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Protection against lightning - Part 2: Risk management

Blitzschutz - Teil 2: Risiko-Management

Protection contre la foudre - Partie 2: Evaluation des risques

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**Protection against lightning -
Part 2: Risk management
(IEC 62305-2:2010, modified)**

Protection contre la foudre -
Partie 2: Evaluation des risques
(CEI 62305-2:2010, modifiée)

Blitzschutz -
Teil 2: Risiko-Management
(IEC 62305-2:2010, modifiziert)

STANDARD PREVIEW
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Contents

Foreword	6
Introduction	7
1 Scope	8
2 Normative references	8
3 Terms, definitions, symbols and abbreviations	8
3.1 Terms and definitions	8
3.2 Symbols and abbreviations	13
4 Explanation of terms	16
4.1 Damage and loss	16
4.2 Risk and risk components	18
4.3 Composition of risk components	20
5 Risk management	21
5.1 Basic procedure	21
5.2 Structure to be considered for risk assessment	22
5.3 Tolerable risk R_T	22
5.4 Specific procedure to evaluate the need of protection	22
5.5 Procedure to evaluate the cost effectiveness of protection	23
5.6 Protection measures	26
5.7 Selection of protection measures	26
6 Assessment of risk components	26
6.1 Basic equation	26
6.2 Assessment of risk components due to flashes to the structure (S1)	27
6.3 Assessment of the risk component due to flashes near the structure (S2)	27
6.4 Assessment of risk components due to flashes to a line connected to the structure (S3)	27
6.5 Assessment of risk component due to flashes near a line connected to the structure (S4)	28
6.6 Summary of risk components	29
6.7 Partitioning of a structure in zones Z_S	29
6.8 Partitioning of a line into sections S_L	30
6.9 Assessment of risk components in a structure with zones Z_S	30
6.10 Cost-benefit analysis for economic loss (L_4)	31
Annex A (informative) Assessment of annual number N of dangerous events	32
A.1 General	32
A.2 Assessment of the average annual number of dangerous events N_D due to flashes to a structure and N_{DJ} to an adjacent structure	32
A.3 Assessment of the average annual number of dangerous events N_M due to flashes near a structure	37
A.4 Assessment of the average annual number of dangerous events N_L due to flashes to a line	38
A.5 Assessment of average annual number of dangerous events N_I due to flashes near a line	39
Annex B (informative) Assessment of probability P_X of damage	40
B.1 General	40
B.2 Probability P_A that a flash to a structure will cause injury to living beings by electric shock	40
B.3 Probability P_B that a flash to a structure will cause physical damage	41

B.4	Probability P_C that a flash to a structure will cause failure of internal systems	41
B.5	Probability P_M that a flash near a structure will cause failure of internal systems ..	43
B.6	Probability P_U that a flash to a line will cause injury to living beings by electric shock	44
B.7	Probability P_V that a flash to a line will cause physical damage	45
B.8	Probability P_W that a flash to a line will cause failure of internal systems	46
B.9	Probability P_Z that a lightning flash near an incoming line will cause failure of internal systems	46
Annex C (informative)	Assessment of amount of loss L_X	48
C.1	General	48
C.2	Mean relative amount of loss per dangerous event	48
C.3	Loss of human life (L1)	48
C.4	Unacceptable loss of service to the public (L2)	51
C.5	Loss of irreplaceable cultural heritage (L3)	52
C.6	Economic loss (L4)	53
Annex D (informative)	Evaluation of costs of loss	56
Annex E (informative)	Case study	57
E.1	General	57
E.2	Country house	57
E.3	Office building	62
E.4	Hospital	69
E.5	Apartment block	80
Bibliography		85

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Figures

Figure 1 – Procedure for deciding the need of protection and for selecting protection measures	24
Figure 2 – Procedure for evaluating the cost effectiveness of protection measures	25
Figure A.1 – Collection area A_D of an isolated structure	33
Figure A.2 – Complex shaped structure	34
Figure A.3 – Different methods to determine the collection area for the given structure	35
Figure A.4 – Structure to be considered for evaluation of collection area A_D	36
Figure A.5 – Collection areas (A_D , A_M , A_I , A_L)	39
Figure E.1 – Country house	57
Figure E.2 – Office building	62
Figure E.3 – Hospital	69
Figure E.4 – Apartment block	81

