# SLOVENSKI STANDARD
# oSIST prEN ISO 22969:2020

**01-september-2020**

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**Barve in laki - Določevanje odboja sončne svetlobe (ISO 22969:2019)**

Paints and varnishes - Determination of solar reflectance (ISO 22969:2019)

Beschichtungsstoffe - Bestimmung der solaren Reflexion (ISO 22969:2019)



Peintures et vernis - Détermination de réflexion solaire (ISO 22969:2019)

**Ta slovenski standard je istoveten z:** **prEN ISO 22969**



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**ICS:**

| | | |
|---|---|---|
| 87.040 | Barve in laki | Paints and varnishes |

**oSIST prEN ISO 22969:2020** **en,fr,de**

INTERNATIONAL STANDARD

**ISO 22969**

First edition
2019-07

# Paints and varnishes — Determination of solar reflectance

*Peintures et vernis — Détermination de réflexion solaire*



Reference number
ISO 22969:2019(E)



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Published in Switzerland

 

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# Foreword

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This document was prepared by Technical Committee ISO/TC 35, *Paints and varnishes*, Subcommittee SC 9, *General test methods for paints and varnishes*.



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.

 

# Introduction

The solar reflectance property of a coating system is determined by the absorbed solar energy (especially heat) of a building or an object.

This property can be expressed by a numerical value determined by calculation, thanks to which the impact of solar energy (especially heat) on the environment can be easily understood.

Reduction of greenhouse gases and carbon dioxide ($CO_2$) is achieved by reflecting the solar energy back into the atmosphere, which, reduces global warming. The effect of energy saving by coating system can be determined using solar reflectance.

# Paints and varnishes — Determination of solar reflectance

## 1 Scope

This document specifies a method to determine the solar reflectance of coating systems using a spectrophotometer with a wide spectral range (300 nm to 2 500 nm) and global solar radiation.

This document is applicable to coating systems.

## 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 3270, *Paints and varnishes and their raw materials — Temperatures and humidities for conditioning and testing*

ISO 4618, *Paints and varnishes — Terms and definitions*



## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 4618 and the following apply.

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



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

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

**3.1**
**global solar radiation**
total of the direct solar radiation incident on a horizontal surface plus all sky and horizontal ground reflected radiation within the 2π steradian field of view of the surface

Note 1 to entry: It is expressed in watts per square metre ($W \cdot m^{-2}$).

**3.2**
**radiant flux**
radiant power
power emitted, transmitted or received in the form of radiation

Note 1 to entry: It is expressed in watts (W).

[SOURCE: IEC 60050-845:1987, 845-01-24]

**3.3**
**reflectance**
$\rho$
ratio of the reflected radiant or luminous flux to the incident flux in the given spectral composition, polarization and geometrical distribution

[SOURCE: IEC 60050-845:1987, 845-04-58]

**3.4**
**solar reflectance**
**SR**
total solar reflectance
TSR
solar reflectance index
SRI
ratio of reflected radiant flux to *global solar radiation* (3.1) on coating system

**3.5**
**integrating sphere**
hollow sphere whose internal surface is a diffuse reflector, as non-selective as possible

Note 1 to entry: An integrating sphere is frequently used with a radiometer or photometer.

[SOURCE: IEC 60050-845:1987, 845-05-24]

**3.6**
**spectrophotometer**
instrument for measuring the ratio of two values of a radiometric quantity at the same wavelength

[SOURCE: IEC 60050-845:1987, 845-05-08]

## 4 Apparatus



### 4.1 Spectrophotometer

Spectrophotometer with a spectrometer capable of collecting radiations from 300 nm to 2 500 nm utilizing an integrating sphere with either 8°:di or di:8° geometry so that the regular or specular reflection may be included. See CIE 15 for details.



## 5 Procedure

### 5.1 Spectral reflectance of test specimen

Measurement of spectral reflectance of test specimens shall use the apparatus described in Clause 4 and the scale used for reflectometers shall be traceable to national metrology institutions. Unless otherwise specified, spectral reflectance is measured from 300 nm to 2 500 nm and sampling interval is 5 nm.

The test specimens shall be measured at the standard conditions, a temperature of (23 ± 2) °C and a relative humidity of (50 ± 5) %, as specified in ISO 3270. If the alternative conditions are used, it shall be stated in the test report.

### 5.2 Reference global solar radiation

Reference global solar radiation as defined by the SMARTS 2.9.5 model shall be used. The parameters of reference global solar radiation are: at sea level for air mass, 1,0; aerosol optical depth, 0,10; water vapor, 1,42 atm-cm; ozone, 0,340 atm-cm. The reference global solar radiation from 300 nm to 2 500 nm for 5 nm interval is described in Annex A. If the parameter to calculate reference global solar radiation is different, it shall be reported.

NOTE SMARTS 2.9.5 is a free software. It can be downloaded from the following website: https://www.nrel.gov/grid/solar-resource/smarts.html

### 5.3 Determination of solar reflectance

Solar reflectance is determined by the spectral reflectance of test specimen and the reference global solar radiation using Formula (1):

$$\rho_S = \frac{\int_{\lambda_1}^{\lambda_2} E(\lambda)\cdot\rho(\lambda)d\lambda}{\int_{\lambda_1}^{\lambda_2} E(\lambda)d\lambda} \quad (1)$$

where

$\rho_s$ is the solar reflectance;

$E(\lambda)$ is the reference global solar radiation ($W\cdot m^{-2}\cdot nm^{-1}$);

$\rho(\lambda)$ is the spectral reflectance of specimen;

$\lambda$ is the range of wavelength from $\lambda_1$ to $\lambda_2$.

NOTE In case of the wavelength interval is 1 nm instead of 5 nm, the formula becomes as follows:

$$\rho_s = \sum_{\lambda_1}^{\lambda_2} E(\lambda)\cdot\rho(\lambda) / \sum_{\lambda_1}^{\lambda_2} E(\lambda)$$



Example of a determination of solar reflectance is shown in Annex B.

## 6 Test report



Test report shall include the followings.

a) a reference to this document, i.e. ISO 22969:2019;

b) a description of test specimen;

c) the type of spectrophotometer;

d) the reflection measurement geometry;

e) the spectral wavelength range and measuring wavelength increments band width and nm-steps used to scan;

f) the spectral reflectance of test specimen;

g) the solar reflectance;

h) any deviation from the test procedure specified;

i) any unusual features observed;

j) the date of the test.