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Distributed energy resources connection with the grid -
Part 2: Additional requirements for PV generation systems

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FOREWORD

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IEC TS 62786-2 has been prepared by IEC technical committee 8: System aspects of electrical energy supply. It is a Technical Specification.

The text of this Technical Specification is based on the following documents:

Draft	Report on voting
8/1756/DTS	8/1790/RVDTS

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 Technical Specification 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.

A list of all parts in the IEC 62786 series, published under the general title *Distributed energy resources connection with the grid*, can be found on the IEC website.

This document is to be read in conjunction with IEC TS 62786-1:2023

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– withdrawn, or
– revised.

INTRODUCTION

The use of solar photovoltaic energy systems or photovoltaic generating systems (PV systems) has been expanding rapidly around the world as one of distributed energy resources (DER). While the growing adoption of PV systems has benefits such as CO_2 reduction, the intermittent power supply characteristic of PV systems raises concerns about the power imbalance in the power network as well as about the instability of electric power networks showing up as voltage fluctuations and frequency deviations.

However, not only can PV systems convert the solar power to electricity, which is fed into the electric power networks, but PV systems can also provide operational functions which support the stability, reliability, and efficiency of electric power networks. Moreover, PV systems can also operate autonomously and are able to respond rapidly to the local conditions of the electrical power network as well as effectively participate in the management of electrical power networks by exchanging information with system operators and other DER.

In 2017, IEC TS 62786 Ed.1, which specified the general requirements for connecting DER to the electrical power network networks, was published. During the development of IEC TS 62786 Ed. 1, it has been recognised that standardization should address the requirements for the specific types of DER. That was because TC82 proposed in 2016 to develop a standard on grid connection requirements for solar photovoltaic energy systems on the basis of IEC TS 62786 and to publish it as a sub-part of IEC TS 62786. Consequently, JWG10 was established under TC8 in 2018, and JWG10 held a kick-off meeting with TC82 and TC120 in March 2018 and agreed to start the development of the TS 62786 series.

In October 2018, JWG10 proposed a new standardization policy for the TS 62786 series so that the TS 62786 series would have a hierarchical structure. The top layer is Part 1 of the TS 62786 series, which specifies general technical requirements for DER relevant to grid connection such as power control and grid protection functions. Additionally, TS 62786-1 specifies new requirements regarding interoperability to implement information exchange for remote monitoring, control and configuration. In October 2021, TC8 CAG agreed on the hierarchical structure of the TS 62786 series, and it was agreed that each technical committee can define testing provisions for evaluating the performance of its own product by referring to the TS 62786 series.

As shown in Figure 1, consolidating other IEC documents which specify requirements relevant to grid connection, Part 2 of TS 62786 supplements TS 62786-1. Moreover, Part 2 adds detailed required specifications for PV systems to provide the bridge between requirements for PV systems and power conversion equipment which constitutes these systems.

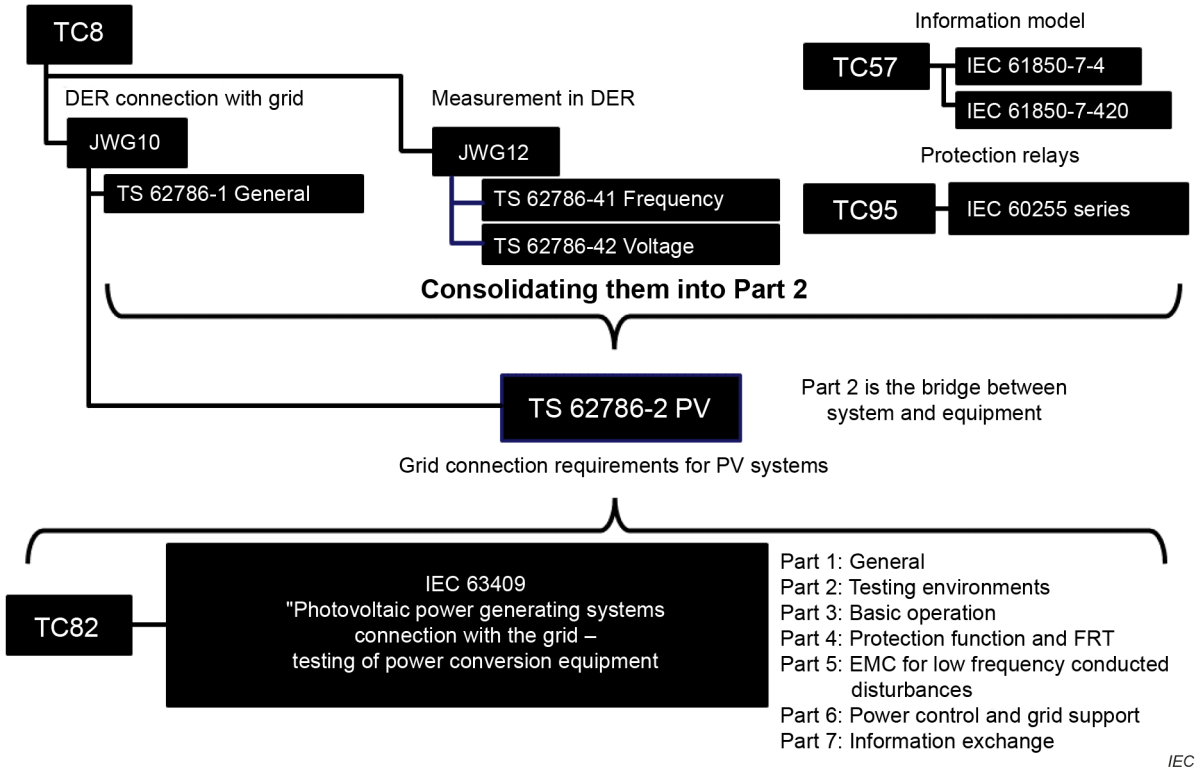

Figure 1 – Overview of IEC documents relevant to the grid connection of PV systems

