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Rolete in polokna ï Toplotno in vizualno ugodje ï Preskus in raļ unske metode

Blinds and shutters - Thermal and visual comfort - Test methods

Abschlüsse - Thermisches und visuelles Verhalten - Prüfverfahren

Stores et fermetures - Confort thermique et lumineux - Méthodes d'essai

Ta slovenski standard je istoveten z: prEN 14500

ICS:

91.060.50 Vrata in okna Doors and windows

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ICS

English Version

Blinds and shutters - Thermal and visual comfort - Test ad calculation methods

Fermetures et stores - Confort thermique et lumineux - Méthodes d'essai et de calcul

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COMITÉ EUROPÉEN DE NORMALISATION
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Contents

Foreword

This document (prEN 14500:2006) 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 document is currently submitted to the CEN Enquiry.

Introduction

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

The present standard is mainly based on the European work performed in TC 89 relating to solar and light transmittance of solar protection devices combined with glazing and the document CIE130-1998 "Practical methods for the measurement of reflectance and transmittance".

1 Scope

This document defines test and calculation methods for the determination of the reflection and transmission characteristics to be used to determine the thermal and visual comfort performance classes of external blinds, internal blinds and shutters, as specified in EN 14501.

This document also specifies the method to determine opacity characteristics of dim-out/black-out external blinds, internal blinds and shutters, as specified in EN 14501.

This document applies to the whole range of shutters, awnings and blinds defined in EN 12216, described as solar protection devices in the present document. Some of the characteristics (e.g. g_{tot}) are not applicable when products are not parallel to the glazing (e. g. folding-arm awnings).

NOTE Informative Annex D presents an approach for the determination of characteristics in case of projectable products.

Products using fluorescent or retroreflecting materials are out of the scope of this document.

2 Normative references

This European Standard incorporates by reference, dated or undated, provisions from other publications. These normative references are cited at the appropriate points in the text and the publications are listed hereafter. Where dated references, subsequent amendments to, or revisions of any of these publications apply to this European Standard only when incorporated into it by amendment or revision. For undated references, the latest edition of the publication referred to applies (including amendments).

CIE 130 - 1998, *Practical methods for the measurement of reflectance and transmittance (ISBN 3 900 734 88 7)*

EN 410, *Glass in building – Determination of luminous and solar characteristics of glazing*

EN 12216, *Blinds and shutters - Terminology – Glossary and definitions*

EN 13363-1, *Solar protection devices combined with glazing – Calculation of solar and light transmittance – Part 1: Simplified method*

EN 13363-2, *Solar protection devices combined with glazing – Calculation of solar and light transmittance – Part 2: Reference method*

EN 14501, *Blinds and Shutters – Thermal and visual comfort – Performance characteristics and classification*

3 Terms and definitions

For the purpose of this standard, the definitions of EN 12216, EN 14501 and the following apply:

3.1 Processes

3.1.1
reflection
process by which radiation is returned by a surface or medium, without change of frequency of its monochromatic components

The following sub-processes are defined herewith:

— Specular (or directional or regular) reflection: reflection in accordance with the laws of geometrical optics, without diffusion.

— Diffuse reflection: reflection due to light scattering, in which, on the macroscopic scale, there is no specular reflection.

— Direct-hemispherical (or mixed) reflection: partly specular and partly diffuse reflection. Direct-hemispherical reflection is the sum of the diffuse and specular reflection.

— Isotropic diffuse reflection: diffuse reflection in which the spatial distribution of the reflected radiation is such that the radiance or luminance is the same in all directions in the hemisphere into which the radiation is reflected.

3.1.2
transmission
passage of radiation through a medium without change of frequency of its monochromatic components

The following sub-processes are defined herewith:

— Directional (or direct-direct) transmission: transmission in accordance with the laws of geometrical optics, without diffusion or redirection.

— Diffuse transmission: transmission due to light scattering, in which, on the macroscopic scale, there is no direct transmission.

— Direct-hemispherical (or mixed or total) transmission: partly directional and partly diffuse transmission. The direct-hemispherical transmission is the sum of the diffuse and direct transmission.

