



IEC 60950-22

Edition 2.0 2016-01  
REDLINE VERSION

# INTERNATIONAL STANDARD



Information technology equipment – Safety –  
Part 22: Equipment to be installed outdoors

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INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## INFORMATION TECHNOLOGY EQUIPMENT – SAFETY –

## Part 22: Equipment to be installed outdoors

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International Standard IEC 60950-22 has been prepared by IEC TC 108: Safety of electronic equipment within the field of audio/video, information technology and communication technology.

This second edition cancels and replaces the first edition published in 2005. It constitutes a technical revision.

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

- more extensive requirements for battery ventilation.

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

FDIS	Report on voting
108/615/FDIS	108/634/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.

This Part 22 of IEC 60950 is intended to be used with IEC 60950-1:2005. The subclauses of IEC 60950-1 apply as far as reasonable. Where safety aspects are similar to those of Part 1 the relevant Part 1 clause or subclause is shown for reference in parentheses after the clause or subclause title in Part 22. Where a requirement in Part 22 refers to a requirement or criterion of Part 1, a specific reference to IEC 60950-1, is made.

A list of all parts in the IEC 60950 series, published under the general title *Information technology equipment – Safety*, can be found on the IEC website.

In this standard, the following print types are used:

- requirements proper and normative annexes: roman type;
- *compliance statements and test specifications: italic type;*
- notes in the text and in tables: smaller roman type;
- terms that are defined on Clause 3 and in IEC 60950-1: SMALL CAPITALS.

The following differing practices of a less permanent nature exist in the countries indicated below.

- 4.1: Outdoor equipment demand special design at temperatures down to –50 °C (Finland, Norway, Sweden)
- 4.3: Rise of earth potential requirements (USA, Canada)
- 8.5.1: Enclosure types specifications (USA, Canada).
- D.4: In Canada and United States, IRM Immersion Oil No. 903 is accepted (USA, Canada).

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website 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.

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## INTRODUCTION

This standard proposes safety requirements for information technology equipment intended to be installed, when exposed wholly or partly, in a location where protection from the weather and other outdoor influences such as rain, dust, etc. normally provided by a building or other structure is limited or non-existent. There are many examples of information technology equipment in use throughout the world that are housed in special ENCLOSURES located on pavements, mounted on telecommunications poles and situated underground. Presently, IEC 60950 has no requirements for such equipment and this proposal would rectify this omission. The proposed requirements would not apply to portable or transportable equipment that may be occasionally used outdoors, but are not intended to be installed in conditions of inclement weather.

It is expected that IEC TC108 will continue to coordinate the output of its work with other technical committees dealing with equipment installed outdoors, such as IEC TC70 (Degrees of protection by enclosures, responsible for IEC 60529) and IEC TC48 (~~Electromechanical Components~~ Electrical connectors and mechanical structures for electrical and electronic equipment).

Annex E describes the rationale behind the treatment of specific safety aspects in this standard.

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# INFORMATION TECHNOLOGY EQUIPMENT – SAFETY –

## Part 22: Equipment to be installed outdoors

### 1 Scope

#### 1.1 Equipment covered

This part of IEC 60950 applies to information technology equipment intended to be installed in an OUTDOOR LOCATION.

The requirements for OUTDOOR EQUIPMENT also apply, where relevant, to ~~empty~~ OUTDOOR ENCLOSURES suitable for direct installation in the field and supplied for housing information technology equipment to be installed in an OUTDOOR LOCATION.

#### 1.2 Additional requirements

Each installation may have particular requirements. Some examples are given in 4.2. In addition, requirements for protection of the OUTDOOR EQUIPMENT against the effects of direct lightning strikes are not covered by the standard. For information on this subject, see IEC ~~61024-1~~ 62305-1.

### 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60068-2-11:1984, *Environmental testing procedures – Part 2-11: Tests – Test Ka: Salt mist*

IEC 60364 (all parts), *Low-voltage electrical installations of buildings*

~~IEC 60364-4-43:2001, *Electrical installations of buildings – Part 4-43: Protection for safety – Protection against overcurrent*~~

IEC 60529:1989, *Degrees of protection provided by enclosures (IP Code)*

IEC 60529:1989/AMD1:1999

IEC 60529:1989/AMD2:2013

IEC 60950-1:2005, *Information technology equipment – Safety – Part 1: General requirements*

IEC 60950-1:2005/AMD1:2009

IEC 60950-1:2005/AMD2:2013

~~IEC 61643 (all parts), *Low-voltage surge protective devices*~~

IEC 62368-1:2014, *Audio/video, information and communication technology equipment – Part 1: Safety requirements*

ISO 178, *Plastics – Determination of flexural properties*

ISO 179 (all parts), *Plastics – Determination of Charpy impact ~~strength~~ properties*

ISO 180, *Plastics – Determination of Izod impact strength*

ISO 527 (all parts), *Plastics – Determination of tensile properties*

ISO 3231, *Paints and varnishes – Determination of resistance to humid atmospheres containing sulfur dioxide*

~~ISO 4628-3, *Paints and varnishes – Evaluation of degradation of coatings – Designation of quantity and size of defects, and of intensity of uniform changes in appearance – Part 3: Assessment of degree of rusting*~~

ISO 4892-1, *Plastics – Methods of exposure to laboratory light sources – General guidance*

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

ISO 4892-4, *Plastics – Methods of exposure to laboratory light sources – Open-flame carbon-arc lamps*

ISO 8256, *Plastics – Determination of tensile-impact strength*

ISO/TS 18173:2005, *Non-destructive testing – General terms and definitions*

ASTM D471-98, *Standard Test Method for Rubber Property-Effect of Liquids*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60950-1 and the following apply.

#### 3.1

##### OUTDOOR LOCATION

location for equipment where protection from the weather and other outdoor influences provided by a building or other structure is limited or non-existent

#### 3.2

##### OUTDOOR EQUIPMENT

equipment specified by the manufacturer to be installed where exposed wholly or partly to the conditions in an OUTDOOR LOCATION

Note 1 to entry: TRANSPORTABLE EQUIPMENT, for example, a laptop or notebook computer, or a telephone, is not OUTDOOR EQUIPMENT unless specified by the manufacturer for continuous use in an OUTDOOR LOCATION.

#### 3.3

##### OUTDOOR ENCLOSURE

part of OUTDOOR EQUIPMENT that is exposed to the adverse conditions in an OUTDOOR LOCATION and that is intended to protect the interior of the equipment from those conditions

Note 1 to entry: An OUTDOOR ENCLOSURE can also perform the functions of one or more of the following: a FIRE ENCLOSURE; an ELECTRICAL ENCLOSURE; a MECHANICAL ENCLOSURE.

Note 2 to entry: A separate cabinet or housing into which the equipment is placed can provide the function of an OUTDOOR ENCLOSURE.

## 4 Conditions for outdoor equipment

### 4.1 Ambient air temperature

OUTDOOR EQUIPMENT and OUTDOOR ENCLOSURES shall be suitable for use at any temperature in the range specified by the manufacturer. If not specified by the manufacturer, the range shall be taken as:

- minimum ambient temperature: –33 °C;
- maximum ambient temperature: +40 °C.

*Compliance is checked by inspection and by evaluation of the data provided by the manufacturer.*

NOTE 1 The temperature values are based on IEC 60721-3-4 class 4K2. These temperatures do not take into account severe environments (for example, extremely cold or extremely warm), nor do they include provision for heating by radiation from the sun (solar loading).

NOTE 2 Attention is drawn to IEC 61587-1 for additional information on performance levels C1, C2 and C3.

NOTE 3 In Finland, Norway and Sweden, the temperature in winter ~~may can~~ be extremely low. For OUTDOOR EQUIPMENT this will demand special design so that the equipment can stand transport, erection and operation/service at temperatures down to –50 °C.

### 4.2 AC Mains supply

#### 4.2.1 General

Mains-operated OUTDOOR EQUIPMENT shall be suitable for the highest ~~Overvoltage Category~~ MAINS TRANSIENT VOLTAGE expected in the installation location.

Consideration shall be given to the following:

- the prospective fault current of the supply to OUTDOOR EQUIPMENT can be higher than for indoor equipment, see IEC 60364-4-43; and
- the ~~Overvoltage Category~~ MAINS TRANSIENT VOLTAGE for OUTDOOR EQUIPMENT can be higher than for indoor equipment.

~~Equipment that is part of the building installation, or that may be subject to transient overvoltages exceeding those for Overvoltage Category II, shall be designed for Overvoltage Category III or IV, unless additional protection is to be provided internal or external to the equipment. In this case, the installation instructions shall state the need for such additional protection.~~

~~It is permitted to include~~ Within a certain overvoltage category, components within OUTDOOR EQUIPMENT that reduce the ~~Overvoltage Category~~ MAINS TRANSIENT VOLTAGE or the prospective fault current. ~~Components used to reduce the Overvoltage Category~~ shall comply with the requirements of the IEC 61643-series.

~~NOTE 1 Annex G of IEC 60950-1 only provides a method of determining minimum CLEARANCES for transient voltages corresponding to Overvoltage Categories III and IV. Other parts of the insulation system, for example requirements for solid insulation and for electric strength testing, must be capable of withstanding the higher transient voltages (see IEC 60664-1).~~

NOTE 1 The overvoltage category of OUTDOOR EQUIPMENT is normally considered to be one of the following:

- if powered via the normal building installation wiring, overvoltage category II;
- if powered directly from the mains distribution system, overvoltage category III;
- if at, or in the proximity of, the origin of the electrical installation, overvoltage category IV.

NOTE 2 For further information regarding protection from overvoltages, see IEC 60364-5-53.

*Compliance is checked by inspection of the equipment and the installation instructions.*

#### 4.2.2 Mains transient voltage on AC mains supply

Equipment that is part of the building installation, or that may be subject to transient overvoltages exceeding those for overvoltage category II, shall be designed for overvoltage category III or IV, unless additional protection is to be provided internally or externally to the equipment. In this case, the installation instructions shall state the need for such additional protection. Clearances in equipment designed for overvoltage category III or IV shall comply with Annex G of IEC 60950-1:2005. The insulation system used in such equipment shall be capable of withstanding the test voltage given in Table 5C of IEC 60950-1:2005/AMD2:2013.

#### 4.2.3 Mains transient voltage on DC mains supply

The transient on a D.C. MAINS SUPPLY depends on the source and the installation of the D.C. MAINS SUPPLY. When determining the D.C. MAINS TRANSIENT VOLTAGE, the installation and the source of the D.C. MAINS shall be taken into account. If these are not known, the MAINS TRANSIENT VOLTAGE on the D.C. MAINS SUPPLY shall be assumed to be 1,5 kV.

The manufacturer shall declare the MAINS TRANSIENT VOLTAGE on the D.C. MAINS SUPPLY in the installation instructions.

#### 4.3 Rise of earth potential

Attention is drawn to the fact that during fault clearing conditions, HAZARDOUS VOLTAGES may exist and be accessible for longer periods than for indoor equipment and special earthing conditions may be necessary. These are typically specified in local installation codes.

NOTE In the USA, these requirements are contained in the National Electrical Code. In Canada, they are contained in the Canadian Electrical Code.

