

TECHNICAL SPECIFICATION

Solar photovoltaic energy systems – Terms, definitions and symbols

Withdrawn



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CONTENTS

FOREWORD.....	3
INTRODUCTION.....	5
1 Scope and object.....	6
2 Normative references	6
3 Glossary of terms and symbols for solar photovoltaic energy systems	6
3.1 Solar photovoltaic cells and modules.....	6
3.2 Solar photovoltaic systems components	16
3.3 Solar photovoltaic systems.....	21
3.4 Solar photovoltaic system and component performance parameters.....	32
3.5 Measurement devices.....	50
3.6 Environmental parameters.....	51
3.7 Quality and testing	59
3.8 Concentrator photovoltaics.....	64
3.9 Project management	66
3.10 Miscellaneous	67
4 Acronyms and abbreviations.....	67
Bibliography.....	70
Index of terms and symbols.....	72

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**SOLAR PHOTOVOLTAIC ENERGY SYSTEMS –
TERMS, DEFINITIONS AND SYMBOLS**

FOREWORD

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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 61836, which is a technical specification, has been prepared IEC technical committee 82: Solar photovoltaic energy systems.

This second edition cancels and replaces the first edition published in 1997. This edition constitutes a technical revision.

This edition included the following significant technical changes with respect to the previous edition:

1) The number of terms has increased. Abbreviations have been included.

2) The terms in Edition 2 are organised into categories and families. Terms contained in families are cross referenced with an alphabetical listing. A bibliography and an index were added. The purpose of aggregating terms into families is to allow readers to easily see the relationships between terms that speak of similar quantities and subjects but that have slight variations.

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

Enquiry draft	Report on voting
82/442/DTS	82/487/RVC

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 publication 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 maintenance result date indicated on the IEC web site 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 edition of this document may be issued at a later date.

INTRODUCTION

Following the development of solar photovoltaic (PV) technology, specific Standards have been prepared by IEC Technical Committee 82 since 1987. The terms and symbols used in the PV industry necessitate a systematisation in order to have a consolidated glossary for experts' common understanding.

This Glossary lists the terms and symbols that the PV industry commonly uses. It is a living document that will change as new terms and symbols are added. These have been harmonized with IEC 60050 and other IEC documents as far as possible. All definitions not included in this Technical Specification may be found elsewhere in other IEC documents.

NOTE 1 The terms "PV", "photovoltaic" and "solar photovoltaic" can be read and used interchangeably and without the need for stating each term to show that each are applicable and commonly used by the solar photovoltaic industry.

NOTE 2 All terms beginning with "solar photovoltaic" and "PV" are listed under their respective "photovoltaic" names.

NOTE 3 The terms are listed alphabetically in ten categories. Under these categories, some of the terms have been grouped into families of related meaning in order for the reader to readily see the differences between the terms.

NOTE 4 This Glossary lists the precise usage of terms. Cross-references are provided to efficiently point the reader to the location of definitions. For example, a "solar photovoltaic array" may also be referred to as "photovoltaic array" or "array" when the reference to it is particularly clear. The definition for this term, for example, occurs under the family heading of "photovoltaic" in the "Solar photovoltaic systems" section.

NOTE 5 The colloquial use of "solar" as the sole adjective of a noun is discouraged. For example, though "solar array" may be commonly used in non-technical conversations, the precise terms are "solar photovoltaic array", "photovoltaic array", and "array".

NOTE 6 Unless specifically noted otherwise, the terms "device", "cell", "module", "array", "sub-array", "field", "component", "system", and "product" refer to items incorporating a photovoltaic device. As a result, each of these terms can be understood to read as "PV device", "PV cell", "PV module", *etc.*, without having to re-state the term "PV" each time, though now and then it is useful to re-state "PV".

NOTE 7 The numeric quantities described by many of the terms can be expressed over any convenient unit of time that the user may wish, such as day, month or year.

NOTE 8 " W_p " is not a recommended unit for rated power. For example for a 50 W module, the correct terminology is "the rated power is 50 W", and not "the power is 50 W_p ".

NOTE 9 The documents from which these terms originated are shown in square brackets []. Some adaptations may have occurred.

NOTE 10 This Glossary document recognises the related IEC co-ordinating Technical Committees:

1	Terminology	77	Electromagnetic compatibility
21	Secondary cells and batteries	82	Solar photovoltaic energy systems
22	Power electronic systems and equipment	88	Wind turbines
47	Semiconductor devices	105	Fuel cell technologies
64	Electrical installations and protection against electric shock	106	Methods for the assessment of electric, magnetic and electromagnetic fields associated with human exposure

SOLAR PHOTOVOLTAIC ENERGY SYSTEMS – TERMS, DEFINITIONS AND SYMBOLS

1 Scope and object

This Technical Specification deals with the terms and symbols from national and international solar photovoltaic standards and relevant documents used within the field of solar photovoltaic (PV) energy systems. It includes the terms and symbols compiled from the published IEC technical committee 82 standards, previously published as technical report IEC 61836:1997.

