
Fotonapetostne naprave - 5. del: Določanje ekvivalentne temperature celice (ECT) fotonapetostnih (PV) naprav po metodi napetosti odprtih sponk (IEC 60904-5:2011)- Dopolnilo A1

Photovoltaic devices - Part 5: Determination of the equivalent cell temperature (ECT) of photovoltaic (PV) devices by the open-circuit voltage method

Photovoltaische Einrichtungen - Teil 5: Bestimmung der gleichwertigen Zellentemperatur von photovoltaischen (PV) Betriebsmitteln nach dem Leerlaufspannungs-Verfahren

Dispositifs photovoltaïques - Partie 5: Détermination de la température de cellule équivalente (ECT) des dispositifs photovoltaïques (PV) par la méthode de la tension en circuit ouvert

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English Version

Photovoltaic devices - Part 5: Determination of the equivalent cell temperature (ECT) of photovoltaic (PV) devices by the open-circuit voltage method
(IEC 60904-5:2011/AMD1:2022)

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(IEC 60904-5:2011/AMD1:2022)

This amendment A1 modifies the European Standard EN 60904-5:2011; it was approved by CENELEC on 2022-12-22. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this amendment the status of a national standard without any alteration.

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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

EN 60904-5:2011/A1:2022 (E)**European foreword**

The text of document 82/2069/FDIS, future IEC 60904-5/AMD1, prepared by IEC/TC 82 "Solar photovoltaic energy systems" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60904-5:2011/A1:2022.

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) 2023-09-22
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2025-12-22

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Any feedback and questions on this document should be directed to the users' national committee. A complete listing of these bodies can be found on the CENELEC website.

Endorsement notice

iTeh STANDARD PREVIEW

The text of the International Standard IEC 60904-5:2011/AMD1:2022 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated:

<https://standards.iteh.ai/catalog/standards/sist/1338af9f-6536-45e8-9402-60904-5-2011-a1-2023>
ISO 7214 NOTE Harmonized as EN ISO 7214

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 Where 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.

Add the following references:

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC/TS 60904-1-2	2019	Photovoltaic devices - Part 1-2: Measurement of current-voltage characteristics of bifacial photovoltaic (PV) devices	-	-
IEC 60904-3	-	Photovoltaic devices - Part 3: Measurement principles for terrestrial photovoltaic (PV) solar devices with reference spectral irradiance data	EN IEC 60904-3	-

Delete the following reference:

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
ISO/IEC 17025	-	General requirements for competence of testing and calibration laboratories	-	-



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INTERNATIONAL STANDARD

NORME INTERNATIONALE

AMENDMENT 1
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Dispositifs photovoltaïques –
Partie 5: Détermination de la température de cellule équivalente (ECT) des dispositifs photovoltaïques (PV) par la méthode de la tension en circuit ouvert

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

PHOTOVOLTAIC DEVICES –

Part 5: Determination of the equivalent cell temperature (ECT) of photovoltaic (PV) devices by the open-circuit voltage method**AMENDMENT 1**

FOREWORD

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Amendment 1 to IEC 60904-5:2011 has been prepared by IEC technical committee 82: Solar photovoltaic energy systems.

The text of this Amendment is based on the following documents:

Draft	Report on voting
82/2069/FDIS	82/2082/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Amendment is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications/.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

Add the following new text:

For modules with large thermal inertia such as glass-glass construction for BIPV applications, measurements become even more challenging with increased temperature difference between the cell and module external temperatures during transient conditions. In addition, for bifacial PV modules the temperature sensors may shade an active cell, potentially even creating local hotspots where sensors are located on effective cell areas.

<https://standards.iteh.ai/catalog/standards/sist/1338af9f-6536-45e8-9402->

NOTE 1 NMOT is defined as the equilibrium mean solar cell junction temperature within an open-rack mounted module operating near peak power, in the following standard reference environment:

- Tilt angle: $(37 \pm 5)^\circ$.
- Total irradiance: 800 W/m².
- Ambient temperature: 20 °C.
- Wind speed: 1 m/s.
- Electrical load: A resistive load sized such that the module will operate near its maximum power point at STC or an electronic maximum power point tracker (MPPT).

NOTE 2 NMOT is similar to the former NOCT except that it is measured with the module under maximum power rather than in open circuit. Under maximum power conditions (electric) energy is withdrawn from the module, therefore less thermal energy is dissipated throughout the module than under open-circuit conditions. Therefore NMOT is typically a few degrees lower than the former NOCT.

1 Scope and object

Replace the first paragraph with the following text:

This part of IEC 60904 describes the preferred method for determining the equivalent cell temperature (ECT) of PV devices (cells, modules and arrays of one type of module), for the purposes of comparing their thermal characteristics, determining NOCT (nominal operating cell temperature) or alternatively NMOT (nominal module operating temperature), and translating measured I-V characteristics to other temperatures.

2 Normative references

Add the following standards to the list of normative references:

IEC TS 60904-1-2:2019, *Photovoltaic devices – Part 1-2: Measurement of current-voltage characteristics of bifacial photovoltaic (PV) devices*

IEC 60904-3, *Photovoltaic devices – Part 3: Measurement principles for terrestrial photovoltaic (PV) solar devices with reference spectral irradiance data*

Delete the following standard from the list of normative references:

ISO/IEC 17025, *General requirements for competence of testing and calibration laboratories*

3.1 Principle

Replace the text of this subclause with the following new text:

Experience shows that the equivalent cell temperature can be determined more precisely by the method described herein than by any alternative technique [1]¹. However, increased variability and errors have been observed at irradiances below 400 W/m², so this method should only be used at irradiances above this threshold.

3.2 General measurement requirements

Add the following new text:

- a) Use of the ECT method requires calibration of the device to be measured.

NOTE It is not sufficient to use calibration of another device of the same type, because even small differences in parameters between a calibrated device and a similar one can lead to significant errors (e.g. 0,3 % variation in module V_{OC} leads to 1 °C impact on ECT temperature).

Renumber existing item a)1) as item b)1) as follows:

- 1) The variation of V_{OC} needs to be linear as defined in IEC 60904-10 with respect to temperature.

Replace item a)2) as item b)2) with the following new text:

- 2) The variation of V_{OC} with respect to irradiance needs to have a quadratic dependence on the logarithm of irradiance.

Delete items a)3) and a)4).

¹ Numbers in square brackets refer to the Bibliography.