*Compliance is checked by evaluation of the installation instructions.*

### 5 Marking and instructions

The installation instructions for OUTDOOR EQUIPMENT shall include details of any special features needed for protection from conditions in the OUTDOOR LOCATION (see 1.7.2 of IEC 60950-1:2005).

If a manufacturer of an OUTDOOR ENCLOSURE classifies a product in accordance with IEC 60529, the IP code shall be declared, however it is not required to mark the IP code on the OUTDOOR ENCLOSURE. It is not required to make such a declaration for OUTDOOR EQUIPMENT.

*Compliance is checked by inspection.*

### 6 Protection from electrical shock in an outdoor location

#### 6.1 Voltage limits of user-accessible parts in outdoor locations

USER-accessible conductive parts in an OUTDOOR LOCATION shall meet the requirements for an SELV CIRCUIT in 2.2.2 and 2.2.3 of IEC 60950-1:2005/AMD2:2013, except that the voltage limits shall not exceed:

- 15 V a.c., 21,2 V peak, or 30 V d.c. under normal operating conditions (see 2.2.2),
- 15 V a.c., 21,2 V peak, or 30 V d.c. for longer than 0,2 s under single fault conditions (see 2.2.3). Moreover, the voltage shall not exceed 30 V a.c., 42,4 V peak or 60 V d.c.

The exception in 2.2.3 of IEC 60950-1:2005/AMD2:2013 relating to 2.3.2.1 b) of the same publication, does not apply to USER-accessible conductive parts.

NOTE 1 Lower voltage limits apply because the contact resistance of the body is reduced when subjected to wet conditions.

NOTE 2 In Denmark, the installation rules require the maximum safe to touch nominal voltage to be 6 V a.c. r.m.s. or 15 V ripple-free d.c. for outside environment, where the installation normally can be humid or wet due to the weather condition including area with shelters, but not in protected walls e.g. carports.

*Compliance is checked by measurement.*

## 6.2 Limited current circuits in outdoor locations

The requirements of 2.4 of IEC 60950–1:2005/AMD1:2009/AMD2:2013, apply without change.

## 6.3 Protection for socket-outlet in outdoor locations

A residual current protective device (RCD) with rated residual operating current not exceeding 30 mA shall be used in the MAINS SUPPLY to socket-outlets intended for general use and with a rated current not exceeding 20 A.

The RCD shall be an integral part of the equipment or of the building installation. If the RCD is part of the building installation, instructions for installations of the RCD shall be provided with the equipment.

## 7 Wiring terminals for connection of external conductors

The mains supply terminations for OUTDOOR EQUIPMENT that is intended to be powered:

- via the normal building installation wiring, shall be as specified in 3.3 of IEC 60950-1:2005/AMD2:2013;
- directly from the mains distribution system, shall be as specified in the IEC 60364 parts.

NOTE For other terminals, IEC 60950-1 applies.

*Compliance is checked by inspection.*

## 8 Construction requirements for outdoor enclosures

### 8.1 General

Protection against corrosion shall be provided by the use of suitable materials or by the application of a protective coating applied to the exposed surface, taking into account the intended conditions of use.

Parts, such as dials or connectors, that serve as a functional part of an OUTDOOR ENCLOSURE shall comply with the same environmental protection requirements as for the OUTDOOR ENCLOSURE.

NOTE 1 Aspects affecting safety which require the integrity of the OUTDOOR ENCLOSURE through the life of the product include:

- continued protection against **impact** access to hazardous parts, including after mechanical strength tests;
- continued protection against ingress of dust and water;
- continued provision of earth continuity.

An OUTDOOR ENCLOSURE shall not be used to carry current during normal operation if this could cause corrosion that would impair safety. This does not preclude connection of a conductive part of an OUTDOOR ENCLOSURE to protective earth for the purpose of carrying fault currents.

NOTE 2 The action of a current flowing through a joint can increase corrosion under wet conditions.

Where a conductive part of an OUTDOOR ENCLOSURE is connected to protective earth for the purpose of carrying fault currents, the resulting connection shall meet the requirements of 2.6 of IEC 60950-1:2005/AMD1:2009/AMD2:2013, after the appropriate weather conditioning tests, see 8.3.

*Compliance is checked by inspection and, if necessary, by the tests of 2.6 of IEC 60950-1:2005/AMD1:2009/AMD2:2013 and 8.3 of this standard.*

## 8.2 Resistance to ultra-violet radiation

Non-metallic parts of an OUTDOOR ENCLOSURE required for compliance with this standard shall be sufficiently resistant to degradation by ultra-violet (UV) radiation.

**Table 1 – Minimum property retention limits after UV exposure**

Parts to be tested	Property	Standard for the test method	Minimum retention after test
Parts providing mechanical support	Tensile strength <sup>a</sup> or	ISO 527	70 %
	Flexural strength <sup>a, b</sup>	ISO 178	70 %
Parts providing impact resistance	Charpy impact <sup>c</sup> or	ISO 179	70 %
	Izod impact <sup>c</sup> or	ISO 180	70 %
	Tensile impact <sup>c</sup>	ISO 8256	70 %
All parts	Flammability classification	1.2.12 and Annex A of IEC 60950-1:2005	see <sup>d</sup>

<sup>a</sup> Tensile strength and flexural strength tests are to be conducted on specimens no thicker than the actual thicknesses.

<sup>b</sup> The side of the sample exposed to UV radiation is to be in contact with the two loading points when using the three-point loading method.

<sup>c</sup> Tests conducted on 3,0 mm thick specimens for Izod impact and tensile impact tests and 4,0 mm thick specimens for Charpy impact tests are considered representative of other thicknesses, down to 0,8 mm.

<sup>d</sup> The flammability classification may change as long as it does not fall below that specified in Clause 4 of IEC 60950-1:2005/AMD1:2009/AMD2:2013.

*Compliance is checked by examination of the construction and of available data regarding the UV resistance characteristics of the ENCLOSURE material and any associated protective coating. If such data is not available, the tests in Table 1 are carried out on the parts.*

*Samples taken from the parts, or consisting of identical material, are prepared according to the standard for the test to be carried out. They are then conditioned according to Annex C. After conditioning, the samples shall show no signs of significant deterioration, such as crazing or cracking. They are then kept at room ambient conditions for not less than 16 h and not more than 96 h, after which they are tested according to the standard for the relevant test.*

*In order to evaluate the percent retention of properties after test, samples that have not been conditioned according to Annex C are tested at the same time as the conditioned samples. The retention shall be as specified in Table 1.*

## 8.3 Resistance to corrosion

### 8.3.1 General

Metallic parts of OUTDOOR ENCLOSURES, with or without protective coatings, shall be resistant to the effects of water-borne contaminants.

Compliance is checked by *either*:

- inspection; *and* by evaluation of data provided by the manufacturer; or, ~~if necessary, by~~
- the tests and criteria as specified in 8.3.2 through 8.3.4; or
- ~~Compliance with the applicable performance level (A1, A2 or A3) of IEC 61587-1 is to be considered an acceptable alternative to complying with 8.3.2 through 8.3.4.~~

### 8.3.2 Test apparatus

The apparatus for the salt spray test ~~comprises~~ *shall consist of* a test chamber and spraying devices as described in IEC 60068-2-11.

The apparatus for the test in a water-saturated sulphur dioxide atmosphere ~~comprises~~ *shall consist of* an inert, hermetically sealed, chamber containing a water-saturated sulphur dioxide atmosphere (see Annex A) in which the test specimens and their supports are held. The chamber is as described in ISO 3231.

### 8.3.3 Test procedure

The test ~~is comprised~~ *shall consist of* two identical and successive 12 day periods.

Each 12 day period ~~is comprised~~ *consists of* test a) followed by test b):

- test a) – 168 h of exposure to the salt spray atmosphere. The concentration of the saline solution forming the salt spray atmosphere is  $5\% \pm 1\%$  by weight and the temperature of the test chamber is maintained at  $35\text{ °C} \pm 2\text{ °C}$ .
- test b) – 5 exposure cycles each consisting of an 8 h exposure to a water-saturated sulphur dioxide-rich atmosphere, (see Annex A), during which the temperature of the test chamber is maintained at  $40\text{ °C} \pm 3\text{ °C}$ , followed by 16 h at rest with the test chamber door open.

After each 12 day period, the test specimens are washed with demineralized water.

*Alternatively, the test procedures as described in the following standards may be used to show compliance:*

- ISO 21207 Method B; or
- ISO 14993; or
- any other equivalent standard.

### 8.3.4 Compliance criteria

Compliance is checked by visual inspection. The equipment shall not show rust, ~~cracking or other deterioration~~ *other than surface corrosion of the protective coating, cracking or other deterioration that will jeopardize the safety aspects as follows: In case of doubt, reference shall be made to ISO 4628-3 to verify that the samples conform to specimen Ri1.*

- continued protection against access to hazardous parts, including after mechanical strength tests; and
- continued protection against ingress of dust and water; and
- continued provision of earth continuity.

However, surface corrosion of the protective coating is permitted.

## 8.4 Bottoms of fire enclosures

The bottom of a FIRE ENCLOSURE of OUTDOOR EQUIPMENT shall comply with 4.6.2 of IEC 60950-1:2005, except there are no requirements for the bottoms of FIRE ENCLOSURES of OUTDOOR EQUIPMENT provided that the installation instructions specify that the equipment is to be mounted directly and permanently on a non-combustible surface (such as concrete or metal). There is no need for a marking on the equipment.

*Compliance is checked by inspection.*

## 8.5 Gaskets

### 8.5.1 General

When gaskets are used as the method providing protection against the ingress of potential contaminants, 8.5.1 through 8.5.3 shall apply as appropriate.

NOTE In Canada and the United States, ENCLOSURE types are specified in the Canadian Electrical Code and the U.S. National Electrical Code.

Joints for all devices closing openings into the equipment cavity of an ENCLOSURE subjected to splashing or seepage of oil, as well as any door or cover for such an ENCLOSURE, shall include a gasket in the full length of the joint.

A gasket of elastomeric or thermoplastic material, or a composition gasket utilizing an elastomeric material that is provided on an ENCLOSURE subjected to water or dust, shall meet requirements of this standard.

*Compliance is checked by inspection and by applying the relevant tests of Annex D.*

### 8.5.2 Oil resistance

A gasket provided on an ENCLOSURE subjected to oil or coolant shall be oil resistant.

*Compliance is checked by inspection and by the oil immersion test of Clause D.4.*

### 8.5.3 Securing means.

A gasket shall be secured with adhesive or by mechanical means. The gasket and its securing means shall not be damaged when the joint is opened.

*Compliance is checked by inspection.*

## 9 Protection of equipment within an outdoor enclosure

### 9.1 Protection from moisture

The OUTDOOR ENCLOSURE shall provide adequate protection from the effect of moisture on the enclosed equipment. Examples of constructions regarded as meeting the requirements are shown in Table 2.

NOTE 1 This does not preclude OUTDOOR ENCLOSURE or OUTDOOR EQUIPMENT being constructed with segmented volumes, each providing a different pollution degree.

