

SINGAPORE STANDARD

Protection against lightning

– Part 2 : Risk management

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– Part 2 : Risk management

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Nanyang Technological University
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CONTENTS

NATIONAL FOREWORD 9

FOREWORD 11

INTRODUCTION 13

1 Scope 15

2 Normative references 15

3 Terms, definitions, symbols and abbreviations 15

 3.1 Terms and definitions 15

 3.2 Symbols and abbreviations 21

4 Explanation of terms 25

 4.1 Damage and loss 25

 4.1.1 Source of damage 25

 4.1.2 Types of damage 25

 4.1.3 Types of loss 25

 4.2 Risk and risk components 26

 4.2.1 Risk 26

 4.2.2 Risk components for a structure due to flashes to the structure 26

 4.2.3 Risk component for a structure due to flashes near the structure 27

 4.2.4 Risk components for a structure due to flashes to a line connected to the structure 27

 4.2.5 Risk component for a structure due to flashes near a line connected to the structure 27

 4.3 Composition of risk components 28

5 Risk management 29

 5.1 Basic procedure 29

 5.2 Structure to be considered for risk assessment 30

 5.3 Tolerable risk R_T 30

 5.4 Specific procedure to evaluate the need of protection 30

 5.5 Procedure to evaluate the cost effectiveness of protection 31

 5.6 Protection measures 34

 5.7 Selection of protection measures 34

6 Assessment of risk components 34

 6.1 Basic equation 34

 6.2 Assessment of risk components due to flashes to the structure (S1) 35

 6.3 Assessment of the risk component due to flashes near the structure (S2) 35

 6.4 Assessment of risk components due to flashes to a line connected to the structure (S3) 35

 6.5 Assessment of risk component due to flashes near a line connected to the structure (S4) 36

 6.6 Summary of risk components 37

 6.7 Partitioning of a structure in zones Z_S 38

 6.8 Partitioning of a line into sections S_L 38

 6.9 Assessment of risk components in a structure with zones Z_S 38

6.9.1	General criteria	38
6.9.2	Single zone structure	39
6.9.3	Multi-zone structure	39
6.10	Cost-benefit analysis for economic loss (L4)	39
Annex A (informative)	Assessment of annual number N of dangerous events	41
Annex B (informative)	Assessment of probability P_X of damage	50
Annex C (informative)	Assessment of amount of loss L_X	58
Annex D (informative)	Evaluation of costs of loss	66
Annex E (informative)	Case study.....	68
Bibliography	98
Figure 1	– Procedure for deciding the need of protection and for selecting protection measures	32
Figure 2	– Procedure for evaluating the cost-effectiveness of protection measures	33
Figure A.1	– Collection area A_D of an isolated structure	42
Figure A.2	– Complex shaped structure	43
Figure A.3	– Different methods to determine the collection area for the given structure	44
Figure A.4	– Structure to be considered for evaluation of collection area A_D	45
Figure A.5	– Collection areas (A_D, A_M, A_I, A_L)	49
Figure E.1	– Country house	68
Figure E.2	– Office building	74
Figure E.3	– Hospital	82
Figure E.4	– Apartment block	94
Table 1	– Sources of damage, types of damage and types of loss according to the point of strike	26
Table 2	– Risk components to be considered for each type of loss in a structure	28
Table 3	– Factors influencing the risk components	29
Table 4	– Typical values of tolerable risk R_T	30
Table 5	– Parameters relevant to the assessment of risk components	36
Table 6	– Risk components for different types of damage and source of damage	37
Table A.1	– Structure location factor C_D	46
Table A.2	– Line installation factor C_I	47
Table A.3	– Line type factor C_T	48
Table A.4	– Line environmental factor C_E	48
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	50
Table B.2	– Values of probability P_B depending on the protection measures to reduce physical damage	51

