



Standard Test Methods for Determining Mechanical Integrity of Photovoltaic Modules¹

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1. Scope

1.1 These test methods cover procedures for determining the ability of photovoltaic modules to withstand the mechanical loads, stresses and deflections used to simulate, on an accelerated basis, high wind conditions, heavy snow and ice accumulation, and non-planar installation effects.

1.1.1 A static load test to 2400 Pa is used to simulate wind loads on both module surfaces.

1.1.2 A static load test to 5400 Pa is used to simulate heavy snow and ice accumulation on the module front surface.

1.1.3 A twist test is used to simulate the non-planar mounting of a photovoltaic module by subjecting it to a twist angle of 1.2°.

1.1.4 A cyclic load test of 10 000 cycles duration and peak loading to 1440 Pa is used to simulate dynamic wind or other flexural loading. Such loading might occur during shipment or after installation at a particular location.

1.2 These test methods define photovoltaic test specimens and mounting methods, and specify parameters that must be recorded and reported.

1.3 Any individual mechanical test may be performed singly, or may be combined into a test sequence with other mechanical or nonmechanical tests, or both. Certain preconditioning test methods such as annealing or light soaking may also be necessary or desirable as a part of such a sequence. However, the determination of such test sequencing and preconditioning is beyond the scope of these test methods.

1.4 These test methods do not establish pass or fail levels. The determination of acceptable or unacceptable results is beyond the scope of these test methods.

1.5 These test methods do not apply to concentrator modules.

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 The following precautionary caveat pertains only to the hazards portion, Section 6, and the warning statements, 7.5.3.2 and 7.6.3.2, of these test methods. *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

[E772 Terminology of Solar Energy Conversion](#)

[E1036 Test Methods for Electrical Performance of Nonconcentrator Terrestrial Photovoltaic Modules and Arrays Using Reference Cells](#)

[E1462 Test Methods for Insulation Integrity and Ground Path Continuity of Photovoltaic Modules](#)

[E1799 Practice for Visual Inspections of Photovoltaic Modules](#)

3. Terminology

3.1 *Definitions*—Definitions of terms used in these test methods may be found in Terminology [E772](#).

4. Significance and Use

4.1 The useful life of photovoltaic modules may depend on their ability to withstand periodic exposure to high wind forces, cyclic loads induced by specific site conditions or shipment methods, high loads caused by accumulated snow and ice on the module surface, and twisting deflections caused by mounting to non-planar surfaces or structures. The effects on the module may be physical or electrical, or both. Most importantly, the effects may compromise the safety of the module, particularly in high voltage applications, or where the public may be exposed to broken glass or other debris.

4.2 These test methods describe procedures for mounting the test specimen, conducting the prescribed mechanical tests, and reporting the effects of the testing.

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.