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Section 443: Protection contre les surtensions d'origine atmosphérique ou dues à des manoeuvres

Electrical installations of buildings –

Part 4:
Protection for safety –
Chapter 44: Protection against overvoltages –
Section 443: Protection against overvoltages of atmospheric origin or due to switching

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ELECTRICAL INSTALLATIONS OF BUILDINGS –

Part 4: Protection for safety – Chapter 44: Protection against overvoltages – Section 443: Protection against overvoltages of atmospheric origin or due to switching

FOREWORD

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3) They have the form of recommendations for international use published in the form of standards, technical reports or guides and they are accepted by the National Committees in that sense.
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International Standard IEC 364-4-443 has been prepared by IEC technical committee 64: Electrical installations of buildings.

This second edition cancels and replaces the first edition published in 1990 and constitutes a technical revision.

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

DIS	Report on voting
64(CO)244/244A	64/777/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.

INTRODUCTION

This section of IEC 364-4 is intended to describe the means by which transient overvoltages can be limited to reduce the risk of failures in the installation, and in electrical equipment connected to it, to an acceptable level. This approach is in line with the principles of insulation coordination in IEC 664. IEC 664-1 requires technical committees to specify an appropriate impulse withstand category (overvoltage category) for their equipment, that means a minimum impulse withstand voltage for the equipment, according to its application and the related impulse withstand categories.

NOTE – Following clause 9 of IEC 664-1, technical committees should specify the relevant information. It is recommended to indicate the rated impulse withstand voltage to be supplied with the equipment and the way this is provided.

ELECTRICAL INSTALLATIONS OF BUILDINGS –

Part 4: Protection for safety – Chapter 44: Protection against overvoltages – Section 443: Protection against overvoltages of atmospheric origin or due to switching

443.1 General

443.1.1 *Scope and object*

This section of IEC 364-4 deals with protection of electrical installations against transient overvoltages of atmospheric origin transmitted by the supply distribution system and against switching overvoltages generated by the equipment within the installation.

Consideration shall be given to the overvoltages which can appear at the origin of an installation, to the expected ceraunic level and to the location and characteristics of overvoltage protective devices, so that the probability of incidents due to overvoltage stresses is reduced to an acceptable level for the safety of persons and property, as well as for the continuity of service desired.

The values of transient overvoltages depend on the nature of the supply distribution system (underground or overhead) and the possible existence of a low-voltage protective device upstream of the origin of the installation and the level of the supply system.

This section provides guidance where protection against overvoltages is covered by inherent control or assured by protective control. If the protection according to this section is not provided, insulation coordination is not assured and the risk due to overvoltages shall be evaluated.

NOTES

1 Where, in this section, the term "transient overvoltage" is used, it is intended to mean statistical lightning overvoltage as defined:

The statistical level of overvoltages is defined as the overvoltage applied to equipment as a result of an event of one specific type in the system (line energization, reclosing, fault occurrence, lightning discharge, etc.), the peak value of which has a probability of being exceeded which is equal to a specified reference probability.

2 As regards transient atmospheric overvoltages, no distinction is made between earthed and unearthed systems.

3 Switching overvoltages generated outside the installation and transmitted by the supply network are under consideration.

4 The rules of this section do not apply to telecommunication systems.

443.1.2 *Normative references*

The following normative documents contain provisions which, through reference in this text, constitute provisions of this section of IEC 364-4. At the time of publication, the

editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this section of IEC 364-4 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 38: 1983, *IEC standard voltages*

IEC 50(826): 1990, *International Electrotechnical Vocabulary (IEV) – Chapter 826: Electrical installations of buildings*

IEC 364-4-442: 1993, *Electrical installations of buildings – Part 4: Protection for safety – Chapter 44: Protection against overvoltages – Section 442: Protection of low-voltage installations against faults between high-voltage systems and earth*

IEC/DIS 364-5-534, *Electrical installations of buildings – Part 5: Selection and erection of electrical equipment – Chapter 53: Switchgear and controlgear – Section 534: Devices for protection against overvoltages* [1)]

IEC 664-1: 1992, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

IEC 1024-1: 1990, *Protection of structures against lightning – Part 1: General principles*

443.2 Classification of impulse withstand categories (overvoltage categories)

443.2.1 *Purpose of classification of impulse withstand categories (overvoltage categories)*

NOTE – See table 44B.

Impulse withstand categories are to distinguish different degrees of availability of equipment with regard to required expectations on continuity of service and on an acceptable risk of failure. By selection of impulse withstand levels of equipment insulation coordination can be achieved in the whole installation reducing the risk of failure to an acceptable level providing a basis for overvoltage control.

A higher characteristic numeral of an impulse withstand category indicates a higher specific impulse withstand of the equipment and offers a wider choice of methods for overvoltage control.

The concept of impulse withstand categories is used for equipment energized directly from the mains.

NOTE – Overvoltages of atmospheric origin are not significantly physically attenuated downstream in most installations. Investigations have shown that the concept of a probabilistic approach has proved reasonable and useful.

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1) At present, at the stage of Draft International Standard.

