



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

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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.

1.2 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 There is no similar or equivalent ISO standard.

1.6 *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:

E 691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method²

E 772 Terminology Relating to Solar Energy Conversion³

E 927 Specification for Solar Simulation for Terrestrial Photovoltaic Testing³

E 941 Test Method for Calibration of Reference Pyranometers With Axis Tilted by the Shading Method²

E 948 Test Method for Electrical Performance of Photovoltaic Cells Using Reference Cells Under Simulated Sunlight³

E 973 Test Method for Determination of the Spectral Mismatch Parameter Between a Photovoltaic Device and a Photovoltaic Reference Cell³

E 1021 Test Methods for Measuring the Spectral Response of Photovoltaic Cells³

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 Annual Book of ASTM Standards, Vol 14.02.

³ Annual Book of ASTM Standards, Vol 12.02.

E 1039 Test Method for Calibration of Silicon Non-Concentrator Photovoltaic Primary Reference Cells Under Global Irradiation³

E 1040 Specification for Physical Characteristics of Non-concentrator Terrestrial Photovoltaic Reference Cells³

E 1125 Test Method for Calibration of Primary Nonconcentrator Terrestrial Photovoltaic Reference Cells Using a Tabular Spectrum³

E 1328 Terminology Relating to Photovoltaic Solar Energy Conversion³

E 1362 Test Method for Calibration of Nonconcentrator Photovoltaic Secondary Reference Cells³

G 159 Tables for References Solar Spectral Irradiance at Air Mass 1.5: Direct Normal and Hemispherical for a 37° Tilted Surface⁴

3. Terminology

3.1 *Definitions*—Definitions of terms used in these test methods may be found in Terminology E 772 and Terminology E 1328.

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.

3.3 Symbols:

3.3.1 The following symbols and units are used in these test methods:

α_r —temperature coefficient of reference cell I_{SC} , °C⁻¹,

α —current temperature coefficient of device under test, °C⁻¹,

$\beta(E)$ —voltage temperature function of device under test, °C⁻¹,

C —calibration constant of reference cell, Am²W⁻¹,

C' —adjusted calibration constant of reference cell, Am²W⁻¹,

C_f —NOCT Correction factor, °C,

⁴ Annual Book of ASTM Standards, Vol 14.04.