SLOVENSKI STANDARD
SIST EN 15976:2011

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Hidroizolacijski trakovi - Ugotavljanje emisivnosti

Flexible sheets for waterproofing - Determination of emissivity

Abdichtungsbahnen - Bestimmung des Emissionsgrades

Feuilles souples d'étanchéité - Détermination de l'émissivité

Ta slovenski standard je istoveten z: **EN 15976:2011**

ICS:

91.100.50 Veziva. Tesnilni materiali Binders. Sealing materials

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EUROPEAN STANDARD

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English Version

Flexible sheets for waterproofing - Determination of emissivity

Feuilles souples d'étanchéité - Détermination de l'émissivité

Abdichtungsbahnen - Bestimmung des Emissionsgrades

This European Standard was approved by CEN on 17 March 2011.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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Management Centre: Avenue Marnix 17, B-1000 Brussels

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Foreword

This document (EN 15976:2011) has been prepared by Technical Committee CEN/TC 254 “Flexible sheets for waterproofing”, the secretariat of which is held by BSI.

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of an identical text or by endorsement, at the latest by October 2011, and conflicting national standards shall be withdrawn at the latest by October 2011.

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1 Scope

This European Standard specifies the method to determine the emissivity of plastic, rubber and bitumen vapour control layers, underlays for walls and underlays for discontinuous roofing.

It also defines a conditioning procedure for these product families in order to quantify the sensitivity of emissivity to humidity and temperature.

2 Normative references

The following referenced documents are indispensable for the application of this European Standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 13416, *Flexible sheets for waterproofing — Bitumen, plastic and rubber sheets for roof waterproofing — Rules for sampling*

3 Terms and definitions

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

3.1
emissivity
emissivity of a material (usually written ε) is the ratio (proportion) of the energy radiated by a surface relative to the energy radiated by a blackbody at the same temperature. It is a measure of a material's ability to radiate heat

3.2
blackbody
blackbody is a theoretical object that absorbs all electromagnetic radiation that falls on it at all wavelengths. No electromagnetic radiation passes through it and none is reflected

NOTE A blackbody is also a perfect emitter with a normal and corrected emissivity of 1.

3.3
TIR
Thermal Infrared Radiation principle

4 Symbols

For the purposes of this document, the following symbols apply

c specific heat capacity is the measure of the heat energy required to increase the temperature of a unit quantity of a substance by a certain temperature interval.

λ the wavelength λ is the distance between repeating units of a propagation wave of a given frequency.

NOTE In this document it is understood the wave length is limited to the infrared light spectrum.

α (alpha) represents the absorption coefficient of a surface and is the ratio of the radiant energy absorbed by that surface relative to that of a blackbody at the same temperature.

ε (epsilon) emissivity (see above definition of emissivity) $(0 \leq \varepsilon \leq 1)$.

ρ (rho) reflectivity coefficient is the proportion of the incident electromagnetic radiation reflected from a surface or an optical element.

τ (tau) transmission coefficient is the proportion of incident electromagnetic radiation (light) passes through a surface or an optical element.

ε_L emissivity for the low emissive calibration standard.

ε_H emissivity for the high emissive calibration standard.

U sensor signal of the specimen in Volt.

U_H sensor signal of the high emissive calibration standard in Volt.

U_L sensor signal of the low emissive calibration standard in Volt.

5 Principle of low emitting surfaces

Flexible sheets for waterproofing with a low emitting surface are commonly referred to as radiant or reflective barriers. The principle of a radiant barrier is based on its ability to reflect radiant heat instead of absorbing it. Radiation (radiant heat) is the transmission of electromagnetic rays through space and in this context "radiation" refers only to the energy of infrared rays. At any temperature, all objects radiate infrared rays, which travel in all directions until they are reflected or absorbed by another object. The heating of objects excites the molecular surface structure, resulting in an emission of infrared radiation from the surface.