The focus of this Technical Specification is "what do the words mean" and not "under what conditions do the terms apply".

2 Normative references

The following referenced documents are indispensable for the application 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 60904-3:1989, *Photovoltaic devices – Part 3: Measurement principles for terrestrial photovoltaic (PV) solar devices with reference spectral irradiance data*

3 Glossary of terms, definitions and symbols for solar photovoltaic energy systems

3.1 Solar photovoltaic cells and modules

This subclause addresses vocabulary pertaining to photovoltaic materials, photovoltaic cells and photovoltaic modules. Other photovoltaic components are described in subclause 3.2. Photovoltaic systems are described in subclause 3.3.

3.1.1 amorphous photovoltaic material

solid-state material in a semi-stable condition with no long-range order in the structural arrangement of the atoms

3.1.2 amorphous silicon

see "silicon/amorphous", 3.1.58a).

3.1.3 anti-reflective coating

layer formed on the surface of a PV cell to reduce reflective loss

3.1.4 back surface field effect

see "effect/back surface field effect", 3.1.25a)

3.1.5 band gap energy

(Unit: eV)

amount of energy required to bring an electron from the state of valence electron to the state of free electron

3.1.6 **barrier energy**

(Unit: eV)

energy given up by an electron in penetrating the PV cell barrier

NOTE The barrier energy is a measure of the electrostatic potential of the barrier.

3.1.7 **bus lines**

see "metallisation line/bus bar", 3.1.37a)

3.1.8 **bypass diode (on a module level)**

diode connected across one or more PV cells in the forward electric current direction to allow the PV module electric current to bypass cells to prevent hot spot or hot cell damage resulting from the reverse voltage biasing from the other cells in that module

3.1.9 **cell**

see "photovoltaic/photovoltaic cell", 3.1.43a).

The following terms are used to describe the structure of PV cells and materials.

a) **CIS photovoltaic cell**

PV cell fabricated of copper indium diselenide (CuInSe_2 , abbreviation CIS) material as a main constituent (thin film type)

b) **compound semiconductor photovoltaic cell**

PV cell made of compound semiconductor, which consists of different chemical elements, such as GaAs (III-V compounds), CdS/CdTe (II-VI compounds), CdS/CuInSe₂, etc.

c) **concentrator photovoltaic cell**

see "concentrator photovoltaic cell", 3.8.5a)

d) **dye-sensitized photovoltaic cell**

photoelectrochemical device using dye molecules with two electrodes and an electrolyte

e) **integrated type photovoltaic cell**

multiple PV cells connected in series produced on a single substrate that appears like a single cell

NOTE 1 Integrated type PV cells may include stacked or side-by-side configurations.

f) **multijunction photovoltaic cell**

see "cell/stacked photovoltaic cell", 3.1.9k)

g) **organic photovoltaic cell**

PV cell fabricated of organic materials being polymers and/or small molecules (thin film type)

h) **PN junction photovoltaic cell**

PV cell using a PN junction

NOTE 2 See also "PN junction", 3.1.34f).

i) **Schottky barrier photovoltaic cell**

PV cell using a Schottky junction formed at the metal-semiconductor interface

j) silicon photovoltaic cell

PV cell fabricated of silicon material as a main constituent

k) stacked photovoltaic cell

PV cell consisting of layers of different PV cells having different optical properties in which incident light is absorbed by each cell layer

l) tandem photovoltaic cell

common name for a stack of two or more PV cells behind each other

m) thin film photovoltaic cell

PV cell made of thin layers of semiconductor material

NOTE 3 See also "silicon/polycrystalline silicon", 3.1.58e).

3.1.10 cell barrier

very thin electric-potential barrier along the interface between the P-type layer and the N-type layer of a PV cell

NOTE 1 A cell barrier is also known as the "depletion zone".

NOTE 2 An enlectric-potential barrier is a region of high electric field strength opposing the passage of an electrically charged particle in a direction depending on the sign of the electric charge.

