



Standard Test Methods for Insulation Integrity and Ground Path Continuity of Photovoltaic Modules¹

This standard is issued under the fixed designation E 1462; 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 (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 These test methods cover procedures for (1) testing for current leakage between the electrical circuit of a photovoltaic module and its external components while a user-specified voltage is applied and (2) for testing for possible module insulation breakdown (dielectric voltage withstand test).

1.2 A procedure is described for measuring the insulation resistance between the electrical circuit of a photovoltaic module and its external components (insulation resistance test).

1.3 A procedure is provided for verifying that electrical continuity exists between the exposed external conductive surfaces of the module, such as the frame, structural members, or edge closures, and its grounding point (ground path continuity test).

1.4 This test method does not establish pass or fail levels. The determination of acceptable or unacceptable results is beyond the scope of this test method.

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 772 Terminology Relating to Solar Energy Conversion²

E 1328 Terminology Relating to Photovoltaic Solar Energy Conversion²

2.2 Underwriters Laboratories Standard:³

ANSI/UL 1703 Standard for Safety for Flat-Plate Photovoltaic Modules and Panels

¹ These test methods are 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. Current edition approved Oct. 10, 2000. Published December 2000. Originally published as E 1462-92. Last previous edition E 1462-95.

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

³ Underwriters Laboratories Incorporated, Publication Stock, 333 Pfingsten Road, Northbrook, IL 60062.

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 *ground path continuity*—the electrical continuity between the external and conductive surfaces of a photovoltaic module and the intended grounding point of the module.

3.2.2 *insulation resistance*—the electrical resistance of a photovoltaic module insulation, measured at a specified applied voltage between the module internal circuitry and its grounding point or mounting structure.

3.2.3 *maximum system voltage*—the maximum electrical potential, referenced at the system grounding point, that can be generated by a photovoltaic power system as specified by the model manufacturer.

4. Summary of Test Method

4.1 *Insulation Integrity*—Two procedures are provided for testing the isolation of the electrically active parts of the module from the accessible conductive parts and the exposed nonconductive surfaces. This isolation is necessary to provide for safe insulation, use, and service of a photovoltaic module or system.

4.1.1 *Dielectric Voltage Withstand Procedure*—A ramped voltage is applied between the photovoltaic circuit and the accessible parts and surfaces of the module outside of the photovoltaic circuit while monitoring the current, or by determining whether the leakage current exceeds a predetermined limit. The module is then inspected for evidence of possible arcing.

4.1.2 *Insulation Resistance Procedure*—The insulation resistance is measured between the photovoltaic circuit and the accessible parts and surfaces of the module outside of the photovoltaic circuit, using a high-impedance ohmmeter.

4.2 *Ground Path Continuity Procedure*—This procedure is intended for verification that electrical continuity exists between all of the external conductive components and the module grounding point specified by the manufacturer. This is accomplished by passing a current between the grounding