NOTE 2 For consideration of the effects of the presence of conductive pollution, as opposed to non-conductive pollution which may can become conductive only due to the presence of moisture, see the relevant requirements in IEC 60529.

**Table 2 – Examples of the provision of pollution degree environments**

Pollution degree	Method of achievement
Pollution degree 3	The use of an ENCLOSURE meeting IPX4 or the Annex B requirements relating to the ingress of water is considered to provide a pollution degree 3 environment within the ENCLOSURE.
Reduction of pollution degree 3 to pollution degree 2	<p>Control Reduction of the pollution degree 3 environment to pollution degree 2 can be accomplished by either:</p> <ul style="list-style-type: none"> <li>– providing continuous energization of the enclosed equipment; or</li> <li>– providing separate climate conditioning which prevents condensation within the OUTDOOR EQUIPMENT or OUTDOOR ENCLOSURE; or</li> <li>– the use of an ENCLOSURE meeting IP54.</li> </ul>
Reduction to pollution degree 1	Control of the environment at the insulation surface to pollution degree 1 can be accomplished by the methods in IEC 60950-1, for example, encapsulation, potting or coating.

Where necessary, the ENCLOSURE of OUTDOOR EQUIPMENT shall be provided with drain holes to control the accumulation of moisture due to:

- entrance of water through openings; and
- condensation, when this is likely to occur (for example, keeping the equipment energized or separately heating the equipment is considered to keep it free of condensation).

The provision of drain holes and their location shall be taken into consideration when determining the IP rating.

*Compliance is checked by inspection and, if necessary, by the relevant tests of IEC 60529 or Annex B.*

*Prior to testing, the equipment shall be mounted, so far as is reasonably practicable, according to the manufacturer's installation instructions. If fans or other means for ventilation are provided, which could affect the ingress of water, the test shall be conducted with the ventilation means both on and off unless it is evident that one of the modes of operation will produce the more onerous result.*

*At the conclusion of the test the following conditions shall exist:*

- For OUTDOOR ENCLOSURES – no water shall have entered the ENCLOSURE.
- For OUTDOOR EQUIPMENT – water is permitted to enter the ENCLOSURE provided it does not:
  - a) deposit on insulation where it could lead to tracking along the CREEPAGE DISTANCE,
  - b) deposit on bare live parts or wiring, or on windings not designed to operate when wet, or
  - c) enter any supply wiring space, see 3.2.9 of IEC 60950-1:2005.

**9.2 Protection from plants and vermin**

If entry by plants and vermin is a consideration, OUTDOOR EQUIPMENT shall have adequate protection.

NOTE For protection against plants and vermin, see IEC 61969-3.

*Compliance is checked by inspection.*

### 9.3 Protection from excessive dust

#### 9.3.1 General

~~If the presence of excessive dust is a consideration~~ Unless the equipment is developed according to the requirements of Pollution Degree 3, OUTDOOR EQUIPMENT shall have adequate protection against the ingress of the dust through the use of an appropriately rated ~~IPXX~~ IP5X or IP6X ENCLOSURE, or equivalent (e.g. an equivalent NEMA rated ENCLOSURE).

NOTE Dust from road vehicles is not considered to be conductive.

*Compliance is checked by inspection and, if necessary, by the relevant tests of IEC 60529 or alternatively, by the tests of 9.3.2 or 9.3.3 using the acceptance conditions of IEC 60529:1989/AMD1:1999, Clause 5, 13.5.2 and 13.6.2.*

#### 9.3.2 IP5X equipment

Dust-proof equipment (first characteristic IP numeral 5) shall be tested in a dust chamber similar to that shown in Figure 2 of IEC 60529:1989, in which talcum powder is maintained in suspension by an air current. The chamber shall contain 2 kg of powder for every cubic meter of its volume. The talcum powder used shall be able to pass through a square-meshed sieve whose nominal wire diameter is 50 µm and whose nominal free distance between wires is 75 µm. It shall not have been used for more than 20 tests. The test shall proceed as follows:

- a) the equipment is suspended outside the dust chamber and operated at rated supply voltage until operating temperature is achieved;
- b) the equipment, whilst still operating, is placed with the minimum disturbance in the dust chamber;
- c) the door of the dust chamber is closed;
- d) the fan/blower causing the talcum powder to be in suspension is switched on;
- e) after 1 min, the equipment is disconnected and allowed to cool for 3 h whilst the talcum powder remains in suspension.

NOTE The 1 min interval between switching on the fan/blower and switching off the equipment is to ensure that the talcum powder is properly in suspension around the equipment during initial cooling, which is most important with smaller equipment. The equipment is operated initially as in item a) to ensure the test chamber is not overheated.

#### 9.3.3 IP6X equipment

Dust-tight equipment (first characteristic IP numeral 6) shall be tested in accordance with 9.3.2.

## 10 Mechanical strength of enclosures

### 10.1 General

OUTDOOR ENCLOSURES and OUTDOOR EQUIPMENT shall have adequate mechanical strength and shall provide protection against access to energized parts and other hazards within the equipment throughout the intended ambient operating range.

*Compliance is checked by the inspection of the construction and available data and, if necessary, by the test of 10.2. After the test the following criteria shall be met:*

- the level of protection shall remain in accordance with 9.1; and
- the requirements of 4.2.1 of IEC 60950-1:2005/AMD1:2009/AMD2:2013, shall be met.

## 10.2 Impact test

*For equipment with an ENCLOSURE made of polymeric material, the ENCLOSURE of the equipment should be subjected to the low temperature conditioning before the impact test. Subsequently OUTDOOR ENCLOSURES and OUTDOOR EQUIPMENT are to be subjected to the impact test of 4.2.5 of IEC 60950-1:2005/AMD1:2009/AMD2:2013. Where the ENCLOSURE is made of polymeric material, the test is carried out at an ambient temperature equal to the minimum ambient temperature specified by the manufacturer or  $-33\text{ °C}$  if no minimum ambient temperature is specified, for 24 h. The test can be applied to a portion of the enclosure representing the largest unreinforced area, supported in its normal position.*

NOTE For requirements in Finland, Norway and Sweden, see 4.1, Note 3.

*The impacts are applied to doors, covers, seams and the like which could affect the ingress of dust and moisture. The test is performed whether or not failure would give direct access to hazardous parts. The impacts are applied ~~immediately after~~ within 2 min of removal from the climatic chamber.*

## 11 Outdoor equipment containing valve regulated or vented batteries

### 11.1 Risk of explosion from lead acid, NiCd and NiMH batteries

The compartment housing a valve regulated or vented battery, where gassing is possible during normal usage or over-charging, shall have adequate ventilation.

In a compartment containing both, a battery and electrical components, the risk of ignition of local concentrations of hydrogen and oxygen by adjacent operational arcing parts, such as contactors and switches close to battery vents or valves, shall be controlled. This shall be achieved, for example, by the use of fully enclosed components, separation of battery compartments or adequate ventilation.

The ventilation system shall be so constructed that any potential fault, including distortion of the battery cases due to overheating or thermal runaway, does not result in the ventilation system failing to vent explosive gasses.

If ventilation tubes are used for conducting explosive gas from the battery cases to the outside air, they shall not be the only means of eliminating the build-up of gas from the cabinet. An independent means of natural ventilation that adequately ventilates the enclosure containing the batteries shall be provided.

If mechanical or forced-air ventilation is used, adequate ventilation shall continue to be provided under single-fault failure conditions.

ENCLOSURES with mechanical or electromechanical dampers shall continue to provide adequate ventilation when the damper is in the closed position.

NOTE Test methods and requirements for stationary batteries are given in IEC 60896-21, IEC 60896-22 and IEC 62485-2.

*Compliance is checked by inspection of the ventilation system for compliance with the above, by verifying that the capability of the housing to ventilate hydrogen is in accordance with 11.2 and, if necessary, by the test in 11.3.*

*Boost charging shall be assumed, unless it can be verified that float charging is maintained under normal and single-fault conditions.*

*For charging conditions where the boost charge voltage exceeds those found in Table 3, the test in 11.3 shall be conducted.*

## 11.2 Ventilation preventing an explosive gas concentration

The requirements of M.7 of IEC 62368-1:2014 apply.

Table 3 shall be used for the calculation of the ventilation air flow instead of Table M.1 of IEC 62368-1:2014.

**Table 3 – Values for current  $I_{float}$  and  $I_{boost}$ , factors  $f_g$  and  $f_s$ , and voltages  $U_{float}$  and  $U_{boost}$**

Parameter	Lead-acid batteries vented cells Sb < 3 % <sup>a</sup>	Lead-acid batteries VRLA cells	NiCd batteries vented cells <sup>b</sup>
Gas emission factor $f_g$	1	0,2	1
Gas emission safety factor $f_s$ (incl. 10 % faulty cells and ageing)	5	5	5
Float charge voltage $U_{float}$ <sup>c</sup> V/cell	2,23	2,27	1,40
Typical float charge current $I_{float}$ A/Ah	1	1	1
Current (float) $I_{gas}$ mA/ Ah (under float charge conditions relevant for air flow calculation)	5	1	5
Boost charge voltage $U_{boost}$ <sup>c</sup> V/cell	2,40	2,40	1,55
Typical boost charge current $I_{boost}$ mA/Ah	4	8	10
Current (boost) $I_{gas}$ mA/Ah (under boost charge conditions relevant for air flow calculation)	20	8	50
<p><sup>a</sup> For an antimony (Sb) content higher than 3 %, the current used for calculations shall be doubled.</p> <p><sup>b</sup> For recombination type NiCd and NiMH cells consult the manufacturer.</p> <p><sup>c</sup> Float and boost charge voltage can vary with the specific gravity of electrolyte in lead-acid cells.</p>			
<p>The values of float and boost charge current increase with temperature. The consequences of an increase in temperature, up to a maximum of 40 °C, have been accommodated in the values in Table 1.</p> <p>In case of use of gas recombination vent plugs, the gas producing current <math>I_{gas}</math> the values for vented cells can be reduced to 50 % of the values for vented cells.</p> <p>The ventilation air volume requirements, for example, for two 48 V strings of VRLA cells in the same battery cabinet and each with 120 Ah rated <math>C_{10}</math> capacity amount, under float and under boost charge service conditions are:</p> <ul style="list-style-type: none"> <li>- service with float charge condition only: <math>Q = 0,05 \times 24 \times 1 \times 120 \times 0,001 = 0,144 \text{ m}^3/\text{h}</math> per string or 288 l/h total;</li> <li>- service with boost charge condition: <math>Q = 0,05 \times 24 \times 8 \times 120 \times 0,001 = 1,15 \text{ m}^3/\text{h}</math> per string or 2 300 l/h total.</li> </ul>			

For the purpose of calculating the area of ventilation openings required for natural ventilation of this subclause, the air velocity is assumed to be 0,1 m/s.