443.2.2 *Description of impulse withstand categories (overvoltage categories)*

Equipment of impulse withstand category I is equipment which is intended to be connected to the fixed electrical installations of buildings. Protective means are taken outside the equipment – either in the fixed installation or between the fixed installation and the equipment – to limit transient overvoltages to the specific level.

Equipment of impulse withstand category II is equipment to be connected to the fixed electrical installations of buildings.

NOTE – Examples of such equipment are household appliances, portable tools and similar loads.

Equipment of impulse withstand category III is equipment which is part of the fixed electrical installations and other equipment where a higher degree of availability is expected.

NOTE – Examples of such equipment are distribution boards, circuit-breakers, wiring systems (see IEC 50(826) [IEV 826-06-01]), including cables, bus-bars, junction boxes, switches, socket-outlets) in the fixed installation, and equipment for industrial use and some other equipment, e.g. stationary motors with permanent connection to the fixed installation.

Equipment of impulse withstand category IV is for use at or in the proximity of the origin of the electrical installations of buildings upstream of the main distribution board.

NOTE – Examples of such equipment are electricity meters, primary overcurrent protection device and ripple control units.

443.3 Arrangements for overvoltage control

NOTES

1 Direct strokes on the low-voltage lines of the supply network or electrical installations of buildings are disregarded (conditions of external influence AQ 3); see IEC 1024-1.

2 Overvoltage control due to switching overvoltages is not necessary in most cases, because statistical evaluations of measurements have shown that there is a low risk of switching overvoltages higher than the level of overvoltage category II.

If the installation of surge protective devices is required in accordance with this section, the following requirements apply.

443.3.1 *Inherent control*

443.3.1.1 Where an installation is supplied by a complete low-voltage underground system and does not include overhead lines, the impulse withstand voltage of equipment in accordance with table 44B is sufficient and no additional protection against overvoltage of atmospheric origin is necessary.

NOTE – A suspended cable having insulated conductors with earthed metallic screen is considered as equivalent to an underground cable.

443.3.1.2 Where an installation is supplied by or includes a low-voltage overhead line and the condition of external influences AQ 1 (≤25 days per year) exists, no additional protection against overvoltages of atmospheric origin is required.

NOTES

1 Additional protection against overvoltages may be necessary in applications where a higher reliability or higher risks (e.g. fire) are expected.

2 According to IEC 1024-1, 25 thunderstorm days per year are equivalent to a value of 2,24 flashes per km^2 and year. This is derived from the formula

$$N_g = 0{,}04\ T_d^{1{,}25}$$

where

N_g is the frequency of flashes per km^2 and year;

T_d is the number of thunderstorm days per year.

443.3.2 *Protective control*

443.3.2.1 Where an installation is supplied by or includes an overhead line, protection against overvoltages of atmospheric origin shall be provided, if the ceraunic level of the location corresponds to the condition of external influences AQ 2 (>25 days per year). The protection level of the protective device shall not be higher than the level of overvoltage category II, given in table 44B.

NOTES

1 The overvoltage level may be controlled by overvoltage protective devices applied close to the origin of the installation either in the overhead lines or in the building installation.

2 Particular protection may be necessary where high reliability or higher risks (e.g. fire) are expected and where the acceptable risk depending on the utilization of the installation is exceptionally low.

443.3.2.2 In the conditions according to 443.3.2.1 the protection against overvoltages of atmospheric origin can be provided in the installation of the building by:

- a surge protective device with a protection level of category II in accordance with IEC/DIS 364-5-534;
- or by other means providing at least an equivalent attenuation of overvoltages.

NOTE – Guidance for coordination of cascaded surge arresters is under consideration.

443.4 Selection of equipment in the installation

443.4.1 Equipment shall be so selected that its rated impulse withstand voltage is not less than the required impulse withstand voltage as specified in table 44B. It is the responsibility of product committees for installation material to require the rated impulse withstand voltage in the relevant standard, as specified in table 44B.

NOTE – Rated impulse withstand voltage is an 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 overvoltages (in accordance with 1.3.9.2 of IEC 664-1).

443.4.2 Equipment having an impulse withstand voltage lower than specified in table 44B may be used, if the higher risk of damage is acceptable. The surge protective devices and their series protective means shall withstand safely the temporary overvoltages of IEC 364-4-442.

Table 44B – Required rated impulse withstand voltage of equipment

Nominal voltage of the installation * V		Required impulse withstand voltage for kV			
Three-phase systems **	Single-phase systems with middle point	Equipment at the origin of the installation (impulse withstand category IV)	Equipment of distribution and final circuits (impulse withstand category III)	Appliances (impulse withstand category II)	Specially protected equipment (impulse withstand category I)
–	120-240	4	2,5	1,5	0,8
230/400 ** 277/480 **	–	6	4	2,5	1,5
400/690	–	8	6	4	2,5
1 000	–	Values subject to system engineers			

* According to IEC 38

** In Canada and USA for voltages to earth higher than 300 V, the impulse withstand voltage corresponding to the next higher voltage in column one applies.

Category I is addressed to particular equipment engineering;
Category II is addressed to product committees for equipment for connection to the mains;
Category III is addressed to product committees of installation material and some special product committees;

Category IV is addressed to supply authorities and system engineers (see also 443.2.2).