

INTERNATIONAL STANDARD



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

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**Mechanical structures for electrical and electronic equipment –
Outdoor enclosures –
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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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ELECTRONIC EQUIPMENT – OUTDOOR ENCLOSURES –****Part 1: Design guidelines****FOREWORD**

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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:

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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 ~~solutions~~ combinations of electrical and electronic equipment, and to be used at non-weather protected locations above ground. ~~This standard is followed by~~

IEC 61969 (all parts) consists of:

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

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

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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 ~~may~~ can be, but is not limited to, sub racks or chassis according to IEC 60917-2-2 (all parts) or IEC 60297-3-101 (all parts). A typical outdoor enclosure is shown in Figure 1.

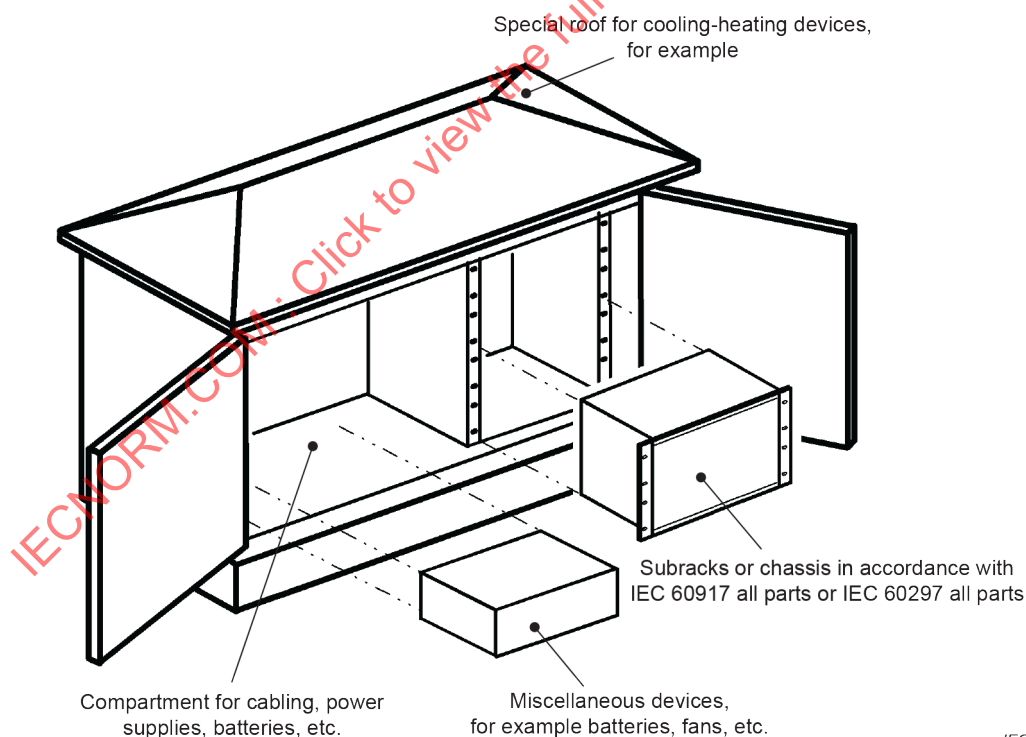


Figure 1 – Typical outdoor enclosure

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

~~IEC 60068 (all parts), Environmental testing~~

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

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: ~~Climatic, mechanical tests~~ 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 IEC 60297 – Part 2: Seismic tests for cabinets and racks~~

~~IEC 61587-3, Mechanical structures for electronic equipment – Tests for IEC 60917 and 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 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, Graphical symbols – Safety colours and safety signs~~

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*
+ A1:1997

ETSI EN 300 194-2-4, *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

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 ~~given in IEC 60050-581 and in the IEC 60917 series, as well as the following~~, 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.

