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An American National Standard

Standard Test Methods for Wet Insulation Integrity Testing of Photovoltaic Modules[1]

This standard is issued under the fixed designation E 1802; 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 verifying the electrical insulation integrity of a photovoltaic module by detecting insulation flaws.

1.2 The insulation integrity procedures are a combination of wet insulation resistance and wet current leakage (high-potential) test procedures.

1.3 These procedures are similar to and reference the insulation integrity test procedures described in Test Methods E 1462, with the difference being that the photovoltaic module under test is immersed in a wetting solution during the procedures.

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 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.* For specific precautionary statements, see Section 6.

2. Referenced Documents

2.1 *ASTM Standards:*

E 772 Terminology Relating to Solar Energy Conversion[2]

E 1328 Terminology Relating to Photovoltaic Solar Energy Conversion[2]

E 1462 Test Methods for Insulation Integrity and Ground Path Continuity of Photovoltaic Modules[2]

3. Terminology

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

4. Significance and Use

4.1 Safe use of photovoltaic modules for power generation require the electrical isolation of the interior circuitry from the outside environment, especially when modules are wet. The purpose of these procedures is to detect flaws in module insulation that may only be evident when a module is wet. For example, these flaws could be small holes in the encapsulation that allow hazardous voltages to be accessible on the outside surface of a module after a period of high humidity.

4.2 Insulation flaws in a module may only become detectable after the module has been immersed for a certain time. For this reason, these procedures specify a minimum amount of time that a module must be immersed prior to the insulation integrity measurements.

4.3 Electrical junction boxes attached to modules are often designed to allow liquid water, accumulated from condensed water vapor, to drain. Such drain paths are usually designed to permit water to exit, but not to allow impinging water from rain or water sprinklers to enter. It is important that all unsubmerged surfaces of junction boxes be thoroughly wetted by spraying during the tests to enable these protective drain features to be properly tested. Therefore, drain holes should not be plugged or otherwise protected.

5. Apparatus

5.1 In addition to the apparatus required for the insulation integrity measurements of Test Methods E 1462, the following apparatus is required.

5.1.1 *Wetting Solution*— A surfactant solution with a maximum resistivity of 35 Ωm and a maximum surface tension of 0.03 Nm^{-1}. The temperature of the solution must be 22 ± 3°C.

5.1.2 *Immersion Tray*— A tray containing the wetting solution (see 5.1.1) into which the test module is immersed during the integrity measurements. The tray must be deep enough to completely immerse the laminate portion of the module in the wetting solution. This requirement does not imply that any electrical junction boxes attached to the module must also be immersed.

6. Hazards

6.1 The electrical measurements used to determine the insulation integrity require applying a high voltage between a test module and a wetting solution (see 5.1.1). Therefore, in addition to the high voltage hazard, additional hazards may exist due to unforeseen conductive paths between the high-voltage source and operators of the test through any spilled wetting solution. It is recommended that testing personnel be isolated from the testing area while the high voltage is

[1] These test methods are under the jurisdiction of ASTM Committee E-44 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] *Annual Book of ASTM Standards*, Vol 12.02.