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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Mechanical structures for electrical and electronic equipment – Outdoor enclosures – Part 1: Design guidelines

Structures mécaniques pour équipement électrique et électronique – Enveloppes de plein air – Partie 1: Lignes directrices pour la conception

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

MECHANICAL STRUCTURES FOR ELECTRICAL AND ELECTRONIC EQUIPMENT – OUTDOOR ENCLOSURES –

Part 1: Design guidelines

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 61969-1 has been prepared by subcommittee 48D: Mechanical structures for electrical and electronic equipment, of IEC technical committee 48: Electrical connectors and mechanical structures for electrical and electronic equipment.

This third edition cancels and replaces the second edition published in 2011. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) alignment with the content of ETSI EN 300 019 and IEC 60721 series latest editions, particularly with the actualization of climate conditions;
b) new requirements added to reflect market requirements on environmental issues;
c) improvement on terminology and overall editorial improvement.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
48D/720/FDIS	48D/723/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 61969 series, published under the general title *Mechanical structures for electrical and electronic equipment – Outdoor enclosures*, can be found on the IEC website.

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

This part of IEC 61969 is intended as a generic guide for the development of further parts within this series of standards, and it provides design guidelines for outdoor enclosures.

The products covered by IEC 61969 (all parts) are empty enclosures for outdoor locations, to be equipped with application-specific combinations of electrical and electronic equipment, and to be used at non-weather protected locations above ground.

IEC 61969 (all parts) consists of:

– a design guidelines general part (IEC 61969-1);
– a coordination dimension standard (IEC 61969-2);
– an environmental requirements and tests, safety aspects standard (IEC 61969-3).

IEC 61969-2 and IEC 61969-3 should be read in conjunction with this document.

MECHANICAL STRUCTURES FOR ELECTRICAL AND ELECTRONIC EQUIPMENT – OUTDOOR ENCLOSURES –

Part 1: Design guidelines

1 Scope

This part of IEC 61969 contains design guidelines for outdoor enclosures and is applicable over a wide field of mechanical, electromechanical and electronic equipment and its installation where a modular design is used.

The objectives of this document are:

– to provide an overview of specifications for enclosures focused on requirements for outdoor applications for stationary use at non-weather protected locations, and

– to achieve product integrity under outdoor conditions and to ease product selection for the sourcing of outdoor enclosures from different vendors.

These enclosures are considered to contain any equipment and provide protection for the outdoor installed facilities against unwanted environmental impacts. The installed equipment can be, but is not limited to, subracks or chassis according to IEC 60917 (all parts) or IEC 60297 (all parts). A typical outdoor enclosure is shown in Figure 1.

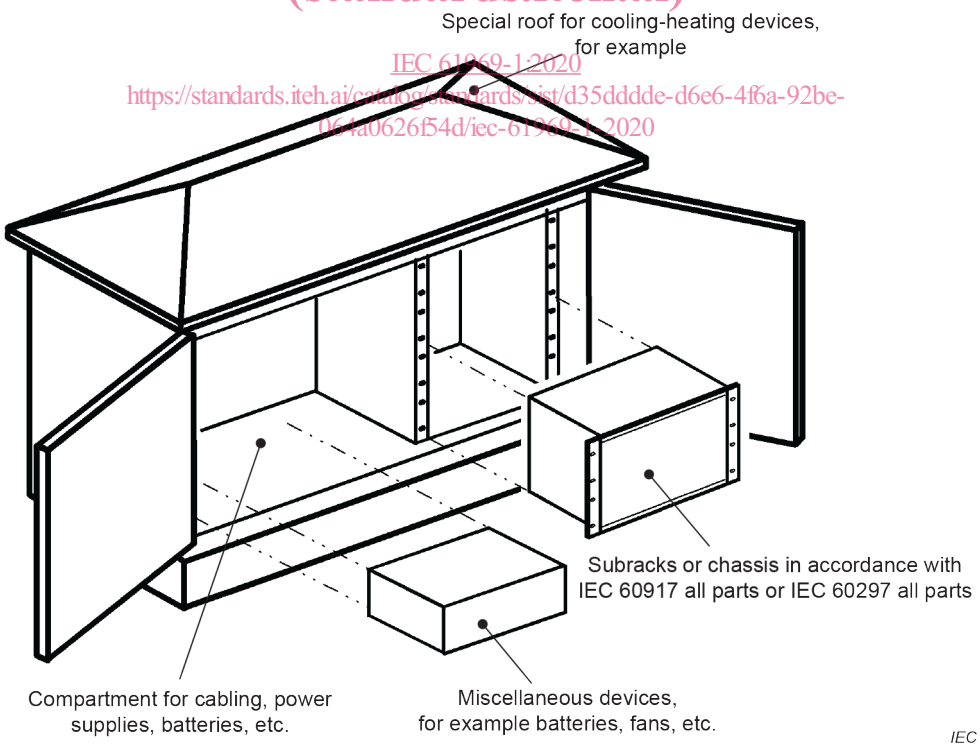

Figure 1 – Typical outdoor enclosure

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60068-2-75, *Environmental testing – Part 2-75: Tests – Test Eh: Hammer tests*