Alternatively, the following equation can be used:

$$A = 28 \times Q$$

where:

$Q$  is the ventilation rate of fresh air (m<sup>3</sup>/h);

$A$  is the free area of openings in air inlet and outlet (cm<sup>2</sup>)

### 11.3 Ventilation test

*The following test shall be used to measure gas concentration if the adequacy of the required ventilation is not obvious.*

*Samples of the atmosphere within the battery compartment are to be taken after 7 h of operation. The samples are to be taken at locations where the greatest concentration of hydrogen gas is likely. The hydrogen gas concentration shall not be more than 1 % by volume if the mixture is in proximity to an ignition source, or exceeding 2 % by volume if the mixture is not in proximity to an ignition source. See 4.3.8 of IEC 60950-1:2005/AMD2:2013 for evaluating the overcharging of a rechargeable battery.*

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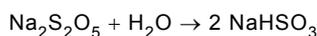
## Annex A (normative)

### Water-saturated sulphur dioxide atmosphere (see 8.3.2 and 8.3.3)

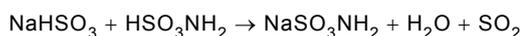
If the test chamber has an internal volume of  $300 \text{ l} \pm 30 \text{ l}$  the water-saturated sulphur dioxide atmosphere is created by the introduction of 0,2 l of sulphur dioxide with a concentration of 0,067 % by volume into the closed test chamber. The sulphur dioxide can either be introduced from a gas cylinder or by creating a specific reaction within the chamber. For test chambers having a different internal volume the quantity of sulphur dioxide is varied accordingly.

Sulphur dioxide can be formed inside the test apparatus by treating sodium pyrosulphite ( $\text{Na}_2\text{S}_2\text{O}_5$ ) with a relatively strong acid, sulphamic acid ( $\text{HSO}_3\text{NH}_2$ ).

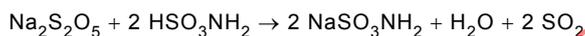
NOTE 1 The method consists of dissolving excess sodium pyrosulphite in water, giving the reaction:



A stoichiometric quantity of sulphamic acid is then added giving the reaction:



The resulting overall reaction is:



To obtain 1 l of  $\text{SO}_2$  under normal conditions of  $0^\circ\text{C}$  temperature and  $1,013 \times 10^5 \text{ Pa}$ , air pressure, 4,24 g sodium pyrosulphite and 4,33 g sulphamic acid are required.

NOTE 2 Sulphamic acid is the only solid mineral acid that is easy to conserve.

NOTE 3 — The above description is taken from 8.2.11.3.1 and 8.2.11.3.2 of IEC 60439-5.

## **Annex B** (normative)

### **Water spray test** (see 9.1)

The water-spray test apparatus, using fresh water, is to consist of three spray heads mounted in a water supply pipe rack as shown in Figure B.1. Spray heads are to be constructed in accordance with the details shown in Figure B.2. The ENCLOSURE is to be positioned in the focal area of the spray heads so that the greatest quantity of water is likely to enter the ENCLOSURE. The water pressure is to be maintained at 34,5 kPa at each spray head. The ENCLOSURE is to be exposed to the water spray for 1 h.

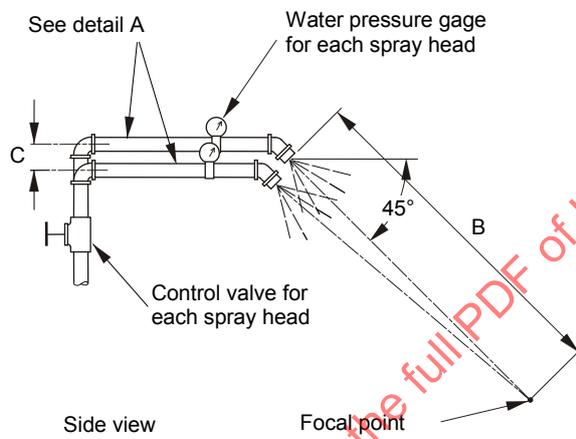
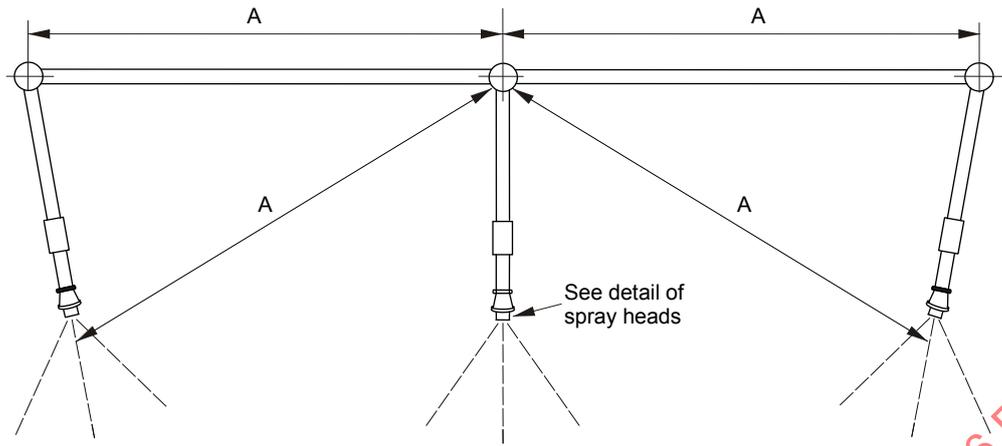
Unless the construction is such that a test on one side of the ENCLOSURE is representative of a test on another side, the test is to be repeated on other sides of the ENCLOSURE as necessary.

The water spray is to produce a uniform spray over the surface or surfaces under test. The various vertical surfaces of an ENCLOSURE may be tested separately or collectively, provided that a uniform spray is applied.

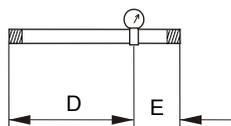
The top surface of the OUTDOOR ENCLOSURE shall be tested by applying a uniform spray from nozzles located at proper heights (see the focal point in Figure B.1), if

- a) there are openings in the top surface, or
- b) from an examination of the construction, it is determined that run-off from the top surface could cause water ingress at a vertical surface which would not be detected by the test of the vertical surface.

If there are openings in a vertical surface, located lower than 250 mm above ground level, such that water ingress from rain bouncing upwards from the ground surface might occur, a test shall be performed, spraying water on the ground surface in front of such openings, over such distance necessary to cause the deflected spray to reach the OUTDOOR ENCLOSURE. This test is not carried out if, from an examination of the construction, it is determined that the test of the vertical surface adequately assures compliance.



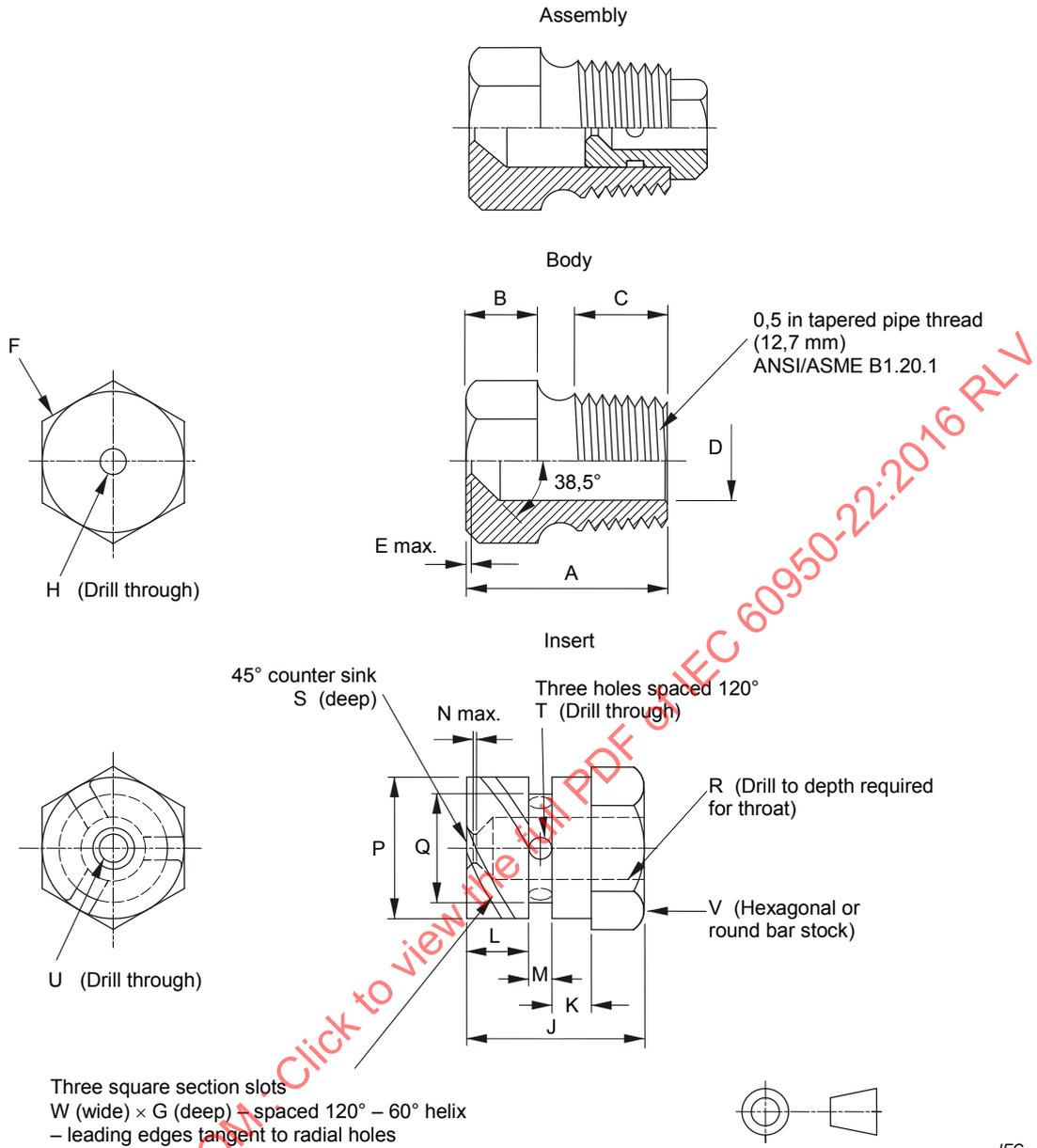
Piezometer assembly  
Detail A



**Key**

Item	mm
A	710
B	1 400
C	55
D	230
E	75

**Figure B.1 – Water-spray test spray-head piping**



Item	mm	Item	mm
A	31,0	N	0,80
B	11,0	P	14,61
C	14,0		14,63
D	14,68	Q	11,51
	14,73		11,53
E	0,40	R	63,5
F	Optional – To serve as a wrench grip	S	0,80
G	1,52	T	2,80
H	5,0	U	2,50
J	18,3	V	16,0
K	3,97	W	16,0
L	6,35		
M	2,38		

Figure B.2 – Water-spray test spray head

## Annex C (normative)

### Ultraviolet light conditioning test (see 8.2)

#### C.1 Test apparatus

Samples are exposed to ultraviolet light by using one of the following apparatus:

- a) a twin enclosed carbon-arc, (see Clause C.3), with continuous exposure for a minimum of 720 h. The test apparatus shall operate with a black-panel temperature of  $(63 \pm 3) ^\circ\text{C}$  in a relative humidity of  $(50 \pm 5) \%$ ; or
- b) a xenon-arc (see Clause C.4), with continuous exposure for a minimum of 1 000 h. The test apparatus shall operate with a 6 500 W, water-cooled xenon-arc lamp, a spectral irradiance of  $0,35 \text{ W/m}^2$  at 340 nm, a black-panel temperature of  $(63 \pm 3) ^\circ\text{C}$  in a relative humidity of  $(50 \pm 5) \%$ .

