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TECHNICAL SPECIFICATION

colour inside

Power quality management –
Part 1: General guidelines

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CONTENTS

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FOREWORD

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IEC TS 63222 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
8/1588/DTS	8/1602/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/standardsdev/publications.

A list of all parts in the IEC 63222 series, published under the general title *Power quality management*, can be found on the IEC website.

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- withdrawn,
- replaced by a revised edition, or
- amended.

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INTRODUCTION

With the development of smart grid and massive deployment of renewable energy, power quality issues have received attention not only from system operators and customers (especially with sensitive power quality loads) but also from market regulators with the demands to provide information on the actual power quality level. Power quality management of the grid is a systematic project which includes the whole process of planning, operation, assessment and mitigation. The characteristics of power supplier, load characteristics of power consumer and external environment will affect the power quality of the grid. This document focuses on the whole process management and is the general guideline for this series of standards.

Traditional electrified railways, steel mills and other non-linear loads are the main pollution sources of the power quality. In recent years, the new loads such as new energy and electric vehicles have brought new challenges to power quality management. The rapid popularization and application of high-tech precision technology has also put forward new requirements for high-quality power supply and consumption system.

Power quality is an important issue for electricity supply network operators, which needs to be handled at planning and operation stages. In order to achieve power quality target, reduce power quality impacts/losses and improve the economic efficiency of the system, power quality regulation and supervision of the operating power system is necessary, and a well-considered power quality planning before project implementation is also needed, such as system expansion, construction and grid connection of the distributed generation. Besides, the users at the end of power system should also be taken into consideration. Power quality problems can cause system instability, equipment abnormal operation and supply interruption. Power quality management is a method to avoid further power quality problems after project implementation.

The standard system in power quality management provides a technical basis for improving power management level and standardizing power quality industry and market. As the general guideline of the standard series, this specification summarizes the power quality indicators and assessment methods, and analyses the overall power quality level by monitoring assessment and predicted assessment. Monitoring system and field test are used to assess the power quality level at different nodes of the grid, and solve users' power quality complaints and other practical problems. Connection and monitoring points are reasonably selected to assess the power quality levels of the grid in operation stage, and it also contributes to the power quality mitigation. In addition, the economical assessment of power quality is regulated in the document. Power quality management use cases in different typical scenarios are shown in Annex A.

POWER QUALITY MANAGEMENT –

Part 1: General guidelines

1 Scope

This part of IEC 63222, which is a Technical Specification, is intended to provide provisions associated to the main use cases regarding recognized engineering practices applicable to power quality management in public electric power supply networks. It summarizes the operation in power quality management and investigates the current standards, for requirement of power quality assessment work, as well as to promote the development of power quality management best practices.

The power quality management domain groups use cases and associated power quality requirements common to network management, including customer support network operation, network and extension planning.

This document captures possible "common and repeated usage" of power quality management under the format of "use case". Use case implementations are given for information purpose only. This document derives the common requirement as provisions by further standardization activities, in terms of actors interacting with the given system. The interface requirement is considered for later standardization activities. The relationship of the stakeholders in power quality management, such as network operator, network user, etc., are discussed in the document. Table 1 highlights the domains and business use cases described.

Table 1 – Content of IEC TS 63222-1

Domain	Content	Scope
Power quality monitoring assessment	Described with 5 business use cases 1) Manage power quality over the grid. 2) Manage power quality through distribution or transmission grid interfaces with another network. 3) Take into account power quality constraints in network operation. 4) Provide reports on network power quality. 5) Manage complaints on power quality over the network. Described with 5 system use cases 1) Assess power quality on the network. 2) Measure power quality on a specific point of the network. 3) Monitor power quality on the network. 4) Engineer a power quality provision. 5) Assess the emission limit related to power quality technical parameters in power system.	Continuous monitoring operation for public power grid
Power quality predicted assessment	Described with 4 business use cases 1) Manage power quality over the grid. 2) Take into account power quality constraints in connecting a user to the grid. 3) Take into account power quality constraints in network development. 4) Provide reports on network power quality. Described with 7 system use cases 1) Predict power quality impact of a construction work or maintenance. 2) Predict power quality impact of a new connection or network development. 3) Measure power quality on a specific point of the network. 4) Monitor power quality on the network. 5) Engineer a power quality provision. 6) Assess power quality on the network. 7) Assess the emission limit related to power quality technical parameters in power system.	Power quality assessment of new construction, reconstruction or expansion projects in the grid

