

INTERNATIONAL STANDARD



**Low-voltage electrical installations –
Part 4-44: Protection for safety – Protection against voltage disturbances and
electromagnetic disturbances**

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CONTENTS

FOREWORD.....	5
INTRODUCTION.....	2
440 Protection against voltage disturbances and electromagnetic disturbances.....	8
440.1 Scope	8
440.2 Normative references.....	8
440.3 Terms, definitions and symbols.....	10
440.3.1 Terms and definitions	10
440.3.2 Symbols	10
441 (Vacant) Void	13
442 Protection of low-voltage installations against temporary overvoltages due to earth faults in the high-voltage system and due to faults in the low-voltage system	13
442.1 Field of application.....	13
442.1.1 General	13
442.1.2 General requirements	13
442.2 Overvoltages in LV-systems during a high-voltage earth fault	13
442.2.1 General	13
442.2.2 Magnitude and duration of power-frequency fault voltage	15
442.2.3 Magnitude and duration of power-frequency stress voltages	16
442.2.4 Requirements for calculation of limits	17
442.3 Power-frequency stress voltage in case of loss of the neutral conductor in a TN and TT system	17
442.4 Power-frequency stress voltage in the event of an earth fault in an IT system with distributed neutral.....	17
442.5 Power-frequency stress voltage in the event of a short-circuit between a line conductor and the neutral conductor	18
443 Protection against transient overvoltages of atmospheric origin or due to switching.....	18
443.1 General.....	18
443.2 Void.....	19
443.3 Void.....	19
443.4 Overvoltage control.....	19
443.5 Risk assessment method	19
443.6 Classification of rated impulse voltages (overvoltage categories).....	21
443.6.1 Purpose of classification of rated impulse voltages (overvoltage categories)	21
443.6.2 Rated impulse voltages of equipment and overvoltage categories.....	22
444 Measures against electromagnetic influences	24
444.1 General.....	24
444.2 Void.....	25
444.3 Void.....	25
444.4 Mitigation of electromagnetic interference (EMI)	25
444.4.1 General	25
444.4.2 Sources of EMI.....	25
444.4.3 Measures to reduce EMI	25
444.4.4 TN-system	27
444.4.5 TT system.....	30
444.4.6 IT system.....	31
444.4.7 Multiple-source supply	32

444.4.8	Transfer of supply	35
444.4.9	Services entering a building	38
444.4.10	Separate buildings	39
444.4.11	Inside buildings	39
444.4.12	Protective devices	41
444.4.13	Signal cables	41
444.5	Earthing and equipotential bonding	41
444.5.1	Interconnection of earth electrodes	41
444.5.2	Interconnection of incoming networks and earthing arrangements	41
444.5.3	Different structures for the network of equipotential conductors and earthing conductors	42
444.5.4	Equipotential bonding networks in buildings with several floors	44
444.5.5	Functional earthing conductor	45
444.5.6	Commercial or industrial buildings containing significant amounts of information technology equipment	46
444.5.7	Earthing arrangements and equipotential bonding of information technology installations for functional purposes	46
444.6	Segregation of circuits	47
444.6.1	General	47
444.6.2	Design requirements	47
444.6.3	Conditions for zero segregation	48
444.7	Cable management systems	49
444.7.1	General	49
444.7.2	Design guidelines	49
444.7.3	Installation guidelines	50
445	Protection against undervoltage	52
Annex A (informative)	Examples of calculated risk level CRL for the use of SPDs	53
A.1	Example 1 – Building in rural environment	53
A.2	Example 2 – Building in rural environment powered in HV	53
A.3	Example 3 – Building in urban environment powered by overhead lines	54
A.4	Example 4 – Building in urban environment powered by underground cables	54
Annex B (informative)	Guidance on overvoltage control by SPDs applied to overhead lines	55
Annex C (informative)	List of notes concerning certain countries	56
Bibliography	58
Figure 1	– Representative schematic sketch diagram for possible connections to earth in substation and LV-installation and occurring overvoltages in case of faults	14
Figure 2	– Tolerable fault voltage due to an earth-fault in the HV system	16
Figure 3	– Illustration of an installation showing the lengths to consider	21
Figure 4	– By-pass conductor for screen reinforcement to provide a common equipotential bonding system	26
Figure 5	– Example of a substitute or by-pass equipotential bonding conductor in a TT-system	26
Figure 6	– Avoidance of neutral conductor currents in a bonded structure by using the TN-S system from the origin of the public supply up to and including the final circuit within a building	28
Figure 7	– Avoidance of neutral conductor currents in a bonded structure by using a TN-S system downstream of a consumer's private supply transformer	29

