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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/Figure/ Table/Note	Type of comment	Commend (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



8A/149/CD

COMMITTEE DRAFT (CD)

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OF INTEREST TO THE FOLLOWING COMMITTEES: TC 8,SC 8B	
FUNCTIONS CONCERNED: ☐ EMC ☐ ENVIRONMENT ☒ QUALITY ASSURANCE ☒ SAFETY	

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TITLE: IEC TR 6XXXX ED1: Integrating distributed PV into LVDC systems and use cases

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CONTENTS

1		
2	FOREWORD	5
3	INTRODUCTION	7
4	1 Scope	8
5	2 Normative references	8
6	3 Terms, definitions and abbreviations	9
7	3.1 Terms and definitions	9
8	3.1.1 Point of common coupling	9
9	3.1.2 Point of connection	9
10	3.1.3 Energy management system	9
11	3.1.4 Distributed energy resources	9
12	3.1.5 Islanding or network splitting	9
13	3.1.6 Islanding detection methods	9
14	3.1.7 Voltage sags or voltage dips	10
15	3.1.8 None detection zone	10
16	3.1.9 Hazard	10
17	3.1.10 Residual current device (RCD)	10
18	3.2 Abbreviations	10
19	4 Selected LVDC Use Cases and Challenges	11
20	4.1 Typical case I: Nushima Island (Japan)	11
21	4.2 Typical case II: LVDC systems enabled hybrid AC/DC systems (Tongli- 22 China)	12
23	4.3 Typical case III: A DC system in RTWH Aachen University (Germany)	12
24	4.4 Typical case IV: Hybrid LVDC systems for hydrogen generation (Singapore)	13
25	4.5 Typical case V: LVDC enabled modern green building system (Switzerland)	14
26	4.6 Typical case VI: Future Tower in low carbon city of Shenzhen, China	15
27	4.7 Technical challenges	15
28	5 DC Interfaces of PV to LVDC systems	16
29	5.1 DC Interfaces for PV Integration	16
30	5.1.1 Problem statement	16
31	5.1.2 Critical issues	17
32	5.2 The controllability of PV systems in LVDC	19
33	5.2.1 Problem statement	19
34	5.2.2 Critical issues	19
35	5.3 Summary	20
36	6 Fault Response of LVDC system integrated with PV Overview	21
37	6.1 Islanding detection of distributed PV systems	21
38	6.1.1 Problem statement	21
39	6.1.2 Critical issues	23
40	6.2 Fault ride-through capability of PV in LVDC system	24
41	6.2.1 Problem statement	24
42	6.2.2 Critical issues	24
43	6.3 Summary	25
44	7 Stability and oscillation suppression of LVDC with PV	25
45	7.1 Problem statement	25
46	7.2 Key issues	25

47	7.2.1	The modelling of LVDC system with distributed energy sources	26
48	7.2.2	Effective stability criterion	27
49	7.2.3	Oscillation suppression and stability enhancement	27
50	7.3	Summary	28
51	8	Coordination with Standards	29
52	8.1	Related standards for grid integration of PV generation	29
53	8.1.1	IEEE 1547: IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces	29
56	8.1.2	IEC 62786: Photovoltaic (PV) systems - Characteristics of the utility interface	29
58	8.2	Related standards for the LVDC distribution system	29
59	8.2.1	IEC-SEG 4 Systems Evaluation Group - Low Voltage Direct Current Applications, Distribution, and Safety for Use in Developed and Developing Economies	29
62	8.2.2	IEC TR 63282	30
63	8.3	Other related standards	30
64	8.3.1	IEC 62109-1: Safety of power converters for use in photovoltaic power systems - Part 1: General requirements	30
66	8.3.2	IEC 62446-1: Photovoltaic (PV) systems - Requirements for testing, documentation and maintenance - Part 1: Grid connected systems - Documentation, commissioning tests and inspections	31
69	8.3.3	IEC TS 62257 Series: Recommendations for Renewable Energy and Hybrid Systems for Rural Electrification	31
71	8.3.4	IEC 60364 Series	31
72	8.3.5	IEC TS 62786: Distributed energy resources connection with the grid	32
73	9	Conclusion and recommendations	32
74		Appendix	34
75		Bibliography	35
76			
77		Figure 1 – LVDC system on Nushima Island.	11
78		Figure 2 – Hybrid AC/DC distribution system demonstration project in Tongli, Suzhou, with the integration of LVDC system.	12
80		Figure 3 – A DC system in Campus Melaten of RTWH Aachen University.	13
81		Figure 4 – A testbed for clean energy innovations with PV and H ₂ generation.	14
82		Figure 5 – A green building with multi-energy supply system.	15
83		Figure 7 – The classification of the RE DC interface from different aspects.	16
84		Figure 8 – Two types of PV integration interface to LVDC in literature. (a) two ports; (b) three ports.	17
86		Figure 9 – A two-stage power converter integrating a PV module to a DC network.	17
87		Figure 10 – Expression of the operation range on the specific front-end input port.	17
88		Figure 11 – PV and its interfacing converter linked to an upstream grid.	20
89		Figure 12 – Classification of islanding detection methods.	21
90		Figure 13 – Schematic diagram of cascaded system in Middlebrook criterion.	26
91		Figure 14 – Unified form of the LVDC systems.	26
92		Figure 15 – Division of two subsystems.	27
93		Figure 16 – Position selection of the virtual impedance.	28

