FLORIDA SOLAR ENERGY CENTER®

FSEC STANDARD

Operation of Photovoltaic Module Performance Certification Program

FSEC Standard 201- 05

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OPERATION OF PHOTOVOLTAIC MODULE PERFORMANCE CERTIFICATION PROGRAM

1.0 Introduction

The Solar Energy Standards Act of 1976, Section 377.705, Florida Statutes, effective October 1976, directs the Florida Solar Energy Center (FSEC) to develop standards for solar energy equipment sold or manufactured in the state, establish criteria for determining the performance of solar energy equipment, and maintain a test facility for evaluating solar energy equipment performance. It provides for FSEC to charge fees to cover the cost of testing and allows the acceptance of test results from other testing organizations.

The Solar Energy Standards Act was amended in 1978 to require that after January 1, 1980, all solar systems manufactured and sold in Florida must meet the standards of FSEC and shall display results of performance tests in a manner prescribed by FSEC.

In 2001, FSEC started a program to test and certify the performance of solar photovoltaic (PV) modules.

This standard was developed to ensure that solar energy equipment manufactured or sold within the state is effective and represents a high level of quality of materials, workmanship, and design. The use of this standard is expected to enhance consumer confidence and improve the design and sizing of PV systems, thereby improving reliability and cost-effectiveness.

2.0 Purpose

This document describes the operation of FSEC's PV module performance certification program and it describes the operational procedures for testing and certifying the power rating of photovoltaic (PV) modules by FSEC.

3.0 Scope and Limitations

This document describes the procedures for random selection of modules for test, customer notification and labeling for flat-plate PV module performance certification. Further, the requirements for requesting testing, module information, module submittal and acceptance of test results from other organizations are described.

The test methods and reporting procedures for PV module performance evaluation are discussed in document FSEC Standard 202 - 05 *Test Method for Photovoltaic Module Power Rating*.

4.0 References

ASTM E 1036-02 Standard Test Methods for Electrical Performance of Non-Concentrator Terrestrial Photovoltaic Modules and Arrays Using Reference Cells.

FSEC Standard 202-05 Test Method for Photovoltaic Module Power Rating

FSEC Fee Schedule for Testing and Certification

IEC 904-3 Measurement Principles for Terrestrial PV Solar Devices with Reference Spectral Irradiance Data.

IEC 60891 Procedures for Temperature and Irradiance Corrections to Measured I-V Characteristics of Crystalline Silicon Photovoltaic Devices.

5.0 Definitions

Model: A photovoltaic system or component that is characterized by a specified size, set of materials, configuration and performance. A change in any of these basic characteristics constitutes a new model.

Photovoltaic Module (flat-plate): The smallest environmentally protected essentially planar assembly of solar cells and ancillary parts, such as interconnections, terminals, and protective devices such as bypass diodes where the assembly is intended to generate dc power under unconcentrated sunlight. The structural (load carrying) member of a module can either be the top layer (superstrate), or the back layer (substrate).

Reference Cell (photovoltaic): A photovoltaic cell whose short circuit current is calibrated at the specified irradiance of a standard reference spectrum.

Reference Module (photovoltaic): A packaged assembly of one or more photovoltaic cells whose short circuit current is calibrated at the specified irradiance of a standard reference spectrum.

Short Circuit Current (of photovoltaic device): The current flowing between the positive and negative terminals under illumination, when the voltage across these terminals is zero.

AM 1.5 Standard Reference Spectrum: The solar spectral irradiance distribution (diffuse and direct) incident at sea level on a sun-facing 37 degree tilted surface from horizontal with precipitable water vapor at 14.2 mm, total ozone at 3.4 mm, and turbidity (base e, λ=0.5 μm) at 0.27.

Test Set (of PV modules): a selection of a particular model of photovoltaic modules that are used in performance testing. The modules in the test set must be identical in all respects, including PV cells, series-parallel connections, substrate, superstrate, encapsulating materials, framing, inter-cell wiring and terminals.

6.0 Application for Test of PV Modules

6.1 Test Application

An individual, company or corporation who desires to have PV modules tested for certification (the requestor) must first make application for testing. The application for testing and certifying PV module power ratings can be obtained from FSEC or its website www.fsec.ucf.edu. With the application for testing, the PV module manufacturer or supplier is required to provide the information as listed in Table 1. Partial or incomplete applications will not be accepted, but will be returned for the completion of the information requested. This information includes the identification of the module manufacturer, module type and model, module serial numbers (or distributor name, address and phone numbers) and reference module information.

6.2 Sample Size

Six (6) modules of a model are required to complete the sample size for a test set.

6.3 Random Selection

A random sample of any modules to be tested will be obtained by either of the following two methods:

- Serial numbers of at least 100 modules from each of three (3) separate production runs, will be submitted with the application. FSEC will then select a random set of modules for testing from the list provided.
- A list of at least three (3) distributors or retailers will be provided to FSEC from whom test modules may be obtained. FSEC will contact the distributors or retailers for a list of serial numbers of modules available. FSEC will then select a random set of modules for testing from the lists provided.

6.4 Similar Models

Models that incorporate changes that the manufacturer may consider insignificant may be submitted for consideration for certification with the test data from similar models. FSEC reserves the right to determine, for testing purposes, if the candidate model is similar or different from the previously tested model.

