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Edition 2.0 2010-12

INTERNATIONAL STANDARD

Protection against lightning – Part 1: General principles

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

PROTECTION AGAINST LIGHTNING –

Part 1: General principles

FOREWORD

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International Standard IEC 62305-1 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) It no longer covers protection of services connected to structures.
2) Isolated interfaces are introduced as protection measures to reduce failure of electric and electronic systems.
3) First negative impulse current is introduced as a new lightning parameter for calculation purposes.
4) Expected surge overcurrents due to lightning flashes have been more accurately specified for low voltage power systems and for telecommunication systems.

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

FDIS	Report on voting
81/370/FDIS	81/380/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- withdrawn,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
- amended.

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

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INTRODUCTION

There are no devices or methods capable of modifying the natural weather phenomena to the extent that they can prevent lightning discharges. Lightning flashes to, or nearby, structures (or lines connected to the structures) are hazardous to people, to the structures themselves, their contents and installations as well as to lines. This is why the application of lightning protection measures is essential.

The need for protection, the economic benefits of installing protection measures and the selection of adequate protection measures should be determined in terms of risk management. Risk management is the subject of IEC 62305-2.

Protection measures considered in IEC 62305 are proved to be effective in risk reduction.

All measures for protection against lightning form the overall lightning protection. For practical reasons the criteria for design, installation and maintenance of lightning protection measures are considered in two separate groups:

– the first group concerning protection measures to reduce physical damage and life hazard in a structure is given in IEC 62305-3;
– the second group concerning protection measures to reduce failures of electrical and electronic systems in a structure is given in IEC 62305-4.

The connection between the parts of IEC 62305 is illustrated in Figure 1.

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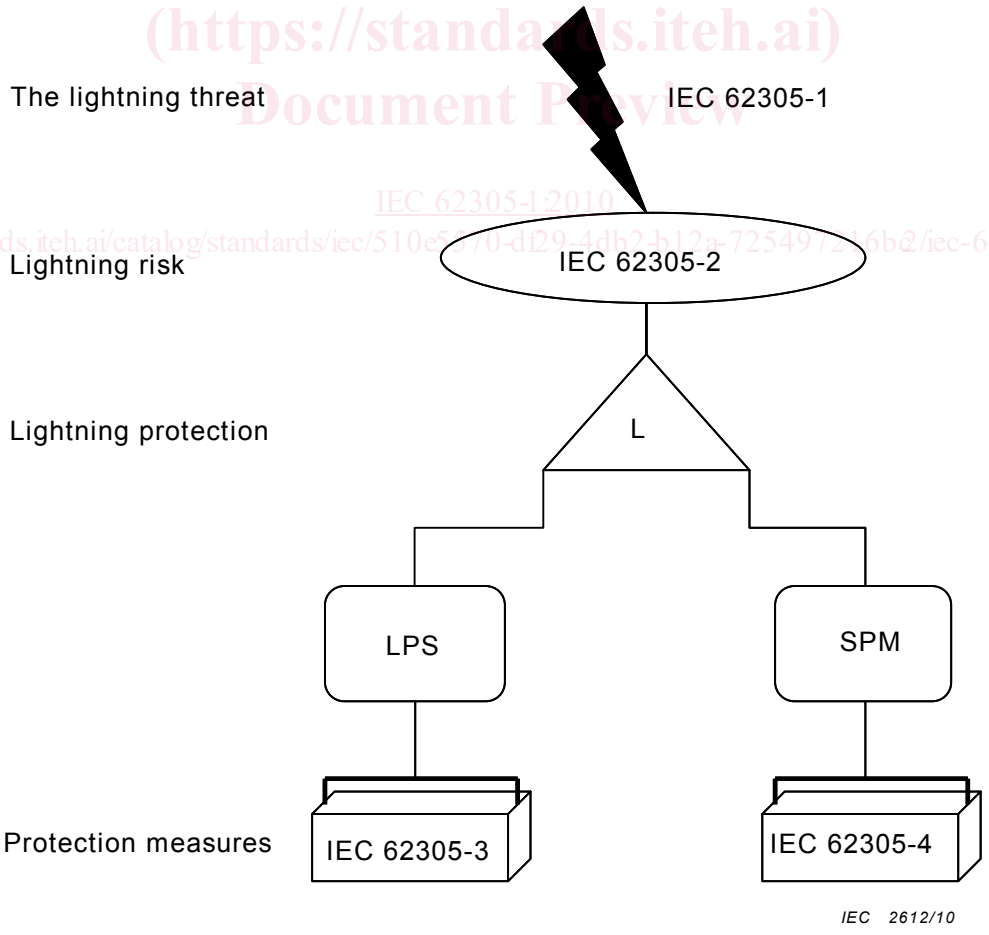

Figure 1 – Connection between the various parts of IEC 62305

PROTECTION AGAINST LIGHTNING –

Part 1: General principles

1 Scope

This part of IEC 62305 provides general principles to be followed for protection of structures against lightning, including their installations and contents, as well as persons.

The following cases are outside the scope of this standard:

– railway systems;
– vehicles, ships, aircraft, offshore installations;
– underground high pressure pipelines;
– pipe, power and telecommunication lines placed outside the structure.

NOTE These systems usually fall under special regulations produced by various specialized authorities.

2 Normative references

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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 62305-2:2010, *Protection against lightning – Part 2: Risk management*

IEC 62305-1:2010
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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*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
lightning flash to earth
electrical discharge of atmospheric origin between cloud and earth consisting of one or more strokes

3.2
downward flash
lightning flash initiated by a downward leader from cloud to earth

NOTE A downward flash consists of a first impulse, which can be followed by subsequent impulses. One or more impulses may be followed by a long stroke.

