

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Mechanical structures for electrical and electronic equipment – Outdoor enclosures – Part 3: Environmental requirements, tests and safety aspects

Structures mécaniques pour équipement électrique et électronique – Enveloppes de plein air – Partie 3: Exigences et essais d'environnement, et aspects liés à la sécurité

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CONTENTS

FOREWORD	3
INTRODUCTION	5
1 Scope	6
2 Normative references	6
3 Terms and definitions	7
4 Coordination dimensions	7
5 Environmental requirements, tests and safety aspects – Classification of environmental conditions	7
6 Test conditions	8
6.1 General	8
6.2 Climatic tests	8
6.3 Biological tests	9
6.4 Tests of resistance against chemically active substances	9
6.5 Tests of resistance against mechanically active substances	9
7 Mechanical tests	10
7.1 General	10
7.2 Transport tests	10
7.3 Lifting and stiffness test	11
8 Safety aspects	11
8.1 General	11
8.2 Locking devices	11
8.3 Vandalism resistance	11
8.4 Firearms resistance (optional)	11
9 Seismic requirements	12
10 Electromagnetic shielding performance	12
11 Thermal management	12
12 Noise emission	12
Bibliography	13
Table 1 – Climatic conditions for environmental classes 1 and 2	8
Table 2 – Biological tests	9
Table 3 – Tests of resistance against chemically active substances	9
Table 4 – Tests of resistance against mechanically active substances	9
Table 5 – Vibration and shock test	10

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**MECHANICAL STRUCTURES FOR ELECTRICAL AND
ELECTRONIC EQUIPMENT – OUTDOOR ENCLOSURES –****Part 3: Environmental requirements, tests and safety aspects**

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 61969-3 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/721/FDIS	48D/724/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.

This International Standard is to be used in conjunction with IEC 61969-1:2020.

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,
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- replaced by a revised edition, or
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INTRODUCTION

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 dimensions standard (IEC 61969-2);
- an environmental requirements and tests, safety aspects standard (IEC 61969-3).

This document provides basic environmental requirements and tests, as well as safety aspects, to be used for outdoor enclosures in absence of local regulatory documents, or of application-specific environmental test requirements.

This document provides manufacturers and users of generic outdoor enclosures with minimum performance compliance criteria. The thermal management solution depends on the specific environment of the outdoor enclosure.

Since forced air heat dissipation and acoustic noise are closely related, noise limitations are typically defined by local regulatory documents.

It is responsibility of the outdoor enclosure vendor to provide a solution for thermal management within the local regulatory noise limitations.

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MECHANICAL STRUCTURES FOR ELECTRICAL AND ELECTRONIC EQUIPMENT – OUTDOOR ENCLOSURES –

Part 3: Environmental requirements, tests and safety aspects

1 Scope

This part of IEC 61969 specifies a set of basic environmental requirements and tests, as well as safety aspects for outdoor enclosures under conditions of non-weather protected locations above ground.

The purpose of this document is to define a minimum level of environmental performance in order to meet requirements of storage, transport and final installation. The intention is to establish basic environmental performance criteria for outdoor enclosure compliance.

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 60068-2-1, *Environmental testing – Part 2-1: Tests – Test A: Cold*

[IEC 61969-3:2020](#)

IEC 60068-2-2, *Environmental testing – Part 2-2: Tests – Test B: Dry heat*

[b66d47093d18/iec-61969-3-2020](#)

IEC 60068-2-6, *Environmental testing – Part 2-6: Tests – Test Fc: Vibration (sinusoidal)*

IEC 60068-2-10, *Environmental testing – Part 2-10: Tests – Test J and guidance: Mould growth*

IEC 60068-2-11, *Basic environmental testing procedures – Part 2-11: Tests – Test Ka: Salt mist*

IEC 60068-2-14, *Environmental testing – Part 2-14: Tests – Test N: Change of temperature*

IEC 60068-2-27, *Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock*

IEC 60068-2-30, *Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12 h + 12 h cycle)*

IEC 60068-2-31, *Environmental testing – Part 2-31: Tests – Test Ec: Rough handling shocks, primarily for equipment-type specimens*