— Isotropic diffuse transmission: diffuse transmission in which the spatial distribution of the transmitted radiation is such that the radiance or luminance is the same in all directions in the hemisphere into which the radiation is transmitted.

3.1.3
absorption
process by which radiant energy is converted to a different form of energy (e.g. heat) by interaction with matter

3.2 Characteristics

3.2.1
reflectance ρ
ratio of the reflected flux to the incident flux

The following sub-characteristics are defined:

— Directional-directional (or direct-direct) reflectance: ratio of the specularly reflected flux to the directional incident flux.

— Directional-diffuse reflectance: ratio of the diffusely reflected flux to the directional incident flux.

— Directional-hemispherical (or total) reflectance: ratio of the total reflected flux to the directional incident flux.

— Diffuse-hemispherical reflectance: ratio of the total reflected flux to the ideally diffuse incident flux. Ideally diffuse irradiation means that the radiance or the luminance is equal for the whole hemisphere of the incident irradiation.

3.2.2
transmittance τ
ratio of the transmitted flux to the incident flux

The following sub-characteristics are defined:

— Directional-directional transmittance: ratio of the directly transmitted flux to the directional incident flux.

— Directional-diffuse transmittance: ratio of the diffusely transmitted flux to the directional incident flux.

— Directional-hemispherical transmittance: ratio of the total transmitted flux to the directional incident flux.

— Diffuse-hemispherical transmittance: ratio of the total transmitted flux to the ideally diffuse incident flux. Ideally diffuse irradiation means that the radiance or the luminance is equal for the whole hemisphere of the incident irradiation.

3.2.3
absorptance α
ratio of the absorbed flux to the incident flux

3.3
angle definitions
All the following angles are defined in a coordinate system which is fixed relative to the orientation of the solar protection device

3.3.1
angle of incidence θ
angle between the normal to the plane of the solar protection device and the direction of the incident radiation (see Figure 1)

3.3.2
altitude angle α_s
projection of the angle of incidence on the vertical plane which contains the direction of the incident radiation (see Figure 1)

3.3.3
azimuth angle γ
projection of the angle of incidence on a plane which is normal to the plane of the solar protection device. The intersection of this projection plane and the plane of the solar protection device is horizontal (see Figure 1).

3.3.4
profile angle α_p
projection of the altitude angle on a vertical plane which is perpendicular to the façade under consideration (see Figure 1). The profile angle is given by the following formula: $\mathrm{tg}\ \alpha_p = \mathrm{tg}\ \theta / \cos \gamma$.

