BS EN 60038:2011

BSI Standards Publication

CENELEC standard voltages

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National foreword

This British Standard is the UK implementation of EN 60038:2011. It is identical to IEC 60038:2009. It supersedes BS 7697:1993, which is withdrawn.

The CENELEC common modifications have been implemented at the appropriate places in the text. The start and finish of each common modifcation is indicated in the text by tags 〉C〈 〉C〈.

The UK participation in its preparation was entrusted to Technical Committee GEL/8, Systems Aspects for Electrical Energy Supply.

A list of organizations represented on this committee can be obtained on request to its secretary.

BSI, as a member of CEN, is obliged to publish EN 60038:2011 as a British Standard. However, attention is drawn to the fact that during the development of this European Standard, the UK committee voted against its approval as a European Standard.

BS EN 60038 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. The reference values contained within this standard do not replace or modify the values given in product standards.

It has been developed from the IEC Standard IEC 60038.

BS EN 60038 is therefore not intended to set definitive limits for voltages which may be present either on the electricity supply network or in a customer's installation.

Other Standards also exist in this area, including BS EN 50160, *Voltage characteristics of electricity supplied by public electricity networks*, and HD 60364-5-52, *Low voltage electrical installations – Part 5-52: Selection and erection of electrical equipment – Wiring systems* (IEC 60364-5-52).

BS EN 50160 describes the limits or values within which the voltage characteristics can be expected to remain at any supply terminal in public electricity networks under normal operating conditions and does not describe the average situation usually experienced by an individual network user.

HD 60364-5-52 covers voltages which may be experienced within a customer's installation. HD 60364 is implemented in the UK by BS 7671 (IET Wiring Regulations).

In Great Britain, voltage limits at a customer's electricity supply terminals are legally defined by Regulation 27 of the Electricity Safety, Quality and Continuity Regulations (ESQCR) 2002, as amended. In Northern Ireland, Regulation 30 of the Electricity Supply Regulations (Northern Ireland) 1988, as amended, applies.

BS 7697:1993, *Nominal voltages for low voltage public electricity supply systems*, was the implementation of an earlier CENELEC Harmonisation Document, HD 472 S1:1989.

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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Compliance with a British Standard cannot confer immunity from legal obligations.

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 60038

October 2011

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Supersedes HD 472 S1:1989 + corr. Feb.2002 + A1:1995

English version

CENELEC standard voltages
(IEC 60038:2009, modified)

Tensions normales du CENELEC
(CEI 60038:2009, modifiée)

CENELEC-Normspannungen
(IEC 60038:2009, modifiziert)

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
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Contents

Foreword

This document (EN 60038:2011) consists of the text of IEC 60038:2009 prepared by IEC/TC 8, "Systems aspects for electrical energy supply ", together with the common modifications prepared by CLC Technical Body 8X, "System aspects of electrical energy supply".

The following dates are 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)	2012-09-05
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2014-09-05

This European Standard supersedes HD 472 S1:1989 + corrigendum February 2002 + A1:1995.

In this standard, the common modifications to the International Standard are indicated by tags 〈C〉 〈C〉.

The main common modifications to IEC 60038:2009 are the following.

- All references to 60 Hz are removed in the European Standard (reason: 60 Hz is not used in Europe for a.c. electric systems).
- The "in some countries" notes related to non-CENELEC countries are removed.
- The value of 100 kV as highest voltage for equipment corresponding to the value of 90 kV as nominal system voltage is added to Table 4 (reason: this value already exists in EN 62271-1 and is widely used in French transmission systems).
- Sentences containing recommendations are generally put in notes.

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.

CENELEC STANDARD VOLTAGES

1 Scope

This publication applies to

– a.c. transmission, distribution and utilization systems and equipment for use in such systems with a standard frequency of 50 Hz [C] *Text deleted* [C] 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 [C] *Text deleted* [C] 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.

[C] NOTE Z1 Only standard frequency 50 Hz is used in Europe for public a.c. transmission and distribution systems. For systems and equipment at 60 Hz, see IEC 60038. [C]

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.

[C] HD 60364-5-52, Low voltage *electrical installations – Part 5-52: Selection and erection of electrical equipment – Wiring systems* (IEC 60364-5-52) [C]

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

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 utilization 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 utilization 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 utilization equipment is intended to be connected to the fixed installation

NOTE Attention is drawn to the fact that in some equipment standards (for example, EN 60335-1 and EN 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.

〖C〉 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 [a]
Nominal voltage (at 50 Hz) [b] V
230
230/400
400/690
1 000
a The three-phase four-wire systems include single-phase circuits (extensions, services, etc.) connected to these systems.
b The lower values 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.

〈C〉

〖C〉 *Text deleted* 〈C〉

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 ±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 〖C〉HD 60364-5-52〈C〉. This utilization voltage range should be taken into account by product committees.

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 [a]

	Voltage			Nominal frequency of a.c. systems
	Lowest V	Nominal V	Highest V	Hz
DC systems	(400) 500 1 000 2 000	(600) 750 1 500 3 000	(720) 900 1 800 3 600[b]	
AC single-phase systems	(4 750) 12 000 19 000	(6 250) 15 000 25 000	(6 900) 17 250 27 500	〉C〈 50 16 2/3 50 〉C〈

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.

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.

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.

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.

Table 3 – AC three-phase systems having a nominal voltage above 1 kV and not exceeding 35 kV and related equipment [a]

〉C〈

Highest voltage for equipment kV	Nominal system voltage kV	
3,6[b]	3,3[b]	3[b]
7,2[b]	6,6[b]	6[b]
12	11	10
(17,5)	–	(15)
24	22	20
36	33	30
40,5	–	35

NOTE It is recommended that in any one country, the ratio between two adjacent nominal voltages should be not less than two.

a These systems are generally three-wire systems. The values indicated are voltages between phases.