IEC 60068-2-60, *Environmental testing – Part 2-60: Tests – Test Ke: Flowing mixed gas corrosion test*

IEC 60068-2-78, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

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

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

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

IEC 61969-1:2020, *Mechanical structures for electrical and electronic equipment – Outdoor enclosures – Part 1: Design guidelines*

IEC 62368-1, *Audio/video, information and communication technology equipment – Part 1: Safety requirements*

ISO 3744, *Acoustics – Determination of sound power levels and sound energy levels of noise sources using sound pressure – Engineering methods for an essentially free field over a reflecting plane*

ISO 4892-2, *Plastics – Methods of exposure to laboratory light sources – Part 2: Xenon-arc lamps*

ETSI EN 300 019-2-2, *Environmental Engineering (EE) – Environmental conditions and environmental tests for telecommunications equipment – Part 2-2: Specification of environmental tests – Transportation*

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3 Terms and definitions (standards.iteh.ai)

For the purposes of this document, the terms and definitions given in IEC 61969-1 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>

4 Coordination dimensions

This clause of IEC 61969-1:2020 applies.

5 Environmental requirements, tests and safety aspects – Classification of environmental conditions

The environmental conditions are derived from IEC 60721-3-4, with the focus on empty outdoor enclosures relevant requirements.

Class 1: Non-weatherprotected location: Covers all regions with a moderate climate.

Class 2: Non-weatherprotected locations, extended: Covers all regions with severe climate.

The individual outdoor enclosure tested to these basic environmental test requirements may claim compliance to either class 1 or class 2 or a combination of class 1/class 2.

6 Test conditions

6.1 General

The basic test conditions shown in Table 1, Table 2, Table 3 and Table 4 reflect typical outdoor enclosure environments to be endured.

6.2 Climatic tests

Table 1 – Climatic conditions for environmental classes 1 and 2

	Environmental parameters	Test severity		Duration	Method
		Class 1	Class 2		
a	Low air temperature	-40 °C	-50 °C	16 h	IEC 60068-2-1: A
b	High air temperature ¹	+85 °C	+85 °C	16 h	IEC 60068-2-2: B
c	Damp heat	+30 °C, 93 %	+30 °C, 93 %	96 h	IEC 60068-2-78: Cb
d	Change of temperature	-40 °C to +23 °C 1 °C/min	-40 °C to + 85 °C 1 °C/min	2 cycles	IEC 60068-2-14: Nb
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e	Condensation	90 % to 100 % RH	90 % to 100 % RH	144 h (6 cycles)	IEC 60068-2-30: Db
f	Precipitation (rain, snow, hail, etc.)	IPX4	IPX5	-	IEC 60529
g	Movement of the surrounding air	50 m/s	60 m/s	-	-
h	Formation of ice and frost	Minimum requirement: No mechanical deformation			-
i	Ultraviolet degradation	Minimum requirement: No reduction in mechanical properties (tensile strength and elongation at yield) by more than 20 %.			ISO 4892-2
For comparable conditions, the International Standard Air, in accordance to ISO 2533 (15 °C at 1 013, 25 hPa) shall be used.					
¹ This maximum temperature includes the effects of heat dissipation caused by active electronics and includes solar load.					

Following the test, compliance is checked by visual inspection of the internal and external parts; no rust, cracking or other deterioration shall be detected with impact to the required function; no ingress of water.

Hinges, locks and handles for example shall be in operating condition.

The test in accordance with Table 1, item h, shall prove that access to the internal equipment is possible without causing permanent degradation of protection levels.

6.3 Biological tests

Table 2 – Biological tests

	Environmental parameters	Test severity		Purpose	Method
		Class 1	Class 2		
a	Flora: Presence of mould, fungus, etc.	Minimum requirement: No reduction in mechanical properties (tensile strength and elongation at yield) by more than 20 %.		To check the material for resistance	IEC 60068-2-10: J
b	Fauna: Presence of rodents and others harmful to the equipment				

Following the test, compliance is checked by visual inspection.