IEC 60417, *Graphical symbols for use on equipment* (available at http://www.graphical-symbols.info/equipment)

IEC 60529, *Degrees of protection provided by enclosures (IP code)*

IEC 60695-11-10, *Fire hazard testing – Part 11-10: Test flames – 50 W horizontal and vertical flame test methods*

IEC 60721-3-2, *Classification of environmental conditions – Part 3-2: Classification of groups of environmental parameters and their severities – Transportation and handling*

IEC 60721-3-4, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Stationary use at non-weatherprotected locations*

IEC 60825-1, *Safety of laser products – Part 1: Equipment specification and requirements*

IEC 60950-1, *Information technology equipment – Safety – Part 1: General requirements*

IEC 61010-1, *Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements*

IEC 61140, *Protection against electric shock – Common aspects for installation and equipment*

IEC 61439-5, *Low-voltage switchgear and controlgear assemblies – Part 5: Assemblies for power distribution in public networks*

IEC 61587-1, *Mechanical structures for electronic equipment – Tests for IEC 60917 and IEC 60297 series – Part 1: Environmental requirements, test set-up and safety aspects for cabinets, racks, subracks and chassis under indoor condition use and transportation*

IEC 62194, *Methods of evaluating the thermal performance of enclosures*

IEC 62262, *Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)*

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

ISO 1518-1, *Paints and varnishes – Determination of scratch resistance – Part 1: Constant-loading method*

ISO 3864-2, *Graphical symbols – Safety colours and safety signs*

ISO 7779, *Acoustics – Measurement of airborne noise emitted by information technology and telecommunications equipment*

ETSI EN 300 019-1-4, *Equipment Engineering (EE) – Environmental conditions and environmental tests for telecommunications equipment – Part 1-4: Classification of environmental conditions – Stationary use at non-weatherprotected locations*

ETSI EN 300 019-2-4, *Equipment Engineering (EE) – Environmental conditions and environmental tests for telecommunications equipment – Part 2-4: Specification of environmental tests – Stationary use at non-weatherprotected locations*

ETSI EN 300 753, *Equipment Engineering (EE) – Acoustic noise emitted by telecommunications equipment*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
outdoor enclosure
enclosure exposed to the outdoor environment, for stationary use at non-weatherprotected locations, for the protection of electrical and electronic equipment installed inside against outdoor environmental conditions

Note 1 to entry: An outdoor enclosure is applicable for wide field of equipment, (e.g. communication system, industrial or signal control, etc.)

Note 2 to entry: The typical installation locations of outdoor enclosures are shown in Figure 2.

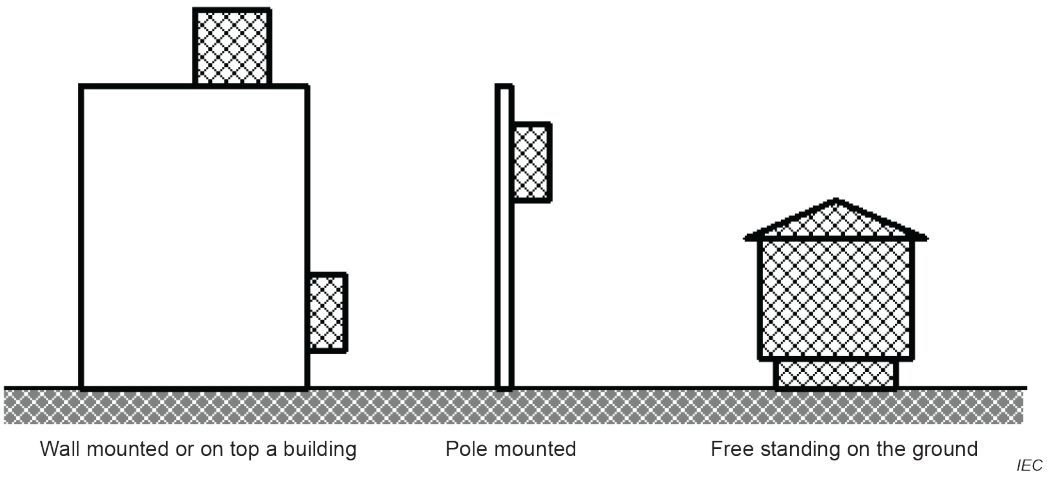

Figure 2 – Locations of outdoor enclosures

3.2
heat transfer rate
k
property with units of W/(m^{2}K), a measure of the rate of heat transfer

Note 1 to entry: Detailed calculations for determination of the enclosure design dependent heat management properties, including the heat transfer rate, are described in IEC 62194.