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.

b These values should not be used for new public distribution systems.

〉C〈

〉C〈 *Text deleted* 〉C〈

〈C〉 NOTE Two columns of nominal system voltages are given above. It is recommended that only one of the two columns should be used in any one country. 〈C〉

4.4 AC three-phase systems having a nominal voltage above 35 kV and not exceeding 230 kV and related equipment

The voltages for an a.c. three-phase system having a nominal voltage above 35 kV and not exceeding 230 kV should be selected from the values given in Table 4.

Table 4 – AC three-phase systems having a nominal voltage above 35 kV and not exceeding 230 kV and related equipment [a]

Highest voltage for equipment kV	Nominal system voltage kV	
(52)	(45)	–
72,5	66	69
〈C〉 100	90	– 〈C〉
123	110	115
145	132	138
(170)	(150)	(154)
245	220	230

[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. The values are voltages between phases.

〈C〉 NOTE 1 Two columns of nominal system voltages are given above. It is recommended that only one of the two columns should be used in any one country.

NOTE 2 It is recommended that in any one country only one value in the following groups should be used for the highest voltage for equipment:

– 123 kV or 145 kV;

– 245 kV or 300 kV (see Table 5) or 362 kV (see Table 5). 〈C〉

4.5 AC three-phase systems having a highest voltage for equipment exceeding 245 kV

The highest voltage for equipment for an a.c. three-phase system exceeding 245 kV should be selected from the values given in Table 5.

Table 5 – AC three-phase systems having a highest voltage for equipment exceeding 245 kV [a]

Highest voltage for equipment kV
(300)
362
420
550[b]
800[c]
1 100
1 200

[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. The values are voltages between phases.

[b] The value 525 kV is also used.

[c] The value 765 kV is also used; the test values for equipment should be the same as defined by the IEC for 765 kV.

〈C〉 NOTE Z1 It is recommended that in any one geographical area, only one value in the following groups should be used for the highest voltage for equipment:

- 245 kV (see Table 4) or 300 kV or 362 kV;
- 362 kV or 420 kV;
- 420 kV or 550 kV;
- 1 100 kV or 1 200 kV.

NOTE In the above sentence, the term "geographical area" may indicate a single country, a group of countries which agree to adopt the same voltage level, or a part of a very large country. 〈C〉

4.6 Equipment having a nominal voltage below 120 V a.c. or below 750 V d.c.

The nominal voltage for equipment below 120 V a.c. or below 750 V d.c. should be selected from the values given in Table 6.

Table 6 – Equipment having a nominal voltage below 120 V a.c. or below 750 V d.c.

DC		AC	
Nominal values		Nominal values	
Preferred V	Supplementary V	Preferred V	Supplementary V
	2,4		
	3		
	4		
	4,5		
	5		5
6		6	
	7,5		
	9		
12		12	
	15		15
24		24	
	30		
36			36
	40		
48		48	
60			60
72			
	80		
96			
			100
110		110	
	125		
220			
	250		
440			
	600		

NOTE 1 Because the voltage of the primary and secondary cells is below 2,4 V, and the choice of the type of cell to be used in various applications will be based on properties other than the voltage, these values are not included in the table. The relevant IEC technical committees may specify types of cells and related voltages for specific applications.

NOTE 2 It is recognized that for technical and economic reasons, additional voltages may be required for certain specific fields of application.

〈C〉 *Annex A deleted* 〈C〉

〈C〉 Annex ZB
(informative)

A-deviations

A-deviation: National deviation due to regulations, the alteration of which is for the time being outside the competence of the CEN/CENELEC national member.

This European Standard does not fall under any Directive of the EC.

In the relevant CEN/CENELEC countries, these A-deviations are valid instead of the provisions of the European Standard until they have been removed.

Clause Deviation

4.3 Czech Republic

According to Czech regulation (Act No. 458/2000 Coll., on the conditions for entrepreneurial activities and the performance of state administration in energy industries and on an amendment to certain acts ("Energy Act"), as amended by later legislative acts and regulations) in Czech republic are using in AC three-phase systems having a nominal voltage above 1 kV and not exceeding 35 kV about following table:

Table 3 – AC three-phase systems having a nominal voltage above 1 kV and not exceeding 35 kV and related equipment [a] used in Czech Republic

Highest voltage for equipment kV	Nominal system voltage kV
3,6[b] 7,2[b] 12 25 38,5	3[b] 6[b] 10 22 35
NOTE It is recommended that in any one country, the ratio between two adjacent nominal voltages should be not less than two.	
a These systems are generally three-wire systems. The values indicated are voltages between phases. 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. b These values should not be used for new public distribution systems.	

〈C〉

Bibliography

IEC 60050-601:1985, *International Electrotechnical Vocabulary – Chapter 601: Generation, transmission and distribution of electricity – General*

EN 60071 (Series), *Insulation co-ordination* [C] (IEC 60071 Series) [C]

[C] EN 60335-1, *Household and similar electrical appliances – Safety – Part 1: General requirements* (IEC 60335-1) [C]

IEC 60364-5-52:2001, *Electrical installations of buildings – Part 5-52: Selection and erection of electrical equipment – Wiring systems*

[C] EN 62271-1:2008, *High-voltage switchgear and controlgear – Part 1: Common specifications* (IEC 62271-1:2007) [C]

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