

# TECHNICAL SPECIFICATION

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Distributed energy resources connection with the grid

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IEC TS 62786:2017

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## 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

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**DISTRIBUTED ENERGY RESOURCES  
CONNECTION WITH THE GRID**

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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

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# 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.

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The requirements of this document can be superseded by laws and regulations where applicable.

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## 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*

## 3 Terms and definitions

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:

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

### 3.1

#### **black start**

start up of an electric power system from a blackout through internal energy resources



### 3.2

#### **converter-type generator**

generator that produces electrical power and is connected to the distribution network via a converter, including doubly-fed induction machines

### 3.3

#### **distributed energy resource**

##### **DER**

generators, including loads having a generating mode (such as electrical energy storage systems) connected to the low or medium voltage distribution network, with their auxiliaries, protection and connection equipment

### 3.4

#### **distribution network**

electric power network for the distribution of electric power from and to network users for which a distribution system operator (DSO) is responsible

### 3.5

#### **distribution system operator**

##### **DSO**

party operating a distribution network

Note 1 to entry: In some countries, a DSO is also referred to as DNO (distribution network operator).

[SOURCE: IEC 60050-617:2009, 617-02-10, modified – Note 1 to entry has been added]

### 3.6

#### **flicker**

impression of unsteadiness of visual sensation induced by a light stimulus whose luminance or spectral distribution fluctuates with time

Note 1 to entry: Flicker can be calculated by short term indicator  $P_{st}$  and long term indicator  $P_{lt}$ .

[SOURCE: IEC 60050-161:1990, 161-08-13, modified – Note 1 to entry has been added]

### 3.7

#### **fundamental frequency**

frequency of the fundamental component of a periodic quantity

Note 1 to entry: For the purpose of this document, the fundamental frequency is the same as the power supply frequency, e.g. 50 Hz or 60 Hz.

[SOURCE: IEC 60050-103, 103-07-21, modified – Note 1 to entry has been added]

### 3.8

#### **fundamental component**

sinusoidal component of Fourier series of periodic quantity having the frequency of the quantity itself

[SOURCE: IEC 60050-103, 103-07-19]

### 3.9

#### **generating unit**

indivisible set of equipment whose primary purpose is to generate electrical power

### 3.10

#### **generating plant**

group of generating units including auxiliaries connected to one POC

**3.11****harmonic frequency**

frequency of a harmonic component

[SOURCE: IEC 60050-103:2009, 103-07-26]

**3.12****harmonic component**

sinusoidal component of Fourier series of a periodic quantity, the harmonic order of which is an integer number greater than one

Note 1 to entry: A component of harmonic  $n$  (with  $n > 1$ ) is generally designated  $n^{\text{th}}$  harmonic. the designation of the fundamental component as "1<sup>st</sup> harmonic" is not recommended.

[SOURCE: IEC 60050-103:2009, 103-07-25]

**3.13****interface protection**

combination of protection relay functions which opens the interface switch of a generating unit and prevents its closure, whichever is appropriate, in the case of:

- a fault on the electric power network;
- an unintentional islanding situation;
- voltage and frequency being outside continuously operating ranges

**3.14****interharmonic frequency**

frequency which is a non-integer multiple of the reference fundamental frequency

Note 1 to entry: By extension from harmonic order, the interharmonic order is the ratio of an interharmonic frequency to the fundamental frequency. This ratio is not an integer (recommended notation: "m").

Note 2 to entry: In the case where  $m < 1$ , the term subharmonic frequency may be used.

[SOURCE: IEC 60050-551:2001, 551-20-06, modified – Note 1 to entry and Note 2 to entry have been added]

**3.15****interharmonic component**

sinusoidal component of a periodic quantity having an interharmonic frequency

Note 1 to entry: Its value is normally expressed as an r.m.s. value.

Note 2 to entry: For brevity, such a component may be referred to simply as an "interharmonic".

[SOURCE: IEC 60050-551:2001, 551-20-08, modified – The existing note has been deleted and Note 1 to entry and Note 2 to entry have been added]

**3.16****long-term flicker indicator**

measure of flicker evaluated over a specified time interval of a relatively long duration, using successive values of the short-term flicker indicator

Note 1 to entry: The duration is typically 2 hours, using 12 successive values of  $P_{st}$ , in accordance with IEC 61000-4-15.

[SOURCE: IEC 60050-161:1990, 161-08-19]

**3.17****low voltage****LV**

set of voltage levels used for the distribution of electricity and whose upper limit is generally accepted to be 1 000 V for alternating current

[SOURCE: IEC 60050-601:1985, 601-01-26]

**3.18****medium voltage****MV**

any set of voltage levels lying between low and high voltage

Note 1 to entry: The boundaries between medium and high voltage levels that overlap and depend on local circumstances as well as history or common usage. Nevertheless the band 1 kV to 35 kV is considered as the accepted medium voltage boundary.