3.1.11 cell junction

see "junction/cell junction", 3.1.34a)

3.1.12 CIS photovoltaic cell

see "cell/CIS photovoltaic cell", 3.1.9a)

3.1.13 compound semiconductor photovoltaic cell

see "cell/compound semiconductor photovoltaic cell", 3.1.9b)

3.1.14 conversion efficiency

(Unit: dimensionless, usually expressed as a percentage, %)

ratio of electric power generated by a PV device per unit area to its incident irradiance as measured under standard test conditions, STC

NOTE See also "conditions/standard test conditions", 3.4.16e).

3.1.15 crystalline silicon

see "silicon/crystalline silicon", 3.1.58b).

3.1.16 current

For PV devices and related entries, see "photovoltaic/photovoltaic current", 3.1.43b)

NOTE There are many uses for the electrical term "current".

3.1.17 Czochralski process

see "ingot manufacturing process/Czochralski process", 3.1.32a)

3.1.18 dark current

(Unit: A)

electric current remaining in a PV device when its incident irradiance is zero

3.1.19 device

see "photovoltaic/photovoltaic device", 3.1.43c)

3.1.20 diffusion layer

portion of P-layer or N-layer prepared by a diffusion of dopants to form a PN junction

3.1.21 directional solidification

see "ingot manufacturing process/directional solidification", 3.1.32b)

3.1.22 donor (in photovoltaic cells)

dopant (such as phosphorus in the case of silicon material) that supplies an additional electron to an otherwise balanced material structure

3.1.23 dopant (in photovoltaic cells)

chemical added in small amounts to a semiconductor material to modify its electrical properties

NOTE 1 An N-dopant introduces more electrons than are required for the structure of the material (e.g., phosphorus for silicon material).

NOTE 2 A P-dopant creates electron vacancies in the material structure (e.g., boron for silicon material).

3.1.24 dye-sensitized photovoltaic cell

see "cell/dye-sensitized photovoltaic cell", 3.1.9d)

3.1.25 effect

see "photovoltaic/photovoltaic effect", 3.1.43d).

a) back-surface field effect

effect where the charge carriers generated near the back side of a PV cell are collected effectively by the inner electric field that is formed by a heavily doped zone near the rear electrode

b) light-confinement effect

effect where the short-circuit electric current is increased by trapping incident light inside a PV cell using textured surfaces and structures, etc.

3.1.26 electromagnetic casting

see "ingot manufacturing process/electromagnetic casting", 3.1.32c).

3.1.27 energy gap

(Unit: eV)

smallest energy difference between two neighbouring allowed bands separated by a forbidden band

[IEV 111-14-37]

NOTE See also "band gap energy", 3.1.5).

3.1.28 float zone melting

see "ingot manufacturing process/float zone melting", 3.1.32d)

3.1.29 grid lines

see "metallisation line/grid line", 3.1.37b)

3.1.30 heterojunction

see "junction/heterojunction", 3.1.34b)

3.1.31 hot spot

intense localised heating occurring in a PV module when its operating electric current exceeds the reduced short-circuit current of a shadowed or faulty PV cell or group of cells within it

NOTE When a hot spot occurs, the affected cell or group of cells is forced into reverse bias and must dissipate power, which can cause overheating. The voltage bias or damage creates a small, localized shunt path where a large portion of the PV module current appears.

3.1.32 ingot manufacturing process

process by which an ingot is manufactured

a) Czochralski process

method of growing a perfect large-size single crystal by slowly lifting, under careful cooling conditions, a rotating seed crystal from a counter-rotating molten silicon bath

NOTE 1 The Czochralski process produces a cylindrical-section silicon ingot, which can be cut into wafers that are usually round or pseudo-square.

b) directional solidification

method of making large-grain multicrystalline silicon ingots by controlling the cooling rate of molten silicon that has been placed in a square-section crucible

NOTE 2 Directional solidification produces a square-section silicon ingot that can be cut into wafers that are square or rectangular.

c) electromagnetic casting

method of making multicrystalline silicon ingots by which a continuously fed square-sectional open-bottom cold crucible of molten silicon is continuously pulled downward through an electromagnetic field

NOTE 3 Electromagnetic casting produces a square-section silicon ingot that can be cut into wafers that are square or rectangular.

d) float zone melting

method of growing and purifying high quality single crystal ingots

3.1.33 integrated type photovoltaic cell

see "cell/integrated type cell", 3.1.9e)

3.1.34 **junction** (of semiconductors)

transition layer between semiconducting regions of different electrical properties, or between a semiconductor and a layer of a different type, being characterized by a potential barrier impeding the movement of charge carriers from one region to the other

[IEV 521-02-72]

a) **cell junction**

junction between the P-type semiconductor and N-type semiconductor of a PV cell

NOTE 1 The PV cell junction lies within the cell barrier or depletion zone.