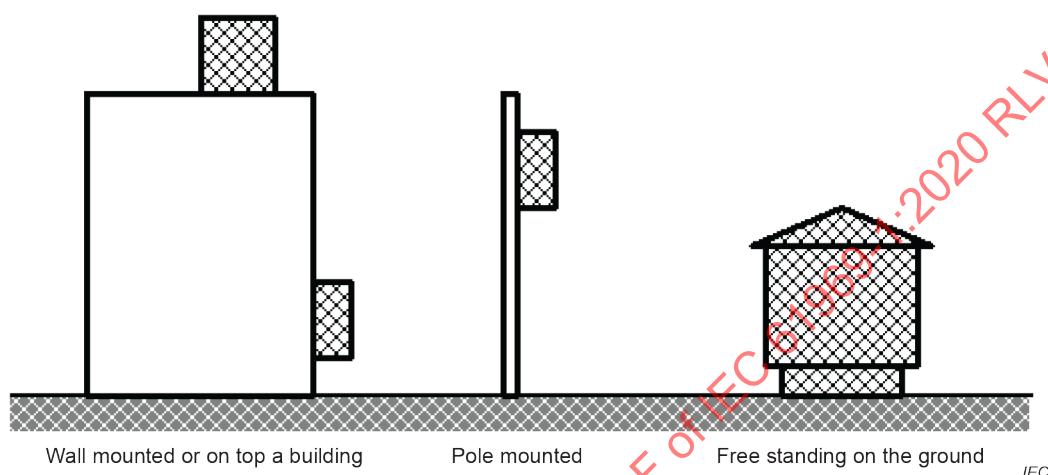


Figure 2 – Locations of outdoor enclosures

3.2

heat transfer rate

k

~~factor-measured~~ property with units of $W/(m^2K)$, 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 ~~Ed. 2.0~~. 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, ~~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	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	ETS-300019-1-4 Requirements and tests may be part of the user specification	ETS-300019-2-4
Protection against insects and termites	ETS-300019-1-4 Requirements and tests may be part of the user specification	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	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 "Earth 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, B.3.1 ISO 3864-2, B.3.2 ISO 3864-2, B.3.6 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 of erection. ~~For safety reasons the maximum static load should be calculated with 1,25 times of the nominal load.~~

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 ~~geographically defined earthquake zones~~ 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.

6 Electromagnetic shielding

In order to achieve electromagnetic compatibility of a final installation, the enclosure may be part of the total shielding concept. As a pre-testing, the shielding performance test may be performed in order to gain the required level of attenuation by the enclosure. The test set-up and the test procedure are described in IEC 61587-3.

7 Thermal management and acoustic noise suppression

Thermal management is the key to survival of electronic equipment in general but especially if exposed to the outdoor environment.

The heat transfer rate k is important for designing the outdoor enclosure because the value affects the temperature difference between inside and outside of the enclosure.

~~As a prime measure the design concept shall be considered for the insulation against heat and cold from the outside environment. Next would be the measure for the heat dissipation from the inside out and, as a precaution against low external temperature requiring internal heating. Depending on the climate conditions and the heat generated inside the enclosure the thermal management may be resolved by passive cooling only. In case of exceeding temperature limits the enclosure may be fitted with active cooling devices, such as filter fans, air to air heat exchangers or air conditioners. For selection of the suitable active cooling the required energy consumption (cost factor and impact to the environment) and the local noise level limits should be carefully considered (regulatory requirements in rural and urban areas). For the method of enclosure thermal performance evaluations see IEC 62194.~~

As a prime measure, thermal insulation against heat and cold from the outside environment shall be considered for the enclosure.

Next, measurement of the heat dissipation from the inside out shall be performed.

If low external temperatures will be experienced, internal heating should be considered.

Depending on the climate conditions and the heat generated inside the enclosure, thermal management may be achieved by passive cooling only.

In cases where the internal temperature of the enclosure would exceed temperature limits, the enclosure may be fitted with active cooling devices, such as filter fans, air to air heat exchangers or air conditioners.

For selection of a suitable active cooling system the required energy consumption (cost factor and impact to the environment) and the local noise level limits should be carefully considered (regulatory requirements in rural and urban areas).

For the method of enclosure thermal performance evaluations, see IEC 62194.

Bibliography

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

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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.