Tables

Table 1 – Sources of damage, types of damage and types of loss according to the point of strike	18
Table 2 – Risk components to be considered for each type of loss in a structure	20
Table 3 – Factors influencing the risk components	21
Table 4 – Typical values of tolerable risk R_T	22
Table 5 – Parameters relevant to the assessment of risk components	28
Table 6 – Risk components for different types of damage and source of damage	29
Table A.1 – Structure location factor C_D	37
Table A.2 – Line installation factor C_I	38

Table A.3 – Line type factor C_T	38
Table A.4 – Line environmental factor C_E	38
Table B.1 – Values of probability P_{TA} that a flash to a structure will cause shock to living beings due to dangerous touch and step voltages	40
Table B.2 – Values of probability P_B depending on the protection measures to reduce physical damage	41
Table B.3 – Value of the probability P_{SPD} as a function of LPL for which SPDs are designed	42
Table B.4 – Values of factors C_{LD} and C_{LI} depending on shielding, grounding and isolation conditions	42
Table B.5 – Value of factor K_{S3} depending on internal wiring	44
Table B.6 – Values of probability P_{TU} that a flash to an entering line will cause shock to living beings due to dangerous touch voltages	45
Table B.7 – Value of the probability P_{EB} as a function of LPL for which SPDs are designed	45
Table B.8 – Values of the probability P_{LD} depending on the resistance R_S of the cable screen and the impulse withstand voltage U_W of the equipment	45
Table B.9 – Values of the probability P_{LI} depending on the line type and the impulse withstand voltage U_W of the equipment	47
Table C.1 – Type of loss L1: Loss values for each zone	49
Table C.2 – Type of loss L1: Typical mean values of L_T , L_F and L_O	49
Table C.3 – Reduction factor r_t as a function of the type of surface of soil or floor	50
Table C.4 – Reduction factor r_p as a function of provisions taken to reduce the consequences of fire	50
Table C.5 – Reduction factor r_f as a function of risk of fire or explosion of structure	51
Table C.6 – Factor h_z increasing the relative amount of loss in presence of a special hazard	51
Table C.7 – Type of loss L2: Loss values for each zone	52
Table C.8 – Type of loss L2: Typical mean values of L_F and L_O	52
Table C.9 – Type of loss L3: Loss values for each zone	52
Table C.10 – Type of loss L3: Typical mean value of L_F	53
Table C.11 – Type of loss L4: Loss values for each zone	53
Table C.12 – Type of loss L4: Typical mean values of L_T , L_F and L_O	54
Table C.Z1 – Values to assess the total value c_t	54
Table C.Z2 – Portions to assess the total values c_a , c_b , c_c , c_s	55
Table E.1 – Country house: Environment and structure characteristics	58
Table E.2 – Country house: Power line	58
Table E.3 – Country house: Telecom line (TLC)	59
Table E.4 – Country house: Factors valid for zone Z_2 (inside the building)	60
Table E.5 – Country house: Collection areas of structure and lines	60
Table E.6 – Country house: Expected annual number of dangerous events	61
Table E.7 – Country house: Risk R_1 for the unprotected structure (values $\times 10^{-5}$)	61
Table E.8 – Country house: Risk components relevant to risk R_1 for protected structure	62
Table E.9 – Office building: Environment and structure characteristics	63
Table E.10 – Office building: Power line	63
Table E.11 – Office building: Telecom line	64
Table E.12 – Office building: Distribution of persons into zones	64
Table E.13 – Office building: Factors valid for zone Z_1 (entrance area outside)	65
Table E.14 – Office building: Factors valid for zone Z_2 (garden outside)	65

