



Standard Test Methods for Solar Radiation Weathering of Photovoltaic Modules¹

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1. Scope

1.1 The three radiant energy weathering procedures described in these test methods are intended to determine the effects of extended outdoor exposure-induced stress that may occur during service life of photovoltaic modules.

1.1.1 Because most accelerated weathering devices are not large enough to accept full-sized photovoltaic modules, the simulated weathering test procedures may be suitable only for smaller test modules. The construction of smaller test modules should be as close in design and function as possible to full-size modules.

1.2 The three solar weathering test methods are as follows:

1.2.1 *Procedure A*—Natural sunlight, real-time exposure testing,

1.2.2 *Procedure B*—Accelerated exposure testing concentrated natural sunlight, and

1.2.3 *Procedure C*—Accelerated exposure testing using simulated sunlight.

1.3 The test methods do not provide for weathering studies on individual components of photovoltaic modules.

1.4 There is no similar or equivalent ISO Standard.

1.5 *Units*—The values stated in SI units are to be regarded as the 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:

E 772 Terminology Relating to Solar Energy Conversion²

E 1036 Test Methods for Testing the Electrical Performance of Nonconcentrator Terrestrial Photovoltaic Modules and Arrays Using Reference Cells²

E 1328 Terminology Relating to Photovoltaic Solar Energy Conversion²

E 1462 Test Methods for Insulation Integrity and Ground Path Continuity of Photovoltaic Modules²

G 7 Practice for Atmospheric Environmental Exposure Testing of Nonmetallic Materials³

G 26 Practice for Operating Light-Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials³

G 90 Practice for Performing Accelerated Outdoor Weathering of Nonmetallic Materials Using Concentrated Natural Sunlight³

3. Terminology

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

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *test specimen, n*—a full-size photovoltaic module, or a smaller size photovoltaic module fabricated with similar materials and processing as a full-size module, that will be subjected to the solar weathering tests.

3.2.2 *total UV dose, n*—see **UV below 385 nm**.

3.2.3 *UV below 385 nm, n*—the radiant exposure in W/m² of wavelengths shorter than 385 nm incident upon a test specimen.

4. Summary of Test Methods

4.1 Three solar weathering test methods are provided for determining the effects of extended outdoor exposure-induced stress that may occur during service life of photovoltaic modules.

4.2 The duration of each of the test methods is determined by the amount of time needed to accumulate a total ultraviolet (wavelengths shorter than 385 nm) exposure of 2000 MJ/m², which is roughly equivalent to 72 months exposure in southern U.S. latitudes. If no failure mechanisms are detected or measured after 2000 MJ/m² of UV radiant exposure, testing shall continue until the photovoltaic module failure mechanisms are characterized or until the UV radiant dose exceeds 6600 MJ/m².

4.3 The three test methods are:

¹ These test methods are under the jurisdiction of ASTM Committee E-44 on Solar, Geothermal, and Other Alternative Energy Sources and is the direct responsibility of Subcommittee E44.09 on Photovoltaic Electric Power Systems.

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² *Annual Book of ASTM Standards*, Vol 12.02.

³ *Annual Book of ASTM Standards*, Vol 14.04.