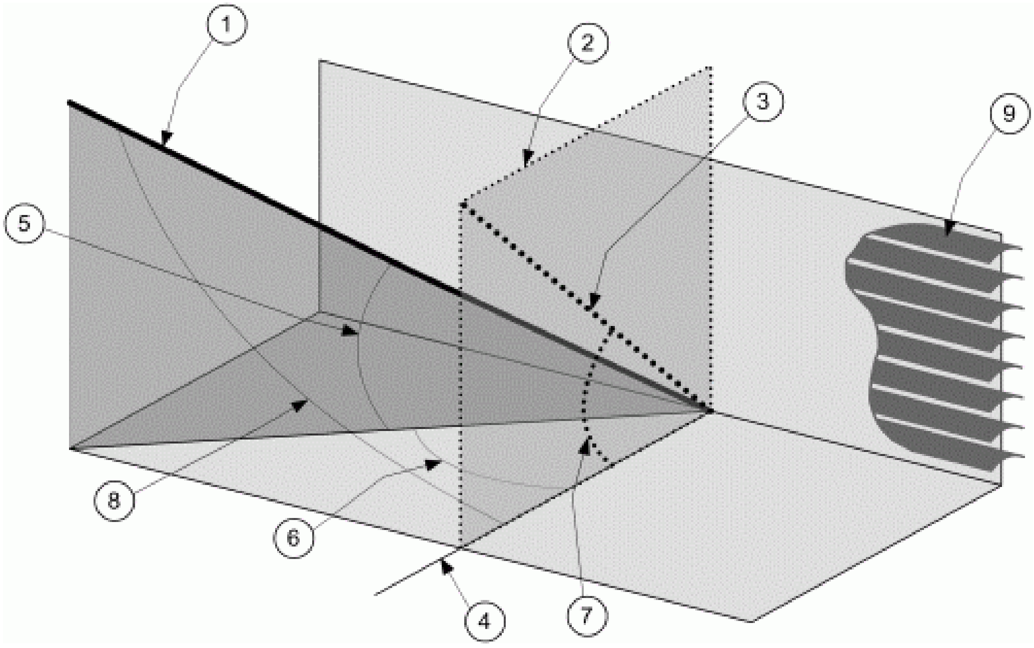


Figure 1 – Angle definitions

Key

1 Direction of the incident radiation
2 Vertical plane normal to the solar protection device
3 Projected direction of the incident radiation
4 Direction normal to the solar protection device
5 Altitude angle (angle in the vertical plane)
6 Azimuth angle (angle in the horizontal plane)
7 Profile angle
8 Angle of incidence
9 Solar protection device

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 2500 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.

4.3 Geometry of the radiation

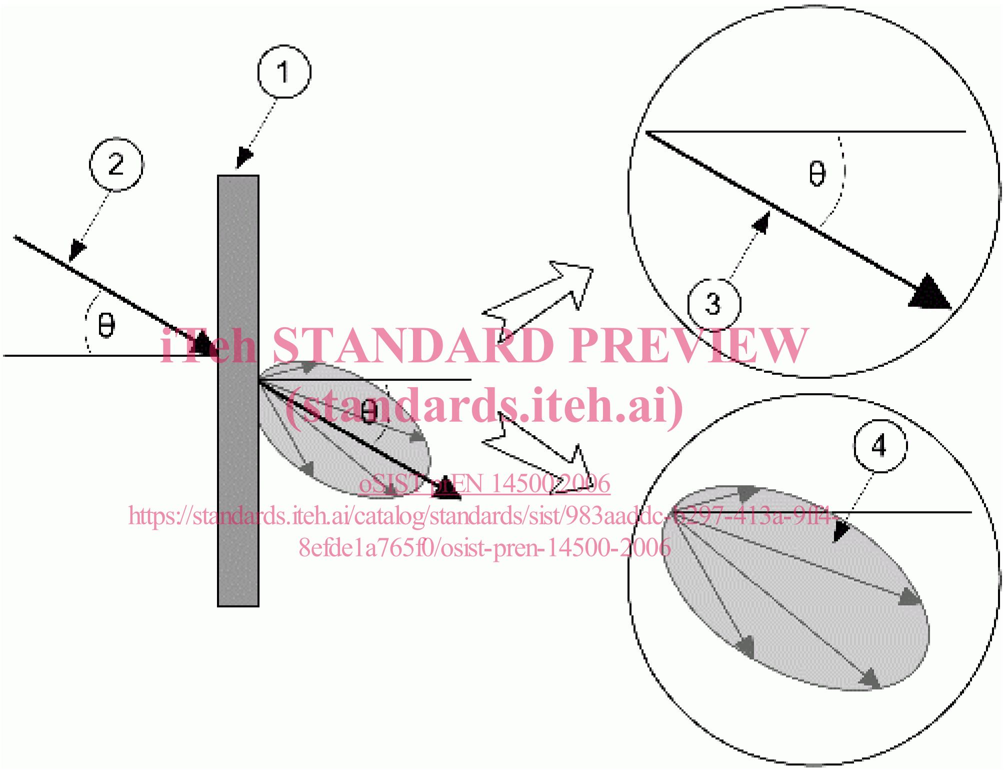
The following subscripts are used to indicate the geometry of the incident radiation and the geometry of the transmitted or reflected radiation (see Figure 2).

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

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

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

— « $_{dif}$ » for diffuse.



