



NSAI
Standards

Irish Standard
I.S. EN 60904-5:2011

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 (EQV))

I.S. EN 60904-5:2011

Incorporating amendments/corrigenda issued since publication:

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I.S. xxx: Irish Standard – national specification based on the consensus of an expert panel and subject to public consultation.

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EUROPEAN STANDARD

EN 60904-5

NORME EUROPÉENNE

EUROPÄISCHE NORM

April 2011

ICS 27.160

Supersedes EN 60904-5:1995

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)**

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
(CEI 60904-5:2011)

Photovoltaische Einrichtungen -
Teil 5: Bestimmung der gleichwertigen
Zellentemperatur von photovoltaischen
(PV) Betriebsmitteln nach dem
Leerlaufspannungs-Verfahren
(IEC 60904-5:2011)

This European Standard was approved by CENELEC on 2011-03-24. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

CENELEC

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

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I.S. EN 60904-5:2011

EN 60904-5:2011

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Foreword

The text of document 82/595/CDV, future edition 2 of IEC 60904-5, prepared by IEC TC 82, Solar photovoltaic energy systems, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60904-5 on 2011-03-24.

This European Standard supersedes EN 60904-5:1995.

The main technical changes with regard to EN 60904-5:1995 are as follows:

- added and updated normative references;
- added reporting section;
- added method on how to extract the input parameters;
- rewritten method on how to calculate ECT;
- reworked formulae to be in line with EN 60891.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN and CENELEC shall not be held responsible for identifying any or all such patent rights.

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 2011-12-24
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2014-03-24

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60904-5:2011 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 referenced documents are indispensable for the application 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 When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
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 reference solar devices	EN 60904-2	-
IEC 60904-7	-	Photovoltaic devices - Part 7: Computation of the spectral mismatch correction for measurements of photovoltaic devices	EN 60904-7	-
IEC 60904-10	-	Photovoltaic devices - Part 10: Methods of linearity measurement	EN 60904-10	-
IEC 61215	-	Crystalline silicon terrestrial photovoltaic (PV) modules - Design qualification and type approval	EN 61215	-
IEC 61829	-	Crystalline silicon photovoltaic (PV) array - On-site measurement of I-V characteristics	EN 61829	-
ISO/IEC 17025	-	General requirements for the competence of testing and calibration laboratories	EN ISO/IEC 17025	-

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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**

FOREWORD

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International Standard IEC 60904-5 has been prepared by IEC technical committee 82: Solar photovoltaic energy systems.

This second edition cancels and replaces the first edition, issued in 1993, and constitutes a technical revision.

The main technical changes with regard to the previous edition are as follows:

- added and updated normative references;
- added reporting section;
- added method on how to extract the input parameters;
- rewritten method on how to calculate ECT;
- reworked formulae to be in line with IEC 60891.

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

CDV	Report on voting
82/595/CDV	82/626/RVC

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

A list of all parts of IEC 60904 series, under the general title *Photovoltaic devices*, can be found on the IEC website.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

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

INTRODUCTION

When temperature sensors, such as thermocouples, are used to determine the cell temperature of PV devices under natural or simulated steady-state irradiance, two main problems arise. First, a considerable spread of temperature can be observed over the area of the module. Second, as the solar cells are usually not accessible, sensors are attached to the back of the module and the measured temperature thus is influenced by the thermal conductivity of the encapsulant and back materials. These problems are aggravated when determining the equivalent cell temperature for on-site measurements of array performance where all cells have slightly different temperatures and one cannot easily determine the average cell temperature.

The equivalent cell temperature (ECT) is the average temperature at the electronic junctions of the device (cells, modules, arrays of one type of module) which equates to the current operating temperature if the entire device were operating uniformly at this junction temperature.

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