Designation: E 1597 – 99

# Standard Test Method for Saltwater Pressure Immersion and Temperature Testing of Photovoltaic Modules for Marine Environments[1]

This standard is issued under the fixed designation E 1597; 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 This test method provides a procedure for determining the ability of photovoltaic modules to withstand repeated immersion or splash exposure by seawater as might be encountered when installed in a marine environment, such as a floating aid-to-navigation. A combined environmental cycling exposure with modules repeatedly submerged in simulated saltwater at varying temperatures and under repetitive pressurization provides an accelerated basis for evaluation of aging effects of a marine environment on module materials and construction.

1.2 This test method defines photovoltaic module test specimens and requirements for positioning modules for test, references suitable methods for determining changes in electrical performance and characteristics, and specifies parameters which must be recorded and reported.

1.3 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.

1.4 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:*

D 1141 Specification for Substitute Ocean Water[2]

E 772 Terminology Relating to Solar Energy Conversion[3]

E 1036 Test Methods for Electrical Performance of Non-concentrator Terrestrial Photovoltaic Modules and Arrays Using Reference Cells[3]

E 1328 Terminology Relating to Photovoltaic Solar Energy Conversion[3]

E 1462 Test Methods for Insulation Integrity and Ground Path Continuity of Photovoltaic Modules[3]

## 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 *Definition of Term Specific to This Standard:*

3.2.1 **PIT**, *n*—Pressure, Immersion, and Temperature.

## 4. Significance and Use

4.1 The useful life of photovoltaic modules deployed in marine applications (such as floating aids-to-navigation) may depend on the ability to withstand repeated exposure to salt atmosphere, immersion in seawater, and the temperature changes associated with seawater splash falling on modules operating in sunlight. The effects of these exposures may be physical or electrical changes in the module, or both.

4.2 This test method describes a procedure for positioning the test specimen, conducting a cyclical combined pressure, immersion, and temperature (PIT) test, and reporting the results. It also references methods for conducting module electrical performance and insulation integrity tests.

4.3 Data generated by this test method may be used to evaluate and compare the effects of a simulated marine environment on test specimens. This test method requires recording of visible effects as well as electrical performance.

4.3.1 Effects on modules may vary from none to significant changes. Some physical changes in the module may be visible when there are no apparent electrical changes in the module. Similarly, electrical changes may occur with no visible changes in the module.

## 5. Apparatus

5.1 In addition to the apparatus required for Test Methods E 1036 and Test Method E 1462, the following apparatus is required.

[1] This test method is 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 11.02.

[3] *Annual Book of ASTM Standards*, Vol 12.02.