



Designation: E 1799 – 96

Standard Practice for Visual Inspections of Photovoltaic Modules¹

This standard is issued under the fixed designation E 1799; 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 practice covers procedures and criteria for visual inspections of photovoltaic modules.

1.2 Visual inspections of photovoltaic modules are normally performed before and after modules have been subjected to environmental stress testing, such as Test Methods E 1038, E 1171, or E 1596.

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

1.4 There is no similar or equivalent ISO standard.

1.5 *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 1038 Test Method for Determining Resistance of Photovoltaic Modules to Hail by Impact With Propelled Ice Balls²

E 1171 Test Method for Photovoltaic Modules in Cyclic Temperature and Humidity Environments²

E 1328 Terminology Relating to Photovoltaic Solar Energy Conversion²

E 1596 Test Methods for Solar Radiation Weathering of Photovoltaic Modules²

3. Terminology

3.1 *Definitions*—Definitions of terms used in this practice may be found in Terminology E 772 and Terminology E 1328.

4. Significance and Use

4.1 Environmental stress tests, such as Test Methods E 1038, E 1171, or E 1596, are normally used to evaluate module designs prior to production or purchase. These test

methods rely on performing electrical tests and visual inspections of modules before and after stress testing to determine the effects of the exposures.

4.2 Effects of environmental stress testing may vary from no effects to significant changes. Some physical changes in the module may be visible when there are no measurable electrical changes. Similarly, electrical changes in the module may occur with no visible changes.

4.3 It is the intent of this practice to provide a recognized procedure for performing visual inspections and to specify effects that should be reported.

4.4 Many of these effects are subjective. In order to determine if a module has passed a visual inspection, the user of this practice must specify what changes or conditions are acceptable. The user may have to judge whether changes noted during an inspection will limit the useful life of a module design.

5. Procedure

5.1 *Pre-Test Inspection*—Inspections performed prior to any environmental stress tests must document the module condition so that any changes that occur during testing can be identified during the post-test inspection.

5.1.1 Visually inspect each module to determine the presence or absence of anomalies or defects. Do not use optical magnification. Such anomalies or defects should include, but are not limited to:

5.1.1.1 Shipping damage,

5.1.1.2 Poor workmanship,

5.1.1.3 Defects in mounting brackets or structures,

5.1.1.4 Cracking, shrinkage, distortion, or tacky surfaces of polymeric materials,

5.1.1.5 Failure of adhesive bonding,

5.1.1.6 Bubbles or delamination of encapsulant materials,

5.1.1.7 Presence of foreign material,

5.1.1.8 Corrosion of fasteners, mechanical members, or electrical circuit elements,

5.1.1.9 Voids in or corrosion of any thin-film photovoltaic layers,

5.1.1.10 Discoloration of superstrate encapsulating materials,

5.1.1.11 Discoloration of active photovoltaic elements,

5.1.1.12 Broken, cracked, etched, or torn external surfaces,

5.1.1.13 Broken or cracked active photovoltaic elements,

¹ This practice 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 Conversion.

Current edition approved April 10, 1996. Published May 1996.

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



5.1.1.14 Broken, cracked, or faulty electrical interconnections,

5.1.1.15 Cracked or damaged structural elements,

5.1.1.16 A photovoltaic cell touching another cell or the module frame,

5.1.1.17 Electrical terminals not bonded to the module or the module junction box,

5.1.1.18 Missing, illegible, or peeling identification labels or markings, and

5.1.1.19 Any additional anomalies or defects specified by the user of this practice that are evident.

5.1.2 Record the results of the visual inspection so that any changes that occur during subsequent testing can be identified. These records may be any combination of descriptions, diagrams, or images of any anomalies or defects noticed during the inspection. The location of any anomalies or defects must be unambiguously documented.

5.2 Post-Test Inspection:

5.2.1 Repeat 5.1.1.

5.2.2 Repeat 5.1.2. It is not necessary to record anomalies or defects that were previously documented in the pre-test inspec-

tion unless the anomalies or defects have visibly changed during the subsequent testing.

5.3 Comparison:

5.3.1 Compare the results of the pre- and post-test inspections to determine the visible effects of the environmental stress testing on the test samples.

6. Report

6.1 The report shall include the following items as a minimum:

6.1.1 Any anomalies or defects, in addition to the criteria of 5.1.1, that the inspections were required to document (see 5.1.1.19),

6.1.2 Results of both visual inspections as recorded in 5.1 and 5.2, and

6.1.3 Determination of the visible effects of the environmental stress testing from 5.3.

7. Keywords

7.1 energy; inspections; modules; photovoltaics; solar; testing; visual

ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.

This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org).