Table B.3 – Value of the probability P_{SPD} as a function of LPL for which SPDs are designed	52
Table B.4 – Values of factors C_{LD} and C_{LI} depending on shielding, grounding and isolation conditions	52
Table B.5 – Value of factor K_{S3} depending on internal wiring	54
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	55
Table B.7 – Value of the probability P_{EB} as a function of LPL for which SPDs are designed	55
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	56
Table B.9 – Values of the probability P_{LI} depending on the line type and the impulse withstand voltage U_W of the equipment	57
Table C.1 – Type of loss L1: Loss values for each zone	59
Table C.2 – Type of loss L1: Typical mean values of L_T , L_F and L_O	59
Table C.3 – Reduction factor r_t as a function of the type of surface of soil or floor	60
Table C.4 – Reduction factor r_p as a function of provisions taken to reduce the consequences of fire	60
Table C.5 – Reduction factor r_f as a function of risk of fire or explosion of structure	61
Table C.6 – Factor h_z increasing the relative amount of loss in presence of a special hazard	61
Table C.7 – Type of loss L2: Loss values for each zone	62
Table C.8 – Type of loss L2: Typical mean values of L_F and L_O	62
Table C.9 – Type of loss L3: Loss values for each zone	63
Table C.10 – Type of loss L3: Typical mean value of L_F	63
Table C.11 – Type of loss L4: Loss values for each zone	64
Table C.12 – Type of loss L4: Typical mean values of L_T , L_F and L_O	65
Table E.1 – Country house: Environment and structure characteristics	69
Table E.2 – Country house: Power line	69
Table E.3 – Country house: Telecom line (TLC)	70
Table E.4 – Country house: Factors valid for zone Z_2 (inside the building)	71
Table E.5 – Country house: Collection areas of structure and lines	71
Table E.6 – Country house: Expected annual number of dangerous events	72
Table E.7 – Country house: Risk R_1 for the unprotected structure (values $\times 10^{-5}$)	72
Table E.8 – Country house: Risk components relevant to risk R_1 for protected structure	73
Table E.9 – Office building: Environment and structure characteristics	74
Table E.10 – Office building: Power line	75
Table E.11 – Office building: Telecom line	75
Table E.12 – Office building: Distribution of persons into zones	76

Table E.13 – Office building: Factors valid for zone Z_1 (entrance area outside)	77
Table E.14 – Office building: Factors valid for zone Z_2 (garden outside)	77
Table E.15 – Office building: Factors valid for zone Z_3 (archive).....	78
Table E.16 – Office building: Factors valid for zone Z_4 (offices).....	78
Table E.17 – Office building: Factors valid for zone Z_5 (computer centre).....	79
Table E.18 – Office building: Collection areas of structure and lines	79
Table E.19 – Office building: Expected annual number of dangerous events	80
Table E.20 – Office building: Risk R_1 for the unprotected structure (values $\times 10^{-5}$)	80
Table E.21 – Office building: Risk R_1 for the protected structure (values $\times 10^{-5}$)	81
Table E.22 – Hospital: Environment and global structure characteristics	82
Table E.23 – Hospital: Power line	82
Table E.24 – Hospital: Telecom line	83
Table E.25 – Hospital: Distribution of persons and of economic values into zones	84
Table E.26 – Hospital: Factors valid for zone Z_1 (outside the building)	85
Table E.27 – Hospital: Factors valid for zone Z_2 (rooms block).....	85
Table E.28 – Hospital: Factors valid for zone Z_3 (operating block).....	86
Table E.29 – Hospital: Factors valid for zone Z_4 (intensive care unit)	87
Table E.30 – Hospital: Collection areas of structure and lines	88
Table E.31 – Hospital: Expected annual number of dangerous events	88
Table E.32 – Hospital: Risk R_1 – Values of probability P for the unprotected structure	88
Table E.33 – Hospital: Risk R_1 for the unprotected structure (values $\times 10^{-5}$)	89
Table E.34 – Hospital: Risk R_1 for the protected structure according to solution a) (values $\times 10^{-5}$).....	90
Table E.35 – Hospital: Risk R_1 for the protected structure according to solution b) (values $\times 10^{-5}$).....	91
Table E.36 – Hospital: Risk R_1 for the protected structure according to solution c) (values $\times 10^{-5}$).....	91
Table E.37 – Hospital: Cost of loss C_L (unprotected) and C_{RL} (protected)	92
Table E.38 – Hospital: Rates relevant to the protection measures	92
Table E.39 – Hospital: Cost C_P and C_{PM} of protection measures (values in \$).....	93
Table E.40 – Hospital: Annual saving of money (values in \$)	93
Table E.41 – Apartment block: Environment and global structure characteristics	94
Table E.42 – Apartment block: Power line	94
Table E.43 – Apartment block: Telecom line	95
Table E.44 – Apartment block: Factors valid for zone Z_2 (inside the building).....	96
Table E.45 – Apartment block: Risk R_1 for the apartment block depending on protection measures	97

