

1 Scope

1.1 Application

This document specifies the main characteristics of the voltage at a network user's supply terminals in public low voltage, medium, high, and extra-high voltage AC electricity networks under normal operating conditions. This document specifies the limits or values within which the voltage characteristics can be expected to remain at any supply terminal in public European electricity networks, only. Industrial networks are excluded from the scope of EN 50160.

NOTE 1 If non-public networks (e.g. residential quarters, energy communities, office centres, shopping centres) have similar end-users as public networks, it is strongly advised to apply the same requirements as for public networks.

This document does not apply under abnormal operating conditions, including the following:

- a) a temporary supply arrangement to keep network users supplied during conditions arising as a result of a fault, maintenance and construction work, or to minimize the extent and duration of a loss of supply;
- b) in the case of non-compliance of a network user's installation or equipment with the relevant standards or with the technical requirements for connection, established either by the public authorities or the network operator, including the limits for the emission of conducted disturbances;

NOTE 2 A network user's installation can include load and generation.

- c) in exceptional situations, in particular:

- 1) exceptional weather conditions and other natural disasters;
- 2) third party interference;
- 3) acts by public authorities,
- 4) industrial actions (subject to legal requirements);
- 5) force majeure;
- 6) power shortages resulting from external events.

The voltage characteristics given in this document refer to conducted disturbances in public electric power networks. They are not intended to be used as electromagnetic compatibility (EMC) levels or product emission limits.

Power quality is related to EMC in several ways – especially because compliance with power quality requirements depends on the control of cumulative effect of electromagnetic emissions from all/multiple equipment and/or installations. Therefore, the voltage characteristics given in this document gives guidance for specifying requirements in equipment product standards and in installation standards.

NOTE 3 The performance of equipment might be impaired if it is subjected to supply conditions which are not specified in the equipment product standard.

NOTE 4 This document can be superseded in total or in part by the terms of a contract between the individual network user and the network operator.

The sharing of complaint management and problem mitigation costs between the involved parties is outside the scope of EN 50160.

Measurement methods to be applied in this document are described in EN 61000-4-30.

1.2 Objective

The objective of this document is to define, describe and specify the characteristics of the supply voltage concerning:

- a) Frequency;
- b) Magnitude;
- c) Waveform;
- d) Symmetry of the line voltages.

This document also covers the continuous characteristics of the supply voltage and other foreseeable phenomena which may influence the voltage characteristics, such as e.g. operational communication, monitoring or measurement signals which are transmitted via power lines.

These characteristics are subject to variations during the normal operation of a supply system due to changes of load, disturbances generated by certain equipment and the occurrence of faults which are mainly caused by external events.

The characteristics vary in a manner which is random in time, with reference to any specific supply terminal, and random in location, with reference to any given instant of time. Because of these variations, the values given in this document for the characteristics can be expected to be exceeded on a small number of occasions.

Some of the phenomena affecting the voltage are particularly unpredictable, which make it very difficult to give useful definite values for the corresponding characteristics. The values given in this document for the voltage characteristics associated with such phenomena, e.g. voltage dips and voltage interruptions, are interpreted accordingly.

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.

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

3 Terms and definitions

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:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1 Electric power network

3.1.1

public electric power network

electric power network to which any network user has access, and which is operated by a regulated (licensed) network operator

3.1.2

closed distribution network

system which distributes electricity within an industrial, commercial, or shared service or residential sites, that is geographically confined

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Note 1 to entry: Closed distribution networks may be private networks.

[SOURCE: Directive 2009/72/EC, Article 28, modified].

3.1.3**point of supply POS****supply terminal**

point in an electric power network designated as such and contractually fixed, at which electric energy is exchanged between contractual partners

[SOURCE: IEC 614-01-02]

Note 1 to entry: In practice it is the location of the interface between the public supply network and a closed distribution network or a network user. The characteristics of the voltage that a network user can expect according to EN 50160 apply at the Point of Supply (supply terminals).

3.1.4**point of connection POC**

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

[SOURCE: IEC 617-04-01]

Note 1 to entry: In some regions the point of supply (supply terminals) is labelled as the point of connection (POC). In practice, the connection to a power system can be one to the public supply network or in some cases to a closed distribution network one. It is worth noting that many standards use the term "point of connection" generally for an interface which is dealt with in the relevant context of the standard.

3.1.5**network operator**

party responsible for operating, ensuring the maintenance of, and if necessary, developing, the supply network in a given area and responsible for ensuring the long term ability of the network to meet reasonable demands for electricity supply

3.1.6**(power) network user**

party being supplied by or supplying to an electricity supply network

Note 1 to entry: In several countries, the term network user includes network operators connected to a supply network with the same or higher voltage level.

3.1.7**power quality PQ**

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

Note 1 to entry: These parameters might, in some cases, relate to the compatibility between electricity supplied on a network and the loads connected to that network.

Note 2 to entry: In the context of this document, power quality refers to the supply terminals and focusses on defining the characteristics of the voltage and frequency.

3.1.8**conducted disturbance**

electromagnetic phenomenon propagated along the line conductors of a supply network

Note 1 to entry: In some cases, an electromagnetic phenomenon is propagated across transformer windings and hence between networks of different voltage levels. These disturbances may degrade the performance of a device, equipment or system or they may cause damage.