b) **heterojunction**

PN junction in which the two regions differ in their doping conductivities, and also in their atomic compositions

c) **homojunction**

PN junction in which the two regions differ in their doping conductivities, but not in their atomic compositions

d) **Schottky barrier**

junction between a metal and a semiconductor in which a transition region, formed at the surface of the semiconductor, acts as a rectifying barrier

[IEV 521-02-71]

e) **PIN junction**

junction consisting of an intrinsic semiconductor between a P-type semiconductor and an N-type semiconductor, intended to reduce the recombination of minority carriers

NOTE 2 A PIN junction is widely used in thin film amorphous silicon PV cells.

f) **PN junction**

junction between a P-type semiconductor and an N-type semiconductor

3.1.35 **light confinement effect**

see "effect/light-confinement effect", 3.1.25b)

3.1.36 **material**

see "photovoltaic/photovoltaic material", 3.1.43e)

3.1.37 **metallisation line**

metallic conductor on the front or back of a PV cell intended to conduct the electric current generated by the PV cell

NOTE 1 A metallisation line can be screen-printed, vapour-deposited or extruded (line-written).

The lines are of two types

a) **bus bar** (of photovoltaic cells)

metallisation line with a cross-section area greater than that of the grid lines, connected to grid lines and intended to carry their electric current to the wires or ribbons interconnecting the PV cell with other PV cells

NOTE 2 Interconnect wires are connected to the bus bars by soldering or welding.

b) **grid line**

metallisation line intended to collect electric current from the surface of the semiconductor of the PV cell

3.1.38 **microcrystalline silicon**

see "silicon/microcrystalline silicon", 3.1.58c).

3.1.39 **module**

see "photovoltaic/photovoltaic module", 3.1.43f).

3.1.40 **multicrystalline silicon**

see "silicon/multicrystalline silicon", 3.1.58d).

3.1.41 **multijunction photovoltaic cell**

see "cell/multijunction photovoltaic cell", 3.1.9f).

3.1.42 **organic photovoltaic cell**

see "cell, organic photovoltaic cell", 3.1.9g).

3.1.43 **photovoltaic, photovoltaics**

(Abbreviation: PV)

photovoltaic, adjective

photovoltaics, noun

relating to electrical phenomena caused by the photovoltaic effect

The following terms are commonly used in describing photovoltaic devices. The term "photovoltaic" is commonly referred to "PV". See also "photovoltaic", 3.2.21 and 3.3.56.

a) **photovoltaic cell**

most elementary photovoltaic device

NOTE 1 In solar PV energy system applications, another term for "photovoltaic cell" is "solar photovoltaic cell", colloquially referred to as a "solar cell".

b) **photovoltaic current**

(Unit: A)

DC electric current generated in a photovoltaic device

NOTE 2 See also "dark current", 3.1.18.

c) **photovoltaic device**

component that exhibits the photovoltaic effect

NOTE 3 Examples of a photovoltaic device includes a photovoltaic cell, module or array.

d) **photovoltaic effect**

production of DC voltage by the absorption of photons

NOTE 4 Currently the photovoltaic effect is known to be produced by specifically designed semiconductors. This results in the direct non-thermal conversion of radiant energy into electrical energy.

e) **photovoltaic material**

material that exhibits the photovoltaic effect

f) **photovoltaic module**

complete and environmentally protected assembly of interconnected photovoltaic cells

NOTE 5 Photovoltaic modules can be assembled into photovoltaic panels and photovoltaic arrays. See "photovoltaic/photovoltaic panel" (3.3.56e) and "photovoltaic/photovoltaic array" (3.3.56a).

3.1.44 **PIN junction**

see "junction/PIN junction", 3.1.34e).

3.1.45 **PN junction**

see "junction/PN junction", 3.1.34f)

3.1.46 **PN junction photovoltaic cell**

see "cell/PN junction cell", 3.1.9h)

3.1.47 **polycrystalline silicon**

see "silicon/polycrystalline silicon", 3.1.58e)

3.1.48 **power**

(Unit: W)

time-based rate of transferring or transforming energy, or of doing work

NOTE Power is commonly but incorrectly used to mean "electricity" or "electrical".

