



# Standard Test Method for Determination of the Spectral Mismatch Parameter Between a Photovoltaic Device and a Photovoltaic Reference Cell<sup>1</sup>

This standard is issued under the fixed designation E 973; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This test method covers a procedure for the determination of a spectral mismatch parameter used in performance testing of photovoltaic devices.

1.2 The spectral mismatch parameter is a measure of the error, introduced in the testing of a photovoltaic device, caused by mismatch between the spectral responses of the photovoltaic device and the photovoltaic reference cell, as well as mismatch between the test light source and the reference spectral irradiance distribution to which the photovoltaic reference cell was calibrated. Examples of reference spectral irradiance distributions are Tables E 490 or G 159.

1.3 The spectral mismatch parameter can be used to correct photovoltaic performance data for spectral mismatch error.

1.4 This test method is intended for use with linear photovoltaic devices.

1.5 *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:*<sup>2</sup>

E 490 Solar Constant and Air Mass Zero Solar Spectral Irradiance Tables

E 772 Terminology Relating to Solar Energy Conversion

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

E 1021 Test Methods for Measuring Spectral Response of Photovoltaic Cells

E 1036 Test Methods for Electrical Performance of Non-Concentrator Terrestrial Photovoltaic Modules and Arrays

using Reference Cells

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

E 1125 Test Method for Calibration of Primary Non-Concentrator Terrestrial Photovoltaic Reference Cells Using a Tabular Spectrum

E 1328 Terminology Relating to Photovoltaic Solar Energy Conversion

E 1362 Test Method for Calibration of Non-Concentrator Photovoltaic Secondary Reference Cells

G 138 Test Method for Calibration of a Spectroradiometer Using a Standard Source of Irradiance

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

G 173 Tables for Reference Solar Spectral Irradiances: Direct Normal and Hemispherical on 37° Tilted Surface

SI 10 Standard for Use of the International System of Units (SI): The Modern Metric System

## 3. Terminology

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

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *test light source, n*—a source of illumination whose spectral irradiance will be used for the spectral mismatch calculation.

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

$M$ —spectral mismatch parameter,

$\epsilon$ —measurement error in short-circuit current,

$\lambda$ —wavelength,  $\mu\text{m}$  or  $\text{nm}$ ,

$R_r(\lambda)$ —spectral response of reference cell,  $\text{AW}^{-1}$ ,

$R_d(\lambda)$ —spectral response of photovoltaic device,  $\text{AW}^{-1}$ ,

$E$ —irradiance,  $\text{Wm}^{-2}$ ,

$E(\lambda)$ —spectral irradiance,  $\text{Wm}^{-2}\mu\text{m}^{-1}$  or  $\text{Wm}^{-2}\text{nm}^{-1}$ , and

$E_o(\lambda)$ —reference spectral irradiance,  $\text{Wm}^{-2}\mu\text{m}^{-1}$  or  $\text{Wm}^{-2}\text{nm}^{-1}$ .

<sup>1</sup> 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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<sup>2</sup> 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.