Figure 8 – TN-C-S system within an existing building installation	30
Figure 9 – TT system within a building installation	31
Figure 10 – IT system within a building installation	32
Figure 11 – TN multiple-source power supply with a non-suitable multiple connection between PEN and earth	33
Figure 12 – TN multiple-source power supplies to an installation with connection to earth of the star points at one and the same point.....	34
Figure 13 – TT multiple-source power supplies to an installation with connection to earth of the star points at one and the same point.....	35
Figure 14 – Three-phase alternative power supply with a 4-pole switch	36
Figure 15 – Neutral current flow in a three-phase alternative power supply with an unsuitable 3-pole switch.....	37
Figure 16 – Single-phase alternative power supply with 2-pole switch.....	38
Figure 17 – Armoured cables and metal pipes entering the buildings (examples)	39
Figure 18 – Illustration of measures in an existing building	40
Figure 19 – Interconnected earth electrodes	41
Figure 20 – Examples of protective conductors in star network	42
Figure 21 – Example of multiple meshed bonding star network	43
Figure 22 – Example of a common meshed bonding star network	44
Figure 23 – Example of equipotential bonding networks in structures without lightning protection systems	45
Figure 24 – Example of cable separation distance	48
Figure 25 – Cable arrangements in metal cable trays.....	50
Figure 26 – Continuity of metallic system components	50
Figure 27 – Location of cables inside metallic construction elements	51
Figure 28 – Connection of metallic sections	51
Table 1 – Power-frequency stress voltages and power-frequency fault voltage in low-voltage system.....	15
Table 2 – Permissible power-frequency stress voltage	17
Table 3 – Calculation of f_{env}	20
Table 4 – Required rated impulse voltage of equipment U_W	23
Table 5 – Summary of minimum separation distances where the specification and/or intended application of the information and communication technology cable is not available	48

INTERNATIONAL ELECTROTECHNICAL COMMISSION

LOW-VOLTAGE ELECTRICAL INSTALLATIONS –

Part 4-44: Protection for safety – Protection against voltage disturbances and electromagnetic disturbances

FOREWORD

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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 60364-4-44:2007+AMD1:2015+AMD2:2018 CSV. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

IEC 60364-4-44 has been prepared by IEC technical committee 64: Electrical installations and protection against electric shock. It is an International Standard.

This third edition cancels and replaces the second edition published in 2007, Amendment 1:2015 and Amendment 2:2018. This edition constitutes a technical revision.

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

- a) the structure of the document has been updated in accordance with the ISO/IEC Directives, Part 2:2021: the terms, definitions and symbols have been regrouped under a new Subclause 440.3, the tables and figures have been renumbered;
- b) Clause 443 has been amended to better introduce the DC SPD and to improve some of the wording.

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

Draft	Report on voting
64/2696/FDIS	64/2737/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 60364 series, published under the general title *Low-voltage electrical installations*, can be found on the IEC website.

The reader's attention is drawn to the fact that Annex C lists all of the "in-some-country" clauses on differing practices of a less permanent nature relating to the subject of this document.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

This part of IEC 60364 covers the protection of electrical installations and measures against voltage disturbances and electromagnetic disturbances.

The requirements are arranged into four clauses as follows:

- | | |
|------------|---|
| Clause 442 | Protection of low-voltage installations against temporary overvoltages due to earth faults in the high-voltage system and due to faults in the low-voltage system |
| Clause 443 | Protection against transient overvoltages of atmospheric origin or due to switching |
| Clause 444 | Measures against electromagnetic influences |
| Clause 445 | Protection against undervoltage |

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LOW-VOLTAGE ELECTRICAL INSTALLATIONS –

Part 4-44: Protection for safety – Protection against voltage disturbances and electromagnetic disturbances

440 Protection against voltage disturbances and electromagnetic disturbances

440.1 Scope

~~The rules of~~ This part of IEC 60364 ~~are intended to provide~~ provides requirements for the safety of electrical installations in the event of voltage disturbances and electromagnetic disturbances generated for different specified reasons.

The ~~rules~~ requirements of this document are not intended to apply to systems for distribution of energy to the public, or power generation and transmission for such systems (see the scope of IEC 60364-1) although such disturbances ~~may~~ can be conducted into or between electrical installations via these supply systems.