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

4.4 Optical factors

The optical factors are designated as follows:

— $\tau_{e, n-n}$ normal-normal solar transmittance

— $\tau_{v, n-n}$ normal-normal light transmittance

— $\tau_{v, n-dif}$ normal-diffuse light transmittance

— $\tau_{v, n-h}$ normal-hemispherical light transmittance

- $\tau_{v,\ dir\text{-}h}$ direct-hemispherical light transmittance
- $\tau_{e,\ n\text{-}h}$ normal-hemispherical solar transmittance
- $\tau_{e,\ dir\text{-}h}$ direct-hemispherical solar transmittance
- $\rho_{v,\ n\text{-}h}$ normal-hemispherical light reflectance
- $\rho_{v,\ dir\text{-}h}$ direct-hemispherical light reflectance
- $\rho_{e,\ n\text{-}h}$ normal-hemispherical solar reflectance
- $\rho_{e,\ dir\text{-}h}$ direct-hemispherical solar reflectance
- $\tau_{v,\ dif\text{-}h}$ diffuse-hemispherical light transmittance

5 Test and calculation methods to be used according to product - Guidelines

5.1 General

The test methods described in this document are intended to be used for testing the characteristics of the curtain elements of solar protection devices. Curtain elements are for example flat sheets of coated aluminium for slats for venetian blinds, fabric materials for roller blinds or glass slats with or without patterns for external glass venetian blinds. The properties of the whole product, which consists of one or more elements, are then calculated according to EN 13363-1 or EN 13363-2. Also a whole product may be tested, if the test equipment is sufficiently large so that the whole product fulfils the requirements of test samples as stated in clause 6.3.

This standard characterises the product performance through the properties of the curtain (centre of product values). However, peripheral gaps and/or holes and the set-up can have a strong effect on the performance of the product under real conditions and shall be considered during set-up.

For all solar protection devices, it is assumed that the products are fully extended (not partially retracted) when solar protection or glare protection is required.

NOTE For building planning it can be useful to take into consideration partially retracted solar protection devices. The properties of the whole window can then be approximated from the properties of the window area with and without solar protection devices.

5.2 Venetian blinds

The solar and light characteristics of venetian blinds shall be:

- Either measured directly on a complete product according to clause 7. The venetian blind shall in this case fulfil the requirements of test samples specified in clause 6.3.
- Or calculated using the properties of the individual slats. The slats characteristics shall be measured according to clause 7 and the calculation method of Annex A of EN 13363-2 shall be used. Additional information/requirements presented in clause 8 shall be used.

NOTE If products cannot be appropriately characterised using EN 13363-2 (for example: mirror finished and/or special shaped slats), a more detailed calculation method may be necessary.

The characteristics of the combination of a venetian blind with a glazing may be measured directly according to clause 7 if the requirements of test sample specified in clause 6.3 are fulfilled.

The different possibilities of determination of venetian blind characteristics are presented in Figure 3.

