

# TECHNICAL SPECIFICATION

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Terrestrial photovoltaic (PV) systems – Guidelines for effective quality assurance in PV systems installation, operation and maintenance  
**ITIH STANDARD PREVIEW  
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IEC TS 63049:2017

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INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**TERRESTRIAL PHOTOVOLTAIC (PV) SYSTEMS –  
GUIDELINES FOR EFFECTIVE QUALITY ASSURANCE  
IN PV SYSTEMS INSTALLATION, OPERATION AND MAINTENANCE**

## FOREWORD

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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.

Technical Specification IEC 63049 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
82/1234/DTS	82/1283A/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.

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- withdrawn,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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## INTRODUCTION

It is frequently observed that problems with PV systems may be related to the system installation in one of multiple ways. Successful completion and continuous operation of PV systems depend on appropriate training of workers, appropriate oversight of their work, and a continual improvement system to learn from identified problems.

In order to supplement multiple IEC standards for qualification of the components and to guide the design of systems, it is useful to have oversight of the installation process. Some installation companies use an ISO 9001 quality management system, but this is a relatively uncommon practice and those that do certify to ISO 9001 may omit some critical elements. Similarly, after completion of the installation, practices for operation and maintenance of a PV system vary widely with variable success.

This document was created to identify critical technical elements that should be included in Quality Assurance programs and, where useful, to provide more specific management requirements than are found in ISO 9001. This document is designed to be implemented as a self-contained certification or in conjunction with ISO 9001.

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# TERRESTRIAL PHOTOVOLTAIC (PV) SYSTEMS – GUIDELINES FOR EFFECTIVE QUALITY ASSURANCE IN PV SYSTEMS INSTALLATION, OPERATION AND MAINTENANCE

## 1 Scope

This document provides the minimum activities deemed necessary to implement an effective Quality Assurance program for the managing and reducing of risk in the installation and operation of photovoltaic (PV) systems. This document defines requirements for certifying that an entity has and uses a Quality Assurance program to prevent, or reduce errors and learns from any new errors in:

- a) installation, and
- b) operation and maintenance of a PV system.

The object of this document is to provide more confidence in the performance and reliability of certified PV systems. By being installed and operated under a Quality Assurance program in accordance with this document, PV systems are expected to operate as designed and as expected based on product warranties.

This document is developed to facilitate implementation of the quality control scheme under the IECRE program, for those who choose to use the IECRE program ("IEC system for certification to standards relating to equipment for use in renewable energy applications").

NOTE This document has been written primarily to apply to large PV plants and similar schemes. Requirements for residential systems and smaller scale installers are being considered for a future version of this document. This document also assumes these requirements apply to the prime contractor who, in turn, is responsible to hold subcontractors and other service providers to the intent of these requirements.

This document is applicable to all PV systems independent of design and technology, i.e. flat panel, Concentrator Photovoltaic (CPV). Quality controls for CPV and nonconventional flat-plate systems will differ somewhat from those of more conventional designs; this document has not considered these differences and is expected to be generally applicable to all PV systems.

This document covers processes starting from the shipment of components out to the installation site and including the transport, unpacking, racking, construction, module installation process and processes associated with operation and maintenance of the PV system.

Compliance to a Quality Management System (QMS) such as ISO 9001 will meet many requirements in this document. The requirements that are unique to this document can be combined with the ISO 9001 audits for those organizations that are already registered to ISO 9001:2015. For the organizations who do not have ISO 9001 registration by a certified body, the entirety of this document applies.

Assessments with respect to this document may be completed to certify a Quality Assurance program for the installation process, for operations and maintenance processes or for both processes.

Clause 4 describes requirements for the installation process; Clause 5 describes requirements for operation and maintenance.

Maintenance of PV systems is often lumped into the catchall term "operations and maintenance" (O&M) This document does not address business or management operational

processes (e.g. forecasting, utility pricing incentives, etc.) or other considerations driven by factors outside of basic system working condition, safety and performance.

