrument provides numerical specifications for the working standards, which have a definite relationship to the CIE values X, Y, and Z.

## 6 Preparation of test specimens

### 6.1 Solid coloured tiles

Take at least three tiles and obtain one specimen for each tile representative of the surface colour of product concerned.

### 6.2 Multi-coloured, non-uniform shade, speckled or textured surface tile

The specimens shall be chosen in order to be representative of the whole chromatic range exhibited on the tile surface. The number of specimens shall be at least as reported in [Table 1](#).

**Table 1 — Minimum number of test specimens**

Tile maximum area, $A$ [cm <sup>2</sup> ]	Total number of tiles	Number of specimens to be tested for each tile	Minimum area of specimen [cm <sup>2</sup> ]	Total number of specimens
$A < 900$	5	1	100	5
$900 \leq A \leq 3\,600$	3	2	225	6
$A > 3\,600$	3	2	900	6

In the case of high colour or shade variability [see NOTE in this subclause], statistical methods shall be used to determine the number of randomly selected tiles that will be representative, but the minimum number of specimens to be tested shall be at least double the number reported in column 3 of [Table 1](#).

The testing surface shall be cleaned with a cloth dampened with a suitable solvent (e.g. ethanol 96 %) and dried before testing.

In case of mosaic, consider a minimum number of tesserae equal to 20 (minimum number of readings per sample reported in [Table 2](#) for  $A < 900$  cm<sup>2</sup>).

Testing surfaces can be also measured in wet conditions. In this case, the surface of the specimens shall be wet with water (grade 2 according to ISO 3696) being sure that it remains in wet condition for at least 5 min. LRV measurements shall be taken as soon as possible after removing any unabsorbed water from the surface with a cloth or sponge that does not leave any solid residue.

NOTE Variability in the colour of the tested specimens is deemed to have occurred where the difference between the highest and lowest LRV  $\geq 4$ .

## 7 Test

### 7.1 Measurement on solid coloured surfaces

The specimen surface is presented to the aperture of the instrument, and its LRV is measured.

Perform the LRV measurement according to one of the conditions detailed in [5.2](#) and record the CIE tristimulus value Y (x and y values may also be reported, but they are not mandatory). Perform at least four measurements for each specimen positioning the instrument at  $20 \pm 5$  mm from the four edges.

In the case of mosaic tiles, perform the measurement for each tessera.

### 7.2 Measurement on multi-coloured surfaces

Perform the LRV measurement according to one of the conditions detailed in [5.2](#), and record the CIE tristimulus value Y (x and y values may also be reported, but they are not mandatory).

Perform at least four measurements at each distinct area of colour for each tile or portion of tiles. The results of each measurement shall be recorded and the average LRV for each area of distinct colour determined.

The average LRV for the overall specimen is given by:

$$LRV_{av} = [ (LRV_{av1} \times A_1) + (LRV_{av2} \times A_2) + (LRV_{avn} \times A_n) ] / A$$

where

$LRV_{av}$  is the average LRV of the overall specimen (CIE Y);

$LRV_{av1}$  is the average LRV of distinct colour “1” of the specimen (CIE Y);

$A_1$  is the area of distinct colour “1” (m<sup>2</sup>);

$LRV_{av2}$  is the average LRV of distinct colour “2” of the specimen (CIE Y);

$A_2$  is the area of distinct colour “2” (m<sup>2</sup>);

$LRV_{avn}$  is the average LRV of distinct colour “n” of the specimen (CIE Y);

$A_n$  is the area of distinct colour “n” (m<sup>2</sup>);

$A$  is the total area (m<sup>2</sup>).

### 7.3 Measurement on non-uniform shade, speckled or textured surface

Perform the LRV measurement according to one of the conditions detailed in 5.2 and record the CIE tristimulus value Y (x and y values may also be reported, but they are not mandatory).

For each specimen, perform the measurements in areas that represent the main chromatic variations of the product.

The number of required minimum sample readings is reported in Table 2. High variation samples may require a greater number of measurements.

**Table 2 — Minimum reading per specimens and per samples**

Tile area [cm <sup>2</sup> ]	Number of specimens to be tested	Minimum reading per specimen	Minimum reading per sample
$A < 900$	5	4	20
$A \geq 900$	6	6	36

In the case of mosaic, carry out the measurements on number of tesserae representative of the colour surface variability; in any case, the minimum number of readings per sample shall be the same as that reported in Table 2 for  $A < 900$  cm<sup>2</sup>.

## 8 Test report

The test report shall include the following information:

- a reference to this document;
- a description of tiles;
- the specimen identification details (in case of 7.2 and 7.3, including photos indicating the points of measurements);



- d) the number of specimens measured;
- e) the method of specimen preparation used;
- f) details of the instrument used (measurement window diameter included) and specific measurement conditions (illuminant and angle/colorimetric observer);
- g) a description of specimen including CIE Y (x and y values may be also reported, but they are not mandatory) colour identification;
- h) a description of the surface characteristics of the product, e.g. solid coloured or multi-coloured, uniform or non-uniform shade, texture, gloss or grain;
- i) the reference to the measurement procedure used ([7.1](#), [7.2](#) or [7.3](#));
- j) LRV measurements for all measurement points;
- k) the average LRV value specifying the measured condition (dry and/or wet);
- l) any deviations from the procedure;
- m) any unusual features observed;
- n) the date of the test.