

Photovoltaic (PV) module performance testing and energy rating - Part 2: Spectral responsivity, incidence angle and module operating temperature measurements

EESTI STANDARDI EESSÕNA

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See Eesti standard EVS-EN 61853-2:2016 sisaldab Euroopa standardi EN 61853-2:2016 ingliskeelset teksti.	This Estonian standard EVS-EN 61853-2:2016 consists of the English text of the European standard EN 61853-2:2016.
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ICS 27.160

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English Version

Photovoltaic (PV) module performance testing and energy rating -
Part 2: Spectral responsivity, incidence angle and module
operating temperature measurements
(IEC 61853-2:2016)

Essais de performance et caractéristiques assignées
d'énergie des modules photovoltaïques (PV) - Partie 2:
Mesurages de réponse spectrale, d'angle d'incidence et de
température de fonctionnement des modules
(IEC 61853-2:2016)

Prüfung des Leistungsverhaltens von photovoltaischen
(PV-)Modulen und Energiebemessung - Teil 2: Messung
der spektralen Empfindlichkeit, des Einfallswinkels und der
Modul-Betriebstemperatur
(IEC 61853-2:2016)

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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European foreword

The text of document 82/1133/FDIS, future edition 1 of IEC 61853-2, prepared by IEC/TC 82 "Solar photovoltaic energy systems" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61853-2:2016.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2017-07-11
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2019-10-11

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Endorsement notice

The text of the International Standard IEC 61853-2:2016 was approved by CENELEC as a European Standard without any modification.

Annex ZA

(normative)

Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60410	-	Sampling plans and procedures for inspection by attributes	-	-
IEC 60891	-	Photovoltaic devices - Procedures for temperature and irradiance corrections to measured I-V characteristics	EN 60891	-
IEC 60904-1	-	Photovoltaic devices - Part 1: Measurement of photovoltaic current-voltage characteristics	EN 60904-1	-
IEC 60904-2	-	Photovoltaic devices - Part 2: Requirements for photovoltaic reference devices	EN 60904-2	-
IEC 60904-5	-	Photovoltaic devices - Part 5: Determination of the equivalent cell temperature (ECT) of photovoltaic (PV) devices by the open-circuit voltage method	EN 60904-5	-
IEC 60904-8	-	Photovoltaic devices - Part 8: Measurement of spectral responsivity of a photovoltaic (PV) device	EN 60904-8	-
IEC 60904-9	-	Photovoltaic devices - Part 9: Solar simulator performance requirements	EN 60904-9	-
IEC 60904-10	-	Photovoltaic devices - Part 10: Methods of linearity measurement	EN 60904-10	-
IEC 61215	series	Terrestrial photovoltaic (PV) modules - Design qualification and type approval	EN 61215	series
IEC 61215-2	-	Terrestrial photovoltaic (PV) modules - Design qualification and type approval - Part 2: Test procedures	EN 61215-2	-
IEC 61646	-	Thin-film terrestrial photovoltaic (PV) modules - Design qualification and type approval	EN 61646	-

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 61853-1	2011	Photovoltaic (PV) module performance testing and energy rating - Part 1: Irradiance and temperature performance measurements and power rating	EN 61853-1	2011
ISO 9059	-	Solar energy - Calibration of field pyrheliometers by comparison to a reference pyrheliometer	-	-

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INTRODUCTION

Photovoltaic (PV) modules are typically rated at standard test conditions (STC) of 25 °C cell temperature, 1 000 W·m⁻² irradiance, and air mass (AM) 1.5 global (G) spectrum. However, the PV modules in the field operate over a range of temperatures, irradiance, and spectra. To accurately predict the energy production of the modules under various field conditions, it is necessary to characterize the modules at a wide range of temperatures, irradiances, angles of incidence, and spectra.

Recognizing this issue, IEC Technical Committee 82 Working Group 2 (TC 82/WG 2) has developed an appropriate power and energy rating standard (IEC 61853). The first part of this four-part standard requires the generation of a 23-element maximum power (P_{\max}) matrix at four different temperatures and seven different irradiance levels. The P_{\max} matrix can be generated using an indoor solar simulator method or outdoor natural sunlight method. The outdoor test method introduces little/no spectral mismatch error and is much less expensive than the indoor test method because it avoids the use of very expensive solar simulators. However, obtaining an accurate and repeatable P_{\max} matrix using the outdoor method over time (several months or years) would be extremely challenging.

This standard consists of four parts:

- IEC 61853-1: *Irradiance and temperature performance measurements and power rating*, which describes requirements for evaluating PV module performance in terms of power (watts) rating over a range of irradiances and temperatures;
- IEC 61853-2: *Spectral responsivity, incidence angle, and module operating temperature measurements*, which describes test procedures for measuring the effect of varying angle of incidence and sunlight spectra as well as the estimation of module temperature from irradiance, ambient temperature, and wind speed;
- IEC 61853-3¹: *Energy rating of PV modules*, which describes the calculations for PV module energy (watt-hours) ratings; and
- IEC 61853-4²: *Standard reference climatic profiles*, which describes the standard time periods and weather conditions that can be used for the energy rating calculations.

Included in the IEC 61853 series of standards are: test methods designed to map module performance over a wide range of temperature and irradiance conditions (IEC 61853-1); test methods to determine spectral responsivity, incidence angle effects and the module operating temperature all as functions of ambient conditions (IEC 61853-2); methods for evaluating instantaneous and integrated power and energy results including a method for stating these results in the form of a numerical rating (IEC 61853-3); and definition of reference irradiance and climatic profiles (IEC 61853-4).

IEC 61853-1 describes requirements for evaluating PV module performance in terms of power (watts) rating over a range of irradiances and temperatures. IEC 61853-2 describes procedures for measuring the performance effect of angle of incidence, the estimation of module temperature from irradiance, ambient temperature and wind speed, and impact of spectral responsivity on module performance. IEC 61853-3 describes the calculations of PV module energy (watt-hours) ratings. IEC 61853-4 describes the standard time periods and weather conditions that can be utilized for calculating energy ratings.

¹ Under preparation: Stage at the time of publication: IEC/ACDV 61853-3:2016.

² Under preparation: Stage at the time of publication: IEC/ACDV 61853-4:2016.