The radiative flux through a body will satisfy the conservation-of-energy equation:

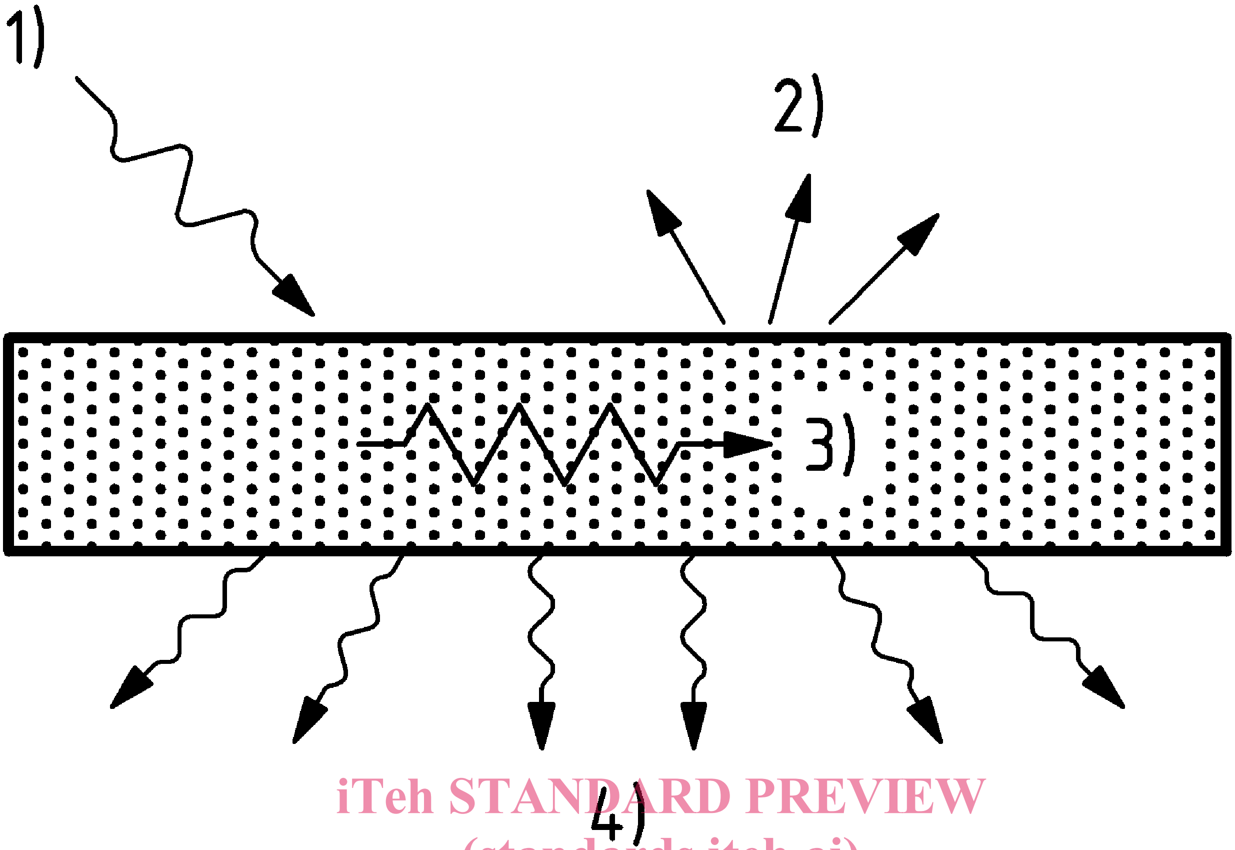
$$\alpha + \rho + \tau = 1$$

Radiant barriers are typically rather opaque to infrared radiation, so in a simplified consideration the transmission is negligible:

$$\Leftrightarrow \tau = 0$$

$$\Leftrightarrow \alpha + \rho = 1$$

$$\Leftrightarrow \alpha = 1 - \rho$$



Key

1 Incident energy

2 Reflected energy

3 Absorbed energy

4 Emitted energy

Figure 1 – Energy diagram

The amount of emitted radiation is a function of the emissivity factor (ε) of the source surface. At the same nominal wave length the absorption factor (α) equals the emissivity factor (ε):