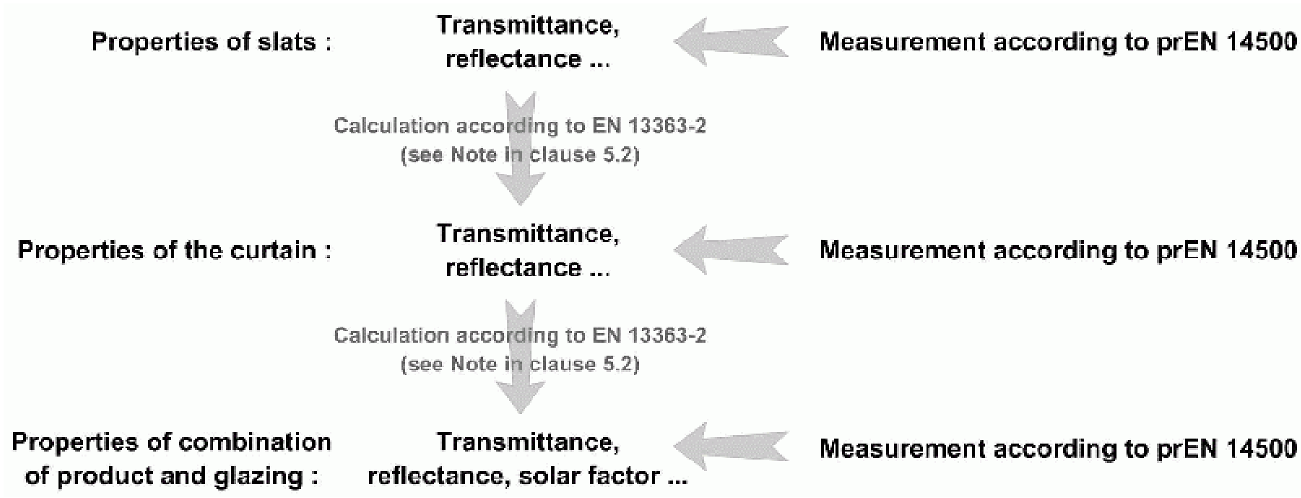


Figure 3 — Options for characterisation of venetian blinds

5.3 Roller blinds

The solar and light characteristics of roller blinds shall be:

— Either measured directly on a complete product according to clause 7. The roller blind shall in this case fulfil the requirements of test sample specified in clause 6.3.

— Or determined using the properties of the fabric. In this case, it is assumed that the properties of the complete product are the same as those of the fabric.

The characteristics of the combination of a roller blind with a glazing may be measured directly according to clause 7 if the requirements of test sample specified in clause 6.3 are fulfilled.

Opacity characteristics may be tested either on the curtain material or on a complete product if the test equipment is large enough. In all cases, it is essential to prevent any lateral losses through peripheral gaps.

The different possibilities of determination of roller blind characteristics are presented in Figure 4.

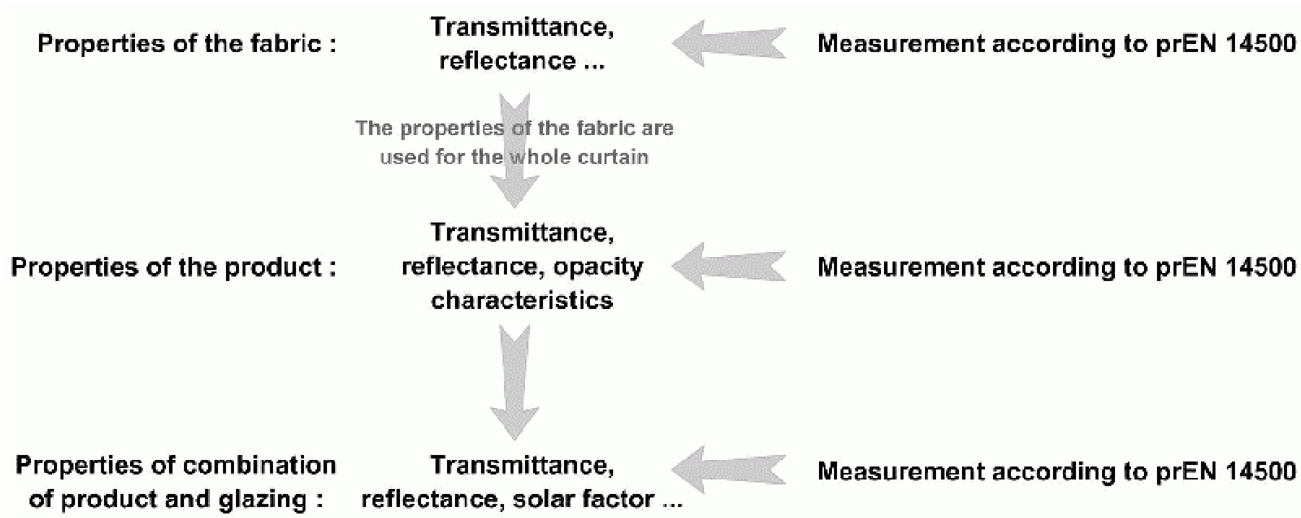


Figure 4 — Options for characterisation of roller blinds

5.4 Pleated blinds

As an approximation the properties of the fabric may be used as properties of the curtain in the same way as for roller blinds (see clause 5.3).

When the measurement set-up is sufficiently large the optical properties of the pleated curtain may be tested directly.

5.5 Projecting awnings

Fabric properties of projecting awnings may be determined according to clause 7.

However, existing calculation methods being only applicable to products which are parallel to the glazing, it is not possible to characterise the performance of a whole product from its fabric properties only.