3.1.49 **primary reference photovoltaic cell**

see "reference photovoltaic cell/primary reference photovoltaic cell", 3.1.50a)

3.1.50 **reference photovoltaic cell**

specially calibrated PV cell that is used to measure irradiance or to set simulator irradiance levels to compensate for non-reference spectral irradiance distribution

a) primary reference photovoltaic cell

reference PV cell whose calibration is based on a radiometer or standard detector conforming to the standard World Radiometric Reference (WRR)

b) secondary reference photovoltaic cell

reference PV cell calibrated in natural or simulated sunlight against a primary reference cell

3.1.51 **reference photovoltaic device**

reference PV cell, package of multiple reference cells or a reference module

3.1.52 **reference photovoltaic module**

specially calibrated PV module that is used to measure irradiance or to set simulator irradiance levels for measuring the performance of other modules having similar spectral response, optical characteristics, dimensions, and electrical circuitry

3.1.53 **ribbon**

thin sheet of crystalline or multicrystalline material produced in a continuous process by withdrawal from a molten bath of the parent material (usually silicon)

3.1.54 **Schottky barrier photovoltaic cell**

see "cell/Schottky barrier photovoltaic cell", 3.1.9i).

3.1.55 **Schottky junction**

see "junction, Schottky barrier", 3.1.34d)

3.1.56 **secondary reference photovoltaic cell**

see "reference photovoltaic cell/secondary reference photovoltaic cell", 3.1.50b).

3.1.57 **semiconductor material**

substance, the conductivity of which, due to charge carriers of both signs, is normally in the range between that of conductors and insulating media, and in which the density of its charge carriers can be changed by external means

[IEV 121-12-06] [IEV 521-02-01, modified]

NOTE 1 The term "semiconductor" generally applies where the charge carriers are electrons or holes.

NOTE 2 In order to increase the conductivity, the energy supplied must be greater than the band gap energy. See also "band gap energy", 3.1.5.

NOTE 3 Certain semiconductors, such as silicon, gallium arsenide, cadmium telluride and copper indium diselenide compounds, to name a number of materials currently available, are well suited to the PV conversion process.

3.1.58 **silicon**

(Symbol: Si)

semi-metallic chemical element, atomic weight of 14, an extensively used semiconductor material, a common constituent of sand and quartz in the form of an oxide, and commonly used in PV cells

NOTE 1 Silicon crystallises in a face-centred cubic lattice like a diamond.

NOTE 2 The terms here are applied to materials, wafers, cells, and modules.

a) **amorphous silicon**

(Symbol: a-Si, a-Si:H)

hydrogenated non-crystalline silicon alloy in a semi-stable condition deposited on a foreign substrate with a thickness of the order of 1 µm

b) **crystalline silicon**

(Symbol: c-Si)

general category of silicon materials exhibiting a crystalline structure, i.e., showing long range ordering of the silicon atoms

c) **microcrystalline silicon**

(Symbol: µc-Si)

hydrogenated silicon alloy deposited on a foreign substrate with a thickness of the order of 1 µm presenting grains < 1 µm of crystalline structure

d) **multicrystalline silicon**

(Symbol: mc-Si)

silicon material that has solidified at such a rate that many large grain single crystals (called crystallites, and ranging from 1 mm to 10 mm) are formed

NOTE 3 The atoms of each crystallite are symmetrically arrayed, but the multitude of crystallites is randomly jumbled.

NOTE 4 Often moulded as a cast ingot or pulled ribbon.

e) polycrystalline silicon

(Symbol: pc-Si)

silicon material deposited on a foreign substrate as a layer with a thickness of 10 µm to 30 µm and a grain size of 1 µm to 1 mm

NOTE 5 Polycrystalline silicon is known as thin film pc-Si.

NOTE 6 Polycrystalline silicon is also a term used in the feedstock silicon fabrication process.

f) single crystalline silicon

(Symbol: sc-Si)

silicon material characterized by an orderly and periodic arrangement of atoms such that it has only one crystal orientation: i.e., all of the atoms are symmetrically arrayed

NOTE 7 Single crystalline silicon is known as mono-crystalline and single crystal.

g) solar photovoltaic grade silicon

(Abbreviation: SOG)

feedstock material with a high chemical purity adapted to the growth of crystalline silicon ingots

3.1.59 silicon photovoltaic cell

see "cell/silicon photovoltaic cell", 3.1.9j).

3.1.60 single crystalline silicon

see "silicon/single crystalline silicon", 3.1.58f).

3.1.61 solar photovoltaic, solar photovoltaics

pertaining to PV devices under the influence of sunlight

NOTE All terms beginning with "solar photovoltaic" are listed under their respective "photovoltaic" names (3.1.43, 3.2.21, and 3.3.56).

3.1.62 stacked photovoltaic cell

see "cell/stacked photovoltaic cell", 3.1.9k).

3.1.63 tandem photovoltaic cell

see "cell/tandem photovoltaic cell", 3.1.9l).

