SINGAPORE STANDARD

SS 555 : Part 2 : 2010

(ICS 29.020; 91.120.40)

CODE OF PRACTICE FOR

Protection against lightning

Part 2 : Risk management

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National Foreword

This Singapore Standard was prepared by the Technical Committee on Lightning Protection under the purview of the Electrical and Electronic Standards Committee.

The review of CP 33 : 1996 – 'Code of practice for lightning protection' resulted in the development of SS 555 which comprises the following parts under the general title 'Code of practice for 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 CP 33 : 1996.

SS 555 : Part 2 : 2010 is a modified adoption of International Standard IEC 62305-2 : 2006 (Edition 1.0), 'Protection against lightning – Risk management'. It introduces evaluation procedures for assessing lightning risk for a structure or its services and selection of lightning protection measures upon completion of risk assessment.

Attention is drawn to the following:

1. Where the words 'International Standard' appear, they should be read as 'Singapore Standard'.

2. The reference 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 modifications to the International Standard IEC 62305-2 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** (editorial unless otherwise stated)
IEC Foreword and Normative References	*Delete* reference to Part 5 of the IEC 62305 series of standards. Explanation: Part 5 will not be published.
3.1.23	*Replace* heading with "Lightning electromagnetic pulse". Explanation: Consistency with the acronym LEMP.

5.4, Table 7	*Replace* title of table with 'Typical values of tolerable risk R_T per year'. Explanation: Consistency with the definition of tolerable risk in 3.1.34.
A.2.3 and A.2.4	*Replace* units for variable N_g with '(flashes/km^2/year)'.
C.3, para 3	*Replace* 'a reduction factor (r_p)' with 'reduction factors (r_p and r_f)'.
C.4, para 3	*Replace* 'reduction factor r_p' with 'reduction factors (r_p and r_f)'.
H 1.5	*Replace* formula for R_O with '$R_O = R_M + R_C + R_W + R_Z = 0$'.
H 2.6	*Replace* formula for R_O with '$R_O = R_M + R_C + R_W + R_Z$'.
H 3.6	*Replace* formula for R_O with '$R_O = R_M + R_C + R_W + R_Z$'.
Table H.41	*Replace* C_{PM} value for SPD (2x) on TLC system C_{PM} with '1200'.
Annex J	*Delete Annex J* *Explanation: The software for risk assessment for structures is not maintained by IEC or SPRING.*

A national Annex ZB providing Singapore's lightning intensity information is included in SS 555 : Part 1 : 2010 to give the user data for risk management calculation which is essential for the appropriate design of a lightning protection system.

In this standard, the following print types are used:

- requirements : in roman type;
- test specifications : in italic type;
- notes : in small roman type;

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

NOTE

1. *Singapore Standards are subject to periodic review to keep abreast of technological changes and new technical developments. The changes in Singapore Standards are documented through the issue of either amendments or revisions.*
2. *Compliance with a Singapore Standard does not exempt users from 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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8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

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

The IEC 62305 series (Parts 1 to 5), is produced in accordance with the New Publications Plan, approved by National Committees (81/171/RQ (2001-06-29)), which restructures and updates, in a more simple and rational form, the publications of the IEC 61024 series, the IEC 61312 series and the IEC 61663 series.

The text of this first edition of IEC 62305-2 is compiled from and replaces

– IEC 61662, first edition (1995) and its Amendment (1996).

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

FDIS	Report on voting
81/263/FDIS	81/268/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, as close as possible, in accordance with the ISO/IEC Directives, Part 2.

IEC 62305 consists of 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

Part 5: Services[1]

The committee has decided that the contents of this publication will remain unchanged until the maintenance result 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.

[1] To be published

INTRODUCTION

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

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.

The hazard to services can result in

– damage to the service itself,
– failure of associated electrical and electronic equipment.

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 standard as the probable average annual loss in a structure and in a service due to lightning flashes, depends on:

– the annual number of lightning flashes influencing the structure and the service;
– 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 services (power, telecommunication lines, other services) or near the services.

Lightning flashes influencing the service may be divided into

– flashes terminating on the service,
– flashes terminating near the service or direct to a structure connected to the service.

Flashes to the structure or a connected service may cause physical damage and life hazards. Flashes near the structure or service as well as flashes to the structure or service 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 1 Malfunctioning of electrical and electronic systems is not covered by the IEC 62305 series. Reference should be made to IEC 61000-4-5 [1][2].

NOTE 2 Information on assessment of the risk due to switching overvoltages is given in Annex F.

2 Figures in square brackets refer to the bibliography.

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

The probability of lightning damage depends on the structure, the services, 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 assessment of risk due to all possible effects of lightning flashes to structures and services is given in this standard, which is a revised version of IEC 61662:1995 and its Amendment 1:1996.

The decision to provide lightning protection may be taken regardless of the outcome of any 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 or for a service 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 60079-10:2002, *Electrical apparatus for explosive gas atmosphere – Part 10: Classification of hazardous areas*

IEC 61241-10:2004, *Electrical apparatus for use in the presence of combustible dust – Part 10: Classification of areas where combustible dusts are or may be present*

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

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

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

IEC 62305-5, *Protection against lightning – Part 5: Services*[3]

ITU-T Recommendation K.46:2000, *Protection of telecommunication lines using metallic symmetric conductors against lightning induced surges*

ITU-T Recommendation K.47:2000, *Protection of telecommunication lines using metallic conductors against direct lightning discharges*

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[3] To be published