

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

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

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



## THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2011 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester.

If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de la CEI ou du Comité national de la CEI du pays du demandeur.

Si vous avez des questions sur le copyright de la CEI ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de la CEI de votre pays de résidence.

IEC Central Office  
3, rue de Varembe  
CH-1211 Geneva 20  
Switzerland  
Email: [inmail@iec.ch](mailto:inmail@iec.ch)  
Web: [www.iec.ch](http://www.iec.ch)

### About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

### About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

- Catalogue of IEC publications: [www.iec.ch/searchpub](http://www.iec.ch/searchpub)

The IEC on-line Catalogue enables you to search by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, withdrawn and replaced publications.

- IEC Just Published: [www.iec.ch/online\\_news/justpub](http://www.iec.ch/online_news/justpub)

Stay up to date on all new IEC publications. Just Published details twice a month all new publications released. Available on-line and also by email.

- Electropedia: [www.electropedia.org](http://www.electropedia.org)

The world's leading online dictionary of electronic and electrical terms containing more than 20 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary online.

- Customer Service Centre: [www.iec.ch/webstore/custserv](http://www.iec.ch/webstore/custserv)

If you wish to give us your feedback on this publication or need further assistance, please visit the Customer Service Centre FAQ or contact us:

Email: [csc@iec.ch](mailto:csc@iec.ch)  
Tel.: +41 22 919 02 11  
Fax: +41 22 919 03 00

### A propos de la CEI

La Commission Electrotechnique internationale (CEI) est la première organisation mondiale qui élabore et publie des normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

### A propos des publications CEI

Le contenu technique des publications de la CEI est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

- Catalogue des publications de la CEI: [www.iec.ch/searchpub/cur\\_fut-f.htm](http://www.iec.ch/searchpub/cur_fut-f.htm)

Le Catalogue en-ligne de la CEI vous permet d'effectuer des recherches en utilisant différents critères (numéro de référence, texte, comité d'études,...). Il donne aussi des informations sur les projets et les publications retirées ou remplacées.

- Just Published CEI: [www.iec.ch/online\\_news/justpub](http://www.iec.ch/online_news/justpub)

Restez informé sur les nouvelles publications de la CEI. Just Published détaille deux fois par mois les nouvelles publications parues. Disponible en-ligne et aussi par email.

- Electropedia: [www.electropedia.org](http://www.electropedia.org)

Le premier dictionnaire en ligne au monde de termes électroniques et électriques. Il contient plus de 20 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans les langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International en ligne.

- Service Clients: [www.iec.ch/webstore/custserv/custserv\\_entry-f.htm](http://www.iec.ch/webstore/custserv/custserv_entry-f.htm)

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions, visitez le FAQ du Service clients ou contactez-nous:

Email: [csc@iec.ch](mailto:csc@iec.ch)  
Tél.: +41 22 919 02 11  
Fax: +41 22 919 03 00

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

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

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

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

COMMISSION  
ELECTROTECHNIQUE  
INTERNATIONALE

PRICE CODE  
CODE PRIX



ICS 31.240

ISBN 978-2-88912-791-7

## CONTENTS

FOREWORD.....	3
INTRODUCTION.....	5
1 Scope.....	6
2 Normative references.....	7
3 Terms and definitions.....	8
4 Dimensions.....	9
5 Environmental requirements and tests, safety aspects.....	9
5.1 Classification of environmental conditions.....	9
5.2 Static load.....	10
5.3 Dynamic stress.....	10
5.4 Seismic performance.....	10
6 Electromagnetic shielding.....	10
7 Thermal management and acoustic noise suppression.....	11
Figure 1 – Typical outdoor enclosure.....	6
Figure 2 – Locations of outdoor enclosures.....	8
Table 1 – Environmental conditions.....	9
Table 2 – Safety aspects.....	10

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**MECHANICAL STRUCTURES FOR 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.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 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 61969-1 has been prepared by subcommittee 48D: Mechanical structures for electronic equipment, of IEC technical committee 48: Electromechanical components and mechanical structures for electronic equipment.

This second edition cancels and replaces the first edition issued in 1999. It constitutes a technical revision.

The main technical changes with regard to the previous edition are as follows:

- a) Addition of design guidance for thermal management and noise suppression as thermal/noise management is often considered a basic requirement of an empty outdoor enclosure. If thermal management components are included in the product, the environmental impact may become the responsibility of the empty outdoor enclosure manufacturer. Therefore the acoustic limitations shall be observed.

Typically, the user of the empty outdoor enclosure follows the local regulatory acoustic requirements (sound power and/or sound pressure). Acoustic measurements may be performed on the empty outdoor enclosure fitted with thermal management components only or, if agreed between manufacturer and user at the final stage of the application specific installation.

- b) Historically, Ed 1 intended to create a market for standardized empty outdoor enclosures offered by multiple vendors. Detail standards such as IEC 61969-2-1 Ed 1 and IEC 61969-2-2 Ed 1 were issued to guide users to preferred and available solutions.