Table E.15 – Office building: Factors valid for zone Z_3 (archive)	66
Table E.16 – Office building: Factors valid for zone Z_4 (offices)	66
Table E.17 – Office building: Factors valid for zone Z_5 (computer centre)	67
Table E.18 – Office building: Collection areas of structure and lines	67
Table E.19 – Office building: Expected annual number of dangerous events	68
Table E.20 – Office building: Risk R_1 for the unprotected structure (values $\times 10^{-5}$)	68
Table E.21 – Office building: Risk R_1 for the protected structure (values $\times 10^{-5}$)	69
Table E.22 – Hospital: Environment and global structure characteristics	70
Table E.23 – Hospital: Power line	70
Table E.24 – Hospital: Telecom line	71
Table E.25 – Hospital: Distribution of persons and of economic values into zones	72
Table E.26 – Hospital: Factors valid for zone Z_1 (outside the building)	73
Table E.27 – Hospital: Factors valid for zone Z_2 (rooms block)	73
Table E.28 – Hospital: Factors valid for zone Z_3 (operating block)	74
Table E.29 – Hospital: Factors valid for zone Z_4 (intensive care unit)	75
Table E.30 – Hospital: Collection areas of structure and lines	75
Table E.31 – Hospital: Expected annual number of dangerous events	76
Table E.32 – Hospital: Risk R_1 – Values of probability P for the unprotected structure	76
Table E.33 – Hospital: Risk R_1 for the unprotected structure (values $\times 10^{-5}$)	77
Table E.34 – Hospital: Risk R_1 for the protected structure according to solution a) (values $\times 10^{-5}$)	78
Table E.35 – Hospital: Risk R_1 for the protected structure according to solution b) (values $\times 10^{-5}$)	78
Table E.36 – Hospital: Risk R_1 for the protected structure according to solution c) (values $\times 10^{-5}$)	79
Table E.37 – Hospital: Cost of loss C_L (unprotected) and C_{RL} (protected)	79
Table E.38 – Hospital: Rates relevant to the protection measures	80
Table E.39 – Hospital: Cost C_P and C_{PM} of protection measures (values in \$)	80
Table E.40 – Hospital: Annual saving of money (values in \$)	80
Table E.41 – Apartment block: Environment and global structure characteristics	81
Table E.42 – Apartment block: Power line	82
Table E.43 – Apartment block: Telecom line	82
Table E.44 – Apartment block: Factors valid for zone Z_2 (inside the building)	83
Table E.45 – Apartment block: Risk R_1 for the apartment block depending on protection measures	84

Foreword

This document (EN 62305-2:2012) consists of the text of IEC 62305-2:2010 prepared by IEC/TC 81, "Lightning protection", together with the common modifications prepared by CLC/TC 81X, "Lightning protection".

The following dates are fixed:

- latest date by which this document has to be implemented (dop) 2013-03-19
at national level by publication of an identical national standard or by endorsement
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2014-01-13

This document supersedes EN 62305-2:2006 + corrigendum November 2006.

EN 62305-2:2012 includes the following significant technical changes with respect to EN 62305-2:2006:

- 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} ;
- 4) extended damage to surroundings structures or to the environment is considered;
- 5) improved formulas 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.

Notes and tables, which are additional to those in IEC 62305-2:2010 are prefixed "Z".

In this document, the common modifications to IEC 62305-2:2010 are indicated by a vertical line in the left margin of the text.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

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 EN 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 EN 62305 series. Reference should be made to EN 61000-4-5 ^{[2]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.

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.

1) Figures in square brackets refer to the bibliography.

1 Scope

This part of EN 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 documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 62305-1:2011, *Protection against lightning – Part 1: General principles* (IEC 62305-1:2010, mod.)

EN 62305-3:2011, *Protection against lightning – Part 3: Physical damage to structures and life hazard* (IEC 62305-3:2010, mod.)

EN 62305-4:2011, *Protection against lightning – Part 4: Electrical and electronic systems within structures* (IEC 62305-4:2010, mod.)

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 EN 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 1 to entry: 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 EN 60079-10-1^[3] and EN 60079-10-2^[4]

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 1 to entry: 'Town centre' is an example of an urban environment.

3.1.5

suburban environment

area with a medium density of buildings

Note 1 to entry: 'Town outskirts' is an example of a suburban environment.

3.1.6

rural environment

area with a low density of buildings

Note 1 to entry: '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

[SOURCE: EN 60664-1:2007, definition 3.9.2, modified]^[5]

Note 1 to entry: For the purposes of this part of EN 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 1 to entry: 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.

3.1.26**physical damage**

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

3.1.27**injury to 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 1 to entry: Although living beings may be injured in other ways, in this part of EN 62305 the term 'injury to living beings' is limited to the threat due to electrical shock (type of damage D1).

3.1.28**failure of electrical and electronic systems**

permanent damage of electrical and electronic systems due to LEMP

3.1.29**probability of damage**

P_X

probability that a dangerous event will cause damage to or in the structure to be protected

3.1.30**loss**

L_X

mean amount of loss (humans and goods) consequent on a specified type of damage due to a dangerous event, relative to the value (humans and goods) of the structure to be protected

3.1.31**risk**

R

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

3.1.32**risk component**

R_X

partial risk depending on the source and the type of damage

3.1.33**tolerable risk**

R_T

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

3.1.34**zone of a structure**

Z_S

part of a structure with homogeneous characteristics where only one set of parameters is involved in assessment of a risk component

3.1.35**section of a line**

S_L

part of a line with homogeneous characteristics where only one set of parameters is involved in the assessment of a risk component

3.1.36**lightning protection zone**

LPZ

zone where the lightning electromagnetic environment is defined

Note 1 to entry: The zone boundaries of an LPZ are not necessarily physical boundaries (e.g. walls, floor and ceiling).