Thus, test results from one model may be used to certify a similar model if the cell type, manufacturing process, and encapsulation and enclosure materials are identical.

Any changes in either the PV cell type or manufacturing process will require re-testing of a test set of modules incorporating the changes.

6.5 Reference Module

FSEC maintains a set of calibrated reference modules for most PV cell types and commercial manufacturing processes. However, if the test set is of a type for which FSEC does not have a calibrated reference module, the requestor must supply a reference module that is spectrally matched to the test set modules. Two (2) independent accredited or national laboratories shall calibrate this reference module. The National Renewable Energy Laboratory (NREL) in Golden, Co. and Sandia National Laboratories (SNL) in Albuquerque, NM are two US laboratories that may perform this service.

7.0 Notification for Module Submittal

A staff member at FSEC will randomly select modules as defined in Section 6.3. When the application is complete, the test will be authorized by a test engineer and program director. Upon authorization, an invoice for testing fees will be sent to the requestor. The module manufacturer or supplier will be notified by FSEC to submit the selected modules for testing. An example of a notification form is provided in Table 2.

8.0 Test Standards and Fees

8.1 Test Standard

Module testing will be conducted in accordance with *FSEC Standard 202-05 Test Method for Photovoltaic Module Power Rating.*

At the completion of the test, the requestor will be provided a final test report and the test data may be posted on the FSEC web site. After the initial test is completed and with agreement by the requestor, test set modules may be utilized for long term outdoor exposure and may be retested periodically.

8.2 Testing Fees

Fees to cover the cost of testing, inspections and services performed may be charged by FSEC prior to testing of the modules. Fee amounts are stated in the *FSEC Fee Schedule*. FSEC may revise the fee schedule as deemed necessary to cover testing and associated costs.

9.0 Certification Labeling

When a PV module certification is completed, FSEC will notify the requestor in writing and will also identify the information required on the certification label. The manufacturer shall display this certification information by means of a label or by direct application on a nameplate.

The manufacturer will have the option of including the required label information using a label format supplied by FSEC, or the manufacturer may use its own designed label or nameplate. If the manufacturer chooses to design a label or nameplate, a sample of the label or nameplate must be submitted to FSEC for approval prior to placement on modules. The approved certification information must be permanently affixed to all production units of the certified model.

The certification symbol may be used in advertising, catalogs and sales promotion material only when each individual model for which the certification applies is clearly identified.

10.0 Acceptance of Test Results from Other Organizations

A PV module tested by an organization other than the Florida Solar Energy Center may be certified as meeting FSEC standards subject to the following provisions:

10.1 Testing by Organizations Other Than FSEC

Modules tested for power rating by the National Renewable Energy Laboratory (NREL) or the Sandia National Laboratory (SNL) will be considered to have been tested under standards equivalent to FSEC standards. Other Testing organizations must meet the following conditions:

a. Hold accreditation to ISO 17025 by a recognized accreditation organization;
b. Conduct testing in accordance with FSEC Standard 201-05, ASTM E1036-02, or IEC 904-3 and IEC 60891; and
c. Allow FSEC personnel to visit the test facility and observe test procedures.

10.2 Documentation Required for Tests by Organizations Other Than FSEC

A requestor for certification of a PV module which was tested by an organization other than FSEC shall:

a. Furnish the module information as required in Table 1;
b. Submit to FSEC a copy of the complete test report;
c. Furnish a statement, signed by a responsible official of the test laboratory that the module tested has met all the requirements of the appropriate test standard;
d. Sign the FSEC labeling agreement.

FSEC reserves the right to determine if a module submitted under this section meets all required provisions before acceptance of the power rating test results.

TABLE 1. REQUIRED INFORMATION

Submitted by (Requestor):

Name	
Title	
Company	
Phone #	
Address	
City, State, Zip	

Module Information:

Module Type and Model(s)	
UL Listed and Designation	
Cell Material	
Cell Junction (single, dual, triple)	
Cell Stringing (series x parallel)	
Module Dimensions (height x width x thickness)	
Module Weight	
Voltage Temperature Coefficient (1/^{o}C)	
Current Temperature Coefficient (1/^{o}C)	
Voltage Irradiance Correction Factor	
Date Manufactured	

Module Production Runs or Distributor Contact Information:

# 1	
# 2	
# 3	

Reference Module:

Type/Material	
Cell Identification / Serial No.	
Manufacturer	
Calibration Laboratory (NREL, SNLA)	
Calibration Procedure (E1039, E1125, E1362)	
Calibration Constant (Isc @ STC)	
Temperature Coefficient of Current (1/^{o}C)	
Date Last Calibrated	

Applicant Signature:_____ Date_____

Name_____Title_____

TABLE 2. NOTIFICATION FOR MODULE SUBMITTAL
(To be completed by the Florida Solar Energy Center)

Application Received by:	
Date:	
Application Accepted by:	
Fee or Donation:	
Modules Selected by:	

Serial Numbers of Selected Modules

Date Notified	Requestor	Test Engineer

Date modules expected at FSEC_____

Test authorized by

_____ Date_____ **_____Date:_____**
Test Engineer **Program Director**