ICS 27.160 SLOVENSKÁ TECHNICKÁ NORMA September 2023

STN	**Fotovoltické energetické systémy Detegovanie a prerušenie jednosmerného oblúka**	**STN EN IEC 63027** 36 4623

Photovoltaic power systems - DC arc detection and interruption

Táto norma obsahuje anglickú verziu európskej normy.
This standard includes the English version of the European Standard.

Táto norma bola oznámená vo Vestníku ÚNMS SR č. 08/23

Obsahuje: EN IEC 63027:2023, IEC 63027:2023

obsahuje farebné strany

137252

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN IEC 63027

June 2023

ICS 27.160

English Version

Photovoltaic power systems - DC arc detection and interruption (IEC 63027:2023)

Systèmes photovoltaïques - Détection et interruption d'arc en courant continu (IEC 63027:2023)

Gleichstrom-Lichtbogenerfassung und -Unterbrechung in photovoltaischen Energiesystemen (IEC 63027:2023)

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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 CEN-CENELEC Management Centre has the same status as the official versions.

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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

Ref. No. EN IEC 63027:2023 E

European foreword

The text of document 82/2112/FDIS, future edition 1 of IEC 63027, prepared by IEC/TC 82 "Solar photovoltaic energy systems" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 63027:2023.

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)	2024-03-07
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2026-06-07

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.

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

The text of the International Standard IEC 63027:2023 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 standard indicated:

IEC 62606:2013	NOTE Approved as EN 62606:2013 (not modified)
IEC 62606:2013/AMD1:2017	NOTE Approved as EN 62606:2013/A1:2017 (not modified)
IEC 62606:2013/AMD2:2022	NOTE Approved as EN 62606:2013/A2:2022 (not modified)[1]

[1] Under preparation. Stage at the time of publication: EN 62606:2023/FprA2:2022.

Annex A
(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.cencenelec.eu.

Publication	Year	Title	EN/HD	Year
IEC 60730-1	2013	Automatic electrical controls - Part 1: General requirements	EN 60730-1	2016
+ A1	2015		+ A1	2019
+ A2	2020		+ A2	2022
IEC 60947-1	2020	Low-voltage switchgear and controlgear - Part 1: General rules	EN IEC 60947-1	2021
IEC 60947-3	2020	Low-voltage switchgear and controlgear - Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units	EN IEC 60947-3	2021
IEC 61508	series	Functional safety of electrical/electronic/programmable electronic safety-related systems	EN 61508	series
IEC 62109-1	2010	Safety of power converters for use in photovoltaic power systems - Part 1: General requirements	-	-
IEC/TS 61836	2016	Solar photovoltaic energy systems - Terms, definitions and symbols	-	-

IEC 63027

Edition 1.0 2023-05

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Photovoltaic power systems – DC arc detection and interruption

Systèmes photovoltaïques – Détection et interruption d'arc en courant continu

IEC 63027:2023-05(en-fr)

IEC 63027

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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Photovoltaic power systems – DC arc detection and interruption

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INTERNATIONAL
ELECTROTECHNICAL
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ELECTROTECHNIQUE
INTERNATIONALE

ICS 27.160

ISBN 978-2-8322-6743-1

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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PHOTOVOLTAIC POWER SYSTEMS – DC ARC DETECTION AND INTERRUPTION

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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IEC 63027 has been prepared by IEC technical committee 82: Solar photovoltaic energy systems. It is an International Standard.

The text of this International Standard is based on the following documents:

Draft	Report on voting
82/2112/FDIS	82/2133/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 International Standard 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/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.

IMPORTANT – The "colour inside" logo on the cover page of this document 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.

INTRODUCTION

This document provides requirements and testing procedures for arc-fault protection devices used in PV systems to reduce the risk of igniting an electrical fire.

A PV system contains a number of distributed DC sources (PV modules) and circuits. In AC systems series arc durations are limited by the alternating current crossing through zero ampere twice per cycle. In DC systems the arcing current may be constant and longer arc durations are expected. In contrast to a centralized power supply, where in case of a fault the circuit is disconnected at the connection to the supply, a PV system is made up of distributed power supplies which cannot disconnect circuits in a single location. For extinguishing series arcs, however, the location of the arc within the circuit is irrelevant as long as the current is interrupted. This arc fault protection may be located inside the inverter, on array circuits, subarray circuits, string circuits, or at the module level. Therefore, this document provides a range of test setups to cover the expected system topologies.

In PV systems earth fault protection is required according to the IEC installation standards. Moreover, single core cables with double or reinforced insulation are required (except ELV systems). Consequently, the risk of parallel arcs is quite low because in most cases an earth fault occurs first. As such, this document does not address requirements or testing for parallel arc detection. The larger risk for PV systems comes from series arcs, therefore the focus of this document is to provide requirements and tests for arc fault protection equipment to ensure that most series arcs in a PV system will be detected.

Many arc fault detectors detect arcs by analyzing and comparing the arc's HF signal emission. These devices may trip due to external disturbances from other equipment connected to the PV array, e.g. the inverter. Therefore, interoperability needs to be evaluated. Other external influences such as radio signals, sparks from trams, and load switching, among others, may also cause nuisance tripping. These causes are a performance issue and therefore not addressed by this document.

Arc fault detectors for PV systems have been introduced as a requirement in the USA since the 2011 U.S. National Electrical Code was published. This led to the development of a PV arc-fault protection product standard, UL 1699B. Experience derived from these documents and their application in the USA has been used as a basis for this document. This document was written in parallel to the maintenance of UL 1699B. Both writing teams considered the work of each other and aligned requirements as much as possible, including the dimensions of the electrodes.

Arc fault detectors have been mandatory for many years in the USA for certain AC installations. Within the IEC, arc fault detectors required according to IEC 62606 have been introduced for certain locations for AC circuits. For PV circuits there was no IEC product standard available. This document therefore now provides test procedures for PV system arc fault detectors, where required by installation standards.

This document was written for the special needs and characteristics of PV systems. The unique aspects of PV DC sources (group of distributed sources, current behavior, dependency to irradiance, system impedance, etc.) differ considerably from other DC sources and applications. Therefore, this PV specific standard was necessary, and equipment compliant to this document is not suitable for other DC sources and applications.

PHOTOVOLTAIC POWER SYSTEMS – DC ARC DETECTION AND INTERRUPTION

1 Scope

This document applies to equipment used for the detection and optionally the interruption of electric DC arcs in photovoltaic (PV) system circuits. The document covers test procedures for the detection of series arcs within PV circuits, and the response times of equipment employed to interrupt the arcs.

The document defines reference scenarios according to which the testing is conducted. This document covers equipment connected to systems not exceeding a maximum PV source circuit voltage of 1 500 V DC.

The detection of parallel circuit arcs is not covered in this document. This document is not applicable to DC sources or applications other than PV DC sources.

NOTE Parallel arc detection may be considered for a future edition.

2 Normative references

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.

IEC 60730-1:2013, *Automatic electrical controls – Part 1: General requirements*
IEC 60730-1:2013/AMD1:2015
IEC 60730-1:2013/AMD2:2020

IEC 60947-1:2020, *Low-voltage switchgear and controlgear – Part 1: General rules*

IEC 60947-3:2020, *Low-voltage switchgear and controlgear – Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units*

IEC 61508 (all parts), *Functional safety of electrical/electronic/programmable electronic safety-related systems*

IEC TS 61836:2016, *Solar photovoltaic energy systems – Terms, definitions and symbols*

IEC 62109-1:2010, *Safety of power converters for use in photovoltaic power systems – Part 1: General requirements*