BS EN 62586-1:2014

BSI Standards Publication

Power quality measurement in power supply systems

Part 1: Power quality instruments (PQI)

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National foreword

This British Standard is the UK implementation of EN 62586-1:2014. It is identical to IEC 62586-1:2013.

The UK participation in its preparation was entrusted to Technical Committee PEL/85, Measuring equipment for electrical and electromagnetic quantities.

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.

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EUROPEAN STANDARD

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EN 62586-1

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English Version

Power quality measurement in power supply systems - Part 1: Power quality instruments (PQI) (IEC 62586-1:2013)

Mesure de la qualité de l'alimentation dans les réseaux d'alimentation - Partie 1: Instruments de mesure de la qualité de l'alimentation
(CEI 62586-1:2013)

Messung der Spannungsqualität in Energieversorgungssystemen - Teil 1: Messgeräte für die Spannungsqualität
(IEC 62586-1:2013)

This European Standard was approved by CENELEC on 2014-01-16. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

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European Committee for Electrotechnical Standardization
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Europäisches Komitee für Elektrotechnische Normung

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Foreword

The text of document 85/460/FDIS, future edition 1 of IEC 62586-1, prepared by IEC/TC 85 "Measuring equipment for electrical and electromagnetic quantities" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62586-1:2014.

The following dates are fixed:

• latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2014-12-20
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2017-01-16

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive.

For the relationship with EU Directive see informative Annex ZZ, which is an integral part of this document.

Endorsement notice

The text of the International Standard IEC 62586-1:2013 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60359	NOTE	Harmonized as EN 60359.
IEC 61010 Series	NOTE	Harmonized as EN 61010 Series (partly modified).

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu

Publication	Year	Title	EN/HD	Year
IEC 60068-1	-	Environmental testing - Part 1: General and guidance	EN 60068-1	-
IEC 60068-2-1	-	Environmental testing - Part 2-1: Tests - Test A: Cold	EN 60068-2-1	-
IEC 60068-2-2	-	Environmental testing - Part 2-2: Tests - Test B: Dry heat	EN 60068-2-2	-
IEC 60068-2-6	-	Environmental testing - Part 2-6: Tests - Test Fc: Vibration (sinusoidal)	EN 60068-2-6	-
IEC 60068-2-14	-	Environmental testing - Part 2-14: Tests - Test N: Change of temperature	EN 60068-2-14	-
IEC 60068-2-27	-	Environmental testing - Part 2-27: Tests - Test Ea and guidance: Shock	EN 60068-2-27	-
IEC 60068-2-31	-	Environmental testing - Part 2-31: Tests - Test Ec: Rough handling shocks, primarily for equipment-type specimens	EN 60068-2-31	-
IEC 60068-2-52	-	Environmental testing - Part 2-52: Tests - Test Kb: Salt mist, cyclic (sodium chloride solution)	EN 60068-2-52	-
IEC 60068-2-57	-	Environmental testing - Part 2-57: Tests - Test Ff: Vibration - Time-history and sine-beat method	EN 60068-2-57	-
IEC 60068-2-78	-	Environmental testing - Part 2-78: Tests - Test Cab: Damp heat, steady state	EN 60068-2-78	-
IEC 60529	-	Degrees of protection provided by enclosures (IP Code)	EN 60529	-
IEC 60654-1	-	Industrial-process measurement and control equipment - Operating conditions - Part 1: Climatic conditions	EN 60654-1	-

Publication	Year	Title	EN/HD	Year
IEC 60664-1	2007	Insulation coordination for equipment within low-voltage systems - Part 1: Principles, requirements and tests	EN 60664-1	2007
IEC 60721-3-1	-	Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities - Section 1: Storage	EN 60721-3-1	-
IEC 60721-3-2	-	Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities - Section 2: Transportation	EN 60721-3-2	-
IEC 60721-3-3	-	Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities - Section 3: Stationary use at weatherprotected locations	EN 60721-3-3	-
IEC 61000-4-7 +A1	2002 2008	Electromagnetic compatibility (EMC) - Part 4-7: Testing and measurement techniques - General guide on harmonics and interharmonics measurements and instrumentation, for power supply systems and equipment connected thereto	EN 61000-4-7 +A1	2002 2009
IEC 61000-4-15	2010	Electromagnetic compatibility (EMC) - Part 4-15: Testing and measurement techniques - Flickermeter - Functional and design specifications	EN 61000-4-15	2011
IEC 61000-4-30	2008	Electromagnetic compatibility (EMC) - Part 4-30 : Testing and measurement techniques - Power quality measurement methods	EN 61000-4-30	2009
IEC/TS 61000-6-5	-	Electromagnetic compatibilty (EMC) - Part 6-5: Generic standards - Immunity for power station and substation environments	-	-
IEC 61010-1	2010	Safety requirements for electrical equipment for measurement, control and laboratory use - Part 1: General requirements	EN 61010-1	2010
IEC 61010-2-030	-	Safety requirements for electrical equipment for measurement, control and laboratory use - Part 2-030: Particular requirements for testing and measuring circuits	EN 61010-2-030	-

Publication	Year	Title	EN/HD	Year
IEC 62262	-	Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)	EN 62262	-
IEC 62586-2	-	Power quality measurement in power supply systems - Part 2: Functional tests and uncertainty requirements	EN 62586-2	-
CISPR 22	-	Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement	EN 55022	-

Annex ZZ
(informative)

Coverage of Essential Requirements of EU Directives

This European Standard has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association and within its scope the standard covers protection requirements of Annex I Article 1 of the EU Directive 2004/108/EC.

Compliance with this standard provides one means of conformity with the specified essential requirements of the Directive concerned.

WARNING: Other requirements and other EU Directives may be applicable to the products falling within the scope of this standard.

CONTENTS

INTRODUCTION

Electricity as delivered to the network users has several characteristics which are variable and which affect its usefulness to the network user.

Power quality instruments on the market have different characteristics. This standard provides a common system of references in order to facilitate their selection, comparison and evaluation. This standard specifies a classification based on product performances, environment and safety.

It is acknowledged that IEC 61000-4-30 is a basic EMC publication. Detailed guidance on instrument performance, performance verification methods, additional influence quantities and other similar information should, in general, be found in a product standard.

IEC 62586-1 is a product standard that refers to IEC 61000-4-30, IEC 61000-4-7 and IEC 61000-4-15 for measuring methods. IEC 62586-2 specifies functional tests and uncertainty requirements for instruments in the scope of IEC 62586-1.

IEC 62586-1 is therefore complementing basic EMC standards with environmental, safety and performance requirements.

POWER QUALITY MEASUREMENT IN POWER SUPPLY SYSTEMS –

Part 1: Power quality instruments (PQI)

1 Scope

This part of IEC 62586 specifies product and performance requirements for instruments whose functions include measuring, recording and possibly monitoring power quality parameters in power supply systems, and whose measuring methods (class A or class S) are defined in IEC 61000-4-30.

These requirements are applicable in single, dual- (split phase) and 3-phase a.c. power supply systems at 50 Hz or 60 Hz.

These instruments can be used:

– in the generation, transmission and distribution of electricity, for example inside a power station, substation or a distributed generator connection.
– at the interface point between the installation and the network, e.g. in order to check the compliance of the connection agreement between a network operator and the customer.

NOTE 1 These instruments can also be used for other applications, e.g. inside commercial / industrial installations especially where comparable measurements are needed (i.e. data centers or petrochemical plants).