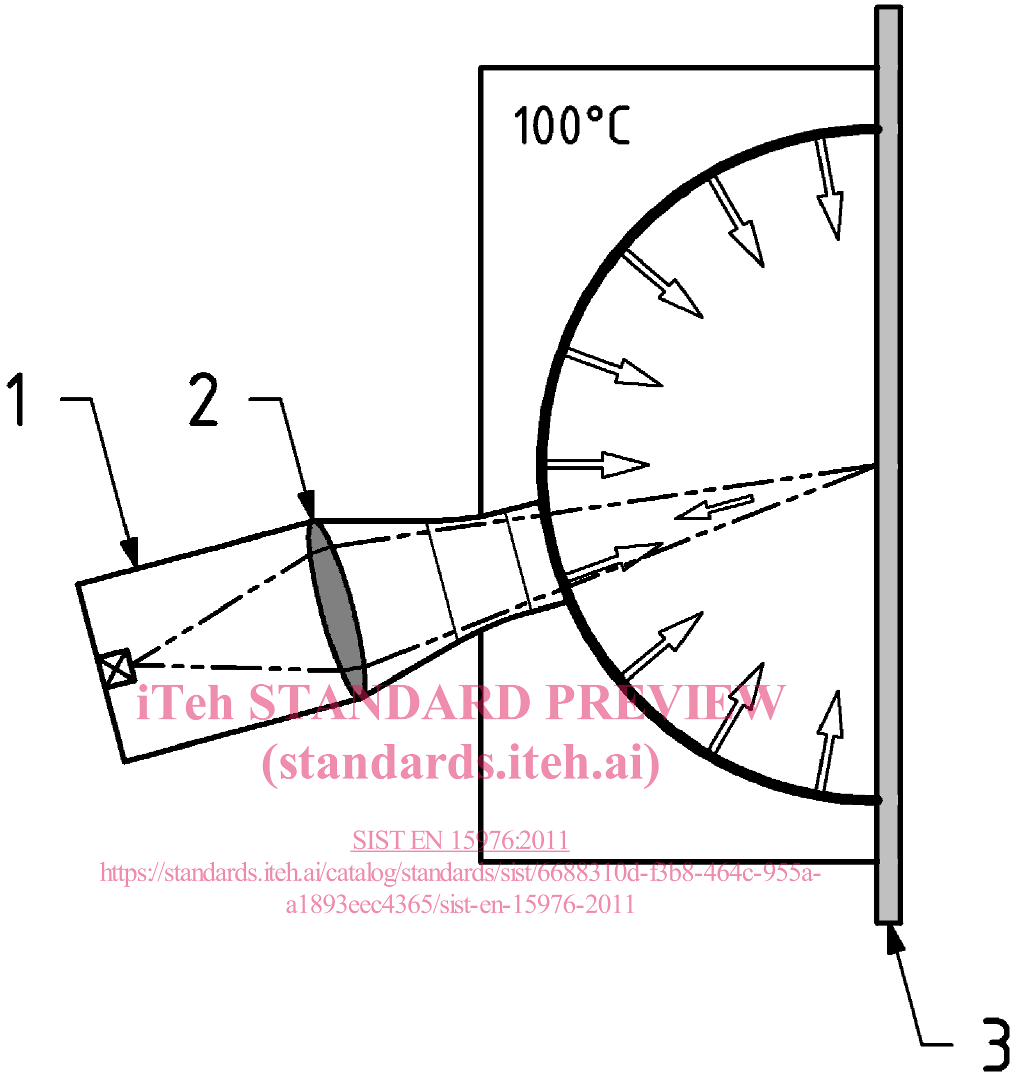
$$\alpha = \varepsilon$$

6 Hemispherical blackbody radiator

6.1 Principle of hemispherical blackbody radiator

The hemispherical radiator (half sphere) in the form of a blackbody uses the thermal infrared radiation principle (TIR-principle). The temperature of the blackbody is set and controlled at 100° (+/- 0,5 °C). The hemispherical shape of the radiator is necessary in order to achieve a complete and homogenous illumination of the measuring surface allowing even the emissivity of rough and structured surfaces to be measured correctly. Part of the energy reflected and emitted by the sample passes through a small opening in the hemispherical radiator and is focussed onto an infrared sensor by an infrared lens. The infrared sensor changes the incident thermal radiation into a voltage signal in a broad band and linear manner (the voltage signal is proportional to the reflected thermal energy).

At any given temperature of a blackbody, the spectral distribution of the thermal radiation is given by Planck’s law. The radiator’s temperature has been chosen to be 100° (± 0,5 °C) so that the corresponding spectrum has its peak at a wavelength (λ) of ca 8 µm and more than 97 % of the radiant energy is in the wavelength range from (2,5 to 40) µm.



Key

1 Thermopile Ir Sensor
2 Ir lens
3 Sample

Figure 2 – Hemispherical blackbody radiator

6.2 Description of hemispherical blackbody radiator and of the specimen holder

In order to reduce the hemispherical blackbody radiator (in the following also written as apparatus) related errors to a minimum the half sphere should have a diameter of not smaller than 70 mm. Also the distance of the surface to measure to the apparatus shall be approximately 2 mm. The axis of the infrared sensor and infrared lens assembly shall point at the centre of the specimen and shall be between 70° and 80° to the specimen surface.

An adequate electronic method to evaluate the measuring signals should be applied. In order to avoid the heat up of the specimen the measuring time should be limited to 3 s maximum.