

INTERNATIONAL STANDARD



Protection against lightning –
Part 2: Risk management

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

PROTECTION AGAINST LIGHTNING –**Part 2: Risk management**

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.
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International Standard IEC 62305-2 has been prepared by IEC technical committee 81: Lightning protection.

This second edition cancels and replaces the first edition, published in 2006, and constitutes a technical revision.

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

- 1) Risk assessment for services connected to structures is excluded from the scope.
- 2) Injuries of living beings caused by electric shock inside the structure are considered.
- 3) Tolerable risk of loss of cultural heritage is lowered from 10^{-3} to 10^{-4} . The value of tolerable risk of loss of economic value ($R_T = 10^{-3}$) is introduced, to be used when data for cost/benefit analysis are not available.
- 4) Extended damage to surroundings structures or to the environment is considered.
- 5) Improved equations are provided for evaluation of

- collection areas relevant to flashes nearby a structure,
 - collection areas relevant to flashes to and nearby a line,
 - probabilities that a flash can cause damage,
 - loss factors even in structures with risk of explosion,
 - risk relevant to a zone of a structure,
 - cost of loss.
- 6) Tables are provided to select the relative amount of loss in all cases.
- 7) Impulse withstand voltage level of equipments was extended down to 1 kV.

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

FDIS	Report on voting
81/371/FDIS	81/381/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.

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

A list of all the parts in the IEC 62305 series, under the general title *Protection against lightning*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability 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 [IEC 62305-2:2010](http://webstore.iec.ch/catalog/standards/iec/019c01db-0a22-470c-bf16-8836e75fcaca/iec-62305-2-2010)
- amended.

A bilingual version of this standard may be issued at a later date.

IMPORTANT – The 'colour inside' logo on the cover page of this publication 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

Lightning flashes to earth may be hazardous to structures and to lines.

The hazard to a structure can result in

- damage to the structure and to its contents,
- failure of associated electrical and electronic systems,
- injury to living beings in or close to the structure.

Consequential effects of the damage and failures may be extended to the surroundings of the structure or may involve its environment.

To reduce the loss due to lightning, protection measures may be required. Whether they are needed, and to what extent, should be determined by risk assessment.

The risk, defined in this part of IEC 62305 as the probable average annual loss in a structure due to lightning flashes, depends on:

- the annual number of lightning flashes influencing the structure;
- the probability of damage by one of the influencing lightning flashes;
- the mean amount of consequential loss.

Lightning flashes influencing the structure may be divided into

- flashes terminating on the structure,
- flashes terminating near the structure, direct to connected lines (power, telecommunication lines,) or near the lines.

Flashes to the structure or a connected line may cause physical damage and life hazards. Flashes near the structure or line as well as flashes to the structure or line may cause failure of electrical and electronic systems due to overvoltages resulting from resistive and inductive coupling of these systems with the lightning current.

Moreover, failures caused by lightning overvoltages in users' installations and in power supply lines may also generate switching type overvoltages in the installations.

NOTE Malfunctioning of electrical and electronic systems is not covered by the IEC 62305 series. Reference should be made to IEC 61000-4-5^[1].

The number of lightning flashes influencing the structure depends on the dimensions and the characteristics of the structure and of the connected lines, on the environmental characteristics of the structure and the lines, as well as on lightning ground flash density in the region where the structure and the lines are located.

The probability of lightning damage depends on the structure, the connected lines, and the lightning current characteristics, as well as on the type and efficiency of applied protection measures.

The annual mean amount of the consequential loss depends on the extent of damage and the consequential effects which may occur as result of a lightning flash.

The effect of protection measures results from the features of each protection measure and may reduce the damage probabilities or the amount of consequential loss.

¹ Figures in square brackets refer to the bibliography.

The decision to provide lightning protection may be taken regardless of the outcome of risk assessment where there is a desire that there be no avoidable risk.

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PROTECTION AGAINST LIGHTNING –

Part 2: Risk management

1 Scope

This part of IEC 62305 is applicable to risk assessment for a structure due to lightning flashes to earth.