#### C.2 Mounting of test samples

The samples are mounted vertically on the inside of the cylinder of the light exposure apparatus, with the widest portion of the sample facing the arcs. They are mounted so that they do not touch each other.

#### C.3 Carbon-arc light-exposure apparatus

The apparatus described in ISO 4892-4, or equivalent, is used in accordance with the procedures given in ISO 4892-1 and ISO 4892-4 using a type 1 filter, with water spray.

#### C.4 Xenon-arc light-exposure apparatus

The apparatus described in ISO 4892-2, or equivalent, is used in accordance with the procedures given in ISO 4892-1 and ISO 4892-2 using method A, with water spray.

## Annex D (normative)

### Gasket tests (see 8.5)

#### D.1 Gasket tests

The relevant tests specified in Clause D.2 or D.3, depending on the type of gasket material used, are applicable to gaskets employed on an ENCLOSURE subjected to water or dust. The additional test of Clause D.4 is applicable to gaskets employed on an ENCLOSURE subjected to oil or coolant. A set of three specimens of the gasket material shall be subjected to the relevant tests.

#### D.2 Tensile strength and elongation tests

This test is applicable to gaskets, which can stretch (such as O-rings). Gasket material shall be of such quality that samples subjected to a temperature of 69 °C to 70 °C in circulating air for 168 h have a tensile strength of not less than 75 % and an elongation of not less than 60 % of values determined for unaged samples. At the conclusion of the tests, there shall be no visible deterioration, deformation, melting, or cracking of the material and the material shall not harden as determined by normal hand flexing.

#### D.3 Compression test

This test is applicable to gaskets with closed cell construction. The set of specimens of gasket material shall be tested to the requirements of a), b) and c) (see Figure D.1). On completion of each test, the specimens shall not show signs of deterioration or cracks that can be seen with normal or corrected vision.

- a) A cylindrical weight sufficient to apply 69 kPa shall be placed on the middle portion of each specimen for a period of 2 h. At the end of that time the weight shall be removed and the specimen allowed to rest at a room temperature of 25 °C ± 3 °C for 30 min. The thickness of the gasket shall then be determined and compared with a measurement obtained before the application of the weight. The compression set shall not exceed 50 % of the initial thickness of the specimen.
- b) Following the test specified in a), the same specimens shall be suspended in an air oven at a temperature of 70 °C for a period of 5 days. The specimens shall then be tested for compliance with a), approximately 24 h after removal from the oven.
- c) Following the test specified in b), the same specimens shall be cooled to ~~a~~ the minimum temperature ~~of -30 °C~~ specified by the manufacturer or -33 °C if no minimum ambient temperature is specified for a period of 24 h and then subjected to an impact from a hammer of 1,35 kg mass falling from a height of 150 mm upon removal from the cold chamber. The hammer head shall be steel, 28,6 mm in diameter and have a flat striking surface, 25,4 mm in diameter with slightly rounded edges. The specimens being tested shall be placed on short lengths of 50 mm by 100 mm minimum wooden pieces (clear spruce) when being impacted. Following the impact the specimens shall be examined for evidence of cracking or other adverse effects. The test shall be continued and the specimens impacted every 24 h for two more days. The specimens shall then be removed from the cold chamber, allowed to rest at a room temperature of 25 °C ± 3 °C for approximately 24 h, and then again tested for compliance with a).

NOTE For requirements in Finland, Norway and Sweden, see 4.1, Note 3.



## **Annex E** (informative)

### **Rationale**

#### **E.1 General**

In preparing this part of IEC 60950, it has been assumed that:

- exterior to the OUTDOOR EQUIPMENT there should be no hazards, just as is the case with other information technology equipment;
- protection against vandalism and other purposeful acts will be treated as a product quality issue (for example, IEC 60950 should not contain requirements for the security of locks, types of acceptable screw head, forced entry tests, etc.).

#### **E.2 Electric shock**

It is believed that most aspects relating to protection against the risk of electric shock are adequately covered by IEC 60950-1:2005 including current proposals, and in some cases, quoted safety standards (in particular, the IEC 60364 series), and with the exception of the following, do not require modification. Specific requirements not already suitably addressed in IEC 60950-1 were considered as follows:

- clearing of earth faults for remotely located (exposed) information technology equipment;
- the degree of protection provided by the enclosure to rain, dust, etc.;
- the effect of moisture and pollution degree on the insulation of the enclosed parts;
- the possible consequences of ingress by plants and animals (since these could bridge or damage insulation);
- the maximum permissible touch voltage and body contact impedance for wet conditions.

It is noted that the voltage limits of USER-accessible circuits and parts in OUTDOOR LOCATIONS only are applicable to circuits and parts that are actually "USER-accessible". If the circuits and parts are not USER accessible (determined via application of accessibility probes) and are enclosed in ELECTRICAL ENCLOSURES, connectors and cable suitable for the outdoor application, including being subject to all relevant OUTDOOR ENCLOSURE testing, voltage limits for indoor locations may be acceptable based on the application. For example, a Power over Ethernet (PoE) surveillance camera mounted outdoors supplied by 48 V d.c. from PoE would be in compliance with Clause 6 if the ELECTRICAL ENCLOSURE met the applicable requirements for OUTDOOR ENCLOSURES.

#### **E.3 Energy related hazards**

It is believed that most aspects relating to protection against energy hazards for humans are adequately covered by IEC 60950-1. However, the level of available fault current at the point of mains supply to the equipment can be significantly higher and hence the rating of components would need to take this into account (underrating of components in this area can also result in a fire hazard).

#### **E.4 Fire**

It is believed that most aspects relating to protection against fire emanating from within the equipment are adequately covered by IEC 60950-1. However, certain measures that may be acceptable for equipment located inside a building would not be acceptable outdoors because they would permit the entry of rain, etc.

For certain types of OUTDOOR EQUIPMENT it could be appropriate to allow the 'no bottom FIRE ENCLOSURE required if mounted on a concrete base' exemption that presently can be used for equipment for use within a RESTRICTED ACCESS LOCATION.

### **E.5 Mechanical hazards**

It is believed that all aspects relating to protection against mechanical hazards emanating from the equipment are adequately covered by IEC 60950-1.

### **E.6 Heat related hazards**

It is believed that most aspects relating to protection against direct heat hazards are adequately covered by IEC 60950-1. However, it may be appropriate to permit higher limits for equipment that is unlikely to be touched by passers by (for example, equipment that is only intended to be pole mounted out of reach).

A default nominal ambient temperature range for OUTDOOR EQUIPMENT has been proposed. The effects of solar heating have not been addressed.

In addition to direct thermal hazards, there is a need to consider consequential hazards. For instance, some plastics become brittle as they become cold. An ENCLOSURE made from such brittle plastic could expose users to other hazards (for example, electrical or mechanical) if it were to break.

### **E.7 Radiation**

It is believed that most aspects relating to direct protection against radiation hazards are adequately covered by IEC 60950-1. However, there may be consequential hazards to consider.

Just as polymeric materials can be affected by low temperatures, they can also become embrittled due to the effect of UV radiation. An ENCLOSURE made from such brittle plastic could expose USERS to other hazards (for example, electrical or mechanical) if it were to break.

### **E.8 Chemical hazards**

It is believed that certain types of OUTDOOR EQUIPMENT need to have measures relating to chemical hazards originating within, or external to, the equipment.

Exposure to chemicals in the environment (for example, salt used to clear roads in the winter) can also cause problems.

### **E.9 Biological hazards**

These are not presently addressed in IEC 60950-1.

As with radiation hazards and chemical hazards, it is thought that there is not likely to be any direct biological hazard. However, plastics and some metals can be attacked by fungi or bacteria and this could result in weakening of protective ENCLOSURES. As stated under 'electric shock', the ingress of plants and animals could result in damage to insulation.

### **E.10 Explosion hazards**

OUTDOOR EQUIPMENT may need to be weather-tight, in such cases there is an increased probability that an explosive atmosphere can build up as a result of:

- hydrogen being produced as a result of charging lead-acid batteries within the equipment and;
- methane and other 'duct gasses' entering the equipment from the outdoors.

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IEC 61969-3, Mechanical structures for electronic equipment – Outdoor enclosures – Part 3: ~~Sectional specification – Climatic, mechanical~~ Environmental requirements, tests and safety aspects ~~for cabinets and cases~~

IEC 62305-1:2010, Protection against lightning – Part 1: General principles

<sup>1)</sup> A consolidated edition (1.1) exists, including IEC 60439-5:1996 and its Amendment 1 (1998).

IEC 62485-2, *Safety requirements for secondary batteries and battery installations – Part 2: Stationary batteries*

~~ASTM D471-98: *Standard Test Method for Rubber Property-Effect of Liquids*~~

ISO 4628-3, *Paints and varnishes – Evaluation of degradation of coatings – Designation of quantity and size of defects, and of intensity of uniform changes in appearance – Part 3: Assessment of degree of rusting*

ISO 14993, *Corrosion of metals and alloys – Accelerated testing involving cyclic exposure to salt mist, "dry" and "wet" conditions*

ISO 21207, *Corrosion tests in artificial atmospheres – Accelerated corrosion tests involving alternate exposure to corrosion-promoting gases, neutral salt-spray and drying*

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# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

**Information technology equipment – Safety –  
Part 22: Equipment to be installed outdoors**

**Matériels de traitement de l'information – Sécurité –  
Partie 22: Matériels destinés à être installés à l'extérieur**

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

## INFORMATION TECHNOLOGY EQUIPMENT – SAFETY –

## Part 22: Equipment to be installed outdoors

## 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 60950-22 has been prepared by IEC TC 108: Safety of electronic equipment within the field of audio/video, information technology and communication technology.

This second edition cancels and replaces the first edition published in 2005. It constitutes a technical revision.

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

- more extensive requirements for battery ventilation.

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

FDIS	Report on voting
108/615/FDIS	108/634/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.

This Part 22 of IEC 60950 is intended to be used with IEC 60950-1:2005. The subclauses of IEC 60950-1 apply as far as reasonable. Where safety aspects are similar to those of Part 1 the relevant Part 1 clause or subclause is shown for reference in parentheses after the clause or subclause title in Part 22. Where a requirement in Part 22 refers to a requirement or criterion of Part 1, a specific reference to IEC 60950-1, is made.

A list of all parts in the IEC 60950 series, published under the general title *Information technology equipment – Safety*, can be found on the IEC website.

In this standard, the following print types are used:

- requirements proper and normative annexes: roman type;
- *compliance statements and test specifications: italic type;*
- notes in the text and in tables: smaller roman type;
- terms that are defined on Clause 3 and in IEC 60950-1: SMALL CAPITALS.

The following differing practices of a less permanent nature exist in the countries indicated below.

