

INTERNATIONAL STANDARD

IEC 60364-4-44

Edition 1.2
2006-11

Edition 1:2001 consolidated with amendments 1:2003 and 2:2006

Electrical installations of buildings –

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

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CONTENTS

FOREWORD.....	9
440 Introduction	13
440.1 (442.1.1) Scope	15
440.2 (442.1.4) Normative references	15
441 (Number available)	17
442 Protection of low-voltage installations against temporary overvoltages and faults between high-voltage systems and earth.....	19
442.1 General requirements	19
442.2 Earthing systems in transformer sub-stations	21
442.3 Earthing arrangements in transformer sub-stations	21
442.4 Earthing arrangements with regard to type of earthing systems in LV installations	21
442.5 Limitation of stress-voltage in LV equipment of transformer sub-stations	23
442.6 Stress voltage in case of loss of the neutral conductor in a TN and TT system	25
442.7 Stress voltage in case of accidental earthing of an IT system	25
442.8 Stress voltage in case of a short-circuit between a line conductor and the neutral conductor	25
443 Protection against overvoltages of atmospheric origin or due to switching	47
443.1 General	47
443.2 Classification of impulse withstand voltages (overvoltage categories).....	47
443.3 Arrangements for overvoltage control	49
443.4 Required impulse withstand voltage of equipment	53
444 Measures against electromagnetic influences	55
444.1 General	55
444.2 (void) NOTE This clause is reserved for future input.	55
444.3 Definitions	57
444.4 Mitigation of Electromagnetic Interference (EMI)	59
444.5 Earthing and equipotential bonding	89
446.6 Segregation of circuits	101
447.7 Cable management systems	107
445 (45) Protection against undervoltage	111
445.1 (451) General requirements.....	111
Annex A (informative) Explanatory notes concerning 442.1 and 442.1.2.....	115
Annex B (informative) Guidance for overvoltage control by SPDs applied to overhead lines.....	119
Annex C (informative) IEC 60364 – Parts 1 to 6: Restructuring	123
Annex D (normative) Determination of the conventional length, d	131

Bibliography	135
Figure 44A – Maximum duration of fault-voltage F and touch voltage T due to an earth-fault in the HV system	27
Figure 44B – TN systems	29
Figure 44C – TT systems	31
Figure 44D – IT system, example a	33
Figure 44E – IT system, example b	35
Figure 44F – IT system, example c1	37
Figure 44G – IT system, example c2	39
Figure 44H – IT system, example d	41
Figure 44J – IT system, example e1	43
Figure 44K – IT system, example e2	45
Figure 44.R1 – By-pass conductor for screen reinforcement to provide a common equipotential bonding system	61
Figure 44.R2 – Example of a substitute or by-pass equipotential bonding conductor in a TT-system	63
Figure 44.R3A – 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	65
Figure 44.R3B – Avoidance of neutral conductor currents in a bonded structure by using a TN-S system downstream of a consumer's private supply transformer	67
Figure 44.R4 – TN-C-S system within an existing building installation	69
Figure 44.R5 – TT system within a building installation	71
Figure 44.R6 – IT system within a building installation	73
Figure 44.R7A – TN multiple-source power supply with a non-suitable multiple connection between PEN and earth	75
Figure 44.R7B – TN multiple source power supplies to an installation with connection to earth of the star points at one and the same point	77
Figure 44.R8 – TT multiple-source power supplies to an installation with connection to earth of the star points at one and the same point	79
Figure 44.R9A – Three-phase alternative power supply with a 4-pole switch	81
Figure 44.R9B – Neutral current flow in a three-phase alternative power supply with an unsuitable 3-pole switch	83
Figure 44.R9C – Single-phase alternative power supply with 2-pole switch	83
Figure 44.R10 – Armoured cables and metal pipes entering the buildings (examples)	85
Figure 44.R11 – Illustration of measures in an existing building	87
Figure 44.R12 – Interconnected earth electrodes	89
Figure 44.R13 – Examples of protective conductors in star network	91
Figure 44.R14 – Example of multiple meshed bonding star network	93
Figure 44.R15 – Example of a common meshed bonding star network	95
Figure 44.R16 – Example of equipotential bonding networks in structures without lightning protection systems	97