Its purpose is to provide a procedure for the evaluation of such a risk. Once an upper tolerable limit for the risk has been selected, this procedure allows the selection of appropriate protection measures to be adopted to reduce the risk to or below the tolerable limit.

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 62305-1:2010, *Protection against lightning – Part 1: General principles*

IEC 62305-3:2010, *Protection against lightning – Part 3: Physical damage to structures and life hazard*

IEC 62305-4:2010, *Protection against lightning – Part 4: Electrical and electronic systems within structures*

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3 Terms, definitions, symbols and abbreviations

For the purposes of this document, the following terms, definitions, symbols and abbreviations, some of which have already been cited in Part 1 but are repeated here for ease of reading, as well as those given in other parts of IEC 62305, apply.

3.1 Terms and definitions

3.1.1

structure to be protected

structure for which protection is required against the effects of lightning in accordance with this standard

NOTE A structure to be protected may be part of a larger structure.

3.1.2

structures with risk of explosion

structures containing solid explosives materials or hazardous zones as determined in accordance with IEC 60079-10-1^[2] and IEC 60079-10-2^[3]

3.1.3

structures dangerous to the environment

structures which may cause biological, chemical or radioactive emission as a consequence of lightning (such as chemical, petrochemical, nuclear plants, etc.)

3.1.4**urban environment**

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

NOTE 'Town centre' is an example of an urban environment.

3.1.5**suburban environment**

area with a medium density of buildings

NOTE 'Town outskirts' is an example of a suburban environment.

3.1.6**rural environment**

area with a low density of buildings

NOTE 'Countryside' is an example of a rural environment.

3.1.7**rated impulse withstand voltage level** U_w

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

[IEC 60664-1:2007, definition 3.9.2, modified]^[4]

NOTE For the purposes of this part of IEC 62305, only the withstand voltage between live conductors and earth is considered.

3.1.8**electrical system**

system incorporating low voltage power supply components

3.1.9**electronic system**

system incorporating sensitive electronic components such as telecommunication equipment, computer, control and instrumentation systems, radio systems, power electronic installations

3.1.10**internal systems**

electrical and electronic systems within a structure

3.1.11**line**

power line or telecommunication line connected to the structure to be protected

3.1.12**telecommunication lines**

lines intended for communication between equipment that may be located in separate structures, such as phone lines and data lines

3.1.13**power lines**

distribution lines feeding electrical energy into a structure to power electrical and electronic equipment located there, such as low voltage (LV) or high voltage (HV) electric mains

3.1.14**dangerous event**

lightning flash to or near the structure to be protected, or to or near a line connected to the structure to be protected that may cause damage

3.1.15

lightning flash to a structure

lightning flash striking a structure to be protected

3.1.16

lightning flash near a structure

lightning flash striking close enough to a structure to be protected that it may cause dangerous overvoltages

3.1.17

lightning flash to a line

lightning flash striking a line connected to the structure to be protected

3.1.18

lightning flash near a line

lightning flash striking close enough to a line connected to the structure to be protected that it may cause dangerous overvoltages

3.1.19

number of dangerous events due to flashes to a structure

N_D

expected average annual number of dangerous events due to lightning flashes to a structure

3.1.20

number of dangerous events due to flashes to a line

N_L

expected average annual number of dangerous events due to lightning flashes to a line

3.1.21

number of dangerous events due to flashes near a structure

N_M

expected average annual number of dangerous events due to lightning flashes near a structure

3.1.22

number of dangerous events due to flashes near a line

N_I

expected average annual number of dangerous events due to lightning flashes near a line

3.1.23

lightning electromagnetic impulse

LEMP

all electromagnetic effects of lightning current via resistive, inductive and capacitive coupling, which create surges and electromagnetic fields

3.1.24

surge

transient created by LEMP that appears as an overvoltage and/or overcurrent

3.1.25

node

point on a line from which onward surge propagation can be assumed to be neglected

NOTE Examples of nodes are a point on a power line branch distribution at an HV/LV transformer or on a power substation, a telecommunication exchange or an equipment (e.g. multiplexer or xDSL equipment) on a telecommunication line.