SLOVENSKI STANDARD
SIST EN 60904-4:2010

01-februar-2010

Fotonapetostne naprave - 4. del: Postopki za vzpostavljanje sledljivosti kalibracije referenčnih sončnih naprav (IEC 60904-4:2009)

Photovoltaic devices -- Part 4: Procedure for establishing the traceability of the calibration of reference solar devices

Photovoltaische Einrichtungen - Teil 4: Referenz-Solarelemente - Verfahren zur Feststellung der Rückverfolgbarkeit der Kalibrierung

Dispositifs photovoltaïques -- Partie 4: Procédures pour établir la traçabilité de l'étalonnage des dispositifs solaires de référence

Ta slovenski standard je istoveten z: **EN 60904-4:2009**

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27.160	Sončna energija	Solar energy engineering

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 60904-4

November 2009

ICS 27.160

English version

Photovoltaic devices - Part 4: Reference solar devices - Procedures for establishing calibration traceability

(IEC 60904-4:2009)

Dispositifs photovoltaïques -
Partie 4: Dispositifs solaires de référence -
Procédures pour établir
la traçabilité de l'étalonnage
(CEI 60904-4:2009)

Photovoltaische Einrichtungen -
Teil 4: Referenz-Solarelemente -
Verfahren zur Feststellung
der Rückverfolgbarkeit der Kalibrierung
(IEC 60904-4:2009)

This European Standard was approved by CENELEC on 2009-09-01. 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.

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CENELEC

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

Central Secretariat: Avenue Marnix 17, B - 1000 Brussels

Ref. No. EN 60904-4:2009 E

Foreword

The text of document 82/533/CDV, future edition 1 of IEC 60904-4, prepared by IEC TC 82, Solar photovoltaic energy systems, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 60904-4 on 2009-09-01.

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)	2010-06-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2012-09-01

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60904-4:2009 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60891	NOTE	Harmonized as EN 60891:1994 (not modified).
IEC 60904-1	NOTE	Harmonized as EN 60904-1:2006 (not modified).
IEC 60904-3	NOTE	Harmonized as EN 60904-3:2008 (not modified).
IEC 60904-7	NOTE	Harmonized as EN 60904-7:2009 (not modified).
IEC 60904-8	NOTE	Harmonized as EN 60904-8:1998 (not modified).
IEC 60904-9	NOTE	Harmonized as EN 60904-9:2007 (not modified).
IEC 61836	NOTE	Harmonized as CLC/TS 61836:2009 (not modified).

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.

Publication	Year	Title	EN/HD	Year
IEC 60904-2	-[1)]	Photovoltaic devices - Part 2: Requirements for reference solar devices	EN 60904-2	2007[2)]
ISO/IEC 17025	-[1)]	General requirements for the competence of testing and calibration laboratories	EN ISO/IEC 17025	2005[2)]
ISO/IEC Guide 98-3	2008	Uncertainty of measurement - Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)	-	-
ISO 9059	-[1)]	Solar energy - Calibration of field pyrheliometers by comparison to a reference pyrheliometer	-	-
ISO 9846	-[1)]	Solar energy - Calibration of a pyranometer using a pyrheliometer	-	-

[1)] Undated reference.

[2)] Valid edition at date of issue.

IEC 60904-4

Edition 1.0 2009-06

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Photovoltaic devices – Part 4: Reference solar devices – Procedures for establishing calibration traceability

Dispositifs photovoltaïques – Partie 4: Dispositifs solaires de référence – Procédures pour établir la traçabilité de l'étalonnage

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 60904-4 has been prepared by IEC technical committee 82: Solar photovoltaic energy systems.

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

CDV	Report on voting
82/533/CDV	82/561/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.

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

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

The committee has decided that the contents of this publication will remain unchanged until the maintenance result 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.

PHOTOVOLTAIC DEVICES –

Part 4: Reference solar devices – Procedures for establishing calibration traceability

1 Scope and object

This part of IEC 60904 sets the requirements for calibration procedures intended to establish the traceability of photovoltaic reference solar devices to SI units as required by IEC 60904-2.

This standard applies to photovoltaic (PV) reference solar devices that are used to measure the irradiance of natural or simulated sunlight for the purpose of quantifying the performance of PV devices. The use of a PV reference solar device is required in the application of IEC 60904-1 and IEC 60904-3.

This standard has been written with single junction PV reference solar devices in mind, in particular crystalline Silicon. However, the main part of the standard is sufficiently general to include other technologies. The methods described in Annex A, however, are limited to single junction technologies.

2 Normative references

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.

IEC 60904-2, *Photovoltaic devices – Part 2: Requirements for reference solar devices*

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

ISO 9059, *Solar energy – Calibration of field pyrheliometers by comparison to a reference pyrheliometer*

ISO 9846, *Solar energy – Calibration of a pyranometer using a pyrheliometer*

ISO/IEC Guide 98-3: 2008, *Uncertainty of measurement – Part 3: Guide to the expression of uncertainty in measurement (GUM: 1995)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

NOTE The different reference instruments for the traceability chain of solar irradiance are defined in this Clause. Table 1 lists and compares them with those in use for time. Figure 1 shows schematically the most common traceability chains, based on the methods described in Annex A.

3.1
primary standard
a device, which implements physically one of the SI units or directly related quantities. They are usually maintained by national metrology institutes (NMIs) or similar organisations entrusted with maintenance of standards for physical quantities. Often referred to also just as the «primary», the physical implementation is selected such that long-term stability, precision

and repeatability of measurement of the quantity it represents are guaranteed to the maximum extent possible by current technology.

NOTE The World Radiometric Reference (WRR) as realized by the World Standard Group (WSG) of cavity radiometers is the accepted primary standard for the measurement of solar irradiance.

3.2
secondary standard
a device, which by periodical comparison with a primary standard, serves to maintain conformity to SI units at other places than that of the primary standard. It does not necessarily use the same technical principles as the primary standard, but strives to achieve similar long-term stability, precision and repeatability.

NOTE Typical secondary standards for solar irradiance are cavity radiometers which participate periodically (normally every 5 years) in the International Pyrheliometer Comparison (IPC) with the WSG.

3.3
primary reference
the reference instrument which a laboratory uses to calibrate secondary references. It is compared at periodic intervals to a secondary standard. Often primary references can be realised at much lower costs than secondary standards.

NOTE Typically a solar cell is used as a reference solar device for the measurement of natural or simulated solar irradiance.

3.4
secondary reference
the measurement device in use for daily routine measurements or to calibrate working references, calibrated at periodic intervals to a primary reference.

NOTE The most common secondary references for the measurement of natural or simulated solar irradiance are solar cells and solar modules.

3.5
traceability
the requirement for any PV reference solar device, to tie its calibration value to SI units in an unbroken and documented chain of calibration transfers including stated uncertainties.

NOTE The WRR has been compared twice to the SI radiometric scale and shown to be within their mutual uncertainty levels. Therefore traceability to WRR automatically provides traceability to SI units. However, the uncertainty of the ratio WRR/SI units needs to be taken into account. The World Radiation Center (WRC) recommends a rectangular uncertainty distribution with 0,3 % half-width. A third comparison is currently underway and should be published in the future.

J. Romero, N.P. Fox, C. Fröhlich *metrologia* **28** (1991) 125-8

J. Romero, N.P. Fox, C. Fröhlich *metrologia* **32** (1995/1996) 523-4