- 4.1: Outdoor equipment demand special design at temperatures down to –50 °C (Finland, Norway, Sweden)
- 4.3: Rise of earth potential requirements (USA, Canada)
- 8.5.1: Enclosure types specifications (USA, Canada).
- D.4: In Canada and United States, IRM Immersion Oil No. 903 is accepted (USA, Canada).

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website 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 proposes safety requirements for information technology equipment intended to be installed, when exposed wholly or partly, in a location where protection from the weather and other outdoor influences such as rain, dust, etc. normally provided by a building or other structure is limited or non-existent. There are many examples of information technology equipment in use throughout the world that are housed in special ENCLOSURES located on pavements, mounted on telecommunications poles and situated underground. Presently, IEC 60950 has no requirements for such equipment and this proposal would rectify this omission. The proposed requirements would not apply to portable or transportable equipment that may be occasionally used outdoors, but are not intended to be installed in conditions of inclement weather.

It is expected that IEC TC108 will continue to coordinate the output of its work with other technical committees dealing with equipment installed outdoors, such as IEC TC70 (Degrees of protection provided by enclosures, responsible for IEC 60529) and IEC TC 48 (Electrical connectors and mechanical structures for electrical and electronic equipment).

Annex E describes the rationale behind the treatment of specific safety aspects in this standard.

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## INFORMATION TECHNOLOGY EQUIPMENT – SAFETY –

### Part 22: Equipment to be installed outdoors

#### 1 Scope

##### 1.1 Equipment covered

This part of IEC 60950 applies to information technology equipment intended to be installed in an OUTDOOR LOCATION.

The requirements for OUTDOOR EQUIPMENT also apply, where relevant, to OUTDOOR ENCLOSURES suitable for direct installation in the field and supplied for housing information technology equipment to be installed in an OUTDOOR LOCATION.

##### 1.2 Additional requirements

Each installation may have particular requirements. Some examples are given in 4.2. In addition, requirements for protection of the OUTDOOR EQUIPMENT against the effects of direct lightning strikes are not covered by the standard. For information on this subject, see IEC 62305-1.

#### 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

IEC 60364 (all parts), *Low-voltage electrical installations*

IEC 60529:1989, *Degrees of protection provided by enclosures (IP Code)*

IEC 60529:1989/AMD1:1999

IEC 60529:1989/AMD2:2013

IEC 60950-1:2005, *Information technology equipment – Safety – Part 1: General requirements*

IEC 60950-1:2005/AMD1:2009

IEC 60950-1:2005/AMD2:2013

IEC 62368-1:2014, *Audio/video, information and communication technology equipment – Part 1: Safety requirements*

ISO 178, *Plastics – Determination of flexural properties*

ISO 179 (all parts), *Plastics – Determination of Charpy impact properties*

ISO 180, *Plastics – Determination of Izod impact strength*

ISO 527 (all parts), *Plastics – Determination of tensile properties*

ISO 3231, *Paints and varnishes – Determination of resistance to humid atmospheres containing sulfur dioxide*

ISO 4892-1, *Plastics – Methods of exposure to laboratory light sources – General guidance*

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

ISO 4892-4, *Plastics – Methods of exposure to laboratory light sources – Open-flame carbon-arc lamps*

ISO 8256, *Plastics – Determination of tensile-impact strength*

ISO/TS 18173:2005, *Non-destructive testing – General terms and definitions*

ASTM D471-98, *Standard Test Method for Rubber Property-Effect of Liquids*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60950-1 and the following apply.

#### 3.1

##### **OUTDOOR LOCATION**

location for equipment where protection from the weather and other outdoor influences provided by a building or other structure is limited or non-existent

#### 3.2

##### **OUTDOOR EQUIPMENT**

equipment specified by the manufacturer to be installed where exposed wholly or partly to the conditions in an OUTDOOR LOCATION

Note 1 to entry: TRANSPORTABLE EQUIPMENT, for example, a laptop or notebook computer, or a telephone, is not OUTDOOR EQUIPMENT unless specified by the manufacturer for continuous use in an OUTDOOR LOCATION.

#### 3.3

##### **OUTDOOR ENCLOSURE**

part of OUTDOOR EQUIPMENT that is exposed to the adverse conditions in an OUTDOOR LOCATION and that is intended to protect the interior of the equipment from those conditions

Note 1 to entry: An OUTDOOR ENCLOSURE can also perform the functions of one or more of the following: a FIRE ENCLOSURE; an ELECTRICAL ENCLOSURE; a MECHANICAL ENCLOSURE.

Note 2 to entry: A separate cabinet or housing into which the equipment is placed can provide the function of an OUTDOOR ENCLOSURE.

### 4 Conditions for outdoor equipment

#### 4.1 Ambient air temperature

OUTDOOR EQUIPMENT and OUTDOOR ENCLOSURES shall be suitable for use at any temperature in the range specified by the manufacturer. If not specified by the manufacturer, the range shall be taken as:

- minimum ambient temperature: –33 °C;
- maximum ambient temperature: +40 °C.

*Compliance is checked by inspection and by evaluation of the data provided by the manufacturer.*

NOTE 1 The temperature values are based on IEC 60721-3-4 class 4K2. These temperatures do not take into account severe environments (for example, extremely cold or extremely warm), nor do they include provision for heating by radiation from the sun (solar loading).

NOTE 2 Attention is drawn to IEC 61587-1 for additional information on performance levels C1, C2 and C3.

NOTE 3 In Finland, Norway and Sweden, the temperature in winter can be extremely low. For OUTDOOR EQUIPMENT this will demand special design so that the equipment can stand transport, erection and operation/service at temperatures down to  $-50^{\circ}\text{C}$ .

## 4.2 Mains supply

### 4.2.1 General

Mains-operated OUTDOOR EQUIPMENT shall be suitable for the highest MAINS TRANSIENT VOLTAGE expected in the installation location.

Consideration shall be given to the following:

- the prospective fault current of the supply to OUTDOOR EQUIPMENT can be higher than for indoor equipment, see IEC 60364-4-43; and
- the MAINS TRANSIENT VOLTAGE for OUTDOOR EQUIPMENT can be higher than for indoor equipment.

Within a certain overvoltage category, components within OUTDOOR EQUIPMENT that reduce the MAINS TRANSIENT VOLTAGE or the prospective fault current shall comply with the requirements of the IEC 61643-series.

NOTE 1 The overvoltage category of OUTDOOR EQUIPMENT is normally considered to be one of the following:

- if powered via the normal building installation wiring, overvoltage category II;
- if powered directly from the mains distribution system, overvoltage category III;
- if at, or in the proximity of, the origin of the electrical installation, overvoltage category IV.

NOTE 2 For further information regarding protection from overvoltages, see IEC 60364-5-53.

*Compliance is checked by inspection of the equipment and the installation instructions.*

### 4.2.2 Mains transient voltage on AC mains supply

Equipment that is part of the building installation, or that may be subject to transient overvoltages exceeding those for overvoltage category II, shall be designed for overvoltage category III or IV, unless additional protection is to be provided internally or externally to the equipment. In this case, the installation instructions shall state the need for such additional protection. Clearances in equipment designed for overvoltage category III or IV shall comply with Annex G of IEC 60950-1:2005. The insulation system used in such equipment shall be capable of withstanding the test voltage given in Table 5C of IEC 60950-1:2005/AMD2:2013.

### 4.2.3 Mains transient voltage on DC mains supply

The transient on a D.C. MAINS SUPPLY depends on the source and the installation of the D.C. MAINS SUPPLY. When determining the D.C. MAINS TRANSIENT VOLTAGE, the installation and the source of the D.C. MAINS shall be taken into account. If these are not known, the MAINS TRANSIENT VOLTAGE on the D.C. MAINS SUPPLY shall be assumed to be 1,5 kV.

The manufacturer shall declare the MAINS TRANSIENT VOLTAGE on the D.C. MAINS SUPPLY in the installation instructions.

### 4.3 Rise of earth potential

Attention is drawn to the fact that during fault clearing conditions, HAZARDOUS VOLTAGES may exist and be accessible for longer periods than for indoor equipment and special earthing conditions may be necessary. These are typically specified in local installation codes.

NOTE In the USA, these requirements are contained in the National Electrical Code. In Canada, they are contained in the Canadian Electrical Code.

*Compliance is checked by evaluation of the installation instructions.*

## 5 Marking and instructions

The installation instructions for OUTDOOR EQUIPMENT shall include details of any special features needed for protection from conditions in the OUTDOOR LOCATION (see 1.7.2 of IEC 60950-1:2005).

If a manufacturer of an OUTDOOR ENCLOSURE classifies a product in accordance with IEC 60529, the IP code shall be declared, however it is not required to mark the IP code on the OUTDOOR ENCLOSURE. It is not required to make such a declaration for OUTDOOR EQUIPMENT.

*Compliance is checked by inspection.*

## 6 Protection from electrical shock in an outdoor location

### 6.1 Voltage limits of user-accessible parts in outdoor locations

USER-accessible conductive parts in an OUTDOOR LOCATION shall meet the requirements for an SELV CIRCUIT in 2.2.2 and 2.2.3 of IEC 60950-1:2005/AMD2:2013, except that the voltage limits shall not exceed:

- 15 V a.c., 21,2 V peak, or 30 V d.c. under normal operating conditions (see 2.2.2),
- 15 V a.c., 21,2 V peak, or 30 V d.c. for longer than 0,2 s under single fault conditions (see 2.2.3). Moreover, the voltage shall not exceed 30 V a.c., 42,4 V peak or 60 V d.c.

The exception in 2.2.3 of IEC 60950-1:2005/AMD2:2013 relating to 2.3.2.1 b) of the same publication, does not apply to USER-accessible conductive parts.

NOTE 1 Lower voltage limits apply because the contact resistance of the body is reduced when subjected to wet conditions.

NOTE 2 In Denmark, the installation rules require the maximum safe to touch nominal voltage to be 6 V a.c. r.m.s. or 15 V ripple-free d.c. for outside environment, where the installation normally can be humid or wet due to the weather condition including area with shelters, but not in protected walls e.g. carports.

*Compliance is checked by measurement.*

### 6.2 Limited current circuits in outdoor locations

The requirements of 2.4 of IEC 60950-1:2005/AMD1:2009/AMD2:2013, apply without change.

### 6.3 Protection for socket-outlet in outdoor locations

A residual current protective device (RCD) with rated residual operating current not exceeding 30 mA shall be used in the MAINS SUPPLY to socket-outlets intended for general use and with a rated current not exceeding 20 A.

The RCD shall be an integral part of the equipment or of the building installation. If the RCD is part of the building installation, instructions for installations of the RCD shall be provided with the equipment.

## 7 Wiring terminals for connection of external conductors

The mains supply terminations for OUTDOOR EQUIPMENT that is intended to be powered:

- via the normal building installation wiring, shall be as specified in 3.3 of IEC 60950-1:2005/AMD2:2013;
- directly from the mains distribution system, shall be as specified in the IEC 60364 parts.

NOTE For other terminals, IEC 60950-1 applies.

*Compliance is checked by inspection.*

## 8 Construction requirements for outdoor enclosures

### 8.1 General

Protection against corrosion shall be provided by the use of suitable materials or by the application of a protective coating applied to the exposed surface, taking into account the intended conditions of use.