These instruments are fixed-installed or portable. They are intended to be used indoors and/or outdoors.

Devices such as digital fault recorders, energy/power meters, protection relays or circuit breakers may include power quality functions defined in 61000-4-30 class A or class S. If such devices are specified according to this standard, then this standard fully applies and applies in addition to the relevant product standard. This standard does not replace the relevant product standard.

NOTE 2 It is not the intent of this standard to address user interface or topics unrelated to device measurement performance.

NOTE 3 The standard does not cover post-processing and interpretation of the data, for example with a dedicated software.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60068-1, *Environmental testing – Part 1: General and guidance*

IEC 60068-2-1, *Environmental testing – Part 2-1: Tests – Tests A: Cold*

IEC 60068-2-2, *Environmental testing – Part 2-2: Tests – Tests B: Dry heat*

IEC 60068-2-6, *Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-14, *Environmental testing – Part 2-14 Tests – Test N: Change of temperature*

IEC 60068-2-27, *Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock*

IEC 60068-2-31, *Environmental testing – Part 2-31: Tests – Test Ec: Rough handling shocks, primarily for equipment-type specimens*

IEC 60068-2-52, *Environmental testing – Part 2-52: Tests – Test Kb: Salt mist, cyclic (sodium chloride solution)*

IEC 60068-2-57, *Environmental testing – Part 2-57: Tests – Test Ff: Vibration – Time-history and sine-beat method*

IEC 60068-2-78, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 60654-1, *Industrial-process measurement and control equipment – Operating conditions – Part 1: Climatic conditions*

IEC 60664-1:2007, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

IEC 60721-3-1, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 1: Storage*

IEC 60721-3-2, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 2: Transportation*

IEC 60721-3-3, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Section 3: Stationary use at weatherprotected locations*

IEC 61000-4-7:2002, *Electromagnetic compatibility (EMC) – Part 4-7: Testing and measurement techniques – General guide on harmonics and interharmonics measurements and instrumentation, for power supply systems and equipment connected thereto* Amendment 1:2008

IEC 61000-4-15:2010, *Electromagnetic compatibility (EMC) – Part 4-15: Testing and measurement techniques – Flickermeter – Functional and design specifications*

IEC 61000-4-30:2008, *Electromagnetic compatibility (EMC) – Part 4-30: Testing and measurement techniques – Power quality measurement methods*

IEC /TS 61000-6-5, *Electromagnetic compatibility (EMC) – Part 6-5: Generic standards – Immunity for power station and substation envir*onments

IEC 61010-1:2010, *Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements*

IEC 61010-2-030, *Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 2-030: Particular requirements for testing and measuring circuits*

IEC 62262, *Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)*

IEC 62586-2, *Power quality measurement in power supply systems – Part 2: Functional tests and uncertainty requirements*

CISPR 22, *Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement*

3 Terms, definitions, abbreviations, notations and symbols

For the purposes of this document, the terms and definitions given in IEC 61000-4-30 as well as the following terms and definitions apply.

3.1 General definitions

3.1.1
power quality instrument
PQI
instrument whose main function is to measure, record and possibly monitor power quality parameters in power supply systems, and whose measuring methods (class A or class S) are defined in IEC 61000-4-30

3.1.2
power quality instrument class A
PQI-A
PQI whose measuring methods comply with class A of IEC 61000-4-30

3.1.3
power quality instrument class S
PQI-S
PQI whose measuring methods comply with class S of IEC 61000-4-30

3.1.4
portable instrument
portable measuring instrument
measuring instrument designed to be easily carried by hand and to be connected and disconnected by the user

[SOURCE: IEC 60050-300:2001, 312-02-18]

3.1.5
fixed installed instrument
fixed installed measuring instrument
measuring instrument designed to be permanently mounted and which is intended to be connected by means of permanently installed connectors

[SOURCE: IEC 60050-300:2001, 312-02-17, modified – “conductors” has been replaced by “connectors”.]

3.1.6
panel mounted instrument
fixed installed instrument intended to be mounted in a cut out of a panel or a chassis

3.1.7
modular instrument fixed on DIN rail
fixed installed instrument intended to be used in switchgear or control gear, fixed on a DIN rail

3.1.8
housing instrument fixed on DIN rail
fixed installed instrument, intended to be fixed on a DIN rail within a control panel

3.2 Terms and definitions related to environments

3.2.1
EMC environment H
harsh EMC environment

EXAMPLES High voltage stations, arc furnaces, welding, aluminium plants.

Note 1 to entry: This environment is described in IEC 61000-6-5 as H environment. A summary description of such environments is given in Annex A.

3.2.2
EMC environment G
general EMC environment

EXAMPLES Power stations, MV and LV substations, extended industrial applications.

Note 1 to entry: This environment is described in IEC 61000-6-5 as G environment. A summary description of such environments is given in Annex A.

3.2.3
uncontrolled environment
environment where climatic conditions such as temperature and humidity depend on external climatic conditions and on housing of products

Note 1 to entry: Shelter or housing can be used to minimize the impact of environment.

3.2.4
controlled environment
environment where climatic conditions such as temperature and humidity are under control

Note 1 to entry: This kind of environment is usually controlled by HVAC systems.

3.2.5
limit range of operation
extreme conditions that an measuring instrument can withstand without damage and without degradation of its metrological characteristics when it is subsequently operated within its rated operating conditions

Note 1 to entry: Measuring instrument should be able to function within the limit range of operation

3.2.6
rated range of operation
range of values of a single influence quantity that forms a part of the rated operating conditions

Note 1 to entry: Uncertainty requirements should be met within the rated range of operation

3.3 Definitions related to uncertainty

3.3.1
intrinsic uncertainty
uncertainty of a measuring instrument when used under reference conditions

Note 1 to entry: In this standard, it is the uncertainty of a measured value defined in its rated range and with all influence quantities under reference conditions, unless otherwise stated.

[SOURCE: IEC 60359:2001, 3.2.10, modified – Note 1 to entry has been added.]

3.3.2
influence quantity
quantity which is not the subject of the measurement and whose change affects the relationship between the indication and the result of the measurement

Note 1 to entry: Influence quantities can originate from the measured system, the measuring equipment or the environment.

Note 2 to entry: As the calibration diagram depends on the influence quantities, in order to assign the result of a measurement it is necessary to know whether the relevant influence quantities lie within the specified range.

[SOURCE: IEC 60359:2001, 3.1.14, modified – Note 3 has been deleted.]

3.3.3
variation
variation due to a single influence quantity
difference between the value measured under reference conditions and any value measured within the rated operating range (for this specific influence quantity)

Note 1 to entry: The other performance characteristics and the other influence quantities should stay within the ranges specified for the reference conditions.

3.3.4
rated operating conditions
set of conditions that must be fulfilled during the measurement in order that a calibration diagram may be valid

Note 1 to entry: Beside the specified measuring range and rated operating ranges for the influence quantities, the conditions may include specified ranges for other performance characteristics and other indications that cannot be expressed as ranges of quantities.

[SOURCE: IEC 60359:2001, 3.3.13]

3.3.5
operating uncertainty
uncertainty under the rated operating conditions

Note 1 to entry: The operating instrumental uncertainty, like the intrinsic one, is not evaluated by the user of the instrument, but is stated by its manufacturer or calibrator. The statement may be expressed by means of an algebraic relation involving the intrinsic instrumental uncertainty and the values of one or several influence quantities, but such a relation is just a convenient means of expressing a set of operating instrumental uncertainties under different operating conditions, not a functional relation to be used for evaluating the propagation of uncertainty inside the instrument.

