



TECHNICAL SPECIFICATION

Distributed energy resources connection with the grid

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 29.240.01

ISBN 978-2-8322-4218-6

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD.....	4
1 Scope and object.....	6
2 Normative references	6
3 Terms and definitions	6
4 Requirements on generating plants	11
4.1 General.....	11
4.2 Connection scheme	12
4.3 Choice of switchgear.....	12
4.3.1 General	12
4.3.2 Interface switch	12
4.4 Normal operating range	12
4.4.1 General	12
4.4.2 Operating frequency range	12
4.4.3 Operating voltage range	13
4.5 Immunity to disturbances	13
4.5.1 General	13
4.5.2 Rate of change of frequency (ROCOF) immunity	13
4.5.3 Under voltage ride through (UVRT) requirements	13
4.5.4 Over voltage ride through (OVRT) requirements	14
4.6 Active power response to frequency deviation.....	14
4.7 Reactive power response to voltage variations and voltage changes.....	15
4.7.1 General	15
4.7.2 Reactive power control	15
4.7.3 Dynamic reactive power support capabilities.....	15
4.8 EMC and power quality	15
4.8.1 General	15
4.8.2 Direct current (DC) injection	16
4.9 Interface protection.....	16
4.10 Connection and start to generate electrical power.....	17
4.10.1 General	17
4.10.2 Connection of synchronous generators	17
4.10.3 Auto reclose of distribution lines	17
4.11 Active power management.....	18
4.12 Monitoring, control and communication	18
4.12.1 Monitoring and control	18
4.12.2 Communication.....	18
5 Conformance tests	18
Annex A (normative) Operating frequency range.....	19
Annex B (normative) Operating voltage range.....	20
Annex C (normative) Under voltage ride through capability of DERs	21
Annex D (normative) Over voltage ride through parameters	22
Bibliography.....	23
Figure 1 – Electricity generating plant connected to a distribution network (schematic view of switches)	10
Figure 2 – Under voltage ride through capability requirements of DER.....	14

Table 1 – Operating frequency requirements of DERs..... 13

Table 2 – Operating voltage requirements of DERs..... 13

Table 3 – Interface protection functions 17

Table A.1 – Continuous operating frequency range..... 19

Table A.2 – Limited operating frequency range 19

Table B.1 – Continuous operating voltage range..... 20

Table B.2 – Limited operating voltage range 20

Table C.1 – UVRT capability of DERs with an interface to the grid based on a synchronous generator 21

Table C.2 – UVRT capability of DERs with an interface to the grid based on non-synchronous generators (eg. converters, DFIG, etc.) 21

Table D.1 – Medium voltage OVRT requirements..... 22

INTERNATIONAL ELECTROTECHNICAL COMMISSION

DISTRIBUTED ENERGY RESOURCES CONNECTION WITH THE GRID

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.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

The main task of IEC technical committees is to prepare International Standards. In exceptional circumstances, a technical committee may propose the publication of a technical specification when

- the required support cannot be obtained for the publication of an International Standard, despite repeated efforts, or
- 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 62786 has been prepared by IEC Technical Committee 8: System aspects for electrical energy supply.

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

Enquiry draft	Report on voting
8/1439/DTS	8/1457/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.

DISTRIBUTED ENERGY RESOURCES CONNECTION WITH THE GRID

1 Scope and object

This technical specification provides principles and technical requirements for distributed energy resources (DERs) connected to the distribution network. It applies to the planning, design, operation and connection of DERs to distribution networks. It includes general requirements, connection scheme, choice of switchgear, normal operating range, immunity to disturbances, active power response to frequency deviation, reactive power response to voltage variations and voltage changes, EMC and power quality, interface protection, connection and start to generate electrical power, active power management, monitoring, control and communication, and conformance tests.

This document specifies interface requirements for connection of generating plants with the distribution network operating at a nominal frequency of 50 Hz or 60 Hz.

DERs include distributed generation and permanently connected electrical energy storage in the form of synchronous generators, asynchronous generators, converters, etc., connected to the medium voltage (MV) or low voltage (LV) distribution network.

NOTE Mobile electrical energy storage devices (e.g. electrical vehicles) are under consideration for future editions.

The requirements of this document can be superseded by laws and regulations where applicable.

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 61000 (all parts), *Electromagnetic compatibility (EMC)*

IEC TS 62749, *Assessment of power quality – Characteristics of electricity supplied by public networks*