However, development showed that this intend (created with user's participation) was not satisfying the user's expectations.

Consequently, the detail standards IEC 61969-2-1 Ed 1 and IEC 61969-2-2 Ed 1 will be withdrawn when IEC 61969-2 Ed 2 is issued. The IEC 61969-2 Ed 2 co-ordination dimensions are based on IEC 60917-1. The definition outdoor cases and outdoor cabinets are merged into the definition outdoor enclosures.

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

FDIS	Report on voting
48D/488/FDIS	48D/498/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 parts of IEC 61969, under the general title, *Mechanical structures for electronic equipment – Outdoor enclosures*, 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.

## INTRODUCTION

This standard is intended as a generic guide for the development of further standards. The products covered are empty enclosures to be equipped with application-specific solutions to be used at non-weather protected locations above ground. This standard is followed by a coordination dimension standard (IEC 61969-2 Ed 2) and an environmental requirements and tests, safety aspect standard (IEC 61969-3 Ed 2).

Withhold

iTeh STANDARD PREVIEW  
(standards.iteh.ai)

<https://standards.iteh.ai/catalog/standards/sist/924ba81e-696f-426b-83ad-bc8a3d3bc253/iec-61969-1-2011>

# MECHANICAL STRUCTURES FOR 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 objective of this standard is to provide an overview of specifications for enclosures focused on requirements for outdoor applications for stationary use at non-weather protected locations. These enclosures are considered to contain any equipment and provide protection for the outdoor installed facilities against unwanted environmental impacts. The installed equipment may be, but is not limited to, sub racks according to IEC 60917-2-2 or IEC 60297-3-101. A typical outdoor enclosure is shown in Figure 1.

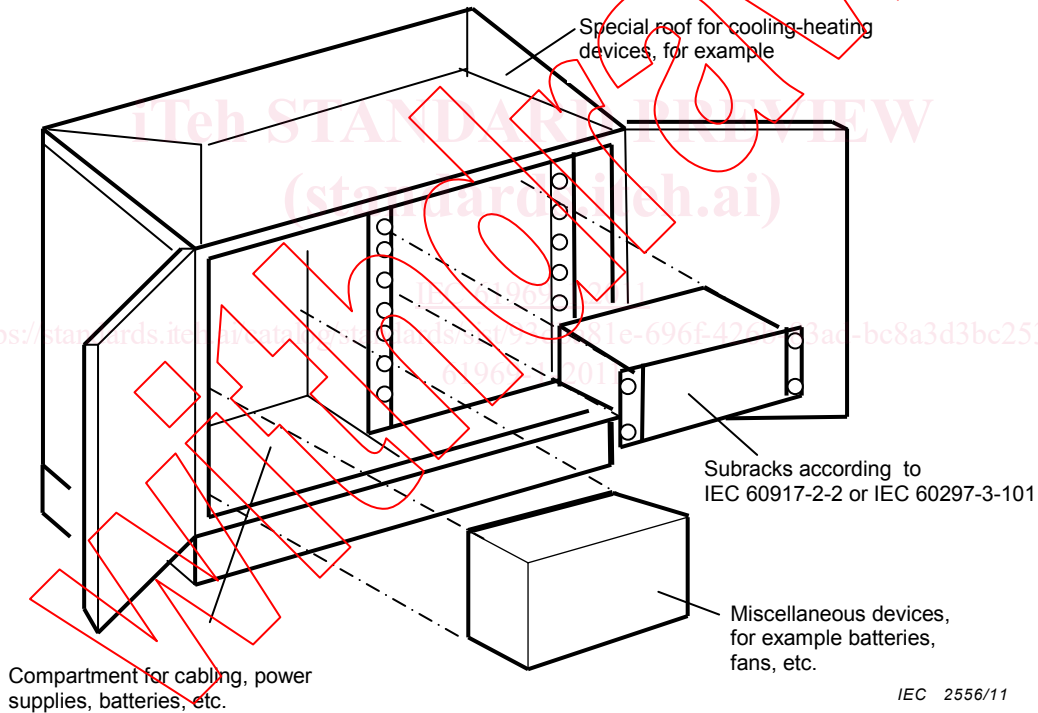


Figure 1 – Typical outdoor enclosure



## 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 60050-581, *International Electrotechnical Vocabulary (IEV) – Part 581: Electromechanical components and mechanical structures for electronic equipment*

IEC 60068 (all parts), *Environmental testing*

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

IEC 60950 (all parts), *Information technology equipment – Safety*

IEC 60297-3-101, *Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 3: Subracks and associated plug-in units*

IEC 60417, *Graphical symbols for use on equipment*

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

IEC 60721 (all parts), *Classification of environmental conditions*

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

IEC 60917 (all parts), *Modular order for the development of mechanical structures for electronic equipment practices*

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 – Part 1: Climatic, mechanical tests and safety aspects for cabinets, racks, subracks and chassis*

