



**SLOVENSKI STANDARD**  
**oSIST IEC 60038:2009**  
**01-november-2009**

---

**Standardne napetosti IEC**

IEC standard voltages

iTeh STANDARD PREVIEW  
(standards.iteh.ai)

Tensions normales de la CEI

**Ta slovenski standard je istoveten z: IEC 60038**

<https://standards.iteh.ai/catalog/standards/sist/fe389dee-6de4-4e2e-a15f-9eb26d340d4f/sist-iec-60038-2010>

**ICS:**

29.020	Elektrotehnika na splošno	Electrical engineering in general
--------	---------------------------	-----------------------------------

**oSIST IEC 60038:2009**

**en,fr**





IEC 60038

Edition 7.0 2009-06

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

HORIZONTAL STANDARD  
NORME HORIZONTALE

IEC standard voltages

Tensions normales de la CEI

STANDARD PREVIEW  
(standards.iteh.ai)

SIST IEC 60038:2010

<https://standards.iteh.ai/catalog/standards/sist/fe389dee-6de4-4e2e-a15f-9eb26d340d4f/sist-iec-60038-2010>

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

COMMISSION  
ELECTROTECHNIQUE  
INTERNATIONALE

PRICE CODE  
CODE PRIX

M

ICS 29.020

ISBN 2-8318-1047-0

## CONTENTS

FOREWORD.....	3
1 Scope.....	5
2 Normative references .....	5
3 Terms and definitions .....	5
4 Standard voltages .....	7
4.1 AC systems having a nominal voltage between 100 V and 1 000 V inclusive and related equipment.....	7
4.2 DC and a.c. traction systems.....	8
4.3 AC three-phase systems having a nominal voltage above 1 kV and not exceeding 35 kV and related equipment .....	8
4.4 AC three-phase systems having a nominal voltage above 35 kV and not exceeding 230 kV and related equipment .....	9
4.5 AC three-phase systems having a highest voltage for equipment exceeding 245 kV.....	10
4.6 Equipment having a nominal voltage below 120 V a.c. or below 750 V d.c.....	11
Annex A (informative) Highest and lowest voltage values at supply and utilization terminals for a.c. systems having a nominal voltage between 100 V and 1 000 V.....	12
Bibliography.....	13

iTeh STANDARD PREVIEW

Table 1 – AC systems having a nominal voltage between 100 V and 1 000 V inclusive and related equipment .....	7
Table 2 – DC and a.c. traction systems <sup>a</sup> .....	8
Table 3 – AC three-phase systems having a nominal voltage above 1 kV and not exceeding 35 kV and related equipment <sup>a</sup> .....	9
Table 4 – AC three-phase systems having a nominal voltage above 35 kV and not exceeding 230 kV and related equipment <sup>a</sup> .....	10
Table 5 – AC three-phase systems having a highest voltage for equipment exceeding 245 kV <sup>a</sup> .....	10
Table 6 – Equipment having a nominal voltage below 120 V a.c. or below 750 V d.c.....	11
Table A.1 – Highest and lowest voltage values at supply and utilization terminals for a.c. systems having a nominal voltage between 100 V and 1 000 V .....	12

# INTERNATIONAL ELECTROTECHNICAL COMMISSION

## IEC STANDARD VOLTAGES

### FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60038 has been prepared by IEC technical committee 8: System aspects for electrical energy supply.

This seventh edition supersedes the sixth edition (1993), its Amendment 1 (1994) and its Amendment 2 (1997). It constitutes a technical revision. The significant technical changes are:

- a clarification of the scope;
- the addition of the values of 230 V (50 Hz) and 230/400 V (60 Hz) to Table 1;
- the update of Table 1 to take into account the end of the transition period for the values of 230/400 V and 400/690 V;
- the replacement of the utilization voltage range at LV by a reference to the relevant standard and an informative annex;
- the addition of the value of 30 kV to Table 3;
- the replacement of the value of 1 050 kV by 1 100 kV in Table 5.