## 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 60364 (all parts), *Low-voltage electrical installations*

IEC 60364-7-712, *Low voltage electrical installation – Part 7-712: Requirements for special installations or locations – Solar photovoltaic (PV) power supply systems*

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

IEC TS 61724-2, *Photovoltaic system performance – Part 2: Capacity evaluation method*

IEC TS 61724-3, *Photovoltaic system performance – Part 3: Energy evaluation method*

IEC 61730 (all parts), *Photovoltaic (PV) module safety qualification*

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

IEC 62109 (all parts), *Safety of power converters for use in photovoltaic power systems*

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

IEC 62446-2, *Photovoltaic (PV) systems – Requirements for testing, documentation and maintenance – Part 2: Grid connected PV systems – Maintenance of PV systems (to be published)*

IEC 62446-3, *Photovoltaic (PV) systems – Requirements for testing, documentation and maintenance – Part 3: Photovoltaic modules and plants – Outdoor infrared thermography*

IEC 62548, *Photovoltaic (PV) arrays – Design requirements*

IEC TS 62738, *Ground-mounted photovoltaic power plants – Design guidelines and recommendations*

IEC 62759-1, *Photovoltaic (PV) modules – Transportation testing – Part 1: Transportation and shipping of module package units*

IEC TS 62915, *Photovoltaic (PV) modules – Retesting for type approval, design and safety qualification*

IEC TS 62941, *Terrestrial photovoltaic (PV) modules – Guideline for increased confidence in PV module design qualification and type approval*

ISO 9000, *Quality management systems – Fundamentals and vocabulary*

ISO 9001:2015, *Quality management systems – Requirements*

ISO 19011, *Guidelines for auditing management systems*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions in ISO 9000, IEC TS 61836 and the following apply.

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

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

#### 3.1

##### **condition adverse to quality**

all-inclusive term used in reference to any of the following: failures, malfunctions, deficiencies, defective items, and non-conformances; such a condition is significant if, uncorrected, it could have a serious effect on safety or operability

### 4 Requirements for PV system installation

#### 4.1 Records requirements

##### 4.1.1 Records system

A records system(s) shall be established by the organization responsible prior to the start of installation activities. Requirements of local standards or regulations for documentation need to be considered to determine minimum documentation for PV systems.

The organization shall define the controls needed for the identification, storage, protection, retrieval, retention and disposition of records.

Records established to provide evidence of conformity to requirements and of the effective operation of the Quality Assurance program shall be controlled.

Records shall remain legible, readily identifiable and retrievable.

##### 4.1.2 Generation of records

The applicable design specifications, procurement documents, contract documents, test procedures, operational procedures, or other documents shall specify the records to be generated, supplied, or retained by or for the project owner.

Documented information that is designated to become records shall be accurate, and completed appropriate to the work accomplished.

##### 4.1.3 Record validation

Documented information shall be considered to be valid records only if stamped, initialled, or signed and dated by authorized personnel or otherwise authenticated, e.g. electronically validated.

## 4.2 Resource management

### 4.2.1 Training programs

#### 4.2.1.1 General

The organization shall maintain a (periodic) training program for all personnel (not just employees) involved with the design and installation of PV projects. In addition to safety, professional, and other requirements, training should include familiarity with relevant sections of the technical photovoltaic documents described in Annex A and methods for handling modules.

#### 4.2.1.2 Records requirements

Documented information of employee training relevant to the installation project shall include the type of training and date of completion.

### 4.2.2 Succession planning

The organization shall plan for succession for key functions that affect customer satisfaction, quality, reliability, safety, and performance, including the installation engineer.

## 4.3 PV system installation

### 4.3.1 General

The organization is required to implement the requirements in accordance with this document for the needed planning and development of processes for PV system installation.

In planning PV system installation, the organization shall determine the following, as appropriate:

- a) quality objectives and requirements for the installation;
- b) the need to establish processes and documents, and to provide resources specific to the installation;
- c) required verification, validation, monitoring, measurement, inspection and test activities specific to the installation and the criteria for installation acceptance;
- d) records needed to provide evidence that the installation processes and the completed installation meet requirements.

The output of this planning shall be in a form suitable for the organization's method of operations.

### 4.3.2 Project management

As appropriate to the organization and the project, the organization shall plan and manage PV system installation in a structured and controlled manner to meet requirements at acceptable risk, within resource and schedule constraints.

### 4.3.3 Determination of requirements

#### 4.3.3.1 General

The organization shall consider requirements and guidelines contained in IEC 62548, IEC TS 62738, IEC 60364, IEC 60364-7-712, and local codes, as applicable. The final requirements shall be documented.

The installation processes shall reflect lessons learned from root cause analysis of problems with previous PV systems, and response to customer complaints or other experience with