[SOURCE: IEC 60359:2001, 3.2.11, modified – the word "instrumental" has been removed from both the term and the definition.]

3.3.6
overall system uncertainty
uncertainty including the uncertainty of all components related to the measurement system (sensors, wires, measuring instrument, etc.) under the rated operating conditions

3.4 Notations

3.4.1 Functions

See functions defined in IEC 61000-4-30.

3.4.2 Symbols and abbreviations

N.R. Not requested

N.A. Not applicable

3.4.3 Indices

min minimum value

max maximum value

4 Environmental conditions

4.1 General

This standard classifies power quality instruments according to the following criterion:

- instruments that are complying either with class A measurement methods of IEC 61000-4-30 (PQI-A) or with class S measurement methods of IEC 61000-4-30 (PQI-S);
- instruments that are either fixed installed (F), or portable (P);
- instruments that are intended to be used either Indoor (I) or Outdoor (O);
- instruments that are intended to be used in generic EMC environment G or in specific harsh EMC environment H. See Annex A.

Instruments shall be named according to coding of Table 1. The list of all allowed instruments is given in Table 2 and Table 3.

Table 1 – Products coding table

Power quality instrument (PQI)	Functions class according to IEC 61000-4-30 (A or S)	Fixed installed (F) or Portable (P) instrument	Indoor (I) or Outdoor (O) application	EMC environment G (blank) or H (-H)
PQI-A or PQI-S		-FI1, -FI2, -FO, -PI or -PO [a]		Blank or -H [a]
[a] See Table 4 and Table 5.				

Table 2 – Definition of class A products

	Fixed installed		Portable	
	Indoor application	Outdoor application	Indoor application	Outdoor application
EMC environment G	PQI-A-FI1 PQI-A-FI2	PQI-A-FO	PQI-A-PI	PQI-A-PO
EMC environment H	PQI-A-FI1-H PQI-A-FI2-H	PQI-A-FO-H	PQI-A-PI-H	PQI-A-PO-H
NOTE FI1 is an indoor environment with uncontrolled temperature variations, while FI2 is an indoor environment with controlled temperature variations				

Table 3 – Definition of class S products

	Fixed installed		Portable	
	Indoor application	**Outdoor application**	**Indoor application**	**Outdoor application**
EMC environment G	PQI-S-FI1 PQI-S-FI2	PQI-S-FO	PQI-S-PI	PQI-S-PO
EMC environment H	PQI-S-FI1-H PQI-S-FI2-H	PQI-S-FO-H	PQI-S-PI-H	PQI-S-PO-H
NOTE FI1 is an indoor environment with uncontrolled temperature variations, while FI2 is an indoor environment with controlled temperature variations				

4.2 Environments FI1, FI2, FI1-H, FI2-H, FO and FO-H

Those environments are dedicated to fixed-installed instruments, used:

– in EMC environment G or in EMC environment H;

– for indoor operation or outdoor operation.

Table 4 – Description of FI1, FI2, FI1-H, FI2-H, FO, FO-H environments

Environmental parameters		Storage and transport	Indoor operation	Outdoor operation
Ambient temperature: limit range of operation [a]		IEC 60721-3-1 / 1K5 -40 °C to + 70 °C IEC 60721-3-2 / 2K4 -40 °C to + 70 °C	FI1: IEC 60721-3-3 / 3K6 -25 °C to + 55 °C FI2: IEC 60721-3-3 / 3K5 mod.: 0 °C to +45 °C	Depends on the geographic regions or the application [g] At least the requirements for indoor operation are mandatory
Ambient temperature: rated range of operation [b]		---	FI1:IEC 60721-3-3 / 3K5 mod. -10 °C to + 45° FI2:IEC 60721-3-3 / 3K5 mod. 0 °C to + 45 °C	IEC 60721-3-3 / 3K6 -25 °C to + 55 °C
Relative humidity: 24 h average		from 5 % to 95 % [d]	from 5 % to 95 % [d]	from 5 % to 95 % [d]
Solar radiations		Negligible	700 W/m^2	1120 W/m^2
Wind-driven precipitation (rain, snow, hail, etc.)		Negligible	Negligible	Significant precipitation.
Air pollution by dust, salt, smoke, corrosive/flammable gas, vapours		No significant air pollution [c]	No significant air pollution [c]	Significant air pollution by dust and salt.
Vibration, earth tremors		IEC 60721-3-1 / 1M1 IEC 60721-3-2 / 2M1	IEC 60721-3-3 / 3M1	IEC 60721-3-3 / 3M1
Electromagnetic disturbances immunity	Environments FI1, FI2, FO	---	IEC 61000-6-5 environment G	IEC 61000-6-5 environment G
	Environments FI1-H, FI2-H, FO-H	---	IEC 61000-6-5 environment H	IEC 61000-6-5 environment H
Altitude		---	≤ 2 000 m	≤ 2 000 m
Pollution degree		---	2 according to IEC 61010	2 or 3 according to IEC 61010

Environmental parameters	Storage and transport	Indoor operation	Outdoor operation
Overvoltage category (related to the mains supply)	---	IEC 61010 Overvoltage category III [e f]	IEC 61010 Overvoltage category III [e f]
Measurement category (related to the measurement inputs)	---	IEC 61010 Measurement category III or IV [e f]	IEC 61010 Measurement category III or IV [e f]

[a] See definition. Temperature may be lower on the front face of panel mounted instruments.

[b] See definition.

[c] These conditions correspond to maximum values given for classes 3C1 and 3S1 in IEC 60721-3-3.

[d] No condensation or ice is considered. See Figure 1.

[e] If the instrument is supplied by the circuit being measured, then Overvoltage category and Measurement category shall be the same category number.

[f] For guidance on the selection of the correct measurement category, see IEC 61010-2-030. For guidance on the overvoltage category, see IEC 61010-1.

[g] Limit range of operation shall be specified by manufacturer.

4.3 Environments PI, PI-H, PO and PO-H

Those environments are dedicated to portable instruments,

– used in EMC environment G or in EMC environment H

– for indoor applications or outdoor applications.

Table 5 – Description of PI, PI-H, PO and PO-H environments

Environmental parameters		Storage	Indoor operation	outdoor operation
Ambient temperature: limit range of operation [a]		IEC 60721-3-1/ 1K5 –40 °C to + 70 °C IEC 60721-3-2 / 2K4 –40 °C to + 70 °C	IEC 60721-3-3 / 3K5 –5 °C to + 45 °C	Depends on the geographic regions or the application [g] At least the requirements for indoor operation are mandatory
Ambient temperature: rated range of operation [b]		---	IEC 60721-3-3 / 3K5 mod. 0 °C to + 40 °C	IEC 60721-3-3 / 3K6 -5 °C to + 45 °C
Relative humidity: 24 h average		from 5 % to 95 % [d]	from 5 % to 95 % [d]	from 5 % to 95 % [d]
Solar radiations		Negligible	700 W/m²	1 120 W/m²
Wind-driven precipitation (rain, snow, hail, etc.)		Negligible	Negligible	Significant precipitation.
Air pollution by dust, salt, smoke, corrosive/flammable gas, vapours		No significant air pollution [c]	No significant air pollution [c]	Significant air pollution by dust and salt.
Vibration, earth tremors		IEC 60721-3-1 / 1M1 IEC 60721-3-2 / 2M1	IEC 60721-3-3 / 3M2	IEC 60721-3-3 / 3M2
Electromagnetic disturbances immunity	Environments PI or PO	---	IEC 61000-6- 5 environment G	IEC 61000-6- 5 environment G
	Environments PI-H or PO-H	---	IEC 61000-6- 5 environment H	IEC 61000-6- 5 environment H
Altitude		≤ 2 000 m	≤ 2 000 m	≤ 2 000 m
Pollution degree		---	2	2 or 3
Overvoltage category (related to the mains)		---	IEC 61010 overvoltage category III [e f]	IEC 61010 overvoltage category III [e f]
Measurement category (related to the measurement inputs)		---	IEC 61010 measurement category III or IV [e f]	IEC 61010 measurement category III or IV [e f]