440.2 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 60038:2009, IEC standard voltages~~

~~IEC 60050-604:1987, International Electrotechnical Vocabulary – Chapter 604: Generation, transmission and distribution of electricity – Operation~~

IEC 60364-1, *Low-voltage electrical installations – Part 1: Fundamental principles, assessment of general characteristics, definitions*

~~IEC 60364-4-41:2005, Electrical installations of buildings – Part 4-41: Protection for safety – Protection against electric shock~~

IEC 60364-5-52, *Low-voltage electrical installations – Part 5-52: Selection and erection of electrical equipment – Wiring systems*

IEC 60364-5-53:2001/2019, *Low-voltage electrical installations ~~of buildings~~ – Part 5-53: Selection and erection of electrical equipment – Devices for protection for safety, isolation, switching ~~and~~, control and monitoring*

IEC 60364-5-53:2001/2019/AMD1:2002/2020

IEC 60364-5-53:2001/2019/AMD2:2015/2024

IEC 60364-5-54:2002,2011, *Low-voltage electrical installations ~~of buildings~~ – Part 5-54: Selection and erection of electrical equipment – Earthing arrangements and protective ~~bonding~~ conductors¹*

IEC 60364-5-54:2011/AMD1:2021

¹ ~~A third edition is currently in preparation.~~

~~IEC 60479-1:2005, Effects of current on human beings and livestock—Part 1: General aspects~~

IEC 60664-1:2007/2020, *Insulation coordination for equipment within low-voltage supply systems – Part 1: Principles, requirements and tests*

~~IEC 60950-1, Information technology equipment—Safety—Part 1: General requirements~~

~~IEC 61000-2-5:1995, Electromagnetic compatibility (EMC)—Part 2: Environment—Section 5: Classification of electromagnetic environments—Basic EMC publication~~

~~IEC 61000-6-1, Electromagnetic compatibility (EMC)—Part 6-1: Generic standards—Immunity for residential, commercial and light industrial environments~~

~~IEC 61000-6-2, Electromagnetic compatibility (EMC)—Part 6-2: Generic standards—Immunity for industrial environments~~

~~IEC 61000-6-3, Electromagnetic compatibility (EMC)—Part 6-3: Generic standards—Emission standard for residential, commercial and light industrial environments~~

~~IEC 61000-6-4, Electromagnetic compatibility (EMC)—Part 6-4: Generic standards—Emission standard for industrial environments~~

IEC 61156 (all parts), *Multicore and symmetrical pair/quad cables for digital communications*

IEC 61196-7, *Coaxial communication cables – Part 7: Sectional specification for cables for BCT cabling in accordance with ISO/IEC 11801-4 – Indoor drop cables for systems operating at 5 MHz – 3 000 6 000 MHz*

~~IEC 61558-2-1, Safety of power transformers, power supplies, reactors and similar products—Part 2-1: Particular requirements for tests for separating transformers and power supplies incorporating separating transformers for general applications~~

~~IEC 61558-2-4, Safety of power transformers, power supply units and similar—Part 2-4: Particular requirements for isolating transformers for general use~~

~~IEC 61558-2-6, Safety of power transformers, power supply units and similar—Part 2-6: Particular requirements for safety isolating transformers for general use~~

~~IEC 61558-2-15, Safety of power transformers, power supply units and similar—Part 2-15: Particular requirements for isolating transformers for the supply of medical locations~~

~~IEC 61643 (all parts), Low-voltage surge protective devices~~

~~IEC 61643-11:2011, Low-voltage surge protective devices—Part 11: Surge protective devices connected to low-voltage power systems—Requirements and test methods~~

~~IEC 61643-22, Low-voltage surge protective devices—Part 22: Surge protective devices connected to telecommunications and signalling networks—Selection and application principles~~

IEC 61936-1, *Power installations exceeding 1 kV AC and 1,5 kV DC – Part 1: Common rules AC*

~~IEC 62305 (all parts), Protection against lightning~~

~~IEC 62305-1, Protection against lightning—Part 1: General principles~~

IEC 62305-3, *Protection against lightning – Part 3: Physical damage to structures and life hazard*

~~IEC 62305-4, Protection against lightning – Part 4: Electrical and electronic systems within structures~~

ISO/IEC 11801-1, *Information technology – Generic cabling for customer premises – Part 1: General requirements*

ISO/IEC 14763-2:~~2012~~2019, *Information technology – Implementation and operation of customer premises cabling – Part 2: Planning and installation*
~~ISO/IEC 14763-2:2012/AMD1:2015~~

ISO/IEC TR 29106, *Information technology – Generic cabling – Introduction to the MICE environmental classification*

440.3 Terms, definitions and symbols

440.3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60364-1 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

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

440.3.1.1 urban environment

area with a high density of buildings or densely populated communities with tall buildings

EXAMPLE Town centre.

440.3.1.2 suburban environment

area with a medium density of buildings

EXAMPLE Town outskirts.

440.3.1.3 rural environment

area with a low density of buildings

EXAMPLE The countryside.

440.3.1.4 surge protective device SPD

device that contains at least one non-linear component that is intended to limit surge voltages and divert surge currents

Note 1 to entry: An SPD is a complete assembly, having appropriate connecting means.