IEC 61587-2, *Mechanical structures for electronic equipment – Tests for IEC 60917 and IEC 60297 – Part 2: Seismic tests for cabinets and racks*

IEC 61587-3, *Mechanical structures for electronic equipment – Tests for IEC 60917 and IEC 60297 – Part 3: Electromagnetic shielding performance tests for cabinets, racks and subracks*

IEC 61969 (all parts) *Mechanical structures for electronic equipment – Outdoor enclosures*

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

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

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

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

ETS 300019-1-4, *Equipment Engineering (EE); Environmental conditions and environmental test for telecommunications equipment – Part 1-4: Classification of environmental conditions Stationary use at non-weatherprotected locations*  
+ A1:1997

ETS 300194-2-4, *Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment – Part 2-4: Specification of environmental tests Stationary use at non-weatherprotected locations*  
+ A1:1997

ETS 300753, *Equipment Engineering (EE); Acoustic noise emitted by telecommunications equipment*

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

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

### 3 Terms and definitions

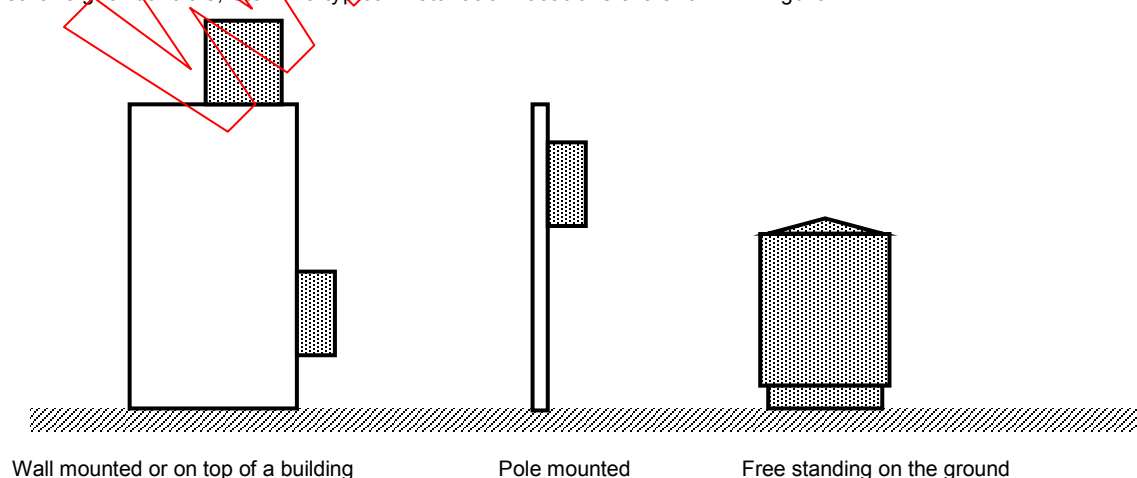
For the purposes of this document, the terms and definitions given in IEC 60050-581 and in the IEC 60917 series, as well as the following, apply.

#### 3.1

##### **outdoor enclosure**

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

NOTE An outdoor enclosure is applicable for a wide field of equipment, e.g.: communication systems, industrial/signal controls, etc. The typical installation locations are shown in Figure 2.



**Figure 2 – Locations of outdoor enclosures**

### 3.2

#### heat transfer rate $k$

factor measured  $W/m^2K$  as the rate of heat transfer

NOTE Detailed calculations for the determination of the enclosure design dependent heat management properties are described in IEC 62194.

## 4 Dimensions

The dimensions of outdoor enclosures consist of coordination dimensions as given in IEC 61969-2 Ed.2.0. The coordination dimensions provide the range and systematic stipulation of possible enclosure internal and external dimensions.

## 5 Environmental requirements and tests, safety aspects

### 5.1 Classification of environmental conditions

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

The selection of relevant requirements, as indicated in Tables 1 and 2, was made with the focus on outdoor specific conditions and, in addition on structural design and safety aspects. The purpose of this standard is to achieve product integrity under outdoor conditions and to ease product selection for the sourcing of outdoor enclosures from different vendors. For details see IEC 61969-3.

**Table 1 – Environmental conditions**

Requirement		Test specification
Temperature	ETS-300019-1-4	ETS-300019-2-4 or IEC 61587-1
Humidity	ETS-300019-1-4	ETS-300019-2-4 or IEC 61587-1
Atmospheric pressure	ETS-300019-1-4	ETS-300019-2-4
Corrosive gases	ETS-300019-1-4	ETS-300019-2-4 or IEC 61587-1
Corrosive liquids	ETS-300019-1-4	ETS-300019-2-4
Solar resistance	ETS-300019-1-4	ETS-300019-2-4
Biological resistance	ETS-300019-1-4	ETS-300019-2-4
Protection against rodents and birds	ETS-300019-1-4	ETS-300019-2-4
Protection against insects and termites	ETS-300019-1-4	ETS-300019-2-4
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	ETS-300753	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.