3.1.64 transparent conducting oxide layer

(Abbreviation: TCO for Transparent Conducting Oxide)

transparent conducting oxide used as an electrode in thin-film PV cells deposited on transparent glass (superstrate configuration)

NOTE See also "transparent electrode", 3.1.67.

3.1.65 textured surface

uneven structure formed on the front surface or back surface of a PV cell to increase the light absorption by decreasing the surface reflection loss and utilizing light confinement effect

3.1.66 **thin film photovoltaic cell**

see "cell/thin film photovoltaic cell", 3.1.9m).

3.1.67 **transparent electrode**

thin film electrode with high electrical conductivity and high optical transmissivity formed on a PV cell

3.1.68 **wafer**

slice of semiconductor material, that forms the mechanical and electrical basis of a crystalline PV cell

3.2 **Solar photovoltaic systems components**

This subclause addresses vocabulary pertaining to the components of a photovoltaic system except photovoltaic modules (see 3.1). Photovoltaic systems are described in subclause 3.3).

3.2.1 **array**

see "photovoltaic/photovoltaic array", 3.3.56a).

3.2.2 **array cable**

see "photovoltaic/photovoltaic array cable", 3.2.21a).

3.2.3 **array junction box**

see "junction box/array junction box", 3.2.16a).

3.2.4 **automatic start/stop**

function to start and/or stop a power conditioner automatically according to the output of a PV array

3.2.5 **blocking diode**

diode connected in series to PV module(s), panel(s), sub-arrays and array(s) to block reverse electric current into such module(s), panel(s), sub-arrays and array(s)

3.2.6 **bypass diode (on a PV system level)**

diode connected in parallel across one or more PV modules in the forward electric current direction to allow the module current to bypass a module to prevent module overheating and burning resulting from the reverse voltage biasing from the other modules in the PV array

NOTE A bypass diode at a PV system level is also known as a system bypass diode or a bypass device.

3.2.7 **commutation (static inverters)**

control of a power conditioner's AC output waveform

The terms of commutation for power conditioners are listed below.

a) line commutation

type of external commutation where the commutating voltage is supplied from the "line", which normally refers to a utility line

b) line commutation type

power conditioner operated with line commutation

c) self-commutation

type of commutation where the commutating voltage is supplied by components within the converter or the electronic switch

d) self-commutation type

power conditioner operated with self-commutation

3.2.8 current control type inverter

see "inverter/current control inverter", 3.2.15a).

3.2.9 current stiff type inverter

see "inverter/current stiff inverter", 3.2.15b).

3.2.10 DC conditioner

PV system component that changes the PV array output voltage into a useable DC voltage

3.2.11 DC main cable

see "photovoltaic/photovoltaic DC main cable", 3.2.21b).

3.2.12 generator junction box

see "junction box/generator junction box", 3.2.16b).

3.2.13 high frequency link type inverter

see "inverter/high frequency link inverter", 3.2.15f).

3.2.14 input voltage operating range

(Unit: V)

input DC voltage range in which the power conditioner operates stably

3.2.15 inverter

electric energy converter that changes direct electric current to single-phase or polyphase alternating currents

[IEV 151-13-46]

NOTE 1 An inverter is one of a number of components that is included in the term "power conditioner".

a) current control inverter

inverter with an output electric current having a specified sine waveform produced by pulse-width modulated (PWM) control or other similar control system

b) current stiff inverter

inverter having an essentially smooth DC input electric current

c) grid-connected inverter

inverter that is able to operate in parallel with the distribution or transmission system of an electrical utility

NOTE 2 A grid-connected inverter is also known variously as a grid-intertie or a grid-tied inverter.

d) grid-dependent inverter

grid-connected inverter that operates only in grid-dependent mode

e) grid-interactive inverter

grid-connected inverter that is able to operate in both stand-alone and parallel modes

NOTE 3 A grid-interactive inverter initiates a grid-parallel mode of operation.

f) high frequency link inverter

inverter with a high frequency transformer for electrical isolation between the inverter's input and output circuits

g) module inverter

inverter that is integrated to the output of a single PV module

NOTE 4 A module inverter is usually attached to the rear of a module.