~~Note 2 to entry: This note applies to the French language only.~~

[SOURCE: IEC 61643-11:2011, 3.1.1]

440.3.1.5 calculated risk level CRL

calculated value of risk used to evaluate the need for transient overvoltage protection

~~Note 1 to entry:— This note applies to the French language only.~~

440.3.1.6 rated impulse voltage

U_W

value of the impulse withstand voltage assigned by the manufacturer to the equipment or to a part of it, characterizing the specified withstand capability of its insulation against transient overvoltages

[SOURCE: IEC 60664-1:2007/2020, ~~3.9.2, Modified~~ ~~— symbol added~~ 3.1.19, modified – In the term, "withstand" has been deleted and the symbol U_{imp} has been replaced with U_W .]

440.3.1.7 bonding network BN

set of interconnected conductive structures that provides an "electromagnetic shield" for electronic systems at frequencies from direct current (DC) to low radio frequency (RF)

~~[3.2.2 of ETS 300 253:1995]~~

Note 1 to entry: The term "electromagnetic shield" denotes any structure used to divert, block or impede the passage of electromagnetic energy. In general, a BN does not need to be connected to earth but BN considered in this standard are connected to earth.

440.3.1.8 bonding ring conductor BRC

earthing bus conductor in the form of a closed ring

~~[3.1.3 of EN 50310:2000]~~

Note 1 to entry: Normally the bonding ring conductor, as part of the bonding network, has multiple connections to the CBN that improves its performance.

440.3.1.9 common equipotential bonding system common bonding network CBN

equipotential bonding system providing both protective-equipotential-bonding and functional-equipotential-bonding

[SOURCE: IEC 60050-195:2021, 195-02-25]

440.3.1.10 equipotential bonding

~~provision~~ set of electric connections intended to achieve equipotentiality between conductive parts

[SOURCE: IEC 60050-195:2021, 195-01-10]

440.3.1.11 earth-electrode network ground-electrode network (US)

part of an earthing arrangement comprising only the earth electrodes and their interconnections

[SOURCE: IEC 60050-195:2021, 195-02-21]

440.3.1.12
meshed bonding network
MESH-BN

bonding network in which all associated equipment frames, racks and cabinets and usually the DC power return conductor, are bonded together as well as at multiple points to the CBN and may have the form of a mesh

~~[3.2.2 of ETS 300 253:1995]~~

Note 1 to entry: The MESH-BN augments the CBN.

440.3.1.13
by-pass equipotential bonding conductor
parallel earthing conductor
PEC

earthing conductor connected in parallel with the screens of signal ~~and~~ or data cables in order to limit the current flowing through the screens

440.3.2 Symbols

In this document, the following symbols are used (see Figure 1).

I_E part of the earth fault current in the high-voltage system that flows through the earthing arrangement of the transformer substation

R_E resistance of the earthing arrangement of the transformer substation

R_A resistance of the earthing arrangement of the exposed-conductive-parts of the equipment of the low-voltage installation

R_B resistance of the earthing arrangement of the low-voltage system neutral, for low-voltage systems in which the earthing arrangements of the transformer substation and of the low-voltage system neutral are electrically independent

U_0 in TN- and TT-systems: nominal AC RMS line voltage to earth

in IT-systems: nominal AC voltage between line conductor and neutral conductor or mid-point conductor, as appropriate

U_f power-frequency fault voltage that appears in the low-voltage system between exposed-conductive-parts and earth for the duration of the fault

U_1 power-frequency stress voltage between the line conductor and the exposed-conductive-parts of the low-voltage equipment of the transformer substation during the fault

U_2 power-frequency stress voltage between the line conductor and the exposed-conductive-parts of the low-voltage equipment of the low-voltage installation during the fault

NOTE 1 The power-frequency stress voltage (U_1 and U_2) is the voltage that appears across the insulation of low-voltage equipment and across surge protective devices connected to the low-voltage system.

The following additional symbols are used in respect of IT-systems in which the exposed-conductive-parts of the equipment of the low-voltage installation are connected to an earthing arrangement that is electrically independent of the earthing arrangement of the transformer substation.

I_h fault current that flows through the earthing arrangement of the exposed-conductive-parts of the equipment of the low-voltage installation during a period when there is a high-voltage fault and a first fault in the low-voltage installation (see Table 1).

I_d fault current, ~~in accordance with 411.6.2,~~ that flows through the earthing arrangement of the exposed-conductive-parts of the low-voltage installation during the first fault in a low-voltage system (see Table 1).

Z impedance (e.g. IMD internal impedance, artificial neutral impedance) between the low-voltage system and an earthing arrangement.