PD IEC TS 62749:2020



BSI Standards Publication

Assessment of power quality — Characteristics of electricity supplied by public networks



National foreword

This Published Document is the UK implementation of IEC TS 62749:2020.

The UK participation in its preparation was entrusted to Technical Committee GEL/8, Systems Aspects for Electrical Energy Supply.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

© The British Standards Institution 2020 Published by BSI Standards Limited 2020

ISBN 978 0 580 51129 5

ICS 17.220.99

Compliance with a British Standard cannot confer immunity from legal obligations.

This Published Document was published under the authority of the Standards Policy and Strategy Committee on 29 February 2020.

Amendments/corrigenda issued since publication

Date Te

Text affected



IEC TS 62749

Edition 2.0 2020-02

TECHNICAL SPECIFICATION



Assessment of power quality – Characteristics of electricity supplied by public networks

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ICS 17.220.99

ISBN 978-2-8322-7849-9

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

CONTENTS

FC	FOREWORD					
IN	INTRODUCTION					
1	Scop	e	8			
2	2 Normative references					
3	Term	s and definitions	9			
4	Reco	mmended values for power quality indices	17			
	4 1	General	17			
	4.1	Frequency deviation	19			
	4.3	Supply voltage deviation	19			
	4.3.1	General	.19			
	4.3.2	Low voltage systems	.19			
	4.3.3	Medium voltage systems	.20			
	4.3.4	High voltage systems	.20			
	4.4	Voltage unbalance	. 20			
	4.5	Flicker	.21			
	4.6	Harmonic and interharmonic voltage	.21			
	4.6.1	General	.21			
	4.6.2	Low voltage systems	.21			
	4.6.3	Medium voltage systems	.22			
	4.6.4	High voltage systems	.23			
	4.7	Voltage dip	.24			
	4.8	Voltage swell	.25			
	4.9	Voltage interruption	.25			
	4.10	Mains communicating voltage	.26			
	4.11	Rapid voltage change	.26			
	4.12	Transient overvoltage	.27			
	4.12.	1 Low voltage systems	.27			
	4.12.	2 Medium and high voltage systems	.27			
5	Obje	ctives and methods for power quality assessment	.27			
	5.1	General	. 27			
	5.2	Site power quality assessment	.28			
	5.2.1	General	.28			
	5.2.2	Continuous phenomena	.28			
	5.2.3	For discontinuous phenomena (single event)	. 30			
	5.3	System aspect power quality assessment	.31			
	5.3.1	General	.31			
	5.3.2	For continuous phenomena	.31			
_	5.3.3	For discontinuous phenomena (events)	.31			
Ar	nnex A (informative) Examples of profiles for power quality specification	.34			
	A.1	General	. 34			
	A.2	LV and MV public distribution networks in European countries	.34			
	A.3	LV, MV and HV power supply system in China	.35			
	A.4	Example of a transmission system in Canada	.36			
A.5 Examples of profiles in Australia						
Ar	Annex B (informative) Additional information on power quality assessments					

IEC TS 6	62749:2020 © IEC 2020 – 3 –			
B.1	Weekly percentile values assessed on a daily sliding basis			
B.2	Example on system aspect continuous disturbance evaluation	39		
B.3	Aggregation method used for events	39		
B.3	1 General			
B.3	2 Time aggregation	39		
Annex C	(informative) Main impact of poor power quality	42		
C.1	General	42		
C.2	Harmonic distortion	42		
C.3	Voltage unbalance	42		
C.4	Voltage deviation	43		
C.5	Frequency deviation	43		
C.6	Voltage fluctuation	43		
C.7	Flicker	43		
C.8	Voltage dip (or voltage sag)	43		
C.9	Transient overvoltages	43		
Annex D micro-gr	(informative) Power quality issues related to distributed generation and ids	44		
D.1	General	44		
D.2	Voltage deviation	44		
D.3	Harmonics	44		
D.4	DG magnetic bias (DC current injection)	44		
D.5	Voltage fluctuation and flicker	45		
D.6	High frequency conducted disturbances	45		
Annex E	(informative) Methods to maintain and improve power quality	46		
E.1	General	46		
E.2	Voltage deviation			
E.3	Harmonics			
E.4	Flicker			
E.5	Voltage unbalance	47		
E.6	Voltage dip/swell/short time interruption	48		
Annex F	(informative) Relation between power quality and EMC			
F.1	General	49		
F.2	Differences between power quality and compatibility levels	49		
F.3	Example of power quality level versus compatibility level			
Annex G	(informative) Other phenomena			
G 1	General	53		
G 2	l evel behaviour over time	53		
G.3	Duration	53		
G 4	Periodicity	53		
G 5	Bandwidth	54		
Annex H	(informative) Role of stakeholders for power quality management –			
	Conoral			
н. Ц Э	Network operator – Network user			
н.2 Ц 2	Network user - Equipment supplier			
н.э ци	Network operator – Equipment supplier			
Bibliogra	inhv			
טוטוסין מאוויץ				