[a]	See definition.
[b]	See definition.
[c]	These conditions correspond to maximum values given for classes 3C1 and 3S1 in IEC 60721-3-3.
[d]	No condensation or ice is considered. See Figure 1.
[e]	If the instrument is supplied by the circuit being measured, then Overvoltage category and Measurement category shall be the same category number.
[f]	For guidance on the selection of the correct measurement category, see IEC 61010-2-030. For guidance on the overvoltage category, see IEC 61010-1.
[g]	Limit range of operation shall be specified by manufacturer.

4.4 Relationship between ambient air temperature and relative humidity

Classes C1 and C2 defined in IEC 60654-1 apply taking into account the values of Table 4 and Table 5.

5 Ratings

5.1 Rated input energising voltages

The preferred rated values of voltages for a.c. (r.m.s.) are those given below, together with those values multiplied by √3 or 1/√3: 100 V; 110 V; 115 V; 120 V; 200 V; 220 V; 230 V; 240 V; 480 V; 600 V and 690 V.

The values above are preferred values however if a PQI complies with a specific country's requirement not covered by the above, this shall be stated by the manufacturer.

5.2 Rated frequencies

The standard rated values of frequency shall be selected from the following:

50 Hz; 60 Hz.

6 Design and construction

6.1 General

The following requirements as well as those given in IEC 62586-2 shall apply.

NOTE IEC 62586-2 specifies functional tests and uncertainty requirements for instruments in the scope of this standard.

6.2 General architecture

Organisation of the measurement chain: the electrical quantity to be measured may be either directly accessible, as it is generally the case in low-voltage systems, or accessible via measurement sensor like voltage sensors (VS) or current sensors (CS).

It shall be possible to download data stored in the instrument, for example with a communication network, or through a removable memory.

Figure 1 below specifies the general architecture of the instrument, the dotted lines show optional units of the instrument.

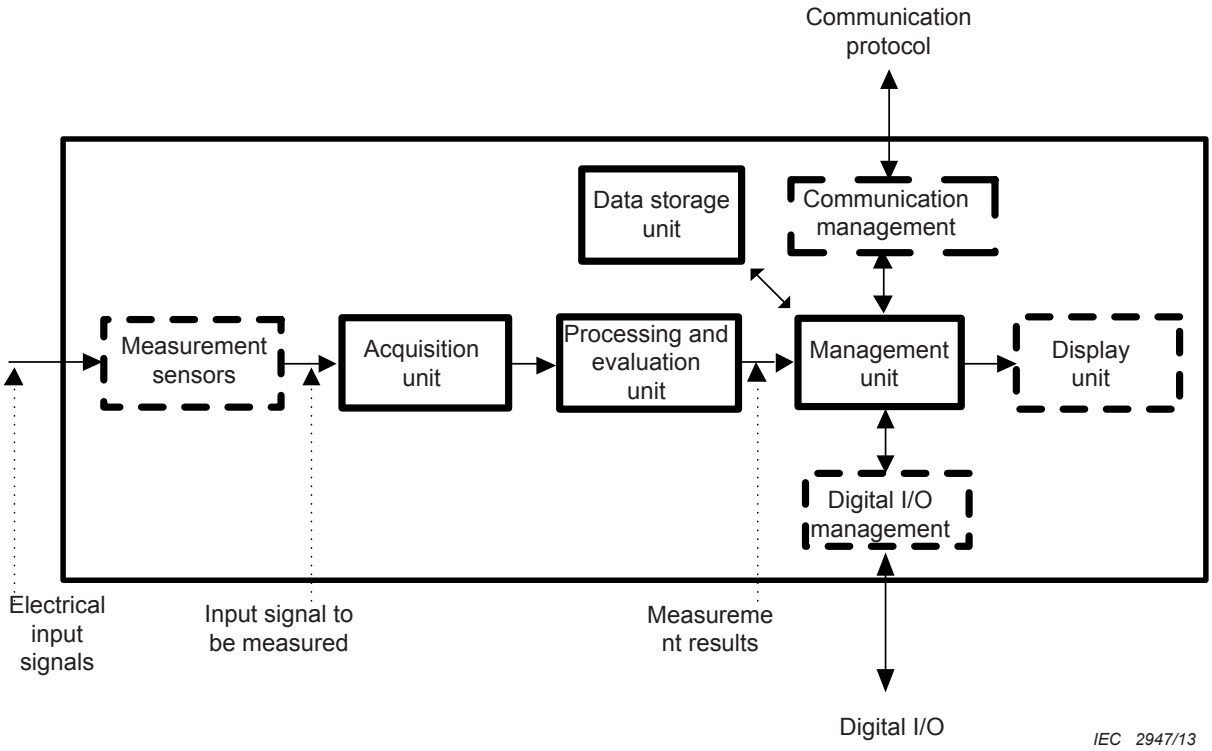


Figure 1 – Instrument generic measurement chain

6.3 Functions embedded in PQI-A and PQI-S

6.3.1 PQI-A minimum functions definition

Any PQI-A shall include all the mandatory functions specified in Table 6.

Table 6 – PQI-A functions

Function and data provided [c]	Requirement [a]	Measurement method, measuring uncertainty and measuring range according to IEC 61000-4-30
Power Frequency 10 sec data	M	class A
Magnitude of the Supply Voltage 150/180 cycles, 10 minutes and 2-hours data.	M	class A
Flicker 10 minutes Pst and 2-hours Plt data.	M	class A
Supply voltage dips and Swells Residual voltage, swell voltage and duration	M	class A
Supply voltage interruptions Residual voltage and duration	M	class A
Supply voltage unbalance 150/180 cycles, 10 minutes and 2-hours data.	M	class A
Voltage Harmonics 150/180 cycles, 10 minutes and 2-hours data.	M	class A
Voltage Inter-harmonics 150/180 cycles, 10 minutes and 2-hours data.	M	class A
Mains Signalling Voltage Msv data	M	class A
Under/over deviation 150/180 cycles, 10 minutes and 2-hours data.	O [b]	class A

[a] M = mandatory; O = optional

[b] When an optional function is embedded, then this function shall comply with the relevant requirements defined in IEC 61000-4-30.

[c] Aggregations data shall be computed by the instrument for all implemented functions, but may be not recorded by the instrument.

NOTE Additional data such as waveform capture can be beneficial for the analysis of dips/swells/interruptions.

6.3.2 PQI-S minimum functions definition

Any PQI-S shall include all the mandatory functions specified in Table 7. Should one of the optional functions of Table 7 be included in the instrument, then this function shall comply with the measurement method, measurement uncertainty and measuring range specified in IEC 61000-4-30.

