



Standard Test Method for Electrical Performance of Photovoltaic Cells Using Reference Cells Under Simulated Sunlight¹

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1. Scope

1.1 This test method covers the determination of the electrical performance of a photovoltaic cell under simulated sunlight by means of a calibrated reference cell procedure.

1.2 Electrical performance measurements are reported with respect to a select set of standard reporting conditions (SRC) (see [Table 1](#)) or to user-specified reporting conditions. In either case, the chosen reporting conditions are abbreviated as RC.

1.2.1 The RC include the cell temperature, the total irradiance, and the reference spectral irradiance distribution.

1.3 This test method is applicable only to photovoltaic cells with a linear short-circuit current versus total irradiance response up to and including the total irradiance used in the measurement.

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

1.5 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this 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:²

[E490](#) Standard Solar Constant and Zero Air Mass Solar Spectral Irradiance Tables

[E491](#) Practice for Solar Simulation for Thermal Balance

¹ This test method is under the jurisdiction of ASTM Committee [E44](#) on Solar, Geothermal and Other Alternative Energy Sources and is 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.

Testing of Spacecraft

[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

[E973](#) Test Method for Determination of the Spectral Mismatch Parameter Between a Photovoltaic Device and a Photovoltaic Reference Cell

[E1125](#) Test Method for Calibration of Primary Non-Concentrator Terrestrial Photovoltaic Reference Cells Using a Tabular Spectrum

[E1362](#) Test Methods for Calibration of Non-Concentrator Photovoltaic Non-Primary Reference Cells

[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 this test method may be found in Terminology [E772](#) and in Specification [E927](#).

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *effective irradiance, n* —the irradiance that a solar simulator produces as measured by a cell's short-circuit current relative to a reference value for the cell's short-circuit current at a particular RC.

3.2.1.1 *Discussion*—This reference value typically corresponds to a different spectral irradiance distribution than the solar simulator.

3.2.2 *reporting conditions, RC, n* —the reference spectral irradiance distribution, total irradiance, and cell temperature to which the photovoltaic current-voltage performance is measured and corrected.

3.2.3 *test cell, n* —the photovoltaic cell to be tested, or cell under test, using the method described herein.

3.3 *Symbols*—The following symbols and units are used in this test method:

3.3.1 0 —as a subscript, denotes a value under the specified RC.

3.3.2 A —area of the test cell, (m^2).

3.3.3 A_R —area of the reference cell, (m^2).