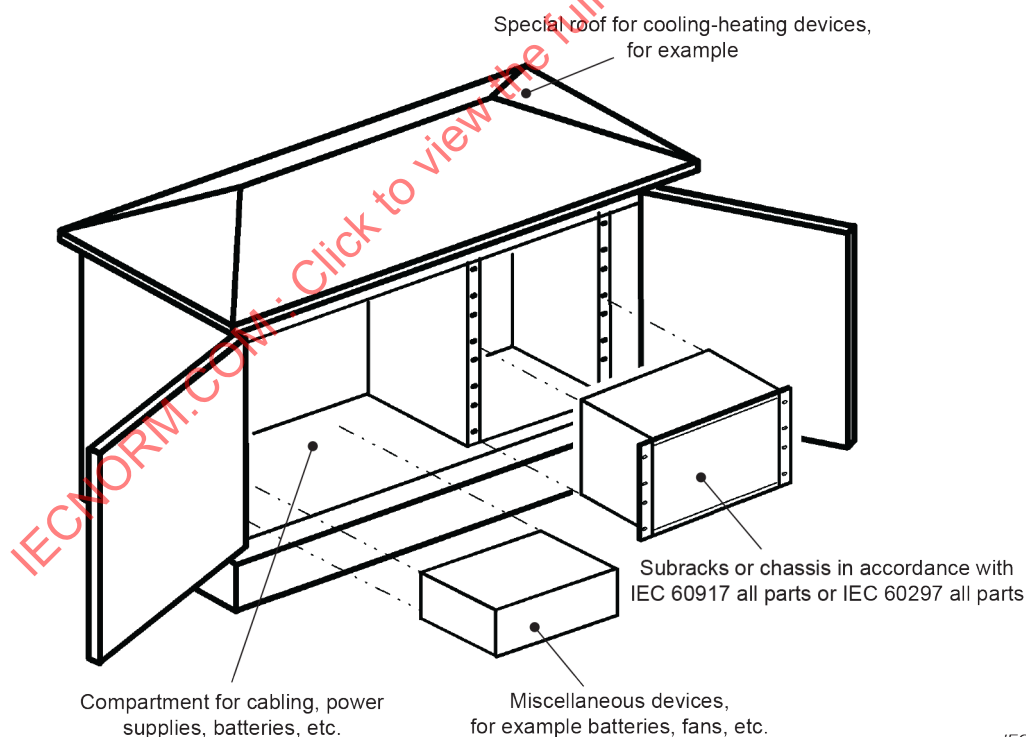


Figure 1 – Typical outdoor enclosure

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.

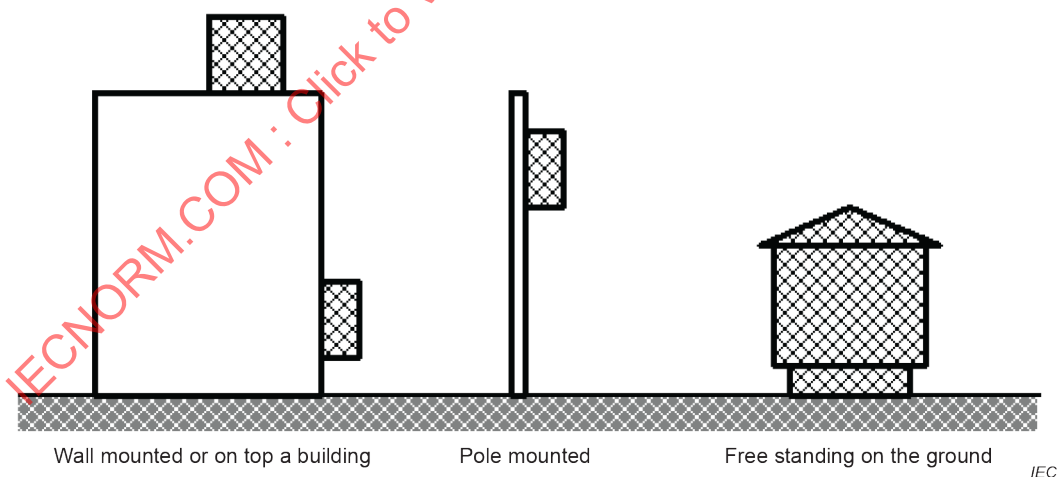


Figure 2 – Locations of outdoor enclosures

3.2

heat transfer rate

k

property with units of $W/(m^2K)$, 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.