NOTE Informative Annex D presents an approach for the determination of characteristics in case of projecting awnings.

5.6 Vertical blinds

Properties of vertical blinds shall be determined according to clause 8.3.

5.7 Shutters

The solar and light characteristics of shutters shall be:

- Either determined for the curtain material according to clause 7.
- Or determined for the complete product according to clause 8.4.

Opacity characteristics may be tested either on the curtain material or on a complete product if the test equipment is large enough. In all cases, it is essential to prevent any lateral losses through peripheral gaps.

6 Measurement set-up

6.1 Measurement principles

6.1.1 Spectral and integral characteristics

Any characteristic referring to optical properties of materials shall be determined under broad-band conditions with a specified illuminant (integral method) or spectrally for defined wavelengths λ (spectral method).

Spectral method

The relevant spectral characteristic (e.g. the normal-hemispherical spectral transmittance $\tau_{n\text{-}h}(\lambda)$) is measured as a function of the wavelength. Spectral measurements can be made either with monochromatic light or with a source having a broad spectrum and a spectroradiometer as detector. When a spectral characteristic of a sample is known, the corresponding integral characteristic can be calculated with the formula given in EN 410.

Integral method

The relevant weighted characteristic is measured directly, using a source with a standard spectral power distribution $S(\lambda)$ and a broad-band detector with the required relative spectral weighting function:

- For broad-band measurements of solar properties characteristic (e.g. the normal-hemispherical solar transmittance $\tau_{e,n\text{-}h}$), the detector system shall have a flat spectral response over the whole solar range and the spectral power distribution of the incident irradiation $S(\lambda)$ shall correspond to the EN 410 solar spectrum.

— For broad-band measurements of the light characteristics (e.g. the normal-hemispherical light transmittance $\tau_{v,n-h}$), the sensitivity of the detector shall correspond to the photopic spectral sensitivity of the human eye V(λ) and the spectral power distribution $S_{D65}(\lambda)$ of the light source shall correspond with the standard illuminant D65 (according to EN 410).

— For broad band measurements of light characteristics it is also possible to use a light source with a spectral power distribution S(λ) that corresponds with the standard solar spectrum and to use a detector with a spectral sensitivity w(λ), so that $S(\lambda)w(\lambda) = S_{D65}(\lambda)V(\lambda)$.

Necessary accuracy: A broad-band light-source/detector system is accurate enough, when the solar or light characteristics for a solar control glazing with a selectivity of $\tau_v / \tau_e > 1,5$ and the results of a clear glass sample do not differ more than 4% relatively from the results determined with a calibrated spectroradiometer with a relative accuracy of 2% or better.

6.1.2 Absolute and relative methods (according to CIE130-1998)

Since they are defined as the ratio of two fluxes, reflectance and transmittance are, in themselves, relative characteristics, but, whenever their values are measured directly without the use of another material standard as a reference, the corresponding method is termed absolute.

Reflectance measurements are carried out with the help of a standard and are accordingly classified as relative methods.

NOTE 1 Absolute methods for reflectance measurements do exist, but they are out of the scope of this standard.

In the case of transmittance, similar considerations apply. Since the flux transmitted through an unknown sample is to be referred to the flux incident on it. This comparison with the incident flux does not, theoretically, require any standard. It is only necessary to leave a free passage for the flux. According to this principle, measurements of transmittance are classified as absolute measurements.

NOTE 2 Relative transmittance measurements can be more appropriate in the case of diffusing test samples. Then a diffusing reference sample can be more accurate.

6.2 Measuring equipment

6.2.1 General

An instrument for measuring the characteristics of materials consists of

— An equipment for irradiation (see clause 6.2.2),

— An equipment for detection (see clause 6.2.3),

— Reference samples (see clause 6.2.4).

6.2.2 Equipment for irradiation

6.2.2.1 Single or double-beam instrument

Two methods of measurement are possible:

— Method A, using a single beam recording instrument;

— Method B, using a double-beam instrument. In double-beam instruments, the beam is switched between a path which has an incidence on the sample and one which does not.

Method B is recommended because of its inherent correction of drift in source brightness or amplifier gain.