NOTE 5 See also "AC module", 3.3.2.

h) non-islanding inverter

inverter that ceases to energize an electricity distribution system that is out of the normal operating specifications for voltage and/or frequency

i) stand-alone inverter

inverter that supplies a load not connected to the distribution or transmission system of an electrical utility

NOTE 6 A stand-alone inverter is also known as a "battery-powered inverter".

j) string inverter

inverter that is designed to operate with a single PV string

NOTE 7 The AC output of a string inverter can be connected in parallel to the output of other string inverters.

k) transformerless inverter

inverter without any isolation transformer

l) utility frequency link inverter

inverter with a utility frequency transformer for electrical isolation at the inverter output

m) utility interactive inverter

inverter used in parallel with the distribution or transmission system of an electrical utility to supply common loads and that may deliver electricity to that distribution or transmission system

n) voltage control inverter

inverter with an output voltage having a specified sine waveform produced by pulse-width modulated (PWM) control, etc.

o) voltage stiff inverter

inverter having an essentially smooth DC input voltage

3.2.16 junction box

closed or protected enclosure in which circuits are electrically connected

a) array junction box

junction box where PV strings are connected

b) generator junction box

junction box where PV arrays are connected

3.2.17 **lead-acid battery**

secondary battery with an aqueous electrolyte based on dilute sulphuric acid, a positive electrode of lead dioxide and a negative electrode of lead

NOTE 1 "Secondary" refers to a rechargeable battery.

NOTE 2 Lead-acid batteries are commonly used in stand-alone PV systems.

a) lead-acid battery for PV systems

generic term for lead-acid batteries used in stand-alone PV systems

NOTE 3 In a narrow sense, a lead-acid battery in PV systems refers to a battery of lead-acid electrochemical cells designed to meet the quality requirements of a PV system.

NOTE 4 A lead-acid battery in PV systems is commonly referred to as a "PV battery".

b) valve regulated lead-acid battery

sealed lead-acid battery in which oxygen gas generated from positive plates is reactively absorbed into negative plates thereby suppressing generation of hydrogen gas

NOTE 5 A valve regulated lead-acid battery is equipped with a valve to release gas outside the battery when pressure builds up in the electrochemical cells.

c) vented lead-acid battery

lead-acid battery designed with a vent mechanism to expel gases generated during charging

3.2.18 **line commutation**

see "commutation/line commutation", 3.2.7a).

3.2.19 **line commutation type**

see "commutation/line commutation type", 3.2.7b).

3.2.20 **non-islanding inverter**

see "inverter/non-islanding inverter", 3.2.15h).

3.2.21 **photovoltaic**

The following terms describe common cabling components of a PV system. See also "photovoltaic" (3.1.43 and 3.3.56).

a) photovoltaic array cable

electrical cable connecting PV arrays to each other

b) photovoltaic DC main cable

cable connecting the generator junction box to the inverter

c) photovoltaic string cable

cable connecting PV modules to form a PV string

d) photovoltaic supply cable

cable connecting the inverter to a distribution circuit of the electrical installation

3.2.22 **power conditioner**

equipment used to convert electricity into a form suitable for subsequent use

NOTE 1 "Power conditioner" is commonly used to mean a piece of equipment comprising an inverter combined with other electrical regulation sub-systems.

NOTE 2 See also "sub-system/power conditioning sub-system" (3.3.75c), and "inverter" (3.2.15).

3.2.23 **pulse width modulation control**

(Abbreviation for Pulse Width Modulation: PWM)

pulse control in which the pulse width or frequency or both are modulated within each fundamental period to produce a certain output waveform [IEC 551-16-30]

3.2.24 **self-commutation**

see "commutation/self-commutation", 3.2.7c).

3.2.25 **self-commutation type**

see "commutation/self-commutation type", 3.2.7d).

3.2.26 **soft-start**

function intended to prevent a voltage dip on the load or the electric power system, which may be caused by the AC output electric current of a starting or re-starting power conditioner

3.2.27 **solar photovoltaic**

see "photovoltaic", 3.1.43.

NOTE All terms beginning with "solar photovoltaic" are listed under their respective "photovoltaic" names (3.1.43, 3.2.21, and 3.3.56).

3.2.28 **stand-alone inverter**

see "inverter/stand-alone inverter", 3.2.15i).

3.2.29 **string cable**

see "photovoltaic/photovoltaic string cable", 3.2.21c).

3.2.30 **string inverter**

see "inverter/string inverter", 3.2.15j).

3.2.31 **supply cable**

see "photovoltaic/photovoltaic supply cable", 3.2.21d).

3.2.32 **support structure**

structure on which PV modules, panels, or arrays are installed

3.2.33 **transformerless type inverter**

see "inverter/transformerless inverter", 3.2.15k).

3.2.34 **utility frequency link type inverter**

see "inverter/utility frequency link inverter", 3.2.15l).

3.2.35 utility interactive inverter

see "inverter/utility interactive inverter", 3.2.15m).

3.2.36 utility interface disconnect switch

switch at the interface between the PV system and the utility grid

3.2.37 valve regulated lead-acid battery

see "lead-acid battery/valve regulated lead-acid battery", 3.2.17b).

