



Standard Test Methods for Solar Energy Transmittance and Reflectance (Terrestrial) of Sheet Materials¹

This standard is issued under the fixed designation E424; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope

1.1 These test methods cover the measurement of solar energy transmittance and reflectance (terrestrial) of materials in sheet form. Method A, using a spectrophotometer, is applicable for both transmittance and reflectance and is the referee method. Method B is applicable only for measurement of transmittance using a pyranometer in an enclosure and the sun as the energy source. Specimens for Method A are limited in size by the geometry of the spectrophotometer while Method B requires a specimen 0.61 m^2 (2 ft^2). For the materials studied by the drafting task group, both test methods give essentially equivalent results.

1.2 *This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:²

E259 Practice for Preparation of Pressed Powder White Reflectance Factor Transfer Standards for Hemispherical and Bi-Directional Geometries

E275 Practice for Describing and Measuring Performance of Ultraviolet and Visible Spectrophotometers

E308 Practice for Computing the Colors of Objects by Using the CIE System

¹ These test methods are under the jurisdiction of ASTM Committee E44 on Solar, Geothermal and Other Alternative Energy Sources and is the direct responsibility of Subcommittee E44.05 on Solar Heating and Cooling Systems and Materials.

Current edition approved Nov. 1, 2015. Published November 2015. Originally approved in 1971. Last previous edition approved in 2007 as E424-71(2007). DOI: 10.1520/E0424-71R15.

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

3. Definitions

3.1 *solar absorptance*—the ratio of absorbed to incident radiant solar energy (equal to unity minus the reflectance and transmittance).

3.2 *solar admittance*—solar heat transfer taking into account reradiated and convected energy.

3.3 *solar energy*—for these methods the direct radiation from the sun at sea level over the solar spectrum as defined in 3.2, its intensity being expressed in watts per unit area.

3.4 *solar reflectance*—the percent of solar radiation (watts/unit area) reflected by a material.

3.5 *solar spectrum*—for the purposes of these methods the solar spectrum at sea level extending from 350 to 2500 nm.

3.6 *solar transmittance*—the percent of solar radiation (watts/unit area) transmitted by a material.

4. Summary of Methods

4.1 *Method A*—Measurements of spectral transmittance, or reflectance *versus* a magnesium oxide standard, are made using an integrating sphere spectrophotometer over the spectral range from 350 to 2500 nm. The illumination and viewing mode shall be normal-diffuse or diffuse-normal. The solar energy transmitted or reflected is obtained by integrating over a standard solar energy distribution curve using weighted or selected ordinates for the appropriate solar-energy distribution. The distribution at sea level, air mass 2, is used.

4.2 *Method B*—Using the sun as the source and a pyranometer as a detector the specimen is made the cover of an enclosure with the plane of the specimen perpendicular to the incident radiation; transmittance is measured as the ratio of the energy transmitted to the incident energy. (The apparatus of Method B has been used for the measurement of solar-energy reflectance but there is insufficient experience with this technique for standardization at present.)