6.4 Tests of resistance against chemically active substances

Table 3 – Tests of resistance against chemically active substances

	Environmental parameters	Test severity		Duration	Method
		Class 1 Mean value	Class 2 Maximum value		
a	Salts: Sea and road salt mist	+35 °C, 5 % NaCl		4 weeks (672 h)	IEC 60068-2-11: Ka
b	Sulphur dioxide ¹	0,3 mg/m ³ 0,11 cm ³ /m ³	1,0 mg/m ³ 0,37 cm ³ /m ³	10 days	IEC 60068-2-60: Ke
c	Hydrogen sulphide ¹	0,1 mg/m ³ 0,071 cm ³ /m ³	0,5 mg/m ³ 0,36 cm ³ /m ³		
d	Chlorine ¹	0,14 mg/m ³ 0,034 cm ³ /m	0,3 mg/m ³ 0,1 cm ³ /m ³		
e	Nitrogen oxides ¹	0,5 mg/m ³ 0,26 cm ³ /m ³	1,0 mg/m ³ 0,52 cm ³ /m ³		
¹ Tests of Table 3 may be combined with tests of Table 1.					

Following each of the tests of Table 3, compliance is checked by visual inspection of the outside of the used materials or coatings.

Surface corrosion of the protective enclosure is allowed.

The enclosure design shall provide protection for electromagnetic interference gaskets and for protective earthing contacts, where no corrosion is permitted.

6.5 Tests of resistance against mechanically active substances

Table 4 – Tests of resistance against mechanically active substances

	Environmental parameters	Test severity Classes 1 and 2	Method
a	Sand	IP5X	IEC 60529
b	Dust (suspension)		
c	Dust (sedimentation)		

Following the test, shall be executed according to the next assessment: no measurable dust shall have entered the enclosure (this is more severe than in IEC 60529 for IP5X, and IP6X may be applied for an intended requirement).

7 Mechanical tests

7.1 General

The purpose of these mechanical tests is to ensure that the outdoor enclosure will withstand handling, storage, transport and protect installed equipment from exposure to mechanical stress. For seismic compliance, see Clause 9. Installations in public areas typically require compliance to more severe local regulatory laws. These and any additional application specific requirements need to be observed. Should the outdoor enclosure be installed in a public place, the power input requirements may have to be in compliance with IEC 61439-5.

7.2 Transport tests

The dynamic tests of an outdoor enclosure shall be conducted under the intended transport conditions. Since outdoor enclosure dynamic transport stress is considerably more severe than typical handling and storage stress, no further dynamic tests are required. For the purpose of this test, no transport packing material is used. The outdoor enclosure shall be mounted to the shock/vibration table by using the intended ground/floor mounting features.

Table 5 shows the chosen severity classes.

Table 5 – Vibration and shock test

	Environmental parameters	Test severity		Method
		Class 1 (controlled transport condition)	Class 2 (limited transport condition)	
a	Vibration, sinusoidal 3 axes, 10 cycles	5 Hz to 9 Hz/3,5 mm displacement 9 Hz-200 Hz/10 m/s ² acceleration 200 Hz to 500 Hz/15 m/s ² acceleration	5 Hz to 9 Hz/3,5 mm displacement 9 Hz to 200 Hz/10 m/s ² acceleration 200 Hz to 500 Hz/15 m/s ² acceleration	IEC 60068-2-6: Fc
b ¹	Vibration, random	-	5 Hz to 20 Hz: 11 m ² /s ³ 20 Hz to 200 Hz: -3 dB/oct.	ETSI EN 300 019-2-2 Class 2.3
c	Shock, 1/2 sine wave vertical axes only No of shocks: 3	Peak acceleration 100 m/s ² Time: 11 ms	Peak acceleration 100 m/s ² Time: 11 ms	IEC 60068-2-27: Ea Shock response spectrum type I
d ²	Free fall: enclosure mass < 20 kg 20 kg to 100 kg > 100 kg	0,25 m 0,25 m 0,10 m	1,25 m 1,00 m 0,25 m	IEC 60068-2-31: Ec
¹ Alternative test. ² The test is excited in the packaging condition.				

Following the test, no deformation or damage of parts that affect form, fit and function shall be found.