Table 7 – PQI-S minimum functions

Function and data provided [c]	Requirement [a]	Measurement method, measuring uncertainty and measuring range according to IEC 61000-4-30
Power frequency 10 s data	M	Class A or class S
Magnitude of the supply voltage 150/180 cycles, 10 minutes and 2-hours data.	M	Class A or class S
Flicker 10 minutes Pst and 2-hours Plt data.	O [b]	Class A or class S
Supply voltage dips and swells Residual voltage, swell voltage and duration	M	Class A or class S
Supply voltage interruptions Residual voltage and duration	M	Class A or class S
Supply voltage unbalance 150/180 cycles, 10 minutes and 2-hours data.	M	Class A or class S
Voltage harmonics 150/180 cycles, 10 minutes and 2-hours data.	O [b]	Class A or class S
Voltage inter-harmonics 150/180 cycles, 10 minutes and 2-hours data.	O [b]	Class A or class S
Mains ignalling voltage Msv data	O [b]	Class A or class S
Under/over deviation 150/180 cycles, 10 minutes and 2-hours data.	O [b]	Class A or class S

[a] M = mandatory; O = optional

[b] When an optional function is embedded, then this function shall comply with the relevant requirements defined in IEC 61000-4-30.

[c] Aggregations data shall be computed by the instrument for all implemented functions, but may be not recorded by the instrument.

NOTE Additional data such as waveform capture can be beneficial for the analysis of dips/swells/interruptions.

6.3.3 Summary of IEC 61000-4-30 requirements for functions

NOTE A summary of the functions is given in IEC 61000-4-30.

In order to measure voltage in the presence of harmonics, the PQI shall be able to measure up to a crest factor 2 (see IEC 61000-4-7).

6.4 Additional requirements complementary to IEC 61000-4-30

6.4.1 Data to be provided for testing reasons

For testing reasons, any PQI shall provide (by any means) all the readings of the power quality parameters defined in IEC 61000-4-30 that a device supports, including the 10/12 cycles values, the 150/180 cycles values, the 10-minutes values, the 2-hours values and the 10 seconds value for frequency measurement.

For testing reasons, any PQI shall provide (by any means) the following information correlated with each power quality reading according to IEC 61000-4-30:

- date;
- time;
- flagging information (for readings that support flagging);
- block numbering of 10/12-cycle and 150/180-cycle measurements within each 10 minutes interval.

Table 8 specifies a summary of the measured values and of the additional internal data.

Table 8 – Summary of measurements requested for testing

<table>
<tr><th>Function</th><th>PQ computation</th><th>Triggered events</th><th>Aggregation</th><th>Additional data for testing</th><th>Flagging</th></tr>
<tr><td>Power frequency</td><td>10 sec measurement</td><td></td><td></td><td></td><td>X</td></tr>
<tr><td>Magnitude of the supply voltage</td><td rowspan="5">10 minutes aggregation measurement
2-hours aggregation measurement</td><td rowspan="5"></td><td>X</td><td rowspan="5">10/12 cycles measurement
150/180 cycles aggregation measurement
Block numbering to RTC 10-min tick (for 10/12-cycle (Overlap 1) and 150/180-cycle (Overlap 2) readings)</td><td>X</td></tr>
<tr><td>Supply voltage unbalance</td><td>X</td><td>X</td></tr>
<tr><td>Voltage harmonics</td><td>X</td><td>X</td></tr>
<tr><td>Voltage inter-harmonics</td><td>X</td><td>X</td></tr>
<tr><td>Under/over deviation</td><td>X</td><td>X</td></tr>
<tr><td>Flicker</td><td>10 minutes P_{st} value
2-hours P_{lt} value</td><td></td><td>according to IEC 61000-4-15</td><td>P_{inst} output (also called “output 5” referenced by IEC 61000-4-15)</td><td>X</td></tr>
<tr><td>Supply voltage dips and interruptions</td><td rowspan="2"></td><td>Residual voltage $U_{rms}(1/2)$ or depth and time stamps (duration)</td><td>N.A.</td><td rowspan="2">Fault records (samples) and $U_{rms}(1/2)$ values during event (independently synchronized on each channel on zero crossing)</td><td>N.A.</td></tr>
<tr><td>Supply voltage swells</td><td>maximum swell magnitude and time stamps (duration)</td><td>N.A.</td><td>N.A.</td></tr>
<tr><td>Mains signalling voltage</td><td>Msv(t)</td><td></td><td>N.A.</td><td>N.A.</td><td>X</td></tr>
</table>

6.4.2 Resolution of the presented data

Resolution of the presented data shall support the required accuracy.

NOTE As an example, with U_{din} = 63 V, a 0,1 % accuracy means a 0,06 V resolution, then at least two decimal digits are requested.

6.4.3 Clarification about “data flagging”

6.4.3.1 Data flagging requirement

Data flagging is based on the IEC 61000-4-30 flagging concept. The detection of interruptions, dips and swells is dependent on the threshold selected by the end-user, and this selection will influence which data is flagged.

Flagged data shall not be removed, as it is intended to warn the end-user that data may be flawed.

NOTE There are two valid flagging approaches that can be implemented by the manufacturers:

– Polyphase approach as specified in IEC 61000-4-30: flag is computed based on the occurrence of polyphase dips / swells / interruptions (one flag for all phases).

– Channel by channel approach: flag is computed from the occurrence of the single phase dips / swells /interruptions channel by channel (one flag per channel).

Manufacturers shall document the approach they implemented. However, if the instrument monitors a polyphase system, then the IEC 61000-4-30 approach for flagging is mandatory.

This product standard does not define when or how the flagging should occur.

It is possible to flag data online either as part of internal aggregation or in a post-processing evaluation task.

The manufacturer shall describe where the data is flagged.

6.4.3.2 Additional “data marking”

Additional data marking, not based on the IEC 61000-4-30 flagging concept, may be available in order to indicate that measured data might be unreliable.

If additional data marking is available, the instrument shall clearly indicate (e.g. with a log file) the time when measurements may be out of the specified uncertainty. The manufacturer shall provide a list of possible causes that can lead to this data marking.

NOTE 1 Example of additional data marking could be the result of: temperature influence on measurement chain, loss of synchronization, voltage measuring input over-range, loss of reference voltage for frequency measurement, phase locked loop failure, etc. This list is not exhaustive.

NOTE 2 Current measuring input over-range is not included because of frequent occurrence.

It is possible to mark data online as part of internal aggregation or in a post-processing evaluation task. This product standard will not define when or how the marking occurs; the manufacturer shall describe how the data is marked.

6.4.4 Temperature drift requirement within the rated range of operation for ambient air temperature

The below requirements do not apply under reference conditions.