3.2.38 vented lead-acid battery

see "lead-acid battery/vented lead-acid battery", 3.2.17c).

3.2.39 voltage control type inverter

see "inverter/voltage control inverter", 3.2.15n).

3.2.40 voltage stiff type inverter

see "inverter/voltage stiff inverter", 3.2.15o).

3.3 Solar photovoltaic systems

This subclause addresses photovoltaic systems as a whole and not as individual components (see 3.1 and 3.2).

3.3.1 AC/AC interface

see "interface/AC/AC interface", 3.3.33a).

3.3.2 AC photovoltaic module

PV module with an integrated inverter in which the electrical terminals are AC only

3.3.3 AC side

see "interface/AC side of the interface", 3.3.33b).

3.3.4 AC side switchover

see "photovoltaic system/grid backed-up photovoltaic system/AC side switchover", 3.3.62e).

3.3.5 array field

see "photovoltaic/photovoltaic array field", 3.3.56b).

3.3.6 assembly

see "photovoltaic/photovoltaic assembly", 3.3.56c).

3.3.7 backfeed operation

see "operation/backfeed operation", 3.3.52b).

3.3.8 **balance of system**

(Abbreviation: BOS)

parts of a PV system other than the PV array field, including switches, controls, meters, power conditioning equipment, PV array support structure, and electricity storage components, if any

3.3.9 **centralized photovoltaic system**

see "photovoltaic system/centralized photovoltaic system", 3.3.62a).

3.3.10 **collective electrification system**

(Abbreviation: CES)

small electric generating system and minigrid that supplies electricity to multiple consumption points from a single or multiple energy resource(s)

3.3.11 **DC/DC interface**

see "interface/DC/DC interface", 3.3.33d).

3.3.12 **DC interface**

see "interface/DC interface", 3.3.33c).

3.3.13 **DC side**

see "interface/DC side of the interface", 3.3.33e).

3.3.14 **DC side switchover**

see "photovoltaic system/grid backed-up photovoltaic system /DC side switchover", 3.3.62e).

3.3.15 **dispatchable electric system**

see "power system/dispatchable power system", 3.3.64a).

3.3.16 **dispersed array system**

see "photovoltaic system/dispersed photovoltaic system/ dispersed-array system", 3.3.62b).

3.3.17 **dispersed photovoltaic system**

see "photovoltaic system/dispersed photovoltaic system", 3.3.62b).

3.3.18 **distributed generation PV system**

see "photovoltaic system/distributed generation PV system", 3.3.62c).

See also "distributed generation system", 3.3.19.

3.3.19 **distributed generation system**

facilities and equipment comprising multiple electricity generating systems that are directly connected to and operate in parallel with a distribution system of an electrical utility

3.3.20 **distributed generator**

(Abbreviation: DG)

electrical generating equipment connected directly to a distributed generation system

NOTE A distributed generator is sometimes called a non-utility generator, abbreviated as a "NUG".

3.3.21 **distribution system**

electrical facility and its components including poles, transformers, disconnects, relays, isolators and wires that are owned by an electrical utility for the purpose of distributing electrical energy from substations to customers

NOTE In some parts of the world, the distribution system operates at a nominal voltage of 34 500 V.

3.3.22 **domestic photovoltaic system**

see "photovoltaic system/domestic photovoltaic system", 3.3.62d).

3.3.23 **electrical utility**

organization responsible for the installation, operation, maintenance and management of all or some portions of major electric generation, transmission, and distribution systems

NOTE "Electrical utility" is preferred over "electric utility".

3.3.24 **electrify**

- 1) to supply electricity, electrical circuits, and associated generation, delivery and management equipment
- 2) to impose a voltage or electric current onto an electrical circuit or device

NOTE "Electrification" is related to "electrify".

3.3.25 **generator**

apparatus that converts non-electric energy into electric energy

NOTE 1 A generator does not include energy storage devices or power conditioners.

NOTE 2 See also "photovoltaic/ photovoltaic generator", 3.3.56d).

3.3.26 **genset**

colloquial term meaning "engine-generator set" consisting of a fuel-driven engine coupled to an electric generator

3.3.27 **grid**

common reference to an electricity distribution and/or transmission system

NOTE 1 "Electric power network" refers to a grid.

a) microgrid

grid isolated from other grids and that is intended to serve only for the distribution of electricity

NOTE 2 A typical microgrid has a total load of less than 100 kVA and is supplied by micropower systems or micropower stations.

NOTE 3 A microgrid usually serves villages and is supplied by fossil-fuel generators and/or renewable energy generators.