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 61000-3 (all parts), *Electromagnetic compatibility (EMC) – Part 3: Limits*

IEC 61000-3-2, *Electromagnetic compatibility (EMC) – Part 3-2: Limits − Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)*

IEC 61000-3-3, *Electromagnetic compatibility (EMC) – Part 3-3: Limits − Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply system, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection*

IEC TS 61000-3-4, *Electromagnetic compatibility (EMC) – Part 3-4: Limits − Limitation of emission of harmonic currents in low-voltage power supply systems for equipment with rated current greater than 16 A*

IEC TS 61000-3-5, *Electromagnetic compatibility (EMC) – Part 3-5: Limits − Limitation of voltage fluctuations and flicker in low-voltage power supply systems for equipment with rated current greater than 75 A*

IEC TR 61000-3-6, *Electromagnetic compatibility (EMC): Limits-Assessment of emission limits for the connection of distorting installations to MV, HV and EHV power systems*

IEC TR 61000-3-7, *Electromagnetic compatibility (EMC): Limits − Assessment of emission limits for the connection of fluctuating load installations to MV, HV and EHV power systems*

IEC 61000-3-8, *Electromagnetic compatibility (EMC) − Part 3: Limits − Section 8: Signalling on low-voltage electrical installations − Emission levels, frequency bands and electromagnetic disturbance levels*

IEC 61000-3-11, *Electromagnetic compatibility (EMC) − Part 3-11: Limits − Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems − Equipment with rated current ≤ 75 A and subject to conditional connection*

IEC 61000-3-12, *Electromagnetic compatibility (EMC) − Part 3-12: Limits − Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current >16 A and ≤ 75 A per phase*

IEC TR 61000-3-13, *Electromagnetic compatibility (EMC) − Limits − Assessment of emission limits for the connection of unbalanced installations to MV, HV and EHV power systems*

IEC TR 61000-3-14, *Electromagnetic compatibility (EMC) − Assessment of emission limits for harmonics, interharmonics, voltage fluctuations and unbalance for the connection of disturbing installations to LV power systems*

IEC 61000-4 (all parts), *Electromagnetic compatibility (EMC) − Part 4: Testing and measurement techniques*

IEC 61000-4-15, *Electromagnetic compatibility (EMC) – Part 4-15: Testing and measurement techniques − Flickermeter − Functional and design specifications*

IEC 61000-4-30:2015, *Electromagnetic compatibility (EMC) – Part 4-30: Testing and measurement techniques − Power quality measurement methods*

IEC 61850 (all parts), *Communication networks and systems for power utility automation*

IEC TR 61850-90-17:2017, *Communication networks and systems for power utility automation − Part 90-17: Using IEC 61850 to transmit power quality data*

IEC 61968-9:2013, *Application integration at electric utilities − System interfaces for distribution management − Part 9: Interfaces for meter reading and control*

IEC TS 62749: 2020, *Assessment of power quality – Characteristics of electricity supplied by public networks*

ISO 10002:2018, *Quality management – Customer satisfaction – Guidelines for complaints handling in organizations*

3 Terms, definitions and abbreviated terms

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 Terms and definitions

3.1.1
power quality
characteristics of the electricity at a given point on an electrical power system, evaluated against a set of reference technical parameters

[SOURCE: IEC 60050-617:2009, 617-01-05, modified – "electric current, voltage and frequencies" has been changed to "electricity"]

3.1.2
power quality indices
technical parameters characterizing the quality of electricity, measured at a given point, relevant for the assessment of the quality of the electricity delivered by a network operator

[SOURCE: IEC TS 62749:2020, 3.29]

3.1.3
nominal voltage
voltage by which a system is designated or identified

[SOURCE: IEC 61000-4-30:2015, 3.18]

3.1.4
voltage unbalance
in a polyphase system, a condition in which the RMS values of the phase voltages (fundamental component) or the phase angles between consecutive phases are not all equal.