Parts, such as dials or connectors, that serve as a functional part of an OUTDOOR ENCLOSURE shall comply with the same environmental protection requirements as for the OUTDOOR ENCLOSURE.

NOTE 1 Aspects affecting safety which require the integrity of the OUTDOOR ENCLOSURE through the life of the product include:

- continued protection against access to hazardous parts, including after mechanical strength tests;
- continued protection against ingress of dust and water;
- continued provision of earth continuity.

An OUTDOOR ENCLOSURE shall not be used to carry current during normal operation if this could cause corrosion that would impair safety. This does not preclude connection of a conductive part of an OUTDOOR ENCLOSURE to protective earth for the purpose of carrying fault currents.

NOTE 2 The action of a current flowing through a joint can increase corrosion under wet conditions.

Where a conductive part of an OUTDOOR ENCLOSURE is connected to protective earth for the purpose of carrying fault currents, the resulting connection shall meet the requirements of 2.6 of IEC 60950-1:2005/AMD1:2009/AMD2:2013, after the appropriate weather conditioning tests, see 8.3.

*Compliance is checked by inspection and, if necessary, by the tests of 2.6 of IEC 60950-1:2005/AMD1:2009/AMD2:2013 and 8.3 of this standard.*

### 8.2 Resistance to ultra-violet radiation

Non-metallic parts of an OUTDOOR ENCLOSURE required for compliance with this standard shall be sufficiently resistant to degradation by ultra-violet (UV) radiation.

**Table 1 – Minimum property retention limits after UV exposure**

Parts to be tested	Property	Standard for the test method	Minimum retention after test
Parts providing mechanical support	Tensile strength <sup>a</sup> or	ISO 527	70 %
	Flexural strength <sup>a, b</sup>	ISO 178	70 %
Parts providing impact resistance	Charpy impact <sup>c</sup> or	ISO 179	70 %
	Izod impact <sup>c</sup> or	ISO 180	70 %
	Tensile impact <sup>c</sup>	ISO 8256	70 %
All parts	Flammability classification	1.2.12 and Annex A of IEC 60950-1:2005	see <sup>d</sup>

<sup>a</sup> Tensile strength and flexural strength tests are to be conducted on specimens no thicker than the actual thicknesses.

<sup>b</sup> The side of the sample exposed to UV radiation is to be in contact with the two loading points when using the three-point loading method.

<sup>c</sup> Tests conducted on 3,0 mm thick specimens for Izod impact and tensile impact tests and 4,0 mm thick specimens for Charpy impact tests are considered representative of other thicknesses, down to 0,8 mm.

<sup>d</sup> The flammability classification may change as long as it does not fall below that specified in Clause 4 of IEC 60950-1:2005/AMD1:2009/AMD2:2013.

Compliance is checked by examination of the construction and of available data regarding the UV resistance characteristics of the ENCLOSURE material and any associated protective coating. If such data is not available, the tests in Table 1 are carried out on the parts.

Samples taken from the parts, or consisting of identical material, are prepared according to the standard for the test to be carried out. They are then conditioned according to Annex C. After conditioning, the samples shall show no signs of significant deterioration, such as crazing or cracking. They are then kept at room ambient conditions for not less than 16 h and not more than 96 h, after which they are tested according to the standard for the relevant test.

In order to evaluate the percent retention of properties after test, samples that have not been conditioned according to Annex C are tested at the same time as the conditioned samples. The retention shall be as specified in Table 1.

**8.3 Resistance to corrosion**

**8.3.1 General**

Metallic parts of OUTDOOR ENCLOSURES, with or without protective coatings, shall be resistant to the effects of water-borne contaminants.

Compliance is checked by either:

- inspection and by evaluation of data provided by the manufacturer; or
- the tests and criteria as specified in 8.3.2 through 8.3.4; or
- the applicable performance level (A1, A2 or A3) of IEC 61587-1.

**8.3.2 Test apparatus**

The apparatus for the salt spray test shall consist of a test chamber and spraying devices as described in IEC 60068-2-11.

*The apparatus for the test in a water-saturated sulphur dioxide atmosphere shall consist of an inert, hermetically sealed, chamber containing a water-saturated sulphur dioxide atmosphere (see Annex A) in which the test specimens and their supports are held. The chamber is as described in ISO 3231.*

### **8.3.3 Test procedure**

*The test shall consist of two identical and successive 12 day periods.*

*Each 12 day period consists of test a) followed by test b):*

*test a) – 168 h of exposure to the salt spray atmosphere. The concentration of the saline solution forming the salt spray atmosphere is  $5\% \pm 1\%$  by weight and the temperature of the test chamber is maintained at  $35\text{ °C} \pm 2\text{ °C}$ .*

*test b) – 5 exposure cycles each consisting of an 8 h exposure to a water-saturated sulphur dioxide-rich atmosphere, (see Annex A), during which the temperature of the test chamber is maintained at  $40\text{ °C} \pm 3\text{ °C}$ , followed by 16 h at rest with the test chamber door open.*

*After each 12 day period, the test specimens are washed with demineralized water.*

*Alternatively, the test procedures as described in the following standards may be used to show compliance:*

- ISO 21207 Method B; or*
- ISO 14993; or*
- any other equivalent standard.*

### **8.3.4 Compliance criteria**

*Compliance is checked by visual inspection. The equipment shall not show rust, other than surface corrosion of the protective coating, cracking or other deterioration that will jeopardize the safety aspects as follows:*

- continued protection against access to hazardous parts, including after mechanical strength tests; and*
- continued protection against ingress of dust and water; and*
- continued provision of earth continuity.*

*However, surface corrosion of the protective coating is permitted.*

## **8.4 Bottoms of fire enclosures**

The bottom of a FIRE ENCLOSURE of OUTDOOR EQUIPMENT shall comply with 4.6.2 of IEC 60950-1:2005, except there are no requirements for the bottoms of FIRE ENCLOSURES of OUTDOOR EQUIPMENT provided that the installation instructions specify that the equipment is to be mounted directly and permanently on a non-combustible surface (such as concrete or metal). There is no need for a marking on the equipment.

*Compliance is checked by inspection.*

## **8.5 Gaskets**

### **8.5.1 General**

When gaskets are used as the method providing protection against the ingress of potential contaminants, 8.5.1 through 8.5.3 shall apply as appropriate.

NOTE In Canada and the United States, ENCLOSURE types are specified in the Canadian Electrical Code and the U.S. National Electrical Code.

Joints for all devices closing openings into the equipment cavity of an ENCLOSURE subjected to splashing or seepage of oil, as well as any door or cover for such an ENCLOSURE, shall include a gasket in the full length of the joint.

A gasket of elastomeric or thermoplastic material, or a composition gasket utilizing an elastomeric material that is provided on an ENCLOSURE subjected to water or dust, shall meet requirements of this standard.

*Compliance is checked by inspection and by applying the relevant tests of Annex D.*

### 8.5.2 Oil resistance

A gasket provided on an ENCLOSURE subjected to oil or coolant shall be oil resistant.

*Compliance is checked by inspection and by the oil immersion test of Clause D.4.*

### 8.5.3 Securing means

A gasket shall be secured with adhesive or by mechanical means. The gasket and its securing means shall not be damaged when the joint is opened.

*Compliance is checked by inspection.*

## 9 Protection of equipment within an outdoor enclosure

### 9.1 Protection from moisture

The OUTDOOR ENCLOSURE shall provide adequate protection from the effect of moisture on the enclosed equipment. Examples of constructions regarded as meeting the requirements are shown in Table 2.

NOTE 1 This does not preclude OUTDOOR ENCLOSURE or OUTDOOR EQUIPMENT being constructed with segmented volumes, each providing a different pollution degree.

NOTE 2 For consideration of the effects of the presence of conductive pollution, as opposed to non-conductive pollution which can become conductive only due to the presence of moisture, see the relevant requirements in IEC 60529.

**Table 2 – Examples of the provision of pollution degree environments**

Pollution degree	Method of achievement
Pollution degree 3	The use of an ENCLOSURE meeting IPX4 or the Annex B requirements relating to the ingress of water is considered to provide a pollution degree 3 environment within the ENCLOSURE.
Reduction of pollution degree 3 to pollution degree 2	Reduction of the pollution degree 3 environment to pollution degree 2 can be accomplished by either: <ul style="list-style-type: none"> <li>– providing continuous energization of the enclosed equipment; or</li> <li>– providing separate climate conditioning which prevents condensation within the OUTDOOR EQUIPMENT or OUTDOOR ENCLOSURE; or</li> <li>– the use of an ENCLOSURE meeting IP54.</li> </ul>
Reduction to pollution degree 1	Control of the environment at the insulation surface to pollution degree 1 can be accomplished by the methods in IEC 60950-1, for example, encapsulation, potting or coating.

Where necessary, the ENCLOSURE of OUTDOOR EQUIPMENT shall be provided with drain holes to control the accumulation of moisture due to:

- entrance of water through openings; and
- condensation, when this is likely to occur (for example, keeping the equipment energized or separately heating the equipment is considered to keep it free of condensation).

The provision of drain holes and their location shall be taken into consideration when determining the IP rating.

*Compliance is checked by inspection and, if necessary, by the relevant tests of IEC 60529 or Annex B.*

*Prior to testing, the equipment shall be mounted, so far as is reasonably practicable, according to the manufacturer's installation instructions. If fans or other means for ventilation are provided, which could affect the ingress of water, the test shall be conducted with the ventilation means both on and off unless it is evident that one of the modes of operation will produce the more onerous result.*

*At the conclusion of the test the following conditions shall exist:*

- For OUTDOOR ENCLOSURES – no water shall have entered the ENCLOSURE.
- For OUTDOOR EQUIPMENT – water is permitted to enter the ENCLOSURE provided it does not:
  - a) deposit on insulation where it could lead to tracking along the CREEPAGE DISTANCE,
  - b) deposit on bare live parts or wiring, or on windings not designed to operate when wet, or
  - c) enter any supply wiring space, see 3.2.9 of IEC 60950-1:2005.

## **9.2 Protection from plants and vermin**

If entry by plants and vermin is a consideration, OUTDOOR EQUIPMENT shall have adequate protection.

NOTE For protection against plants and vermin, see IEC 61969-3.

*Compliance is checked by inspection.*

## **9.3 Protection from excessive dust**

### **9.3.1 General**

Unless the equipment is developed according to the requirements of Pollution Degree 3, OUTDOOR EQUIPMENT shall have adequate protection against the ingress of the dust through the use of an appropriately rated IP5X or IP6X ENCLOSURE, or equivalent (e.g. an equivalent NEMA rated ENCLOSURE).

NOTE Dust from road vehicles is not considered to be conductive.