Figure 44.R17A – Separation between power and information technology cables for cable route lengths $\leq 35\text{m}$	103
Figure 44.R17B – Separation between power and information technology cables for cable route lengths $> 35\text{m}$	105
Figure 44.R18 – Separation of cables in wiring systems	105
Figure 44.R19 – Cable arrangements in metal cable-trays	107
Figure 44.R20 – Continuity of metallic system components	109
Figure 44.R21 – Location of cables inside metallic construction elements	109
Figure 44.R22 – Connection of metallic sections	111
Figure 44Q – Examples of how to apply d_1 , d_2 and d_3 for the determination of d	133
Table 44A – Permissible stress voltage	19
Table 44B – Required rated impulse withstand voltage of equipment	55
Table B.1 – Different possibilities for IT systems	121
Table C.1 – Relationship between restructured and original parts	123
Table C.2 – Relationship between new and old clause numbering	127

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRICAL INSTALLATIONS OF BUILDINGS –

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

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

This consolidated version of IEC 60364-4-44 consists of the first edition (2001), its amendment 1 (2003) [documents 64/1303/FDIS and 64/1329/RVD] and its amendment 2 (2006) [documents 64/1533/FDIS and 64/1547/RVD].

The technical content is therefore identical to the base edition and its amendments and has been prepared for user convenience.

It bears the edition number 1.2.

A vertical line in the margin shows where the base publication has been modified by amendments 1 and 2.

The IEC 60364 series (parts 1 to 6), is currently being restructured, without any technical changes, into a more simple form (see annex C).

According to a unanimous decision by the Committee of Action (CA/1720/RV (2000-03-21)), the restructured parts of IEC 60364 have not been submitted to National Committees for approval.

Annexes A, B and C are for information only.

Annex D forms an integral part of this standard.

The committee has decided that the contents of the base publication and its amendments 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.

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440 Introduction

Part 4-44 of IEC 60364 covers the protection of electrical installations and measures against voltage disturbances and electromagnetic disturbances.

The requirements are arranged into three sections as follows:

Clause 442 Protection of low-voltage installations against temporary overvoltages and faults between high-voltage systems and earth

Clause 443 Protection against overvoltages of atmospheric origin or due to switching

Clause 444 Measures against electromagnetic influences

Part 4-44 (2001) brings together these clauses, which were previously published separately.

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Withholding

ELECTRICAL INSTALLATIONS OF BUILDINGS –

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

440.1 (442.1.1) Scope

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

The rules of this part do not apply to systems that are wholly or partly under the control of public power supply companies (see scope of IEC 60364-1) although voltage and electromagnetic disturbances may be conducted or induced into electrical installations via these supply systems.

440.2 (442.1.4) 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 60038:1983, *IEC standard voltages*

IEC 60050(604):1987, *International Electrotechnical Vocabulary – Chapter 604: Generation, transmission and distribution of electricity – Operation*

IEC 60050(826):1982, *International Electrotechnical Vocabulary – Chapter 826: Electrical installations of buildings*

IEC 60364-1:2001, *Electrical installations of buildings – Part 1: Scope, object and fundamental principles*

IEC 60364-4-41:2001, *Electrical installations of buildings – Part 4-41: Protection for safety – Protection against electric shock*

IEC 60364-4-42:2001, *Electrical installations of buildings – Part 4-42: Protection for safety – Protection against thermal effects*

IEC 60364-5-53:2001, *Electrical installations of buildings – Part 5-53: Selection and erection of electrical equipment – Isolation, switching and control*

IEC 60364-5-54, *Electrical installations of buildings – Part 5-54: Selection and erection of electrical equipment – Earthing arrangements and protective conductors and equipotential bonding*¹⁾

IEC 60479-1:1994, *Effects of current on human beings and livestock – Part 1: General aspects*

IEC 60664-1:1992, *Insulation co-ordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

¹⁾ To be published.

