



# TECHNICAL SPECIFICATION



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**Photovoltaic (PV) systems – Requirements for testing, documentation and maintenance –  
Part 3: Photovoltaic modules and plants – Outdoor infrared thermography**

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

### **PHOTOVOLTAIC (PV) SYSTEMS – REQUIREMENTS FOR TESTING, DOCUMENTATION AND MAINTENANCE –**

#### **Part 3: Photovoltaic modules and plants – Outdoor infrared thermography**

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- the subject is still under technical development or where, for any other reason, there is the future but no immediate possibility of an agreement on an International Standard.

Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC TS 62446-3, which is a technical specification, has been prepared by IEC technical committee 82: Solar photovoltaic energy systems.

The text of this technical specification is based on the following documents:

Enquiry draft	Report on voting
82/1188/DTS	82/1242A/RVDTS

Full information on the voting for the approval of this technical specification 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.

A list of all parts in the IEC 62446 series, published under the general title *Photovoltaic (PV) systems – Requirements for testing, documentation and maintenance*, can be found on the IEC website.

The committee has decided that the contents of this 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

- transformed into an International standard,
- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

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## **PHOTOVOLTAIC (PV) SYSTEMS – REQUIREMENTS FOR TESTING, DOCUMENTATION AND MAINTENANCE –**

### **Part 3: Photovoltaic modules and plants – Outdoor infrared thermography**

#### **1 Scope**

This part of IEC 62446 defines outdoor thermographic (infrared) inspection of PV modules and plants in operation. The inspection can include cables, contacts, fuses, switches, inverters, and batteries. This inspection supports the preventive maintenance for fire protection, the availability of the system for power production, and the inspection of the quality of the PV modules. Included in this document are the requirements for the measurement equipment, ambient conditions, inspection procedure, inspection report, personnel qualification and a matrix for thermal abnormalities as a guideline for the inspection.

This document defines outdoor thermography on photovoltaic (PV) modules and Balance-of-system (BOS) components of PV power plants in operation, using passive techniques (standard system operating conditions under natural sunlight, without any external power or irradiation sources). IEC 60904-12-1 covers general methods for laboratory or production-line PV module thermographic imaging but not the specific details that are most relevant to outdoor imaging of operational power plants including BOS components.

Two different levels of inspections are currently used:

- a) A simplified thermographic inspection. This is a limited inspection to verify that the PV modules and BOS components are functioning, with reduced requirements for the qualification of personnel. For example, during a basic commissioning of a PV plant. Authoritative conclusions regarding module quality are not possible with this inspection, and examples of abnormalities are provided to aid the inspector.
- b) A detailed thermographic inspection and analysis. This may include thermal signatures which differ from the examples provided, and therefore requires a deeper understanding of the thermal abnormalities. For example, it may be used for periodic inspections according to the IEC 62446 series and for trouble-shooting the cause of underperforming systems. Absolute temperature measurements may be made. An authorized expert in PV plants, together with thermography experts can perform the inspection.

#### **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 60050-131, *International Electrotechnical Vocabulary – Part 131: Circuit theory*

IEC 60216-2, *Electrical insulating materials – Thermal endurance properties – Part 2: Determination of thermal endurance properties of electrical insulating materials – Choice of test criteria*

IEC 60216-5, *Electrical insulating materials – Thermal endurance properties – Part 5: Determination of relative thermal endurance index (RTE) of an insulating material*

IEC 60269-1, *Low-voltage fuses – Part 1: General requirements*

IEC 61095, *Electromechanical contactors for household and similar purposes*

IEC 61215-1, *Terrestrial photovoltaic (PV) modules – Design qualification and type approval – Part 1: Test requirements*

IEC 61439-1, *Low-voltage switchgear and controlgear assemblies – Part 1: General rules*

IEC 61724-1, *Photovoltaic system performance – Part 1: Monitoring*

IEC 61730-1, *Photovoltaic (PV) module safety qualification –Part 1: Requirements for construction*

IEC 61730-2, *Photovoltaic (PV) module safety qualification –Part 1: Requirements for testing*

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

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

IEC 62446-1, *Photovoltaic (PV) systems – Requirements for testing, documentation and maintenance – Part 1: Grid connected systems – Documentation, commissioning tests and inspection*

IEC 62446-2:–, *Photovoltaic (PV) systems – Requirements for testing, documentation and maintenance – Part 2: Grid connected photovoltaic (PV) systems – Maintenance of PV systems<sup>1</sup>*

IEC 62930:–, *Electric cables for photovoltaic systems with a voltage rating of 1,5 kV d.c.<sup>1</sup>*

ISO 9488, *Solar energy – Vocabulary*

ISO 9712, *Non-destructive testing — Qualification and certification of NDT Personnel*

VATh- Directive, *Electrical Infrared Inspections – Low Voltage. Planning, execution and documentation of infrared surveys on electrical systems and components ≤1kV* ([http://www.vath.de/docs/richtlinien/VATh-Richtlinie\\_Elektro\\_NS+PV\\_engl\\_web.pdf](http://www.vath.de/docs/richtlinien/VATh-Richtlinie_Elektro_NS+PV_engl_web.pdf))

EN 16714-3, *Non-destructive testing – Thermographic testing of electric installations*

EN 50110-1, *Operation of electrical installations – Part 1: General requirements*

DGUV BGV/GUV-V A3 E, *Accident prevention regulations, Electrical installations and equipment*

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<sup>1</sup> To be published.