



Standard Test Methods for Electrical Performance of Nonconcentrator Terrestrial Photovoltaic Modules and Arrays Using Reference Cells¹

This standard is issued under the fixed designation E1036; 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.

1. Scope

1.1 These test methods cover the electrical performance of photovoltaic modules and arrays under natural or simulated sunlight using a calibrated reference cell.

1.1.1 These test methods allow a reference module to be used instead of a reference cell provided the reference module has been calibrated using these test methods against a calibrated reference cell.

1.2 Measurements under a variety of conditions are allowed; results are reported under a select set of reporting conditions (RC) to facilitate comparison of results.

1.3 These test methods apply only to nonconcentrator terrestrial modules and arrays.

1.4 The performance parameters determined by these test methods apply only at the time of the test, and imply no past or future performance level.

1.5 These test methods apply to photovoltaic modules and arrays that do not contain series-connected photovoltaic multijunction devices; such module and arrays should be tested according to Test Methods E2236.

1.6 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.7 *This standard does not purport to address all of the safety concerns, 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

¹ These test methods are under the jurisdiction of ASTM Committee E44 on Solar, Geothermal and Other Alternative Energy Sources and are the direct responsibility of Subcommittee E44.09 on Photovoltaic Electric Power Conversion.

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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.

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

E772 Terminology of Solar Energy Conversion

E927 Specification for Solar Simulation for Photovoltaic Testing

E941 Test Method for Calibration of Reference Pyranometers With Axis Tilted by the Shading Method (Withdrawn 2005)³

E948 Test Method for Electrical Performance of Photovoltaic Cells Using Reference Cells Under Simulated Sunlight

E973 Test Method for Determination of the Spectral Mismatch Parameter Between a Photovoltaic Device and a Photovoltaic Reference Cell

E1021 Test Method for Spectral Responsivity Measurements of Photovoltaic Devices

E1040 Specification for Physical Characteristics of Nonconcentrator Terrestrial Photovoltaic Reference Cells

E1125 Test Method for Calibration of Primary Non-Concentrator Terrestrial Photovoltaic Reference Cells Using a Tabular Spectrum

E1362 Test Method for Calibration of Non-Concentrator Photovoltaic Secondary Reference Cells

E2236 Test Methods for Measurement of Electrical Performance and Spectral Response of Nonconcentrator Multijunction Photovoltaic Cells and Modules

G173 Tables for Reference Solar Spectral Irradiances: Direct Normal and Hemispherical on 37° Tilted Surface

3. Terminology

3.1 *Definitions*—Definitions of terms used in these test methods may be found in Terminology E772.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *nominal operating cell temperature, NOCT, n*—the temperature of a solar cell inside a module operating at an ambient temperature of 20°C, an irradiance of 800 Wm⁻², and an average wind speed of 1 ms⁻¹.

3.2.2 *reporting conditions, RC, n*—the device temperature, total irradiance, and reference spectral irradiance conditions that module or array performance data are corrected to.

³ The last approved version of this historical standard is referenced on www.astm.org.