BS EN 62817:2015+A1:2017

BSI Standards Publication

Photovoltaic systems - Design qualification of solar trackers (IEC 62817:2014/A1:2017)

bsi.

National foreword

This British Standard is the UK implementation of EN 62817:2015+A1:2017. It is identical to IEC 62817:2014 including amendment 1:2017. It supersedes BS EN 62817:2015, which is withdrawn.

The text of IEC amendment 1:2017 has been provided in its entirety at the beginning of this document. BSI's policy of providing consolidated content remains unchanged; however, in the interest of expediency, in this instance BSI have chosen to collate the relevant content at the beginning of this document.

The UK participation in its preparation was entrusted to Technical Committee GEL/82, Photovoltaic Energy Systems.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Published by BSI Standards Limited 2018

ISBN 978 0 580 92309 8

ICS 27.160

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 July 2015.

Amendments/corrigenda issued since publication

Date	Text affected
30 April 2018	Implementation of IEC amendment 1:2017 with CENELEC endorsement A1:2017

EUROPEAN STANDARD

EN 62817:2015/A1

EUROPÄISCHE NORM

November 2017

ICS 27.160

English Version

Photovoltaic systems - Design qualification of solar trackers (IEC 62817:2014/A1:2017)

Systèmes photovoltaïques - Qualification de conception des suiveurs solaires (IEC 62817:2014/A1:2017)

Sonnen-Nachführeinrichtungen für photovoltaische Systeme - Bauarteignung (IEC 62817:2014/A1:2017)

This amendment A1 modifies the European Standard EN 62817:2015; it was approved by CENELEC on 2017-09-01. 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.

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

This amendment 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 CEN-CENELEC Management Centre 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, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

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

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN 62817:2015/A1:2017 E

European foreword

The text of document 82/1018/CDV, future edition 1 of IEC 62817:2014/A1:2017, prepared by IEC/TC 82 "Solar photovoltaic energy systems" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62817:2015/A1:2017.

The following dates are fixed:

• latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2018-06-01
• latest date by which the national standards conflicting with this document have to be withdrawn	(dow)	2020-09-01

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

Endorsement notice

The text of the International Standard IEC 62817:2014/A1:2017 was approved by CENELEC as a European Standard without any modification.

FOREWORD

This amendment has been prepared by IEC technical committee 82: Solar photovoltaic energy systems.

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

CDV	Report on voting
82/1018/CDV	82/1097/RVC

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

The committee has decided that the contents of this amendment and the base publication will remain unchanged until the stability date indicated on the IEC website 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.

7.3.3 Calibration of pointing error measurement tool

Add the following to 7.3.3

A procedure for calibration of pointing error measurement tool does not exist in this or any other IEC document. It is recommended that the pointing error measurement tool be calibrated at least once per year per the following:

Outdoor tracker pointing error sensor calibration procedure:

Apparatus and measurement requirements: Device for mounting and orienting the pointing error sensor (typically a solar tracker but other devices suffice), data acquisition system capable of measuring outputs of the pointing error sensor, recording the timestamp that is accurate to the true time within 2 s, visual verification of no clouds impinging the view of the sun during the entire measurement period (including thin cirrus clouds) or verification during the entire measurement period that the DNI varies no more than 2 % from maximum to minimum values recorded.

a) Determine the measurement range for which the calibration is desired. The maximum measurement range is the field of view of the sensor under calibration but a smaller measurement range can be used as applicable to the calibration.
b) Assume that ±1° is the measurement range for the calibration. Mount the sensor on the alignment device and adjust the position of the device so that the sensor is pointing approximately 1° (or other determined measurement range) ahead of the sun’s movement path in both axes of orientation. If the alignment device is a solar tracker, this means aligning the sensor with the solar tracker’s mounting plane and then moving the solar

tracker 1° ahead of the sun's position (in both axes). Fix the position of the alignment device (this means stopping movement of a solar tracker).

c) Start the data acquisition, recording both the timestamp and outputs of the pointing error sensor at a 10 s or shorter interval. Record data for the time period it takes for the sun to walk through the desired measurement range for each axis under calibration (for this example this is 2° of sun movement for the ±1° measurement range). The time necessary for the sun to move the desired range depends on the latitude/longitude of the measurement location, the day of the year, and the time of day. Input this information into the Solpos or SPA algorithms for determining sun location during the test period (freely available at http://www.nrel.gov/midc/srrl_bms/).

d) After completion of the data acquisition period, using the timestamp from the dataset, merge sun position data from the Solpos or SPA algorithms for both solar zenith and solar azimuth angle into the measured data set. Determine the solar zenith and azimuth positions for which the outputs of each axis of the pointing sensor correspond to zero pointing error (For most sensor designs this corresponds to a zero voltage output signal). Data points can be interpolated between to find the zero pointing error position. These azimuth and zenith positions should be recorded as the "fixed azimuth" and "fixed zenith" pointing position of the sensor for the calibration period.