IEC 60742:1983, *Isolating transformers and safety isolating transformers – Requirements*

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 61024-1:1990, *Protection of structures against lightning – Part 1: General principles*

IEC 61312-1:1995, *Protection against lightning electromagnetic impulse – Part 1: General principles*

IEC 61558-2-1, *Safety of power transformers, power supply units and similar – Part 2: Particular requirements for separating transformers for general use*

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

IEC 61558-2-6, *Safety of power transformers, power supply units and similar – Part 2: 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), *Surge protective devices connected to low-voltage power distribution systems*

IEC 61662:1995, *Assessment of the risk of damage due to lightning*
Amendment 1 (1996)

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

441 (Number available)

NOTE This has been introduced to enable the later text to retain the original number.

442 Protection of low-voltage installations against temporary overvoltages and faults between high-voltage systems and earth

442.1 General requirements

NOTE The following clauses consider only four situations which generally cause the most severe temporary overvoltages such as defined in IEC 60050(604), definition 604-03-12:

- fault between the high-voltage system(s) and earth. The corresponding subclauses should be read in conjunction with annex A;
- loss of the neutral in a low-voltage TN and TT system (see 442.6);
- accidental earthing of a low-voltage IT system (see 442.7);
- short-circuit in the low-voltage installation (see 442.8).

442.1.2 Fault-voltage

The magnitude and the duration of the fault-voltage or the touch voltage due to an earth-fault in the high-voltage system shall not exceed the values given by curve F and T respectively of figure 44A.

442.1.3 Stress-voltage

The magnitude and the duration of the power-frequency stress voltage of the LV equipment in the consumer's installation due to an earth fault in the high voltage system shall not exceed the values of table 44A.

NOTE 1 The power-frequency stress voltage is the voltage which appears across the insulation.

NOTE 2 A higher stress voltage is permitted for the low-voltage equipment of the sub-station if the insulation level of the equipment is compatible and under the conditions of 442.3.

Table 44A – Permissible stress voltage

Permissible a.c. stress voltage on equipment in low-voltage installations V	Disconnecting time s
$U_0 + 250$ V	>5
$U_0 + 1\,200$ V	≤5

NOTE 1 In particular cases (e.g. line conductor earthed), where the (highest) nominal voltage of the low-voltage system to earth is not U_0 , this voltage shall be specified.

NOTE 2 The first line of the table relates to systems having long disconnection times, for example inductively earthed high-voltage system. The second line relates to systems having short disconnection times, for example solidly earthed high-voltage systems. Both lines together are relevant design criteria for insulation of low-voltage equipment with regard to temporary overvoltage (see 1.3.7.1 of IEC 60664-1).

NOTE 3 Such temporary a.c. overvoltage is also to be expected in basic, double and reinforced insulation of low-voltage equipment used outside the main equipotential bonding and connected to a TN system (whose neutral conductor is earthed in the transformer substation through the protective earth electrode of the high-voltage system). It is not necessary to expect such overvoltage within the area of main equipotential bonding which is connected to the protective conductor of a TN system at the origin of the installation of the building.

442.2 Earthing systems in transformer sub-stations

At the transformer sub-station, there shall be one earthing system to which shall be connected

- earth electrodes,
- the transformer tank,
- metallic coverings of high-voltage cables,
- metallic coverings of low-voltage cables except where the neutral conductor is earthed via a separate earth electrode,
- earth wires of high-voltage systems,
- the exposed-conductive-parts of high-voltage and low-voltage equipment,
- extraneous-conductive-parts.

442.3 Earthing arrangements in transformer sub-stations

The conditions enumerated under 442.4 and 442.5 are deemed to be complied with if one or both of the conditions stated in 442.3.1 or the condition in 442.3.2 is met. Where none of the conditions of 442.3.1 or 442.3.2 is met, the requirements of 442.4 and 442.5 shall be applied.

442.3.1 The transformer sub-stations shall be connected to cables with suitable earthed metallic coverings, whether high-voltage cables, low-voltage cables or a combination of both high- and low-voltage cables.