The text of this standard is based on the following documents:

FDIS	Report on voting
8/1260/FDIS	8/1264/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

It has the status of a horizontal standard in accordance with IEC Guide 108.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

iTeh STANDARD PREVIEW  
(standards.iteh.ai)

SIST IEC 60038:2010

<https://standards.iteh.ai/catalog/standards/sist/fe389dee-6de4-4e2e-a15f-9eb26d340d4f/sist-iec-60038-2010>

## IEC STANDARD VOLTAGES

### 1 Scope

This publication applies to

- a.c. transmission, distribution and utilization systems and equipment for use in such systems with standard frequencies 50 Hz and 60 Hz having a nominal voltage above 100 V;
- a.c. and d.c. traction systems;
- a.c. and d.c. equipment having nominal voltages below 120 V a.c. or below 750 V d.c., the a.c. voltages being intended (but not exclusively) for 50 Hz and 60 Hz applications; such equipment covers batteries (from primary or secondary cells), other power supply devices (a.c. or d.c.), electrical equipment (including industrial and communication), and appliances.

This publication does not apply to voltages representing or transmitting signals or measured values.

This publication does not apply to standard voltages of components and parts used within electrical devices or items of equipment.

This publication specifies standard voltage values which are intended to serve

- as preferential values for the nominal voltage of electrical supply systems, and
- as reference values for equipment and system design.

NOTE 1 Two main reasons have led to the values specified in this standard:

The values of nominal voltage (or highest voltage for equipment) specified in this standard are mainly based on the historical development of electrical supply systems throughout the world, since these values turned out to be the most common ones, and have achieved worldwide recognition;

The voltage ranges mentioned in this standard have been recognized to be the most appropriate ones as a basis for design and testing of electrical equipment and systems.

NOTE 2 It is nevertheless the task of system and product standards to define appropriate testing values, testing conditions and acceptance criteria.

### 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.

IEC 60364-5-52: *Electrical installations of buildings – Part 5-52: Selection and erection of electrical equipment – Wiring systems*

### 3 Terms and definitions

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

For alternating voltages, the voltages stated below are r.m.s. values.

**3.1****nominal system voltage**

a suitable approximate value of voltage used to designate or identify a system

[IEV 601-01-21, modified]

**3.2****highest voltage of a system  
(excluding transient or abnormal conditions)**

the highest value of operating voltage which occurs under normal operating conditions at any time and at any point on the system

NOTE It excludes transient overvoltages, such as those due to switching operations, and temporary variations of voltage.

[IEV 601-01-23, modified]

**3.3****lowest voltage of a system  
(excluding transient or abnormal conditions)**

the lowest value of operating voltage which occurs under normal operating conditions at any time and at any point on the system

NOTE It excludes transient voltages, such as those due to switching operations, and temporary variations of voltage.

[IEV 601-01-24, modified]

**3.4****supply terminals**

point in a transmission or distribution network designated as such and contractually fixed, at which electrical energy is exchanged between contractual partners

<https://standards.iteh.ai/catalog/standards/sist/fe389dee-6de4-4e2e-a15f-9eb26d340d4f/sist-iec-60038-2010>

**3.5****supply voltage**

the phase-to-phase or phase-to-neutral voltage at the supply terminals

NOTE An equivalent definition is: the line-to-line or line-to-neutral voltage at the supply terminals.

**3.6****supply voltage range**

the voltage range at the supply terminals

**3.7****utilization voltage**

the phase-to-phase or phase-to-neutral voltage at the outlets or at the points where utilisation equipment is intended to be connected to the fixed installation

NOTE An equivalent definition is: the line-to-line or line-to-neutral voltage at the outlets or at the points where utilisation equipment is intended to be connected to the fixed installation.

**3.8****utilization voltage range**

the voltage range at the outlets or at the points where utilisation equipment is intended to be connected to the fixed installation

NOTE Attention is drawn to the fact that in some equipment standards (for example, IEC 60335-1 and IEC 60071), the term "voltage range" has a different meaning.



**3.9****highest voltage for equipment**

highest voltage for which the equipment is specified regarding:

- a) the insulation;
- b) other characteristics which may be linked to this highest voltage in the relevant equipment recommendations.

