Photovoltaic (PV) arrays – Design requirements
0 National Foreword

This draft Tanzania Standard has been prepared by the TBS Renewable Energy Technical Committee, under the supervision of the Electrotechnical Divisional Standards Committee (EDC). This draft Tanzania Standard is an adoption of the International Standard IEC 62548:2016 Photovoltaic (PV) arrays – Design requirements which has been prepared by the International Electrotechnical Commission.

1 Terminology and conventions

Some terminologies and certain conventions are not identical with those used in Tanzania standards; attention is drawn especially to the following:

1) The comma has been used as a decimal marker for metric dimensions. In Tanzania Standards, it is current practice to use "full point" on the baseline as the decimal marker.

2) Where the words “International Standard(s)” appear, referring to this standard they should read “Tanzania Standard(s)".
Photovoltaic (PV) arrays – Design requirements

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

PHOTOVOLTAIC (PV) ARRAYS – DESIGN REQUIREMENTS

FOREWORD

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International Standard IEC 62548 has been prepared by IEC technical committee 82: Solar photovoltaic energy systems.

This International Standard cancels and replaces the first edition of IEC TS 62548 published in 2013.

This International Standard includes the following significant technical changes with respect to IEC TS 62548:

a) provisions for systems including DC to DC conditioning units;

b) considerable revision of Clause 6 on safety issues which includes provisions for protection against electric shock including array insulation monitoring and earth fault detection.
The text of this document is based on the following documents:

<table>
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<th>Report on voting</th>
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<td>82/1149/FDIS</td>
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Full information on the voting for the approval of this document can be found in the report on voting indicated in the above table.

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

Attention is drawn to the co-existence of IEC 60364-7-712 and IEC 62548. Both standards have been developed in close coordination by different technical committees.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://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 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.
PHOTOVOLTAIC (PV) ARRAYS –
DESIGN REQUIREMENTS

1 Scope and object

This International Standard sets out design requirements for photovoltaic (PV) arrays including DC array wiring, electrical protection devices, switching and earthing provisions. The scope includes all parts of the PV array up to but not including energy storage devices, power conversion equipment or loads. An exception is that provisions relating to power conversion equipment are covered only where DC safety issues are involved. The interconnection of small DC conditioning units intended for connection to PV modules are also included.

The object of this document is to address the design safety requirements arising from the particular characteristics of photovoltaic systems. Direct current systems, and PV arrays in particular, pose some hazards in addition to those derived from conventional AC power systems, including the ability to produce and sustain electrical arcs with currents that are not greater than normal operating currents.

In grid connected systems, the safety requirements of this document are however critically dependent on the inverters associated with PV arrays complying with the requirements of IEC 62109-1 and IEC 62109-2.

Installation requirements are also critically dependent on compliance with the IEC 60364 series (see Clause 4).

PV arrays of less than 100 W and less than 35 V DC open circuit voltage at STC are not covered by this document.

PV arrays in grid connected systems connected to medium or high voltage systems are not covered in this document. Variations and additional requirements for large-scale ground mounted PV power plants with restricted access to personnel will also be addressed in IEC TS 62738.

Additional requirements may be needed for more specialized installations, for example concentrating systems, tracking systems or building integrated PV.

The present international standard also includes extra protection requirements of PV arrays when they are directly connected with batteries at the DC level.

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 60228, Conductors of insulated cables

IEC 60269 -6, Low-voltage fuses – Part 6: Supplementary requirements for fuse-links for the protection of solar photovoltaic energy systems

1 Under preparation. Stage at the time of publication: IEC 2CD 62738.
IEC 60287 (all parts), Electric cables – Calculation of the current rating

IEC 60364-1, Low-voltage electrical installations – Part 1: Fundamental principles, assessment of general characteristics, definitions

IEC 60364-4 (all parts), Low-voltage electrical installations – Part 4: Protection for safety

IEC 60364-41:2005, Low-voltage electrical installations – Part 4-41: Protection for safety – Protection against electric shock

IEC 60364-5 (all parts), Electrical installations of buildings – Part 5: Selection and erection of electrical equipment

IEC 60364-5-52, Low-voltage electrical installations – Part 5-52: Selection and erection of electrical equipment – Wiring systems

IEC 60364-5-54, Low-voltage electrical installations – Part 5-54: Selection and erection of electrical equipment – Earthing arrangements and protective conductors

IEC 60364-6, Low-voltage electrical installations – Part 6: Verification

IEC 60445:2010, Basic and safety principles for man-machine interface, marking and identification – Identification of equipment terminals, conductor terminations and conductors

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

IEC 60898-2, Circuit-breakers for overcurrent protection for household and similar installations – Part 2: Circuit-breakers for a.c. and d.c. operation

IEC 60947 (all parts), Low-voltage switchgear and controlgear

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

IEC 60947-2, Low-voltage switchgear and controlgear – Part 2: Circuit-breakers

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

IEC 61215 (all parts), Terrestrial photovoltaic (PV) modules – Design qualification and type approval

IEC 61557-2, Electrical safety in low voltage distribution systems up to 1 000 V a.c. and 1500V d.c.– Equipment for testing, measuring or monitoring of protective measures – Part 2: Insulation resistance

IEC 61557-8, Electrical safety in low voltage distribution systems up to 1 000 V a.c. and 1500V d.c.– Equipment for testing, measuring or monitoring of protective measures – Part 8: Insulation monitoring devices for IT systems

IEC 61643-21, Low-voltage surge protective devices – Part 21: Surge protective devices connected to telecommunications and signalling networks – Performance requirements and testing methods

IEC 61643-22, Low-voltage surge protective devices – Part 22: Surge protective devices connected to telecommunications and signalling networks – Selection and application principles
3 Terms, definitions, symbols and abbreviated terms

3.1 Terms, definitions and symbols

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at http://www.iso.org/obp

3.1.1 blocking diode
diode connected in series with module(s), panel(s), sub-arrays and array(s) to block reverse current into such module(s), panel(s), sub-array(s) and array(s)

3.1.2 bonding conductor
conductor provided for functional or protective equipotential bonding

3.1.3 bypass diode
diode connected across one or more cells in the forward current direction to allow the module current to bypass shaded or broken cells to prevent hot spot or hot cell damage resulting from the reverse voltage biasing from the other cells in that module