3.3
upward flash
lightning flash initiated by an upward leader from an earthed structure to cloud

NOTE An upward flash consists of a first long stroke with or without multiple superimposed impulses. One or more impulses may be followed by a long stroke.

3.4
lightning stroke
single electrical discharge in a lightning flash to earth

3.5
short stroke
part of the lightning flash which corresponds to an impulse current

NOTE This current has a time T_2 to the half peak value on the tail typically less than 2 ms (see Figure A.1).

3.6
long stroke
part of the lightning flash which corresponds to a continuing current

NOTE The duration time T_{LONG} (time from the 10 % value on the front to the 10 % value on the tail) of this continuing current is typically more than 2 ms and less than 1 s (see Figure A.2).

3.7
multiple strokes
lightning flash consisting on average of 3-4 strokes, with typical time interval between them of about 50 ms

NOTE Events having up to a few dozen strokes with intervals between them ranging from 10 ms to 250 ms have been reported.

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3.8
point of strike
point where a lightning flash strikes the earth, or protruding structure (e.g. structure, LPS, line, tree, etc.)

NOTE A lightning flash may have more than one point of strike.

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3.9
lightning current
i
current flowing at the point of strike

3.10
current peak value
I
maximum value of the lightning current

3.11
average steepness of the front of impulse current
average rate of change of current within a time interval $\Delta t = t_2 - t_1$

NOTE It is expressed by the difference $\Delta i = i(t_2) - i(t_1)$ of the values of the current at the start and at the end of this interval, divided by the time interval $\Delta t = t_2 - t_1$ (see Figure A.1).

3.12
front time of impulse current
T_1
virtual parameter defined as 1,25 times the time interval between the instants when the 10 % and 90 % of the peak value are reached (see Figure A.1)

3.13
virtual origin of impulse current
O_1
point of intersection with time axis of a straight line drawn through the 10 % and the 90 % reference points on the stroke current front (see Figure A.1); it precedes by 0,1 T_1 that instant at which the current attains 10 % of its peak value

3.14
time to half value on the tail of impulse current
T_2
virtual parameter defined as the time interval between the virtual origin O_1 and the instant at which the current has decreased to half the peak value on the tail (see Figure A.1)

3.15
flash duration
T
time for which the lightning current flows at the point of strike

3.16
duration of long stroke current
T_{LONG}
time duration during which the current in a long stroke is between 10 % of the peak value during the increase of the continuing current and 10 % of the peak value during the decrease of the continuing current (see Figure A.2)

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3.17
flash charge
Q_{FLASH}
value resulting from the time integral of the lightning current for the entire lightning flash duration

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3.18
impulse charge
Q_{SHORT}
value resulting from the time integral of the lightning current in an impulse

3.19
long stroke charge
Q_{LONG}
value resulting from the time integral of the lightning current in a long stroke

3.20
specific energy
W/R
value resulting from the time integral of the square of the lightning current for the entire flash duration

NOTE It represents the energy dissipated by the lightning current in a unit resistance.

3.21
specific energy of impulse current
value resulting from the time integral of the square of the lightning current for the duration of the impulse

NOTE The specific energy in a long stroke current is negligible.

3.22
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.

3.23
line
power line or telecommunication line connected to the structure to be protected

3.24
telecommunication lines
lines intended for communication between equipment that may be located in separate structures, such as a phone line and a data line

3.25
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

3.26
lightning flash to a structure
lightning flash striking a structure to be protected

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3.27
lightning flash near a structure
lightning flash striking close enough to a structure to be protected that it may cause dangerous overvoltages

3.28
electrical system
system incorporating low voltage power supply components

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3.29
electronic system
system incorporating sensitive electronic components such as telecommunication equipment, computer, control and instrumentation systems, radio systems, power electronic installations

3.30
internal systems
electrical and electronic systems within a structure

3.31
physical damage
damage to a structure (or to its contents) due to mechanical, thermal, chemical and explosive effects of lightning

3.32
injury of living beings
permanent injuries, including loss of life, to people or to animals by electric shock due to touch and step voltages caused by lightning

NOTE Although living beings may be injured in other ways, in this standard the term ‘injury to living beings’ is limited to the threat due to electrical shock (type of damage D1).

3.33
failure of electrical and electronic systems
permanent damage of electrical and electronic systems due to LEMP

3.34
lightning electromagnetic impulse
LEMP
all electromagnetic effects of lightning current via resistive, inductive and capacitive coupling that create surges and radiated electromagnetic fields

3.35
surge
transient created by LEMP that appears as an overvoltage and/or an overcurrent

3.36
lightning protection zone
LPZ
zone where the lightning electromagnetic environment is defined

NOTE The zone boundaries of an LPZ are not necessarily physical boundaries (e.g. walls, floor and ceiling).

3.37
risk
R
value of probable average annual loss (humans or goods) due to lightning, relative to the total value (humans or goods) of the structure to be protected

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3.38
tolerable risk
R_T
maximum value of the risk which can be tolerated for the structure to be protected

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3.39
lightning protection level
LPL
number related to a set of lightning current parameters values relevant to the probability that the associated maximum and minimum design values will not be exceeded in naturally occurring lightning

NOTE Lightning protection level is used to design protection measures according to the relevant set of lightning current parameters.

3.40
protection measures
measures to be adopted for the structure to be protected in order to reduce the risk

3.41
lightning protection
LP
complete system for protection of structures against lightning, including their internal systems and contents, as well as persons, in general consisting of an LPS and SPM

3.42
lightning protection system
LPS
complete system used to reduce physical damage due to lightning flashes to a structure

NOTE It consists of both external and internal lightning protection systems.