e) Calculate the true azimuth and zenith pointing error for every data point in the data set as follows:

$$True\ Zenith\ Pointing\ Error = Zenith_{Solpos} - Zenith_{FixedPosition}$$

$$True\ Azimuth\ Pointing\ Error = (Azimuth_{Solpos} - Azimuth_{FixedPosition}) \cdot Sine(Zenith_{Solpos})$$

Note that the *True Azimuth Pointing Error* is an approximation which is only valid as $(Azimuth_{Solpos} - Azimuth_{FixedPosition})$ approaches 0. For cases where values of $(Azimuth_{Solpos} - Azimuth_{FixedPosition})$ are less than 5 and where $Zenith_{Solpos}$ is more than 3, the error of the approximation is less than 0,0001°. Generally speaking achieving the conditions for such low error is achievable.

f) Plot the *True Zenith Pointing Error* against the corresponding sensor output for the zenith axis. The sensor manufacturer shall establish the details of the final output signal to be used for the calibration plots as some sensors have a single signal while others that have multiple signals that together are used for determining the measured pointing error. Plot the *True Azimuth Pointing Error* against the corresponding sensor output for the azimuth axis. For both plots apply a linear fit to the data set. Report the fit coefficients and the standard deviation of the slope. The slope is the calibration factor between the output signal and the pointing error in degrees. Note that the calibration procedure presented here is a relative measurement of the sensor's ability to represent a change in pointing error with a change in its output and does not prove absolute pointing error. Also, the calibration procedure is described in terms of azimuth and zenith as this relates to the Solpos and SPA algorithms but the calibration coefficients apply to the two generic axes of the sensor that can be mounted on various tracker configurations.

8.4.4 Torsional stiffness, mechanical drift, drive torque, and backlash testing

8.4.4.2 Procedure, paragraph preceding Option a)

In this paragraph, replace the last three sentences with the following text:

Assuming the tracker has a horizontal stow position, the stow moment coefficient derived from third-party wind tunnel or field test data shall be for the tracker in a position 3° from horizontal. This deviation from horizontal accounts for potential deviations from stow to the true horizontal position and for minor variations in ground slope in otherwise flat areas. Wind tunnel testing shall demonstrate establishment of a representative atmospheric boundary layer which includes turbulence that accounts for the normal deviations in wind flow from purely horizontal. Wind tunnel data shall be collected at the 3° tilt position, unless the said tracker cannot achieve this position. In such an event, the wind tunnel testing and derivation of the moment coefficient shall be performed at the nearest position to horizontal that the tracker can achieve.

NOTE The tilt position for extreme moment testing was changed from 10° to 3°, as the original 10° was deemed overly conservative. Appropriate wind tunnel atmospheric boundary layers already account for deviations from horizontal wind flows which the 10° was originally claimed to take into account.

8.5 Environmental testing

8.5.2 Procedure

Replace the existing item a) with the following new item a):

a) Temperature cycle (no humidity added to the air) where inclusion of dust is recommended as follows but is not required: at least 40 cycles and 480 h shall be completed. The maximum temperature shall be 55 °C and the minimum temperature shall be –20 °C. If the operational temperature range specified in Table 1 (see 6.12.1) indicates the tracker can operate outside –20 °C to 55 °C, then the temperature range of this test shall be expanded to coincide with the specified values. In other words, –20 °C to 55 °C can be considered the minimum test conditions, but more extreme values shall be applied to align with the specification sheet. The cycle shall dwell for at least 5 min, but not more than 15 min, at ±3 °C of the maximum and minimum temperatures per average surface temperature measurements at three distinct points on the drive train. The temperature measurement points shall be documented and have justification supporting that surface measurements are on an object with significant thermal mass in relation to the system under test. For the first 240 h, dust should be circulated around the dynamic mechanical interfaces of the drive train. When dust is included in the test, A4 dust per ISO 1203-1 shall be used (contains distribution of both fine and coarse particles). A temporary structure can be used to contain the region of circulating dust, as opposed to circulating dust in the entire environmental chamber. A blower or other mechanism shall be used to ensure that dust is circulating in the air. Because dust will settle and collect on surfaces, it may be necessary to periodically add additional dust to the blower system through the course of the 240 h. Video, photographs, or other methods shall document that dust is visible in the air at 10 min intervals throughout the test. An alternate option is to complete the 240 h of dust testing at a steady temperature after the onset of the 480 h of temperature cycling. The combination of the dust and temperature cycling is recommended because it shortens test time and because temperature cycles can cause expansion and contraction of seals and other parts that may enhance the ability for dust to penetrate into places that can ultimately lead to failure. The alternate option is provided, because facilities may not be readily available that can combine both tests, or such a test could be prohibitively expensive. The test report shall clearly indicate if dust testing was or was not completed.

