

SINGAPORE STANDARD

Protection against lightning

– Part 4 : Electrical and electronic systems within structures

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– Part 4 : Electrical and electronic systems within structures

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National Environment Agency
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Singapore Manufacturing Federation
SP Group
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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 4 : 2018 is an identical adoption of IEC 62305-4 : 2010 (Edition 2.0), ‘Protection against lightning – Electrical and electronic systems within structures’, published by the International Electrotechnical Commission. It provides information on protection measures to reduce the risk of permanent failures of electrical and electronic systems within structures due to coupling of radiated electromagnetic fields, conducted and induced surges from LEMP.

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.

Application of electromagnetic shielding and surge protection as part of the lightning protection measures should be considered for the enhancement of safety to personnel and equipment.

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
Normative references	<i>Replace</i> IEC 61643-1, Low-voltage surge protective devices – Part 1: Surge protective devices connected to low-voltage power distribution systems – Requirements and tests with IEC 61643-11, Low-voltage surge protective devices – Part 11: Surge protective devices connected to low-voltage power systems – Requirements and test methods Explanation: IEC 61643-1 was withdrawn and replaced by IEC 61643-11.
3.17, 3.18, 3.19, 7, C.2.2	<i>Replace</i> IEC 61643-1 with IEC 61643-11 Explanation: IEC 61643-1 was withdrawn and replaced by IEC 61643-11.
D.1	<i>Delete</i> “future” in the references to IEC 61643-11 standards Explanation: IEC 61643-11 was published in 2011.

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.*
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3. *Compliance with a SS or TR does not exempt users from any legal obligations*

INTERNATIONAL ELECTROTECHNICAL COMMISSION

PROTECTION AGAINST LIGHTNING –

Part 4: Electrical and electronic systems within structures

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 62305-4 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) Isolating interfaces capable of reducing conducted surges on lines entering the structure are introduced.
- 2) Minimum cross-sections for bonding components are slightly modified.
- 3) First negative impulse current is introduced for calculation purposes as electromagnetic source of harm to the internal systems.

- 4) Selection of SPD with regard to voltage protection level is improved to take into account oscillation and induction phenomena in the circuit downstream of SPD.
- 5) Annex C dealing with SPD coordination is withdrawn and referred back to SC 37A.
- 6) A new informative Annex D is introduced giving information on factors to be considered in the selection of SPDs.

This bilingual version (2012-06) 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
81/373/FDIS	81/383/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.

The French version of this standard has not been voted upon.

This publication has been drafted, as closely as possible, 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.

INTRODUCTION

Lightning as a source of harm is a very high energy phenomenon. Lightning flashes release many hundreds of mega-joules of energy. When compared with the milli-joules of energy that may be sufficient to cause damage to sensitive electronic equipment in electrical and electronic systems within a structure, it is clear that additional protection measures will be necessary to protect some of this equipment.

The need for this International Standard has arisen due to the increasing cost of failures of electrical and electronic systems, caused by electromagnetic effects of lightning. Of particular importance are electronic systems used in data processing and storage as well as process control and safety for plants of considerable capital cost, size and complexity (for which plant outages are very undesirable for cost and safety reasons).

Lightning can cause different types of damage in a structure, as defined in IEC 62305-1:

- D1 injury to living beings by electric shock;
- D2 physical damage (fire, explosion, mechanical destruction, chemical release) due to lightning current effects, including sparking;
- D3 failure of internal systems due to LEMP.

IEC 62305-3 deals with the protection measures to reduce the risk of physical damage and life hazard, but does not cover the protection of electrical and electronic systems.

This Part 4 of IEC 62305 therefore provides information on protection measures to reduce the risk of permanent failures of electrical and electronic systems within structures.

Permanent failure of electrical and electronic systems can be caused by the lightning electromagnetic impulse (LEMP) via:

- a) conducted and induced surges transmitted to equipment via connecting wiring;
- b) the effects of radiated electromagnetic fields directly into equipment itself.

Surges to the structure can originate from sources external to the structure or from within the structure itself:

- surges which originate externally from the structure are created by lightning flashes striking incoming lines or the nearby ground, and are transmitted to electrical and electronic systems within the structure via these lines;
- surges which originate internally within the structure are created by lightning flashes striking the structure itself or the nearby ground.

NOTE 1 Surges can also originate internally within the structure, from switching effects, e.g. switching of inductive loads.

The coupling can arise from different mechanisms:

- resistive coupling (e.g. the earth impedance of the earth-termination system or the cable shield resistance);
- magnetic field coupling (e.g. caused by wiring loops in the electrical and electronic system or by inductance of bonding conductors);
- electric field coupling (e.g. caused by rod antenna reception).

NOTE 2 The effects of electric field coupling are generally very small when compared to the magnetic field coupling and can be disregarded.

Radiated electromagnetic fields can be generated via

- the direct lightning current flowing in the lightning channel,
- the partial lightning current flowing in conductors (e.g. in the down-conductors of an external LPS in accordance with IEC 62305-3 or in an external spatial shield in accordance with this standard).

PROTECTION AGAINST LIGHTNING –

Part 4: Electrical and electronic systems within structures

1 Scope

This part of IEC 62305 provides information for the design, installation, inspection, maintenance and testing of electrical and electronic system protection (SPM) to reduce the risk of permanent failures due to lightning electromagnetic impulse (LEMP) within a structure.

This standard does not cover protection against electromagnetic interference due to lightning, which may cause malfunctioning of internal systems. However, the information reported in Annex A can also be used to evaluate such disturbances. Protection measures against electromagnetic interference are covered in IEC 60364-4-44 ^[1] ¹ and in the IEC 61000 series ^[2].

This standard provides guidelines for cooperation between the designer of the electrical and electronic system, and the designer of the protection measures, in an attempt to achieve optimum protection effectiveness.

This standard does not deal with detailed design of the electrical and electronic systems themselves.

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 60364-5-53:2001, *Electrical installations of buildings – Part 5-53: Selection and erection of electrical equipment – Isolation, switching and control*

IEC 60664-1:2007, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

IEC 61000-4-5:2005, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*

IEC 61000-4-9:1993, *Electromagnetic compatibility (EMC) – Part 4-9: Testing and measurement techniques – Pulse magnetic field immunity test – Basic EMC Publication*

IEC 61000-4-10:1993, *Electromagnetic compatibility (EMC) – Part 4-10: Testing and measurement techniques – Damped oscillatory magnetic field immunity test – Basic EMC Publication*

IEC 61643-1:2005, *Low-voltage surge protective devices – Part 1: Surge protective devices connected to low-voltage power distribution systems – Requirements and tests*

¹ Figures in square brackets refer to the bibliography.