6 Electromagnetic shielding

In order to achieve electromagnetic compatibility of a final installation, the enclosure may be part of the total shielding concept. As a pre-test, the shielding performance test may be performed in order to gain the required level of attenuation by the enclosure. The test set-up and the test procedure are described in IEC 61587-3.

7 Thermal management and acoustic noise suppression

Thermal management is the key to survival of electronic equipment in general but especially if exposed to the outdoor environment.

The heat transfer rate k is important for designing the outdoor enclosure because the value affects the temperature difference between inside and outside of the enclosure.

As a prime measure, thermal insulation against heat and cold from the outside environment shall be considered for the enclosure.

Next, measurement of the heat dissipation from the inside out shall be performed.

If low external temperatures will be experienced, internal heating should be considered.

Depending on the climate conditions and the heat generated inside the enclosure, thermal management may be achieved by passive cooling only.

In cases where the internal temperature of the enclosure would exceed temperature limits, the enclosure may be fitted with active cooling devices, such as filter fans, air to air heat exchangers or air conditioners.

For selection of a suitable active cooling system the required energy consumption (cost factor and impact to the environment) and the local noise level limits should be carefully considered (regulatory requirements in rural and urban areas).

For the method of enclosure thermal performance evaluations, see IEC 62194.

Bibliography

- IEC 60068-2-1, *Environmental testing – Part 2-1: Tests – Test A: Cold*
- IEC 60068-2-2, *Environmental testing – Part 2-2: Tests – Test B: Dry heat*
- IEC 60068-2-5, *Environmental testing – Part 2-5: Tests – Test Sa: Simulated solar radiation at ground level and guidance for solar radiation testing and weathering*
- 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 60297 (all parts), *Mechanical structures for electronic equipment – Dimensions of mechanical structures of the 482,6 mm (19 in) series*
- IEC 60297-3-100, *Mechanical structures for electronic equipment – Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 3-100: Basic dimensions of front panels, subracks, chassis, racks and cabinets*
- IEC 60917 (all parts), *Modular order for the development of mechanical structures for electronic equipment practices*
- IEC 60917-1, *Modular order for the development of mechanical structures for electrical and electronic equipment practices – Part 1: Generic standard*
- IEC 60917-2, *Modular order for the development of mechanical structures for electronic equipment practices – Part 2: Sectional specification – Interface co-ordination dimensions for the 25 mm equipment practice*
- 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 60297 – Part 3: Electromagnetic shielding performance tests for cabinets and subracks*
- IEC 61969-2, *Mechanical structures for electronic equipment – Outdoor enclosures – Part 2: Coordination dimensions*

IEC 61969-3, *Mechanical structures for electrical and electronic equipment – Outdoor enclosures – Part 3: Environmental requirements, tests and safety aspects*

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COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

**STRUCTURES MÉCANIQUES POUR ÉQUIPEMENT ÉLECTRIQUE
ET ÉLECTRONIQUE – ENVELOPPES DE PLEIN AIR –****Partie 1: Lignes directrices pour la conception****AVANT-PROPOS**

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La Norme internationale IEC 61969-1 a été établie par le sous-comité 48D: Structures mécaniques pour les équipements électriques et électroniques, du comité d'études 48 de l'IEC: Connecteurs électriques et structures mécaniques pour les équipements électriques et électroniques.

Cette troisième édition annule et remplace la deuxième édition parue en 2011. Cette édition constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

- a) alignement sur le contenu de l'édition la plus récente des séries ETSI EN 300 019 et IEC 60721, en particulier concernant l'actualisation des conditions climatiques;

- b) ajout de nouvelles exigences pour refléter celles du marché relatives aux questions environnementales;
- c) amélioration de la terminologie et modifications éditoriales générales.

Le texte de cette Norme internationale est issu des documents suivants:

FDIS	Rapport de vote
48D/720/FDIS	48D/723/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à l'approbation de la présente Norme internationale.