95	Table 1 – Features of Islanding Detection Methods	21
96		
97		

INTERNATIONAL ELECTROTECHNICAL COMMISSION

INTEGRATING DISTRIBUTED PV INTO LVDC SYSTEMS AND USE CASES

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

Draft TR	Report on voting
XXX	XXX

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 Report 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/standardsdev/publications.

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INTRODUCTION

During the 2019 IEC SC 8A plenary meeting in Shanghai, China, the decision(DECISION 2019/5) was made by the meeting and written into List of Decisions (see document 8A/61/DL): The China National Committee proposed a new Preliminary Work Item (PWI) called “Integrating distributed PV into LVDC systems and use cases”. It was approved to create a new WG led by SC 8A, with participation from SC 8B called “Integrating distributed PV into DC systems and use cases”. It was approved to nominate Prof. ZHU Miao from CN NC as the convenor.

The task is to develop a series of projects regarding integrating distributed PV into DC systems and use cases with emphasis on large-scale and high penetration of renewable energy (RE) via LVDC system within the following scopes of operational behavior and coordinated control between RE and DC system, for example including DC interface for RE integration, fault response and stability issues of LVDC integrated RE, and etc.

It is increasingly important to optimize the performance and efficiency of renewable-enabled power systems by integrating DC power into various low voltage applications, such as buildings, vehicles, and electronic devices. DC power generated by PV systems is more compatible with the DC-based electronic devices used in these applications, making it more efficient and cost-effective.

Nonetheless, there lacks a standard or reference framework that would orient OEMs (Original Equipment Manufacturers), EPCs (Engineering, Procurement, and Construction) as well as other RE system operators to provide continuous high-quality generation services to grids.

In this context, the intention of this document is to present necessary technical screening and then to offer profound insights to the formulation of relevant standards. It helps to deal with both the converter-level and grid-level requirements on PV integration via DC integration, to pave a way to further develop a series of standards/technical reports with emphasis on high penetration of PV via LVDC system.

INTEGRATING DISTRIBUTED PV INTO LVDC SYSTEMS AND USE CASES

1 Scope

The document reviews existing theoretical attempts and engineering applications in the area of solar PV systems coupled to LVDC systems. There are four aspects that are identified to be highly relevant to standard compilations:

- power converters and possible control mechanisms that are eligible for facilitating the interlinking between PV and LVDC networks;
- local PV system islanding detection algorithms and fault ride through in case of main grid faults;
- stability analysis of PV interacting with LVDC systems and corresponding stabilization methods;

An inventory of existing (mostly IEC and national) standards is also presented, based on which different sorts of PV integration scenarios are elaborated. Gaps between actual standards and future needs are analyzed and recommendations for evolution are presented.

2 Normative references

The following referenced documents are indispensable for the application of this document.