The total length of these cables shall exceed 1 km.

442.3.2 The earthing resistance of the exposed-conductive-parts of the transformer sub-station does not exceed 1 Ω .

442.4 Earthing arrangements with regard to type of earthing systems in LV installations

442.4.1 Symbols

In the following subclauses, the symbols are

I_m that part of the earth fault current in the high-voltage system that flows through the earth electrode of the exposed-conductive-parts of the transformer sub-station.

R is the resistance of the earth electrode of the exposed-conductive-parts of the transformer sub-station.

U_0 is the line-to-neutral voltage of the low-voltage system.

U is the line-to-line voltage of the low-voltage system.

U_f is the fault-voltage in the LV system between exposed-conductive-parts and earth.

U_1 is the stress-voltage in the LV equipment of the transformer sub-station.

U_2 is the stress-voltage in the LV equipment of the consumer's system.

442.4.2 TN systems

- a) When the fault-voltage $R \times I_m$ is disconnected within a time given in figure 44A, the neutral conductor of the LV system may be connected to the earthing electrode of the exposed-conductive-parts of the transformer sub-station (see TN-a in figure 44B).

NOTE If the exposed-conductive-parts of the low-voltage equipment of the consumer's installation within the building are connected to the main equipotential bonding by a protective conductor, the touch voltage will be effectively zero.

- b) If the condition under a) is not fulfilled, the neutral conductor of the LV system shall be earthed via an electrically independent earth electrode (see TN-b in figure 44B). In this case, the conditions of 442.5.1 apply.

442.4.3 systems

- a) When the relation between the stress-voltage ($R \times I_m + U_0$) and the disconnecting time given in table 44A is complied with for the LV equipment of the consumer's installation, the neutral conductor of the LV system may be connected to the earthing electrode of the exposed-conductive-parts of the transformer sub-station (see TT-a in figure 44C).

- b) If the condition under a) is not fulfilled, the neutral conductor of the LV system shall be earthed via an electrically independent earth electrode (see TT-b in figure 44C). In this case, the conditions of 442.5.1 apply.

If the exposed-conductive-parts of the low-voltage equipment of the consumer's installation within the building are connected to the main equipotential bonding by a protective conductor, the touch voltage will be effectively zero.

442.4.4 IT-systems

- a) When the fault-voltage $R \times I_m$ is disconnected within a time given in figure 44A, the exposed-conductive-parts of the LV equipment of the consumer's installation may be connected to the earthing electrode of the exposed-conductive-parts of the sub-station (see figures 44D, 44J and 44K).

If this condition is not fulfilled, the exposed-conductive-parts of the LV equipment of the LV installation shall be connected to an earthing system electrically independent from the earthing electrode of the exposed-conductive-parts of the sub-station (see figures 44E to 44H).

- b) When the exposed-conductive-parts of the LV equipment in the consumer's installation are earthed via an earth electrode electrically independent of the earth electrode of the transformer sub-station, and when the relation between the stress-voltage ($R \times I_m + U$) and the disconnecting time given in table 44A is complied with for the LV equipment of the consumer's installation, the neutral impedance of the LV system, if any, may be connected to the earth electrode of the exposed-conductive-parts of the transformer sub-station (see figure 44E).

If this condition is not fulfilled, the neutral impedance shall be earthed via an electrically independent earth electrode (see figures 44F and 44H). In this case, the conditions of 442.5.2 apply.

442.5 Limitation of stress-voltage in LV equipment of transformer sub-stations

442.5.1 TN and TT systems

When in TN and TT systems the neutral conductor is earthed via an earth electrode electrically independent of the earth electrode of the exposed-conductive-parts of the transformer substation (see figures TN – b in figure 44B and TT – b in figure 44C), the stress-voltage ($R \times I_m + U_0$) shall be disconnected in time compatible with the insulation level of the LV equipment of the transformer sub-station.

NOTE The insulation level of the LV equipment of the transformer sub-station may be higher than the value given in table 44A.