Ce document a été rédigé selon les Directives ISO/IEC, Partie 2.

Une liste de toutes les parties de la série IEC 61969, publiées sous le titre général *Structures mécaniques pour les équipements électriques et électroniques – Enveloppes de plein air*, peut être consultée sur le site web de l'IEC.

Les futures normes de cette série porteront dorénavant le nouveau titre général cité ci-dessus. Le titre des normes existant déjà dans cette série sera mis à jour lors de la prochaine édition.

Le comité a décidé que le contenu de ce document ne sera pas modifié avant la date de stabilité indiquée sur le site web de l'IEC sous "<http://webstore.iec.ch>" dans les données relatives au document recherché. A cette date, le document sera

- reconduit,
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- amendé.

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INTRODUCTION

La présente partie de l'IEC 61969 est destinée à servir de guide générique pour le développement d'autres parties au sein de cette série de normes et fournit des lignes directrices pour la conception d'enveloppes de plein air.

Les produits couverts par l'IEC 61969 (toutes les parties) sont les enveloppes vides pour les emplacements de plein air, destinées à être équipées de combinaisons d'équipements électriques et électroniques spécifiques à l'application, et à être utilisées dans des emplacements non protégés contre les intempéries au-dessus du sol.

La présente partie comprend:

- une partie générale donnant les lignes directrices pour la conception (IEC 61969-1);
- une norme traitant des dimensions de coordination (IEC 61969-2);
- une norme détaillant les exigences et essais d'environnement, et les aspects liés à la sécurité (IEC 61969-3).

Il convient que l'IEC 61969-2 et l'IEC 61969-3 soient lues conjointement avec le présent document.

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STRUCTURES MÉCANIQUES POUR ÉQUIPEMENT ÉLECTRIQUE ET ÉLECTRONIQUE – ENVELOPPES DE PLEIN AIR –