1 Scope

This part of the IEC TS 62786 series supplements IEC TS 62786-1, and specifies requirements for the connection of the solar photovoltaic energy system or photovoltaic generating system (PV system) with an electric power network, or the network. This document covers all sizes of PV systems connected to low voltage or medium voltage power networks and gives typical requirements for various sizes of PV systems.

In this document, requirements for grid-connected PV systems are applied to those categorized as grid tied, grid tied with storage and grid tied with storage and back up. Mini-grid and Micro-grid are out of scope. Those types of PV systems with possible elements are described in 4.3.

This document specifies the following technical requirements for the PV system:

– reference points of requirements,
– elements and configuration,
– basic operation,
– protection and fault ride through function,
– power control and grid support function,
– electromagnetic compatibility for low frequency conducted disturbances,
– information exchange for remote monitoring, control, and configuration.

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 60050-901:2013, *International Electrotechnical Vocabulary (IEV) – Part 901: Standardization*

IEC 60255-127, *Measuring relays and protection equipment – Part 127: Functional requirements for over/under voltage protection*

IEC 60255-181, *Measuring relays and protection equipment – Part 181: Functional requirements for frequency protection*

IEC 61000-2-2:2002, *Electromagnetic compatibility (EMC) – Part 2-2: Environment – Compatibility levels for low-frequency conducted disturbances and signalling in public low-voltage power supply systems*

IEC 61000-2-4:2024, *Electromagnetic compatibility (EMC) – Part 2-4: Environment – Compatibility levels in power distribution systems in industrial locations for low-frequency conducted disturbances*

IEC 61000-2-12, *Electromagnetic compatibility (EMC) – Part 2-12: Environment – Compatibility levels for low-frequency conducted disturbances and signalling in public medium-voltage power supply systems*

IEC 61000-4-27, *Electromagnetic compatibility (EMC) – Part 4-27: Testing and measurement techniques – Unbalance, immunity test for equipment with input current not exceeding 16 A per phase*

Bibliography

IEC 60375, *Conventions concerning electric circuits*

IEC 61000-4-11, *Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests for equipment with input current up to 16 A per phase*

IEC 61000-4-13, *Electromagnetic compatibility (EMC) – Part 4-13: Testing and measurement techniques – Harmonics and interharmonics including mains signalling at a.c. power port, low frequency immunity test*

IEC 61000-4-19, *Electromagnetic compatibility (EMC) – Part 4-19: Testing and measurement techniques – Test for immunity to conducted, differential mode disturbances and signalling in the frequency range 2 kHz to 150 kHz at a.c. power ports*

IEC 61000-4-28, *Electromagnetic compatibility (EMC) – Part 4-28: Testing and measurement techniques – Variation of power frequency, immunity test for equipment with input current not exceeding 16 A per phase*

IEC 61000-4-34, *Electromagnetic compatibility (EMC) – Part 4-34: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests for equipment with mains current more than 16 A per phase*

IEC 61557-12, *Electrical safety in low voltage distribution systems up to 1 000 V AC and 1 500 V DC – Equipment for testing, measuring or monitoring of protective measures – Part 12: Power metering and monitoring devices (PMD)*

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

IEC 61850-7-4, *Communication networks and systems for power utility automation – Part 7-4: Basic communication structure – Compatible logical node classes and data object classes*

IEC 61850-7-420, *Communication networks and systems for power utility automation – Part 7-420: Basic communication structure – Distributed energy resources and distribution automation logical nodes*

IEC TR 61850-90-7:2023, *Communication networks and systems for power utility automation – Part 90-7: Object models for power converters in distributed energy resources (DER) systems*

IEC 62053-23, *Electricity metering equipment – Particular requirements – Part 23: Static meters for reactive energy (classes 2 and 3)*

IEC TS 62786-3, *Distributed energy resources connection with the grid – Part 3 Additional requirements for Stationary Battery Energy Storage System*

IEC TS 62786-41, *Distributed energy resources connection with the grid – Part 41: Requirements for frequency measurement used to control distributed energy resources (DER) and loads*

EN 50549-10:2022, *Requirements for generating plants to be connected in parallel with distribution networks – Part 10: Tests for conformity assessment of generating units*

IEEE 1547.1-2020, *IEEE Standard Conformance Test Procedures For Equipment Interconnecting Distributed Energy Resources With Electric Power Systems And Associated Interfaces*

AS/NZS 4777.2:2020, *Grid connection of energy systems via inverters, Part 2: Inverter requirements*

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