EUROPEAN STANDARD EN 62817

EUROPÄISCHE NORM March 2015

ICS 27.160

English Version

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Systèmes photovoltaïques - Qualification de conception des suiveurs solaires (IEC 62817:2014)

Sonnen-Nachführeinrichtungen für photovoltaische Systeme - Bauarteignung (IEC 62817:2014)

This European Standard was approved by CENELEC on 2014-09-29. 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.

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Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN 62817:2015 E

The text of document 82/853/FDIS, future edition 1 of IEC 62817, prepared by IEC/TC 82 "Solar photovoltaic energy systems" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62817:2015.

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)	2015-09-13
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2017-09-29

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Endorsement notice

The text of the International Standard IEC 62817:2014 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.

Publication	Year	Title	EN/HD	Year
IEC 60068-2-6	-	Environmental testing -- Part 2-6: Tests - Test Fc: Vibration (sinusoidal)	EN 60068-2-6	-
IEC 60068-2-21	-	Environmental testing -- Part 2-21: Tests - Test U: Robustness of terminations and integral mounting devices	EN 60068-2-21	-
IEC 60068-2-27	-	Environmental testing -- Part 2-27: Tests - Test Ea and guidance: Shock	EN 60068-2-27	-
IEC 60068-2-75	-	Environmental testing -- Part 2-75: Tests - Test Eh: Hammer tests	EN 60068-2-75	-
IEC 60529	-	Degrees of protection provided by enclosures (IP Code)	-	-
IEC 60904-3	2008	Photovoltaic devices -- Part 3: Measurement principles for terrestrial photovoltaic (PV) solar devices with reference spectral irradiance data	EN 60904-3	2008
IEC 61000-4-5	2005	Electromagnetic compatibility (EMC) -- Part 4-5: Testing and measurement techniques - Surge immunity test	EN 61000-4-5	2006
IEC 62262	2002	Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)	EN 62262	2002
ISO 12103-1	-	Road vehicles_- Test dust for filter evaluation_- Part_1: Arizona test dust	-	-
ISO/IEC 17025	-	General requirements for the competence of testing and calibration laboratories	EN ISO/IEC 17025	-

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BS EN 62817:2015

INTERNATIONAL ELECTROTECHNICAL COMMISSION

PHOTOVOLTAIC SYSTEMS – DESIGN QUALIFICATION OF SOLAR TRACKERS

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 62817 has been prepared by IEC technical committee 82: Solar photovoltaic energy systems.

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

FDIS	Report on voting
82/853/FDIS	82/877/RVD

Full information on the voting for the approval of this international 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.

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.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

BS EN 62817:2015

PHOTOVOLTAIC SYSTEMS – DESIGN QUALIFICATION OF SOLAR TRACKERS

1 Scope and object

This International Standard is a design qualification standard applicable to solar trackers for photovoltaic systems, but may be used for trackers in other solar applications. The standard defines test procedures for both key components and for the complete tracker system. In some cases, test procedures describe methods to measure and/or calculate parameters to be reported in the defined tracker specification sheet. In other cases, the test procedure results in a pass/fail criterion.

The objective of this design qualification standard is twofold.

First, this standard ensures the user of the said tracker that parameters reported in the specification sheet were measured by consistent and accepted industry procedures. This provides customers with a sound basis for comparing and selecting a tracker appropriate to their specific needs. This standard provides industry-wide definitions and parameters for solar trackers. Each vendor can design, build, and specify the functionality and accuracy with uniform definition. This allows consistency in specifying the requirements for purchasing, comparing the products from different vendors, and verifying the quality of the products.

Second, the tests with pass/fail criteria are engineered with the purpose of separating tracker designs that are likely to have early failures from those designs that are sound and suitable for use as specified by the manufacturer. Mechanical and environmental testing in this standard is designed to gauge the tracker's ability to perform under varying operating conditions, as well as to survive extreme conditions. Mechanical testing is not intended to certify structural and foundational designs, because this type of certification is specific to local jurisdictions, soil types, and other local requirements.

2 Normative references

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.

IEC 60068-2-6, *Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-21, *Environmental testing – Part 2-21: Tests – Test U: Robustness of terminations and integral mounting devices*

IEC 60068-2-27, *Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock*

IEC 60068-2-75, *Environmental testing – Part 2-75: Tests – Test Eh: Hammer tests*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 60904-3:2008, *Photovoltaic devices – Part 3: Measurement principles for terrestrial photovoltaic (PV) solar devices with reference spectral irradiance data*

IEC 61000-4-5:2005, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*