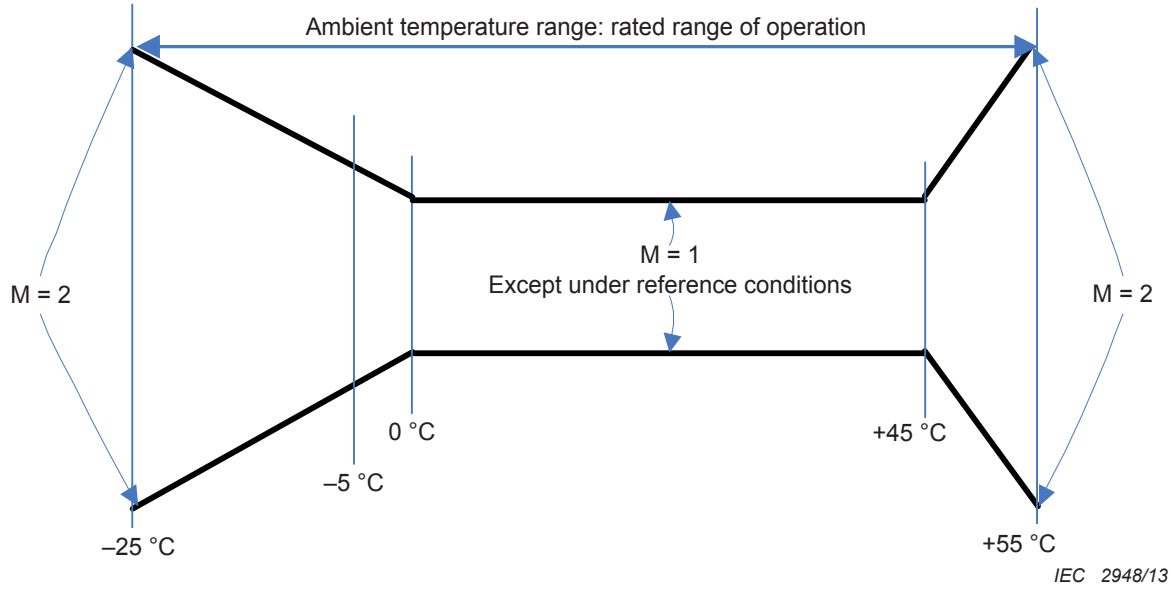
When operating outside reference conditions, the maximum variation caused by change of air temperature from reference conditions (as defined in clause 8.2), within the limit of the rated

range of operation for air temperature according to Table 4 and Table 5, shall not exceed the measurement uncertainty (as specified in IEC 61000-4-30) multiplied by M, where M is given in Table 9:

Table 9 – Uncertainty multipliers for different temperature ranges

Air temperature	Maximum value for M
Between 0 °C and +45 °C	1,0
Below 0 °C	1,0 at 0 °C, varying linearly to 2,0 at -25 °C as illustrated in Figure 2.
Above +45 °C	1,0 at +45 °C, varying linearly to 2,0 at +55 °C as illustrated in Figure 2.

Instruments are only required to meet these drift requirements within their rated range of operation for ambient temperature according to Table 4 and Table 5.



An example for class A measurement of magnitude of voltage is given below:

- Consider the case of a PQI-A instrument, for the magnitude of supply voltage parameter.
- A measurement is taken under reference conditions to obtain the reference measurement (which shall be within ±0,1 % of U_{din} from the expected value, according to the IEC 61000-4-30 Class A measurement uncertainty).
- Then, as the ambient temperature varies, the measurement may only vary from the reference measurement by the amount specified above.
- Some sample temperatures and the allowable measurement variations are:

  –25 °C: May vary from reference measurement by ±0,2 % of U_{din} (M = 2)

  –10 °C: May vary from reference measurement by ±0,14 % of U_{din} (M = 1,4)

  –5 °C: May vary from reference measurement by ±0,12 % of U_{din} (M = 1,2)

  0 °C: May vary from reference measurement by ±0,1 % of U_{din} (M = 1)

  +45 °C: May vary from reference measurement by ±0,1 % of U_{din} (M = 1)

  +55 °C: May vary from reference measurement by ±0,2 % of U_{din} (M = 2)

Figure 2 – Uncertainty requirement as a function of temperature

6.5 Safety requirements

Overvoltage categories specified in IEC 61010-1 as well as measurement categories specified in IEC 61010-2-030 shall apply.

Circuits intended to be connected to an external accessible circuit shall be considered as accessible conductive parts, for example communication circuits.

A communication port that may be connected to a data system shall also be considered as an accessible conductive part.

These accessible conductive parts require protection against single fault.

NOTE Basic insulation is not a sufficient protection against single fault condition. Examples of relevant insulation are double insulation or reinforced insulation or other protection means specified in IEC 61010 series.

The neutral conductor within the instrument shall be considered as a hazardous live part.

The connection of a PQI to an external high voltage sensor (e.g. for systems with rated voltages higher than 1 000 V a.c.) is allowed provided that design features of such sensors prevent any hazards.

6.6 EMC requirements

6.6.1 Emissions

CISPR 22 class A requirements shall apply.

6.6.2 Immunity

Instruments shall comply with the relevant environment as defined in Table 4 and Table 5.

6.7 Climatic requirements of PQI

Instruments shall comply with the relevant environment as defined in Table 4 and Table 5.

6.8 Mechanical requirements

6.8.1 Product mechanical robustness

Instruments shall comply with the relevant environment as defined in Table 4 and Table 5.

6.8.2 Enclosure robustness

The requirements of Table 10 shall be fulfilled as type-tests.

Table 10 – Enclosure mechanical requirements

Enclosure robustness, de-energised test	Reference standard	Fixed installed equipment [a]	Portable equipment [a]
Protection provided by enclosure	IEC 62262	IK 06 (1 J)	IK 06 (1 J)
[a] For mechanical tests with an equipment de-energised, the product functions shall remain in their specifications after the test.			

The performance of the enclosure shall not be degraded.

There shall be no visible mechanical or structural failures and the electrical performance of the instruments shall not be affected by the tests listed in this clause.

NOTE 1 Some examples of structural failures are cracks, fractures, deformations, delaminations.

NOTE 2 This test deals with robustness and is different from the one defined in IEC 61010 series regarding the performance criteria.

6.9 Degree of protection by enclosures

The manufacturer shall document equipment Intrusion Protection (IP) according to IEC 60529. The minimum requirements are given in Table 11. It specifies the minimum IP requirements for the different kind of housings of PQI instruments.

Table 11 – Minimum IP requirements

	For indoor applications		For outdoor applications	
Kind of instrument	**Exposed parts (e.g. front panel)** [a]	**Not exposed parts (e.g. housing), except front panel**	**Exposed parts (e.g. front panel not in a cabinet)** [a] [b]	**Not exposed parts (e.g housing, front panel in a cabinet), except front panel**
Fixed installed, panel mounted instruments [b]	IP 40	IP 20	IP 54 when installed according to the manufacturer's instructions.	IP 51 when installed according to the manufacturer's instructions
Fixed installed, modular instruments fixed on DIN rails within distribution panel [b]	IP 40	IP 20		
Fixed installed, housing instruments fixed on DIN rails [b]	IP 20	IP 20		
Portable instruments.	IP 40	IP 40	IP 52	IP 51
[a] Except for temporary opened covers.				
[b] See definitions.				

6.10 Start-up requirements

With a steady-state signal applied to the measurement inputs prior to applying power to the device, an accurate reading of the magnitude of the supply voltage shall be available via communications or local user interface 15 s after applying power to the device. If the start-up is longer than 15 s, manufacturers shall specify the maximum time until measurement quantities shall be available via communications or local user interface after power supply is applied.

7 Marking and operating instructions

7.1 General

Marking and operating instructions shall comply with IEC 61010-1, additional requirements are specified below.

7.2 Marking

The type of instruments shall be marked according to Table 1, Table 2 and Table 3. This marking shall be explained in the operating instruction manual, for example copy the relevant line of Table 2 or Table 3 in this manual or explain the rationale of the marking.

7.3 Operating instructions

The manufacturer shall specify the instrument characteristics according to Table 12.