IEC 60364-1: Low-voltage electrical installations - Part 1: Fundamental principles, assessment of general characteristics, definitions

IEC 60364-7-712: Requirements for special installations or locations - Solar photovoltaic (PV) power supply systems

IEC 60364-8-82: Low-voltage electrical installations - Part 8-82: Functional aspects - Prosumer's low-voltage electrical installations

IEC 62109-1: 2010 Safety of power converters for use in photovoltaic power systems - Part 1: General requirements

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

IEC 62786: Photovoltaic (PV) systems - Characteristics of the utility interface

IEC TS 62257 Series: Recommendations for Renewable Energy and Hybrid Systems for Rural Electrification

IEC TS 62257-2: Recommendations for renewable energy and hybrid systems for rural electrification - Part 2: From requirements to a range of electrification systems

IEC TS 62257-4: Recommendations for renewable energy and hybrid systems for rural electrification - Part 4: System selection and design

IEC TS 62786: Distributed energy resources connection with the grid

IEC TR 63282: LVDC systems - Assessment of standard voltages and power quality requirements

IEEE 1547 series: IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces

EN50549-1 Requirements for generating plants to be connected in parallel with distribution networks - Part 1: Connection to a LV distribution network - Generating plants up to and including Type B

EN 50549-2 Requirements for generating plants to be connected in parallel with distribution networks - Part 2: Connection to a MV distribution network - Generating plants up to and including Type B

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

3 Terms, definitions and abbreviations

3.1 Terms and definitions

3.1.1 Point of common coupling

The point in an electric power system, electrically nearest to a particular load, at which other loads are, or may be, connected

Note 1 to entry: These loads can be either devices, equipment or systems, or distinct network users' installations.

[SOURCE: IEC 614-01-12]

3.1.2 Point of connection

Reference point on the electric power system where the user's electrical facility is connected

[SOURCE: IEC 617-04-01]

Note: the difference between PCC and POC can refer to Figure A1.

3.1.3 Energy management system

Computer system comprising a software platform providing basic support services and a set of applications providing the functionality needed for the effective operation of electrical generation and transmission facilities so as to assure adequate security of energy supply at minimum cost

[SOURCE: IEC 61970-301: 2013]

3.1.4 Distributed energy resources

Generators (with their auxiliaries, protection and connection equipment), including loads having a generating mode (such as electrical energy storage systems), connected to a low voltage or a medium-voltage network [SOURCE: IEC 617-04-20]

3.1.5 Islanding or network splitting

The process whereby a power system is split into two or more islands

Note – Islanding is either a deliberate emergency measure (intentional islanding mode), or the result of automatic protection or control action, or the result of human error (unintentional islanding mode) .

[SOURCE: IEC 603-04-31]

3.1.6 Islanding detection methods

Techniques used in grid-tied systems to detect the occurrence of islanding

3.1.7 Voltage sags or voltage dips

Sudden voltage reduction at a point in an electric power system, followed by voltage recovery after a short time interval, from a few periods of the sinusoidal wave of the voltage to a few seconds

[SOURCE: IEC 614-01-08]

3.1.8 None detection zone

An area within a sensor's range where it is unable to detect the presence of an object or signal

3.1.9 Hazard

Potential source of harm

Note 1 to entry: The term hazard may be qualified in order to define its origin or the nature of the expected harm (e.g., electric shock hazard, crushing hazard, cutting hazard, toxic hazard, fire hazard, drowning hazard)

[SOURCE: IEC 351-57-01]

3.1.10 Residual current device (RCD)

Mechanical switching device or association of devices designed to make, carry and break currents under normal service conditions and to cause the opening of the contacts when the residual current attains a given value under specified conditions [SOURCE: IEC 442-05-02]

3.2 Abbreviations

BVCC	bus voltage-controlled converter
CPL	constant power load
CHP	combined heat and power
DER	distributed energy resources
EMS	energy management system
EPC	engineering, procurement, and construction
ESS	energy storage system
FRT	fault ride through
IBC	intermediate bus converter
IDMs	islanding detection methods
LVDC	low voltage direct current
MPPT	maximum power point tracking
NDZ	none detection zone
OEM	original equipment manufacturer
PCC	point of common coupling
POC	point of connection
PWM	pulse width modulation
RCD	residual protection device
RE	renewable energy
RHP	right-half-plane
SEG	standardization evaluation groups