

Abstract

- NREL leads and contributes to the development of radiometric standards and associated best practices through the American Society for Testing Materials (ASTM) International, the International Energy Agency (IEA), International Organization for Standardization (ISO) and the International Commission on Illumination (CIE).
- Development of best practices and consensus standards in solar measurement enables the industry to develop common protocols for solar project development and operations. This reduces barriers to financing and reduces warranty costs.
- These standards and best practices play an essential role in weathering and durability, including standard conditions, methods and instrumentation, accelerated testing, and service lifetime of materials systems.

Standard Committees

ASTM G03 → Weathering and Durability

- Durability and performance of materials, components, and assemblies
- Nomenclature, standard conditions, calibration methods, as well as instrumentation, natural and accelerated weathering exposure, and service life testing.

ASTM E44 → Solar, Geothermal, and Alternative Energy

- Solar heating and cooling systems and materials
- Photovoltaic electric power conversion
- Geothermal field development, utilization, and materials
- Optical materials for solar applications
- Heat metering.

CIE: International Commission on Illumination

- Science and art of light and lighting, color and vision, and image technology
- Recognized by ISO as an international standardization body.

ISO/TC 180/SC 1 Climate: Measurement and Data

- Calibration and specification of radiometers
- Development of reference spectral irradiance
- Radiometers recommended practice for use.

Standards

Recent standards

- ISO 9060:2018 Solar energy: Specification and classification of instruments for measuring hemispherical solar and direct solar radiation
- ASTM G213-17: Standard Guide for Evaluating Uncertainty in Calibration and Field Measurements of Broadband Irradiance with Pyranometers and Pyrheliometers
- ASTM G214-16: Test Method for the Integration of Digital Spectral Data for Weathering and Durability Applications

Proposed new standards

- [WK38983](#): New Guide for Performance Classification of Solar Radiometers
- [WK57619](#): Obtaining Irradiance at the Specimen Plane in Artificial Accelerated Weathering Apparatus
- [WK57714](#): Estimation of UV Irradiance Received by Samples as a Function of Location, Orientation, and Tilt

Relevant ASTM G03 Standards

- G130-12 Standard Test Method for Calibration of Narrow- and Broad-Band Ultraviolet Radiometers Using a Spectroradiometer
- G138-12 Standard Test Method for Calibration of a Spectroradiometer Using a Standard Source of Irradiance
- G167-15 Standard Test Method for Calibration of a Pyranometer Using a Pyrheliometer
- G173-03(2012) Standard Tables for Reference Solar Spectral Irradiances: Direct Normal and Hemispherical on 37° Tilted Surface
- G183-15 Standard Practice for Field Use of Pyranometers, Pyrheliometers, and UV Radiometers

Relevant ASTM E44 Standards

- E424-71(2015) Standard Test Methods for Solar Energy Transmittance and Reflectance (Terrestrial) of Sheet Materials
- E972-96(2013) Standard Test Method for Solar Photometric Transmittance of Sheet Materials Using Sunlight
- E1084-86(2015) Standard Test Method for Solar Transmittance (Terrestrial) of Sheet Materials Using Sunlight
- E1175-87(2015) Standard Test Method for Determining Solar or Photopic Reflectance, Transmittance, and Absorptance of Materials Using a Large Diameter Integrating Sphere

ISO/TC 180/SC 1

- ISO 9059:1990 Solar energy -- Calibration of field pyrheliometers by comparison to a reference pyrheliometer
- ISO 9845-1:1992 Solar energy -- Reference solar spectral irradiance at the ground at different receiving conditions -- Part 1: Direct normal and hemispherical solar irradiance for air mass 1,5
- ISO 9846:1993 Solar energy -- Calibration of a pyranometer using a pyrheliometer
- ISO 9847:1992 Solar energy -- Calibration of field pyranometers by comparison to a reference pyranometer
- ISO/TR 9901:1990 Solar energy -- Field pyranometers -- Recommended practice for use
- ISO 9060:2018 Solar energy -- Specification and classification of instruments for measuring

CIE TC 2-88: Standard Reference Solar Spectra for Industrial Applications

Solar spectral irradiance that includes increased sampling intervals based on explicit meteorological input parameters for the SMARTS 2.9.5 model.

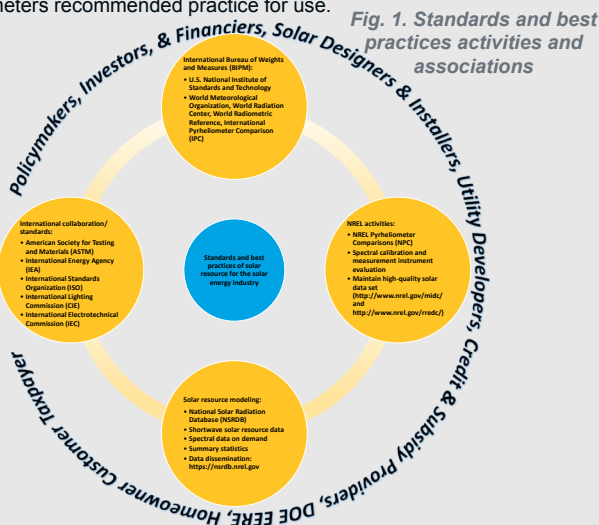


Fig. 1. Standards and best practices activities and associations