Table 12 – Characteristics specification template

Function symbols	Function	Class according to IEC 61000-4-30 (A or S) or Not Applicable	Range	Additional information
f	Power frequency			
U	Magnitude of the supply Voltage		(Expressed as a range of U_{din}) [a]	(Expressed as a range of voltage)
P_{st}, P_{lt}	Flicker			
U_{dip}, U_{swl}	Supply voltage dips and swells		N.A.	
U_{int}	Supply voltage interruptions			
u_0, u_2	Supply voltage unbalance			
U_h	Voltage harmonics			
U_{ih}	Voltage inter-harmonics			
Msv	Mains signalling voltage			
Under/over	Under/over deviation			
It is strongly recommended that all functions are listed, and only existing ones are specified.				
[a] For example, an instrument specified for range of U_{din} = [100 V to 400 V] shall meet the uncertainty requirement for at least 10 V to 600 V for class A, 20 V to 480 V for class S.				

8 Functional, environmental and safety type tests

8.1 General

Functional, environmental and safety type tests shall be performed according to requirements specified in this Clause 8.

8.2 Reference conditions for type tests

All type tests shall be carried out under reference conditions specified in Table 13 unless otherwise specified.

Table 13 – Reference conditions for testing

Conditions	Reference conditions
Operating temperature	23 °C ± 2 °C or otherwise specified by manufacturer
Relative humidity (RH)	40 % to 60 % RH
Auxiliary supply voltage	rated power supply voltage ±1 %
Phases	three phases available [a]
External continuous magnetic field	≤ 40 A/m d.c. ≤ 3 A/m a.c. at 50/60 Hz
D.c. component on voltage and current	none
Waveform	sinusoidal
Frequency	f_{nom} = 50 Hz ±0,5 Hz or 60 Hz ±0,5 Hz [b c]
Voltage magnitude	U_{din} ±1 % [b]
Flicker	P_{st} < 0,1 [b]
Unbalance	100 % ±0,5 % of U_{din} on all channels. Unless otherwise noted, use phase angles of 0° ± 0,05° (Channel 1), -120° ± 0,05° (Channel 2), 120° ± 0,05° (Channel 3) (equivalent to u_0 = 0 %, u_2 = 0 %) [b]
Harmonics	0 % to 3 % of U_{din} [b]
Interharmonics	0 % to 0,5 % of U_{din} [b]

[a] Required only in the case of three-phase systems.

[b] According to Testing state 1 of Table 2 of IEC 61000-4-30:2008

[c] f_{nom} shall be selected by the manufacturer.

8.3 Safety tests

Safety tests shall be conducted according to IEC 61010-1.

8.4 EMC tests

8.4.1 Emissions

Emission tests shall be conducted according to CISPR 22.

8.4.2 Immunity

EMC tests shall be conducted according to IEC/TS 61000-6-5, taking into account the "Measurement" performance criteria. PQI-x-xx shall comply with G environment. PQI-x-xx-H shall comply with H environment.

For electromagnetic phenomena classified as “continuous phenomena” the performance criteria in IEC/TS 61000-6-5 state “normal performance within the specification limits”. This requirement shall apply to all steady-state measurements specified by IEC 61000-4-30 that are provided by the PQI. Testing of continuous EMC phenomena shall therefore ensure that both:

a) the PQI is operational, and
b) the PQI continues to provide accurate steady-state measurements, both during and after the time when continuous EMC phenomena are applied.

For electromagnetic phenomena classified as “transient phenomena with high occurrence” or “transient phenomena with low occurrence” the performance criteria in IEC/TS 61000-6-5

state “temporary degradation, self-recovered, without affecting the measurement accuracy of analogue or digital indication.” This requirement shall apply to all steady-state measurements specified by IEC 61000-4-30 that are provided by the PQI. Testing of transient EMC phenomena shall therefore ensure that both:

1) the PQI is operational, and
2) the PQI continues to provide accurate steady-state measurements, after the transient EMC phenomena are applied (but not necessarily during the time when they are applied).

In all cases, when applying the performance criteria, the references to “specification limits” and “measurement accuracy of analogue or digital indication” shall be interpreted as referring to the measuring uncertainty specified in IEC 61000-4-30 for the applicable steady-state measurements (power frequency, magnitude of supply voltage, flicker, supply voltage unbalance, voltage harmonics, voltage interharmonics, mains signalling voltage, and underdeviation / overdeviation).

Measuring inputs and mains inputs shall fulfil the applicable performance criteria for the surge test according to IEC 61000-6-5, but in addition with the level of rated measurement category as defined in IEC 61010-2-30 and rated measurement category as defined in IEC 60664-1:2007, Table 1 (Rated impulse voltage for equipment energized directly from the low-voltage mains).

NOTE For example, a PQI compliant to IEC 60664-1, for 600 V working voltage with overvoltage category IV shall withstand an 8 kV surge. The isolation test voltage depends on isolation system type of voltage inputs (base, reinforced, double), see table K.104 in 61010-2-030.

8.5 Climatic tests

Requirements of Table 14 shall be achieved.

Table 14 – Climatic requirements

Climatic test, in operation	**Standard and level**	**Test requirements** [b]	**Temperature limits according to environments**			
			FI [c]	**FO** [c]	**PI** [c]	**PO** [c]
Cold	IEC 60068-2-1:2007 Test Ad	96 h	–25 °C	[d]	–5 °C	[d]
Dry heat	IEC 60068-2-2:2007 Test Bd	96 h	+55 °C	[d]	+45 °C	[d]
Damp heat	IEC 60068-2-78:2012 Test Cab	93 % RH, 4 days	+40 °C	+55 °C	+40 °C	+55 °C
Temperature changes with a specified variation speed	IEC 60068-2-14:2009 Test Nb	0 °C to maximum temperature, 1 °C / min, t1 = 2 h, 5 cycles	+55 °C	+70 °C	+45 °C	+70 °C
Salt mist	IEC 60068-2-52:1996 Test Kb, level 2	3 spray periods of 2 h each with a storage of 22 h after each	This test shall be made only for Outdoor applications.			
Climatic test, de-energized	**Standard and level**	**Test requirements**	**Temperature limits according to environments**			
			FI [c]	**FO** [c]	**PI** [c]	**PO** [c]
Cold	IEC 60068-2-1:2007 Test Ab	96 h	–40 °C	–40 °C	–40 °C	–40 °C
Dry heat	IEC 60068-2-1:2007 Test Ab	96 h	+70 °C	+70 °C	+70 °C	+70 °C
Temperature changes with a specified variation speed	IEC 60068-2-14:2009 Test Nb	–40 °C to maximum temperature, 3 °C / min, t1 = 2 h, 5 cycles	+70 °C	+70 °C	+70 °C	+70 °C

[a] For tests with de-energised equipment, the product functions shall remain in their specifications after the test.

[b] For tests with equipment in operation, the product functions shall remain in their specifications during the test.

[c] Guidance for ambient temperature shall be found in IEC 60068-1.

[d] According to manufacturer specification.

8.6 Mechanical tests

8.6.1 Product mechanical robustness

Requirements of Table 15 shall be fulfilled as type-tests.