Partie 1: Lignes directrices pour la conception

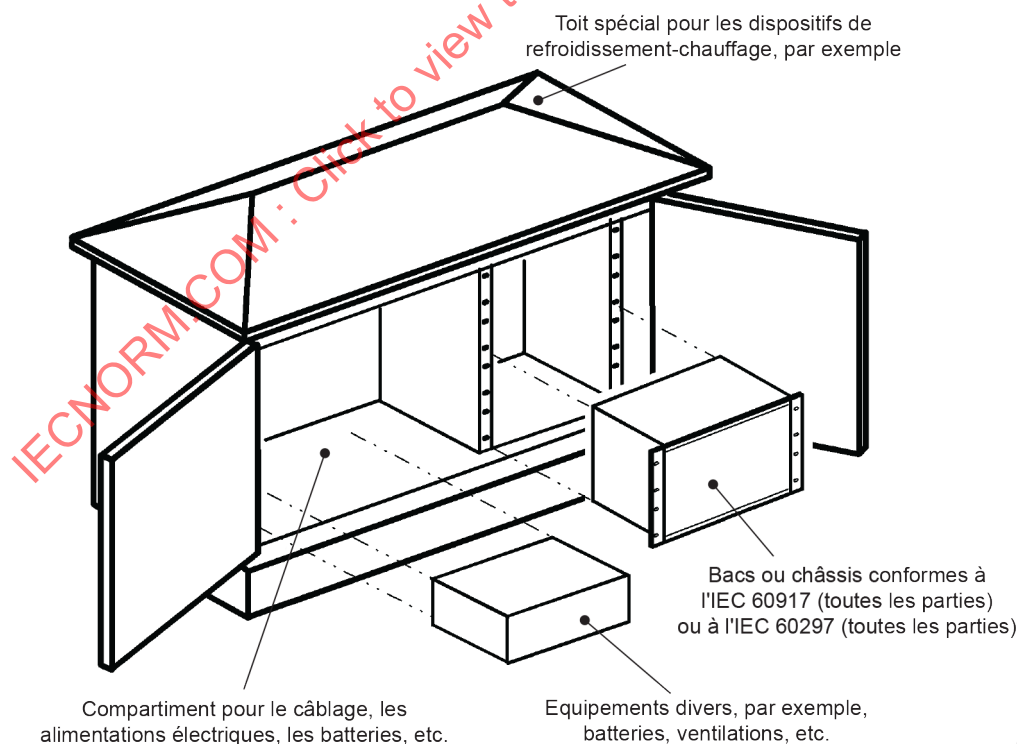
1 Domaine d'application

La présente partie de l'IEC 61969 fournit des lignes directrices pour la conception des enveloppes de plein air et s'applique à une grande variété d'équipements mécaniques, électromécaniques et électroniques et à leur installation en configuration modulaire.

Le présent document est destiné:

- à fournir une vue d'ensemble des spécifications applicables aux enveloppes, portant essentiellement sur les exigences propres aux applications de plein air pour une utilisation à poste fixe à des emplacements non protégés contre les intempéries, et
- à assurer l'intégrité du produit dans des conditions extérieures et à faciliter le choix du produit lors de l'approvisionnement en enveloppes de plein air auprès des différents vendeurs.

Ces enveloppes sont supposées contenir tous types d'équipements et protéger les installations situées en plein air contre les effets indésirables dus à l'environnement. L'équipement installé peut, entre autres, être constitué de bacs ou de châssis conformes à l'IEC 60917 (toutes les parties) ou l'IEC 60297 (toutes les parties). Une enveloppe de plein air typique est représentée à la Figure 1.



IEC

Figure 1 – Enveloppe de plein air typique

2 Références normatives

Les documents suivants sont cités dans le texte de sorte qu'ils constituent, pour tout ou partie de leur contenu, des exigences du présent document. Pour les références datées, seule l'édition citée s'applique. Pour les références non datées, la dernière édition du document de référence s'applique (y compris les éventuels amendements).

IEC 60068-2-75, *Essais d'environnement – Partie 2-75: Essais – Essai Eh: Essais au marteau*

IEC 60417, *Symboles graphiques utilisables sur le matériel* (disponible à l'adresse <http://www.graphical-symbols.info/equipment>)

IEC 60529, *Degrés de protection procurés par les enveloppes (Code IP)*

IEC 60695-11-10, *Essais relatifs aux risques du feu – Partie 11-10: Flammes d'essai – Méthodes d'essai horizontal et vertical à la flamme de 50 W*

IEC 60721-3-2, *Classification des conditions d'environnement – Partie 3: Classification des groupements des agents d'environnement et de leurs sévérités – Section 2: Transport et manutention*

IEC 60721-3-4, *Classification des conditions d'environnement – Partie 3: Classification des groupements des agents d'environnement et de leurs sévérités – Section 4: Utilisation à poste fixe, non protégé contre les intempéries*

IEC 60825-1, *Sécurité des appareils à laser – Partie 1: Classification des matériels et exigences*

IEC 60950-1, *Matériels de traitement de l'information – Sécurité – Partie 1: Exigences générales*

IEC 61010-1, *Règles de sécurité pour appareils électriques de mesurage, de régulation et de laboratoire – Partie 1: Exigences générales*

IEC 61140, *Protection contre les chocs électriques – Aspects communs aux installations et aux matériels*

IEC 61439-5, *Ensembles d'appareillage à basse tension – Partie 5: Ensembles pour réseaux de distribution publique*

IEC 61587-1, *Structures mécaniques pour équipement électronique – Essais pour les séries IEC 60917 et IEC 60297 – Partie 1: Exigences environnementales, montage d'essai et aspects liés à la sécurité des baies, bâtis, bacs à cartes et châssis dans des conditions d'utilisation intérieure ou de transport*

IEC 62194, *Méthodes d'évaluation de la performance thermique des enveloppes*

IEC 62262, *Degrés de protection procurés par les enveloppes de matériels électriques contre les impacts mécaniques externes (code IK)*

IEC 62305-4, *Protection contre la foudre – Partie 4: Réseaux de puissance et de communication dans les structures*

ISO 1518-1, *Peintures et vernis – Détermination de la résistance à la rayure – Partie 1: Méthode à charge constante*