

**AVALIKE ELEKTRIVÕRKUDE PINGE TUNNUSSUURUSED**

**Voltage characteristics of electricity supplied by public electricity networks**

**EESTI STANDARDI EESSÕNA****NATIONAL FOREWORD**

See Eesti standard EVS-EN 50160:2010 sisaldab Euroopa standardi EN 50160:2010+AC:2010 ingliskeelset teksti ja selle muudatuste A1:2015, A2:2019 ja A3:2019 ingliskeelset teksti.	This Estonian standard EVS-EN 50160:2010 consists of the English text of the European standard EN 50160:2010+AC:2010 and its amendments A1:2015, A2:2019 and A3:2019.
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English Version

## Voltage characteristics of electricity supplied by public electricity networks

Caractéristiques de la tension fournie par les réseaux  
publics de distribution

Merkmale der Spannung in öffentlichen  
Elektrizitätsversorgungsnetzen

This European Standard was approved by CENELEC on 2010-03-01, Amendment A1 was approved by CENELEC on 2014-09-30, Amendment A2 was approved by CENELEC on 2019-03-25, Amendment A3 was approved by CENELEC on 2019-03-25. 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.

This European Standard and its amendments exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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European Committee for Electrotechnical Standardization  
Comité Européen de Normalisation Electrotechnique  
Europäisches Komitee für Elektrotechnische Normung

**CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels**

## Foreword

This European Standard was prepared by Working Group 1, Physical characteristics of electrical energy, of the Technical Committee CENELEC TC 8X, System aspects of electrical energy supply. It was submitted to the formal vote and was approved by CENELEC as EN 50160 on 2010-03-01.

This document is the result of an intensive cooperation between CENELEC and CEER, with involvement of CEER experts in TC 8X WG1 as well as in related Task Forces.

This document supersedes EN 50160:2007.

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

The following dates were fixed:

- |  |       |                                |
|--|-------|--------------------------------|
| – latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement | (dop) | 2011-03-01                     |
| – latest date by which the national standards conflicting with the EN have to be withdrawn   | (dow) | <b>AC</b> 2013-03-01 <b>AC</b> |

The main differences from EN 50160:2007 are:

- new organization of the document by grouping clauses related to events and continuous phenomena;
- modification of some definitions and completion by some new definitions;
- new Clause 6 relevant to voltage characteristics in high voltage networks.

This work has been deemed so important, that before submission for vote, a CENELEC enquiry has been made, where NCs had the opportunity to respond to the most essential questions resulting from the WG discussions. This enquiry resulted in an extensive number of valuable comments, which have been carefully examined for possible consideration either for the voting draft in particular or for further work within WG1 on some main issues. Following that, the draft has been revised in depth, considering in particular the comments received on:


- the subclauses relevant to supply voltage changes, where a new formulation (capable of encompassing the needs expressed by the vast majority of the NCs) has been introduced,
- the new Clause 6, relevant to voltage characteristics in high voltage networks, where limits for harmonics and unbalance have been changed into indicative values, as new measurement surveys are taking place in several European countries, and it has been recognized as appropriate to wait for the relevant results before considering the setting of limits.

### **A1 EN 50160:2010/A1:2015 foreword**

This document (EN 50160:2010/A1:2015) has been prepared by CLC/TC 8X "System aspects of electrical energy supply".

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2015-09-30
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## EN 50160:2010/A2:2019 European foreword


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The purpose of this document is to provide further development of the standard; that relating to:

- clarification concerning defined ranges of power frequency, for the purpose of this standard only;
- a first approach to include power quality issues concerning the frequency range 2 – 150 kHz. 


## EN 50160:2010/A3:2019 European foreword

This document (EN 50160:2010/A3:2019) has been prepared by CLC/TC 8X "System aspects of electrical energy supply".

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

The purpose of this document is to update the specification of PQ levels for harmonics, concerning the 15<sup>th</sup> and 21<sup>th</sup> harmonic, with regard to the development in loads connected to supply networks. 

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## 1 Scope and object

### 1.1 Scope

This European Standard defines, describes and specifies the main characteristics of the voltage at a network user's supply terminals in public low voltage, medium and high voltage AC electricity networks under normal operating conditions. This standard describes the limits or values within which the voltage characteristics can be expected to remain at any supply terminal in public European electricity networks and does not describe the average situation usually experienced by an individual network user.

NOTE 1 For the definitions of low, medium and high voltage see 3 (Definitions).

This European Standard 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 may 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 standard are not intended to be used as electromagnetic compatibility (EMC) levels or user emission limits for conducted disturbances in public electricity networks.

The voltage characteristics given in this standard are not intended to be used to specify 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.

This standard may be superseded in total or in part by the terms of a contract between the individual network user and the network operator.

NOTE 4 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 standard are described in EN 61000-4-30.

### 1.2 Object

The object of this European Standard 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.



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 standard 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 standard for the voltage characteristics associated with such phenomena, e.g. voltage dips and voltage interruptions, shall be interpreted accordingly.

## 2 Normative references

The following referenced documents are indispensable for the application 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 60664-1	2007	Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests (IEC 60664-1:2007)
EN 61000-3-3	2008	Electromagnetic compatibility (EMC) – Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current $\leq 16$ A per phase and not subject to conditional connection (IEC 61000-3-3:2008)
<b>[A2]</b> EN 61000-4-30	2015	Electromagnetic compatibility (EMC) – Part 4-30: Testing and measurement techniques – Power quality measurement methods (IEC 61000-4-30:2015) <b>[A2]</b>
IEC 60364-5-53	2001	Electrical installations of buildings –
+ A1	2002	Part 5-53: Selection and erection of electrical equipment – Isolation, switching and control
IEC/TR 61000-2-8	2002	Electromagnetic compatibility (EMC) – Part 2-8: Environment – Voltage dips and short interruptions on public electric power supply systems with statistical measurement results
IEC/TR 61000-3-7	2008	Electromagnetic compatibility (EMC) – Part 3-7: Assessment of emission limits for fluctuating loads in MV and HV power systems

## 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

### 3.1

#### **conducted disturbance**

electromagnetic phenomenon propagated along the line conductors of a supply network

NOTE 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.

### 3.2

#### **declared supply voltage**

$U_c$

supply voltage  $U_c$  agreed by the network operator and the network user