3.3
static load
maximum mechanical load that an enclosure is able to sustain in static condition without mechanical failure, as the gross weight of enclosure including all deemed equipment, multiplied by a safety factor 1,25

4 Coordination dimensions

The dimensions of outdoor enclosures consist of coordination dimensions as given in IEC 61969-2. The coordination dimensions provide the range and systematic stipulation of possible enclosure internal and external dimensions.

5 Environmental requirements, tests and safety aspects

5.1 Classification of environmental conditions

The classification of environmental conditions for outdoor enclosures is based on requirements as defined in IEC 60721-3-2 and IEC 60721-3-4, and the tests are in accordance with the relevant parts of the IEC 60068 series.

The selection of relevant requirements, as indicated in Table 1 and Table 2, was made with the focus on outdoor specific conditions and on structural design and safety aspects.

Table 1 – Environmental conditions

Requirement		Test specification
Temperature	ETSI EN 300 019-1-4	ETSI EN 300 019-2-4 or IEC 61587-1
Humidity	ETSI EN 300 019-1-4	ETSI EN 300 019-2-4 or IEC 61587-1
Atmospheric pressure	ETSI EN 300 019-1-4	ETSI EN 300 019-2-4
Corrosive gases	ETSI EN 300 019-1-4	ETSI EN 300 019-2-4 or IEC 61587-1
Corrosive liquids	ETSI EN 300 019-1-4	ETSI EN 300 019-2-4
Solar resistance	ETSI EN 300 019-1-4	ETSI EN 300 019-2-4
Biological resistance	ETSI EN 300 019-1-4	ETSI EN 300 019-2-4
Protection against rodents and birds	Requirements and tests may be part of the user specification	
Protection against insects and termites	Requirements and tests may be part of the user specification	
Weather resistance	Climatic conditions	Additional IEC 60529 for tightness
Thermal management	Requirements may be application specific	For thermal enclosure properties see IEC 62194
Acoustical noise suppression	ETSI EN 300 753	ISO 7779
Paint (colour, gloss, adhesion, flex, scratch, etc.)	May be part of the users' specification For extreme conditions, anti-graffiti may be required Paints and varnishes – Scratch test	ISO 1518-1, etc.
Heat transfer rate k	Methods of evaluating the thermal performance of enclosures IEC 62194	
NOTE For details about classifications of environmental conditions, see IEC 61969-3.		

Table 2 – Safety aspects

Requirement		Test specification
Earth bonding	The responsibility of the vendor is to provide sufficient conductivity between different parts of the enclosure and means for the earth bonding of equipment IEC 61140	Using IEC 60950-1 and IEC 61439-5 for equipped enclosure IEC 61010-1/IEC 60825-1
Lightning strike	To be observed in the total "bonding network" concept	IEC 62305-4
Mechanical safety	IK code according to IEC 62262	For testing IEC 60068-2-75
Vandalism	Requirements shall be part of the vendor specification	Tests may be part of the vendor specification
Warning labels [a]	General warning, caution, risk of danger Caution, risk of life Caution, risk of electric shock Caution, hot surface	ISO 3864-2 ISO 3864-2 ISO 3864-2 IEC 60417
Security, vandalism protection	Requirements for the resistance of the enclosure and the locking devices against unauthorised access	Tests may be part of the user specifications
Flammability	Material properties may be specified by user	IEC 60695-11-10

[a] Application of warning labels (on the outside accessible surface and/or inside an outdoor enclosure) is the responsibility of the system integrator, as it depends on a risk assessment on the outdoor enclosure completely populated with the application-specific electrical and electronic equipment.

5.2 Static load

The static load capacity definition of an outdoor enclosure shall be based on the intended transport and handling conditions as they occur at the installation place.

Outdoor enclosures deemed to be installed on ground are considered street enclosures, typically e.g. for traffic controls or last mile telephone line distribution, which need special precautions against physical impacts.

Pole- and wall- mounted enclosures may be out of the reach of persons whereas the weather impact may cause special precaution for the stability of the installation.

5.3 Dynamic stress

Dynamic stress shall be considered during transportation, handling at the place of installation and in respect to possible environmental impacts. If the enclosure is loaded with equipment, the maximum weight should be specified by the vendor in respect to the classification of environmental conditions as under 5.1.

5.4 Seismic performance

In case of installation deemed to occur in a seismic hazard zone, a standard enclosure may be tested with internally mounted dummy loads simulating the equipment and structural anchoring simulating the place of installation.

The results of such tests can be used as reference for the product offering by a standard enclosure vendor, but it does not exempt from final equipment testing.

The test conditions are described in IEC 61587-2.