3.1.37**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 1 to entry: Lightning protection level is used to design protection measures according to the relevant set of lightning current parameters.

3.1.38**protection measures**

measures to be adopted in the structure to be protected, in order to reduce the risk

3.1.39**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

3.1.40**lightning protection system**

LPS

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

Note 1 to entry: It consists of both external and internal lightning protection systems.

3.1.41**LEMP protection measures**

SPM

measures taken to protect internal systems against the effects of LEMP

Note 1 to entry: This is part of overall lightning protection.

3.1.42**magnetic shield**

closed, metallic, grid-like or continuous screen enveloping the structure to be protected, or part of it, used to reduce failures of electrical and electronic systems

3.1.43**lightning protective cable**

special cable with increased dielectric strength and whose metallic sheath is in continuous contact with the soil either directly or by use of conducting plastic covering

3.1.44**lightning protective cable duct**

cable duct of low resistivity in contact with the soil

EXAMPLE Concrete with interconnected structural steel reinforcements or metallic duct.

3.1.45**surge protective device**

SPD

device intended to limit transient overvoltages and divert surge currents; contains at least one non-linear component

3.1.46**coordinated SPD system**

SPDs properly selected, coordinated and installed to form a system intended to reduce failures of electrical and electronic systems

3.1.47**isolating interfaces**

devices which are capable of reducing conducted surges on lines entering the LPZ

Note 1 to entry: These include isolation transformers with earthed screen between windings, metal-free fibre optic cables and opto-isolators.

Note 2 to entry: Insulation withstand characteristics of these devices are suitable for this application intrinsically or via SPD.

3.1.48**lightning equipotential bonding**

EB

bonding to LPS of separated metallic parts, by direct conductive connections or via surge protective devices, to reduce potential differences caused by lightning current

3.1.49**zone 0**

place in which an explosive atmosphere consisting of a mixture of air and flammable substances in the form of gas, vapour or mist is present continuously or for long periods or frequently

[SOURCE:IEC 60050-426:2008, 426-03-03, modified]^[6]

3.1.50**zone 1**

place in which an explosive atmosphere consisting of a mixture of air and flammable substances in the form of gas, vapour or mist is likely to occur in normal operation occasionally

[SOURCE:IEC 60050-426:2008, 426-03-04, modified]^[6]

3.1.51**zone 2**

place in which an explosive atmosphere consisting of a mixture of air and flammable substances in the form of gas, vapour or mist is not likely to occur in normal operation but, if it does occur, will persist for a short period only

Note 1 to entry: In this definition, the word "persist" means the total time for which the flammable atmosphere will exist. This will normally comprise the total of the duration of the release, plus the time taken for the flammable atmosphere to disperse after the release has stopped.

Note 2 to entry: Indications of the frequency of the occurrence and duration may be taken from codes relating to specific industries or applications.

[SOURCE:IEC 60050-426:2008, 426-03-05, modified]^[6]

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3.1.52**zone 20**

place in which an explosive atmosphere, in the form of a cloud of combustible dust in air, is present continuously, or for long periods, or frequently

[SOURCE:EN 60079-10-2:2009, 6.2, modified]^[4]

3.1.53**zone 21**

place in which an explosive atmosphere, in the form of a cloud of combustible dust in air, is likely to occur in normal operation occasionally

[SOURCE:EN 60079-10-2:2009, 6.2, modified]^[4]

3.1.54**zone 22**

place in which an explosive atmosphere, in the form of a cloud of combustible dust in air, is not likely to occur in normal operation but, if it does occur, will persist for a short period only

[SOURCE:EN 60079-10-2:2009, 6.2, modified]^[4]

3.2 Symbols and abbreviations

<i>a</i>	Amortization rate	Annex D
<i>A_D</i>	Collection area for flashes to an isolated structure.....	A.2.1.1
<i>A_{DJ}</i>	Collection area for flashes to an adjacent structure.....	A.2.5
<i>A_{D'}</i>	Collection area attributed to an elevated roof protrusion	A.2.1.2
<i>A_I</i>	Collection area for flashes near a line.....	A.5