Note 1 to entry: The degree of the inequality is usually expressed as the ratios of the negative- and zero-sequence components to the positive-sequence component.

Note 2 to entry: In this standard, voltage unbalance is considered in relation to 3-phase systems.

[SOURCE: IEC 60050-161:1990 161-08-09, modified – "phase voltages" has been changed to "phase voltages (fundamental component)", notes to entry have been added]

3.1.5
voltage deviation
difference between the supply voltage at a given instant and the declared supply voltage

3.1.6
flicker
impression of unsteadiness of visual sensation induced by a light stimulus whose luminance or spectral distribution fluctuates with time

[SOURCE: IEC 60050-161:1990 161-08-13]

3.1.7
voltage dip
a sudden reduction of the voltage at a point in an electrical system followed by voltage recovery after a short period of time from a few cycles to a few seconds.

[SOURCE: IEC 60050-161:1990, 161-08-10]

3.1.8
short interruption
the disappearance of the supply voltage for a time interval whose duration is between two specified limits

Note 1 to entry: A short interruption is considered to be a reduction of the supply voltage to less than 1 % of the nominal voltage, with the lower limit of the duration typically a few tenths of a second, and its upper limit typically in the order of one minute (or, in some cases up to three minutes).

[SOURCE: IEC 60050-161:1990,161-08-20]

3.1.9
harmonic component
sinusoidal component of a periodic quantity having a harmonic frequency

[SOURCE: IEC 60050-551:2001, 551-20-07, modified – The note has been deleted]

3.1.10
harmonic frequency
frequency which is an integer multiple greater than one of the fundamental frequency or of the reference fundamental frequency

[SOURCE: IEC 60050-551:2001, 551-20-05]

3.1.11
interharmonic component
sinusoidal component of a periodic quantity having an interharmonic frequency

Note 1 to entry: For practical analysis, an approximation of the periodicity may be necessary.

[SOURCE: IEC 60050-551:2001, 551-20-08]

3.1.12
interharmonic frequency
frequency which is a non-integer multiple of the reference fundamental frequency

[SOURCE: IEC 60050-551:2001, 551-20-06]

3.1.13
system operator
network 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]

3.1.14
(power) network user
(power) system user
party supplying electric power and energy to, or being supplied with electric power and energy from, a transmission system or a distribution system

[SOURCE: IEC 60050-617:2009, 617-02-07]

3.1.15
stakeholders
individual, group or organization that has an interest in an organization or activity

Note 1 to entry: Usually a stakeholder can affect or is affected by the organization or the activity.

[SOURCE: IEC 60050-904:2014, 904-01-10]

3.1.16
system average RMS variation frequency index
SARFI
a power quality index that provides a count or rate of voltage dips, swells, and/or interruptions for a system.

[SOURCE: IEC TS 62749: 2020, 5.3.3.2]

3.1.17
distribution system operator
party operating a distribution system

[SOURCE: IEC 60050-617:2009, 617-02-10]

3.1.18
transmission system operator
party operating a transmission system

[SOURCE: IEC 60050-617:2009, 617-02-11]

3.2 Abbreviated terms

Abbreviations used in the text are defined in Table 2.

Table 2 – Abbreviations of IEC TS 63222-1

Abbreviation	Definition
PQ	Power Quality
BUC	Business use case
SUC	System use case
VSC	Voltage Source Converter
PCC	Point of Common Coupling
SCADA	Supervisory Control and Data Acquisition
SARFI	System Average RMS variation Frequency Index
FACTS	Flexible AC Transmission Systems
SVC	Static Var Compensator
STATCOM	Static Synchronous Compensator
UPS	Uninterrupted Power Supply
APF	Active Power Filter
DVR	Dynamic Voltage Restorer
LN	Logical Node
RVC	Rapid Voltage Change
RTC	Real Time Clock
EMC	Electromagnetic Compatibility
BESS	Battery Energy Storage system