Table 15 – Product mechanical requirements

Mechanical robustness, in operation test	**Standard and level**	**Test requirement for fixed installed equipment [a]**	**Test requirement for portable equipment [a]**
Behaviour to vibrations	IEC 60068-2-6 Test Fc	Frequency range: 10 Hz to 150 Hz Sweeping frequency range: 58 Hz to 60 Hz 0,075 mm, 2 Hz to 9 Hz, 20 cycles 0,5 g_n, 9 Hz to 150 Hz, 20 cycles	Frequency range: 10 Hz to 150 Hz Sweeping frequency range: 58 Hz to 60 Hz 0,075 mm, 2 Hz to 9 Hz, 20 cycles 0,5 g_n, 9 Hz to 150 Hz, 20 cycles
Behaviour to shocks [d]	IEC 60068-2-27 Test Ea	---	10 g_n / 11 ms, 3 pulses
Behaviour to earthquakes [d]	IEC 60068-2-57	1-35 Hz, Zero period acceleration = 1 g_n horizontal, 0,5 g_n vertical	---
Mechanical robustness, de-energised test (transport)	**Standard and level**	**Test requirement for fixed installed equipment [b]**	**Test requirement for portable equipment [b]**
Endurance to vibrations	IEC 60068-2-6 Test Fc	Frequency range: 5 Hz to 150 Hz Sweeping frequency range: 8 Hz to 9 Hz 7,5 mm, 2 Hz to 9Hz, 20 cycles 2 g_n, 9 Hz to 150Hz, 20 cycles	Frequency range: 5 Hz to 150 Hz Sweeping frequency range: 8 Hz to 9 Hz 7,5 mm, 2 Hz to 9Hz, 20 cycles 2 g_n, 9 Hz to 150Hz, 20 cycles
Resistance to shocks	IEC 60068-2-27 Test Ea	15 g_n / 11 ms, 3 pulses	30 g_n / 11 ms, 3 pulses
Free fall tests	IEC 60068-2-31 Test Ec, free fall procedure 1	The test shall be conducted with equipment in the transport packaging [c] Free fall 500 mm Number of stresses: 2 each side	The test shall be conducted with equipment in the transport packaging Free fall 1 000 mm Number of stresses: 2 each side

[a] For tests with an equipment in operation, the product functions shall remain in their specifications during the test.

[b] For tests with de-energised equipment, the product functions shall remain in their specifications after the test.

[c] The test shall be conducted without changing the packaging between tests.

[d] The requirement can also be met by placing the instrument into an adequate enclosure / cabinet

8.6.2 Degree of protection provide by enclosures for electrical equipment against external mechanical impacts (IK code)

Tests shall be achieved according to IEC 62262.

8.6.3 Degree of protection by enclosure (IP code)

Tests shall be achieved according to IEC 60529.

8.7 Functional and uncertainty tests

Functional type tests shall be performed according to requirements specified in IEC 62586-2.

9 Routine tests

9.1 General

Routine tests shall be performed according to requirements specified in this Clause 9.

9.2 Protective bonding test

PQI shall be tested in accordance with IEC 61010-1:2010, Annex F.

9.3 Dielectric strength test

PQI shall be tested in accordance with IEC 61010-1:2010, Annex F.

9.4 Intrinsic uncertainty test

The manufacturer shall perform a routine test on intrinsic uncertainty on 100 % of equipment produced. This routine test aims at detecting specific hardware non conformity during manufacturing, and shall include at least the magnitude of supply voltage function.

Any of the 10/12 cycle value or aggregated values may be used to verify the requirement.

It is strongly recommended that the results of this test should be recorded.

10 Certificates and declarations

NOTE 1 An example of template is provided in IEC 62586-2.

NOTE 2 A certificate is delivered by a third part assessor (e.g. a test lab) while a declaration is delivered by the manufacturer itself.

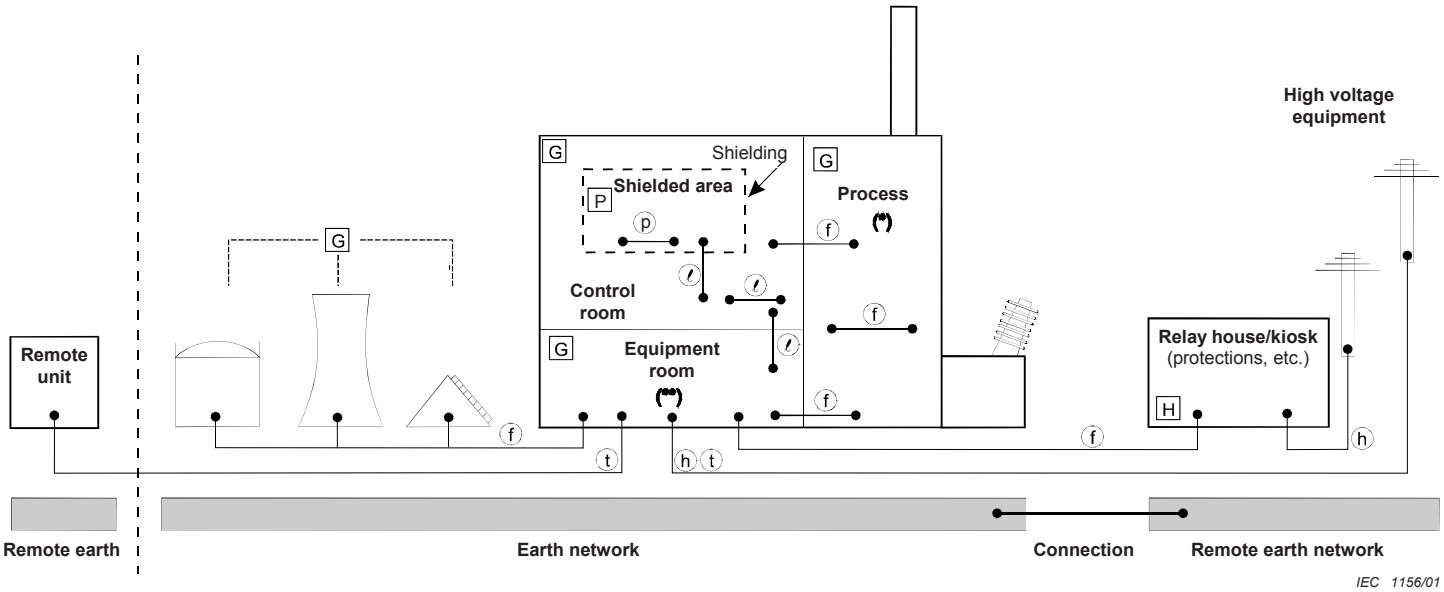
11 Re-calibration and re-verification

The manufacturer shall provide guidance for re-calibration and re-verification.

Annex A
(informative)

Information about environment H and G described in IEC/TS 61000-6-5

Figure 3 of IEC/TS 61000-6-5:2001 is reproduced here in Figure A.1 for convenience. For any further information, please refer to IEC/TS 61000-6-5.



Key

* Boiler, generator, turbine, switchgear, MV substations, etc.

** Control apparatus, electric relays, transducer relays, etc.

Type of location for enclosure, power supply and functional earth ports

G Normal location in power stations and MV substations – examples are control room, equipment room and process area.

H Normal location in HV substations – examples are control building, relay house and switchyard area.

P Protected location, if any – example is a shielded area in the control room.

Type of signal port connections

ℓ Local – examples are connections within a control room or equipment room.

f Field – examples are connections between process and equipment room.

h HV equipment – examples are connections to circuit breakers, voltage/current transformers, etc.

t Telecommunication – examples are connections to power line carrier or remote terminal units.

p Protected, if any – examples are connections inside a shielded room.

Figure A.1 – Example of power station and substation: selection of the specification for apparatus and the related connections

Bibliography

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IEC 60359, *Electrical and electronic measurement equipment – Expression of performance*

IEC 61010 (all parts), *Safety requirements for electrical equipment for measurement, control, and laboratory use*

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