Note 2 to entry: Because of existing network structures, boundary between MV and HV can be different from country to country.

[SOURCE: IEC 60050-601:1985, 601-01-28, modified – The existing note has been modified and Note 2 to entry has been added]

**3.19****point of connection****POC**

physical connection point on the distribution network where a generating plant is connected

**3.20****power factor**

under periodic conditions, ratio of the absolute value of the active power  $P$  to the apparent power  $S$ :

$$\lambda = \frac{|P|}{S}$$

Note 1 to entry: Under sinusoidal conditions, the power factor is the absolute value of the active factor.

[SOURCE: IEC 60050-131:2002, 131-11-46]

**3.21****rapid voltage changes****RVC**

quick transition (that may last several cycles) in r.m.s. voltage between two steady-state conditions while the voltage stays within the thresholds defined for voltage swells and dips

Note 1 to entry: RVC is expressed by the relative steady state voltage change or by a maximum r.m.s. voltage change aggregated over several cycles.

**3.22****short term flicker indicator**

measure of flicker evaluated over a specified time interval of a relatively short duration

Note 1 to entry: The duration is typically 10 minutes, in accordance with IEC 61000-4-15.

[SOURCE: IEC 60050-161:1990, 161-08-18]

**3.23****short-time withstand current**

the current that a circuit or a switching device in the closed position can carry during a specified short time under prescribed conditions of use and behaviour

[SOURCE: IEC 60050-441:2000, 441-17-17]

**3.24  
system operator**

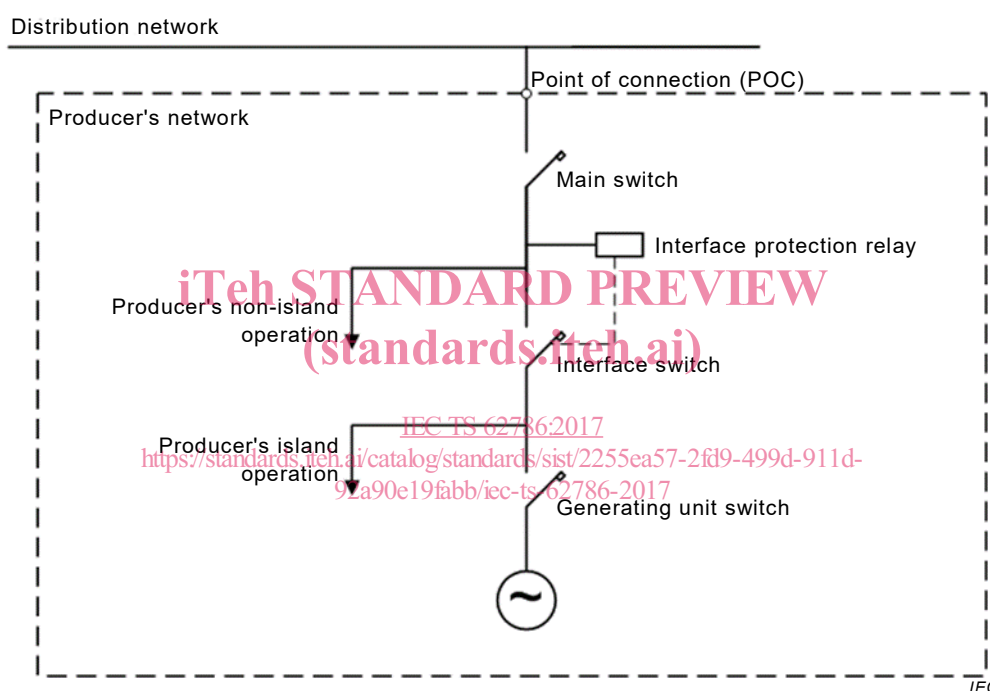
party responsible for safe and reliable operation of a part of the electric power system in a certain area and for connection to other parts of the electric power system

[SOURCE: IEC 60050-617:2009, 617-02-09]

**3.25  
switch**

device for changing the electric connections among its terminals

[SOURCE: IEC 60050-151:2001, 151-12-22]



**Figure 1 – Electricity generating plant connected to a distribution network (schematic view of switches)**

**3.26  
main switch**

switch installed as close as possible to the point of connection, for protection against internal faults and disconnection of the whole plant from the distribution network

Note 1 to entry: See also Figure 1.

**3.27  
interface switch**

switch (circuit breaker, switch or contactor) installed in the producer's network, for separating the part(s) of the producer's network containing at least one generation unit from the distribution network

Note 1 to entry: See also Figure 1.

Note 2 to entry: In some situations, the interface switch may be used to enable island operation of part of the producer's network, if technically feasible.