National Foreword

This Singapore Standard was prepared by the Working Group on Lightning Protection appointed by the Technical Committee on Buildings Facilities and Services under the direction of the Electrical and Electronic Standards Committee.

This is a revision of SS 555 – ‘Code of practice for protection against lightning’. The revised SS 555 comprises the following parts under the general title ‘Protection against lightning’:

- Part 1 : General principles
- Part 2 : Risk management
- Part 3 : Physical damage to structures and life hazard
- Part 4 : Electrical and electronic systems within structures

The four parts replace the 2010 edition of the SS 555 series of standards.

SS 555 : Part 2 : 2018 is an identical adoption of IEC 62305-2 : 2010 (Edition 2.0), ‘Protection against lightning – Risk management’, published by the International Electrotechnical Commission. It introduces evaluation procedures for assessing lightning risk for a structure and selection of lightning protection measures upon completion of risk assessment.

The committee considered methods for artificially increasing the range of attraction of a lightning conductor but on the evidence available, was unable to make a recommendation. It was noted that none of the reference codes used in the drafting of this Code recommends the use of such methods. The codes referred to were IEC 62305 : 2010 Parts 1 to 4. In addition, there are no devices nor methods capable of modifying the natural weather phenomena to the extent that they can prevent lightning discharges. Lightning flashes to, or nearby, structures (or services 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.

Attention is drawn to the following:

1. Where appropriate, the words ‘International Standard’ shall be read as ‘Singapore Standard’.
2. The references to International Standards shall be replaced by the following Singapore Standards:

International Standard	Corresponding Singapore Standard
IEC 62305	SS 555
IEC 62305-1	SS 555-1
IEC 62305-2	SS 555-2
IEC 62305-3	SS 555-3
IEC 62305-4	SS 555-4

3. The comma has been used throughout as a decimal marker whereas in Singapore Standards it is a practice to use a full point on the baseline as the decimal marker.
4. The editorial changes are as follows. To facilitate identification, the affected text of the International Standard which is to be changed is indicated by a left marginal bar adjacent to it.

Clause/Subclause	Modifications
3.1.23	<i>Replace</i> heading with “Lightning electromagnetic pulse”. Explanation: Consistency with the acronym LEMP.
A.2.4, A.2.5, A.3, A.4 and A.5	<i>Replace</i> units for variable N_G with ‘(flashes/km ² /year)’. Explanation: It is a local term.

Annex ZB in Part 1 of SS 555 provides information on Singapore’s lightning intensity to give the user data for risk management calculation which is essential for the appropriate design of a lightning protection system.

Attention is drawn to the possibility that some of the elements of this Singapore Standard may be the subject of patent rights. Enterprise Singapore shall not be held responsible for identifying any or all of such patent rights.

NOTE

1. *Singapore Standards (SSs) and Technical References (TRs) are reviewed periodically to keep abreast of technical changes, technological developments and industry practices. The changes are documented through the issue of either amendments or revisions.*
2. *An SS or TR is voluntary in nature except when it is made mandatory by a regulatory authority. It can also be cited in contracts making its application a business necessity. Users are advised to assess and determine whether the SS or TR is suitable for their intended use or purpose. If required, they should refer to the relevant professionals or experts for advice on the use of the document. Enterprise Singapore shall not be liable for any damages whether directly or indirectly suffered by anyone or any organisation as a result of the use of any SS or TR.*
3. *Compliance with a SS or TR does not exempt users from any legal obligations*

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 changed 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 equipment was extended down to 1 kV.

This bilingual version corresponds to the monolingual English version, published in 2010-12.

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
- 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.

¹ Figures in square brackets refer to the bibliography.

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

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*