

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE



BASIC EMC PUBLICATION

PUBLICATION FONDAMENTALE EN CEM

**Power quality measurement in power supply systems –  
Part 1: Power quality instruments (PQI)**

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**Mesure de la qualité de l'alimentation dans les réseaux d'alimentation –  
Partie 1: Instruments de qualité de l'alimentation (PQI)**

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**POWER QUALITY MEASUREMENT IN POWER  
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International Standard IEC 62586-1 has been prepared by IEC technical committee 85: Measuring equipment for electrical and electromagnetic quantities.

This second edition cancels and replaces the first edition published in 2013. This edition constitutes a technical revision.

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

- a) integration of the new measurement functions of IEC 61000-4-30:2015 (e.g. RVC and current functions);
- b) integration of the new requirements of IEC/TS 61000-6-5:2015, update of definitions of environment G and H, update of applicable EMC performance criteria;
- c) correction of minor mistakes, improvement in specification.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
85/586/FDIS	85/590/RVD

Full information on the voting for the approval of this International Standard 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.

It has the status of a basic EMC publication in accordance with IEC Guide 107.

A list of all parts of the IEC 62586 series, published under the general title *Power quality measurement in power supply systems*, 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 "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

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## INTRODUCTION

Electricity as delivered to the customers has several characteristics that are variable and that affect its usefulness to the customers.

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

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

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

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

This document does not address the user interface or topics unrelated to measurement performance of device.

This document does not cover post-processing and interpretation of the data with, for example, dedicated software.

### 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 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, *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 61000-6-5, *Electromagnetic compatibility (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*

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 32, *Electromagnetic compatibility of multimedia equipment – Emission requirements*

### 3 Terms, definitions, symbols and abbreviated terms

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

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##### 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

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

Note 1 to entry: This environment is described in IEC 61000-6-5 as environment in substations.

### 3.2.2

#### **EMC environment G**

general EMC environment

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

Note 1 to entry: This environment is described in IEC 61000-6-5 as environment in power stations

### 3.2.3

#### **limit range of operation**

extreme operating conditions that a 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

### 3.2.4

#### **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 document, 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 and instrumental was removed.]

### 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 to entry 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

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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 abbreviated terms

**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 document classifies power quality instruments according to the following criteria:

- 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 indoors (I) or outdoors (O);
- instruments that are intended to be used in generic EMC environment G or in specific harsh EMC environment H.

NOTE See Annex A for complementary information on definitions of EMC environment G and EMC environment H.

Instruments shall be named according to the 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 <sup>a</sup>		Blank or -H <sup>a</sup>
<sup>a</sup> See Table 4 and Table 5.				

**Table 2 – Definition of class A products**

	Fixed installed		Portable	
	Indoor application	Outdoor application	Indoor application	Outdoor application
<b>EMC environment G</b>	PQI-A-FI1 PQI-A-FI2	PQI-A-FO	PQI-A-PI	PQI-A-PO
<b>EMC environment H</b>	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
<b>EMC environment G</b>	PQI-S-FI1 PQI-S-FI2	PQI-S-FO	PQI-S-PI	PQI-S-PO
<b>EMC environment H</b>	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				