NOTE Equipment may only be used on systems having a highest system voltage less than or equal to its highest voltage for equipment.

**4 Standard voltages****4.1 AC systems having a nominal voltage between 100 V and 1 000 V inclusive and related equipment**

The nominal voltage of an a.c. system in the range from 100 V to 1 000 V should be selected from the values given in Table 1.

**Table 1 – AC systems having a nominal voltage between 100 V and 1 000 V inclusive and related equipment**

Three-phase four-wire or three-wire systems		Single-phase three-wire systems
Nominal voltage V		Nominal voltage V
50 Hz	60 Hz	60 Hz
–	120/208	120/240 <sup>d</sup>
230 <sup>c</sup>	240 <sup>c</sup>	–
230/400 <sup>a</sup>	230/400 <sup>a</sup>	–
–	277/480	–
–	480	–
–	347/600	–
–	600	–
400/690 <sup>b</sup>	–	–
1 000	–	–

<sup>a</sup> The value of 230/400 V is the result of the evolution of 220/380 V and 240/415 V systems which has been completed in Europe and many other countries. However, 220/380 V and 240/415 V systems still exist.

<sup>b</sup> The value of 400/690 V is the result of the evolution of 380/660 V systems which has been completed in Europe and many other countries. However, 380/660 V systems still exist.

<sup>c</sup> The value of 200 V or 220 V is also used in some countries.

<sup>d</sup> The values of 100/200 V are also used in some countries on 50 Hz or 60 Hz systems.

In Table 1, the three-phase four-wire systems and single-phase three-wire systems include single-phase circuits (extensions, services, etc.) connected to these systems.

The lower values in the first and second columns are voltages to neutral and the higher values are voltages between phases. When one value only is indicated, it refers to three-wire systems and specifies the voltage between phases. The lower value in the third column is the voltage to neutral and the higher value is the voltage between lines.

Voltages in excess of 230/400 V are intended for heavy industrial applications and large commercial premises.

Concerning supply voltage range, under normal operating conditions, the supply voltage should not differ from the nominal voltage of the system by more than  $\pm 10\%$ .

For the utilization voltage range, in addition to the voltage variations at the supply terminals, voltage drops may occur within the consumer's installations. For more information, see IEC 60364-5-52. This utilization voltage range should be taken into account by product committees.

NOTE The highest and lowest voltage values at supply terminals and at utilization terminals, as they can be derived from the above and from IEC 60364-5-52:2001, are provided for information in Annex A.

**4.2 DC and a.c. traction systems**

The voltages of a d.c. or a.c. traction system should be selected from the values given in Table 2.

**Table 2 – DC and a.c. traction systems <sup>a</sup>**

	Voltage			Nominal frequency of a.c. systems Hz
	Lowest V	Nominal V	Highest V	
DC systems	(400) 500 1 000 2 000	(600) 750 1 500 3 000	(720) 900 1 800 3 600 <sup>b</sup>	
AC single-phase systems	(4 750) 12 000 19 000	(6 250) 15 000 25 000	(6 900) 17 250 27 500	50 or 60 16 <sup>2</sup> / <sub>3</sub> 50 or 60
<p>a The values indicated in parentheses should be considered as non-preferred values. It is recommended that these values should not be used for new systems to be constructed in future. In particular for a.c. single-phase systems, the nominal voltage 6 250 V should be used only when local conditions make it impossible to adopt the nominal voltage 25 000 V.</p> <p>The values indicated in the table above are the values agreed by the international mixed committee on electric traction equipment (C.M.T.) and by IEC technical committee 9, Electrical equipment and systems for railways.</p> <p>b In certain European countries, this voltage may reach 4 000 V. The electrical equipment of vehicles operating international services in these countries shall be capable of withstanding this absolute maximal voltage for brief periods of up to 5 min.</p>				

**4.3 AC three-phase systems having a nominal voltage above 1 kV and not exceeding 35 kV and related equipment**

The voltages for an a.c. three-phase system having a nominal voltage above 1 kV and not exceeding 35 kV should be selected from the values given in Table 3.