Figure 1 – Mains communicating voltages recommended values in percent of U_N used in public LV networks (or U_C in public MV networks)	26
Figure 2 – Example for illustrating voltage <i>THD</i> assessment result trends	30
Figure 3 – Example showing information of single event assessment	31
Figure B.1 – Comparison of two methods of assessing weekly 95 th percentile values	38
Figure B.2 – Example for illustrating the differences resulted by time aggregation method	40
Figure B.3 – Example of time sequence of voltage dips that can be aggregated in two different ways	41
Figure F.1 – Application points in a LV system (example)	50
Figure F.2 – Relation between disturbance levels (schematic significance only)	50
Figure F.3 – Cumulative distribution of all <i>THD</i> values recorded at 30 points of supply of the LV system, during one week	51
Figure F.4 – Weekly 95 th percentile <i>THD</i> values evaluated at each monitored LV point of supply	52
Table 1 – Classification of electromagnetic phenomena addressed by power quality indices	8
Table 2 – Flicker severity P_{lt} recommended values	21
Table 3 – Recommended values of individual harmonic voltages at the low voltage points of supply for orders up to 50 given in percent of the fundamental voltage U_I	22
Table 4 – Recommended values of individual harmonic voltages at the medium voltage points of supply for orders up to 50 given in percent of the fundamental voltage U_1	23
Table 5 – Indicative values of individual harmonic voltages at the high voltage points of supply given in percent of the fundamental voltage U_1	24
Table 6 – Site power quality assessment methods	29
Table 7 – Example of single event assessment	30
Table 8 – List of individual events measured at a single monitoring site	32
Table 9 – SARFI-X indices coming out of Table 8	32
Table 10 – Magnitude-duration table format	33
Table A.1 – Examples of profiles in European countries	34
Table A.2 – Examples of profiles in China	35
Table A.3 – Examples of profiles in Canada	36
Table A.4 – Examples of profiles in Australia	37
Table B.1 – Listing of system power quality evaluation	39

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ASSESSMENT OF POWER QUALITY – CHARACTERISTICS OF ELECTRICITY SUPPLIED BY PUBLIC NETWORKS

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 62749, which is a technical specification, has been prepared by IEC technical committee 8: System aspects of electrical energy supply.

- 6 -

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

Draft TS	Report on voting
8/1512/DTS	8/1524/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.

This second edition cancels and replaces the first edition published in 2015. This edition constitutes a technical revision.

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

- a) minimum number of remaining data for weekly analysis,
- b) improvement of the compatibility between EN 50160 and IEC TS 62749,
- c) further explanation of the conception of daily sliding window,
- d) further explanation of the aggregation method used for events,
- e) further explanation of the relation between Power Quality and EMC,
- f) addition of a new definition of mains communicating system (MCS),
- g) addition of a new Annex G: Other phenomena,
- h) transfer of the main content of IEC TR 62510 to IEC TS 62749.

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.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

The description of electricity is of fundamental importance within electricity supply systems. In the past, its characteristics depended less on its generation than on the way in which it was transported by networks and being used by the equipment of the multiple users. Faults or other events such as short-circuit and lightning strikes occurring within users' installations or public networks also disturb or degrade it.

Nowadays, Smart Grid construction and massive deployment of renewable energy sources increase the complexity of power quality management. For more information about power quality issues related to distributed generation and micro-grids, refer to Annex D.

NOTE For more information about role of stakeholders for power quality management, see Annex H.

There is a need for a common set of power quality (PQ) indices and measurement methods in order to allow different system operators to measure and report power quality in a consistent manner.

Regarding the limits or levels of power quality, the situation differs. Historically, the electrical systems in different countries/regions have been designed in different ways to cater for national/regional variations like different geographic, climatic or commercial conditions, etc. It is thus essential that any set of internationally agreed power quality limits or levels also recognize these differences, which depends namely on the system configuration, the transfer characteristics between the different voltage levels (attenuation or amplification), the actual disturbance levels on the system, etc.

Also, the quality of power is not absolute. Optimizing power quality should be carried out in a cost-effective manner to balance network user power quality requirements and willingness to pay for it with power quality supply costs.

Therefore, some of the objectives recommended hereafter allow for a range of values, or options, while still ensuring the coordination of disturbance levels between different parts of the system or voltage levels.

Then, the requirements to be applied can be expressed by the association of the IEC Power Quality framework from the normative part of this document and profiles. Examples of profiles are given in Annex A.

ASSESSMENT OF POWER QUALITY – CHARACTERISTICS OF ELECTRICITY SUPPLIED BY PUBLIC NETWORKS

1 Scope

This Technical Specification specifies the expected characteristics of electricity at the point of supply of public low, medium and high voltage, 50 Hz or 60 Hz, networks, as well as power quality assessment methods.

NOTE 1 The boundaries between the various voltage levels can be different for different countries/regions. In the context of this TS, the following terms for system voltage are used:

- low voltage (LV) refers to $U_{\rm N} \leq$ 1 kV;
- medium voltage (MV) refers to 1 kV < $U_{\rm N}$ \leq 35 kV;
- high voltage (HV) refers to 35 kV < $U_{\rm N}$ \leq 230 kV.

NOTE 2 Because of existing network structures, in some countries/regions, the boundary between medium and high voltage can be different.

This document applies to the phenomena listed in Table 1.

Continuous phenomena	Discontinuous phenomena – Events	Other phenomena
	Evente	
FREQUENCY DEVIATION	SUPPLY INTERRUPTION	MAINS COMMUNICATING VOLTAGES
SUPPLY VOLTAGE DEVIATION	VOLTAGE DIP	
VOLTAGE UNBALANCE	VOLTAGE SWELL	
HARMONIC VOLTAGE	TRANSIENT OVERVOLTAGE	
INTERHARMONIC VOLTAGE	RAPID VOLTAGE CHANGE	
FLICKER (VOLTAGE FLUCTUATION)		

Table 1 – Classification of electromagnetic phenomena addressed by power quality indices

NOTE 3 Specification of related measurement methods can be found in IEC 61000-4-30.

NOTE 4 Specification of the performance of related measuring instruments can be found in IEC 62586.

While power quality is related to EMC in a number of ways, especially because compliance with power quality requirements depends on the control of cumulative effect of electromagnetic emission from all/multiple equipment and/or installations, this document is not an EMC publication (see also Annex F).

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 60038, IEC standard voltages