*Compliance is checked by inspection and, if necessary, by the relevant tests of IEC 60529 or alternatively, by the tests of 9.3.2 or 9.3.3 using the acceptance conditions of IEC 60529:1989/AMD1:1999, Clause 5, 13.5.2 and 13.6.2.*

### **9.3.2 IP5X equipment**

Dust-proof equipment (first characteristic IP numeral 5) shall be tested in a dust chamber similar to that shown in Figure 2 of IEC 60529:1989, in which talcum powder is maintained in suspension by an air current. The chamber shall contain 2 kg of powder for every cubic meter of its volume. The talcum powder used shall be able to pass through a square-meshed sieve whose nominal wire diameter is 50  $\mu\text{m}$  and whose nominal free distance between wires is 75  $\mu\text{m}$ . It shall not have been used for more than 20 tests. The test shall proceed as follows:

- a) the equipment is suspended outside the dust chamber and operated at rated supply voltage until operating temperature is achieved;
- b) the equipment, whilst still operating, is placed with the minimum disturbance in the dust chamber;
- c) the door of the dust chamber is closed;
- d) the fan/blower causing the talcum powder to be in suspension is switched on;
- e) after 1 min, the equipment is disconnected and allowed to cool for 3 h whilst the talcum powder remains in suspension.

NOTE The 1 min interval between switching on the fan/blower and switching off the equipment is to ensure that the talcum powder is properly in suspension around the equipment during initial cooling, which is most important with smaller equipment. The equipment is operated initially as in item a) to ensure the test chamber is not overheated.

### 9.3.3 IP6X equipment

Dust-tight equipment (first characteristic IP numeral 6) shall be tested in accordance with 9.3.2.

## 10 Mechanical strength of enclosures

### 10.1 General

OUTDOOR ENCLOSURES and OUTDOOR EQUIPMENT shall have adequate mechanical strength and shall provide protection against access to energized parts and other hazards within the equipment throughout the intended ambient operating range.

*Compliance is checked by the inspection of the construction and available data and, if necessary, by the test of 10.2. After the test the following criteria shall be met:*

- *the level of protection shall remain in accordance with 9.1; and*
- *the requirements of 4.2.1 of IEC 60950-1:2005/AMD1:2009/AMD2:2013, shall be met.*

### 10.2 Impact test

*For equipment with an ENCLOSURE made of polymeric material, the ENCLOSURE of the equipment should be subjected to the low temperature conditioning before the impact test. Subsequently OUTDOOR ENCLOSURES and OUTDOOR EQUIPMENT are to be subjected to the impact test of 4.2.5 of IEC 60950-1:2005/AMD1:2009/AMD2:2013. Where the ENCLOSURE is made of polymeric material, the test is carried out at an ambient temperature equal to the minimum ambient temperature specified by the manufacturer or –33 °C if no minimum ambient temperature is specified, for 24 h. The test can be applied to a portion of the enclosure representing the largest unreinforced area, supported in its normal position.*

NOTE For requirements in Finland, Norway and Sweden, see 4.1, Note 3.

*The impacts are applied to doors, covers, seams and the like which could affect the ingress of dust and moisture. The test is performed whether or not failure would give direct access to hazardous parts. The impacts are applied within 2 min of removal from the climatic chamber.*

## 11 Outdoor equipment containing valve regulated or vented batteries

### 11.1 Risk of explosion from lead acid, NiCd and NiMH batteries

The compartment housing a valve regulated or vented battery, where gassing is possible during normal usage or over-charging, shall have adequate ventilation.

In a compartment containing both, a battery and electrical components, the risk of ignition of local concentrations of hydrogen and oxygen by adjacent operational arcing parts, such as contactors and switches close to battery vents or valves, shall be controlled. This shall be achieved, for example, by the use of fully enclosed components, separation of battery compartments or adequate ventilation.

The ventilation system shall be so constructed that any potential fault, including distortion of the battery cases due to overheating or thermal runaway, does not result in the ventilation system failing to vent explosive gasses.

If ventilation tubes are used for conducting explosive gas from the battery cases to the outside air, they shall not be the only means of eliminating the build-up of gas from the cabinet. An independent means of natural ventilation that adequately ventilates the enclosure containing the batteries shall be provided.

If mechanical or forced-air ventilation is used, adequate ventilation shall continue to be provided under single-fault failure conditions.

ENCLOSURES with mechanical or electromechanical dampers shall continue to provide adequate ventilation when the damper is in the closed position.

NOTE Test methods and requirements for stationary batteries are given in IEC 60896-21, IEC 60896-22 and IEC 62485-2.

*Compliance is checked by inspection of the ventilation system for compliance with the above, by verifying that the capability of the housing to ventilate hydrogen is in accordance with 11.2 and, if necessary, by the test in 11.3.*

*Boost charging shall be assumed, unless it can be verified that float charging is maintained under normal and single-fault conditions.*

*For charging conditions where the boost charge voltage exceeds those found in Table 3, the test in 11.3 shall be conducted.*

## **11.2 Ventilation preventing an explosive gas concentration**

The requirements of M.7 of IEC 62368-1:2014 apply.

Table 3 shall be used for the calculation of the ventilation air flow instead of Table M.1 of IEC 62368-1:2014.

**Table 3 – Values for current  $I_{float}$  and  $I_{boost}$ , factors  $f_g$  and  $f_s$ , and voltages  $U_{float}$  and  $U_{boost}$**

Parameter	Lead-acid batteries vented cells Sb < 3 % <sup>a</sup>	Lead-acid batteries VRLA cells	NiCd batteries vented cells <sup>b</sup>
Gas emission factor $f_g$	1	0,2	1
Gas emission safety factor $f_s$ (incl. 10 % faulty cells and ageing)	5	5	5
Float charge voltage $U_{float}$ <sup>c</sup> V/cell	2,23	2,27	1,40
Typical float charge current $I_{float}$ A/Ah	1	1	1
Current (float) $I_{gas}$ mA/ Ah (under float charge conditions relevant for air flow calculation)	5	1	5
Boost charge voltage $U_{boost}$ <sup>c</sup> V/cell	2,40	2,40	1,55
Typical boost charge current $I_{boost}$ mA/Ah	4	8	10
Current (boost) $I_{gas}$ mA/Ah (under boost charge conditions relevant for air flow calculation)	20	8	50
<p><sup>a</sup> For an antimony (Sb) content higher than 3 %, the current used for calculations shall be doubled.</p> <p><sup>b</sup> For recombination type NiCd and NiMH cells consult the manufacturer.</p> <p><sup>c</sup> Float and boost charge voltage can vary with the specific gravity of electrolyte in lead-acid cells.</p>			
<p>The values of float and boost charge current increase with temperature. The consequences of an increase in temperature, up to a maximum of 40 °C, have been accommodated in the values in Table 1.</p> <p>In case of use of gas recombination vent plugs, the gas producing current <math>I_{gas}</math> the values for vented cells can be reduced to 50 % of the values for vented cells.</p> <p>The ventilation air volume requirements, for example, for two 48 V strings of VRLA cells in the same battery cabinet and each with 120 Ah rated <math>C_{10}</math> capacity amount, under float and under boost charge service conditions are:</p> <ul style="list-style-type: none"> <li>- service with float charge condition only: <math>Q = 0,05 \times 24 \times 1 \times 120 \times 0,001 = 0,144 \text{ m}^3/\text{h}</math> per string or 288 l/h total;</li> <li>- service with boost charge condition: <math>Q = 0,05 \times 24 \times 8 \times 120 \times 0,001 = 1,15 \text{ m}^3/\text{h}</math> per string or 2 300 l/h total.</li> </ul>			

For the purpose of calculating the area of ventilation openings required for natural ventilation of this subclause, the air velocity is assumed to be 0,1 m/s.

Alternatively, the following equation can be used:

$$A = 28 \times Q$$

where:

$Q$  is the ventilation rate of fresh air ( $\text{m}^3/\text{h}$ );

$A$  is the free area of openings in air inlet and outlet ( $\text{cm}^2$ )

### 11.3 Ventilation test

*The following test shall be used to measure gas concentration if the adequacy of the required ventilation is not obvious.*

*Samples of the atmosphere within the battery compartment are to be taken after 7 h of operation. The samples are to be taken at locations where the greatest concentration of hydrogen gas is likely. The hydrogen gas concentration shall not be more than 1 % by volume if the mixture is in proximity to an ignition source, or exceeding 2 % by volume if the mixture is not in proximity to an ignition source. See 4.3.8 of IEC 60950-1:2005/AMD2:2013 for evaluating the overcharging of a rechargeable battery.*

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## Annex A (normative)

### Water-saturated sulphur dioxide atmosphere (see 8.3.2 and 8.3.3)

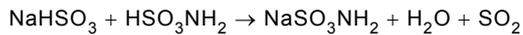
If the test chamber has an internal volume of  $300 \text{ l} \pm 30 \text{ l}$  the water-saturated sulphur dioxide atmosphere is created by the introduction of 0,2 l of sulphur dioxide with a concentration of 0,067 % by volume into the closed test chamber. The sulphur dioxide can either be introduced from a gas cylinder or by creating a specific reaction within the chamber. For test chambers having a different internal volume the quantity of sulphur dioxide is varied accordingly.

Sulphur dioxide can be formed inside the test apparatus by treating sodium pyrosulphite ( $\text{Na}_2\text{S}_2\text{O}_5$ ) with a relatively strong acid, sulphamic acid ( $\text{HSO}_3\text{NH}_2$ ).

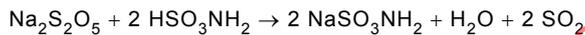
NOTE 1 The method consists of dissolving excess sodium pyrosulphite in water, giving the reaction:



A stoichiometric quantity of sulphamic acid is then added giving the reaction:



The resulting overall reaction is:



To obtain 1 l of  $\text{SO}_2$  under normal conditions of  $0^\circ\text{C}$  temperature and  $1,013 \times 10^5 \text{ Pa}$ , air pressure, 4,24 g sodium pyrosulphite and 4,33 g sulphamic acid are required.

NOTE 2 Sulphamic acid is the only solid mineral acid that is easy to conserve.

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## **Annex B** (normative)

### **Water spray test** (see 9.1)

The water-spray test apparatus, using fresh water, is to consist of three spray heads mounted in a water supply pipe rack as shown in Figure B.1. Spray heads are to be constructed in accordance with the details shown in Figure B.2. The ENCLOSURE is to be positioned in the focal area of the spray heads so that the greatest quantity of water is likely to enter the ENCLOSURE. The water pressure is to be maintained at 34,5 kPa at each spray head. The ENCLOSURE is to be exposed to the water spray for 1 h.

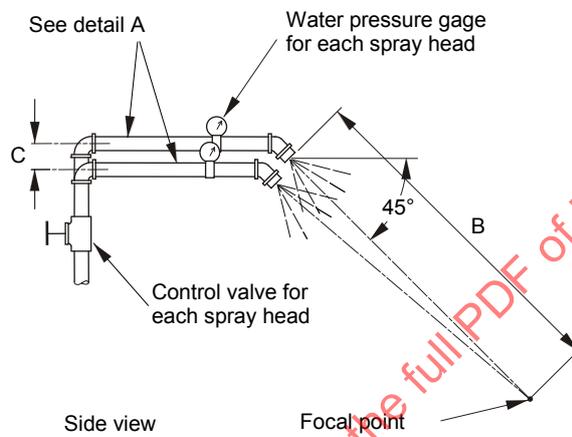
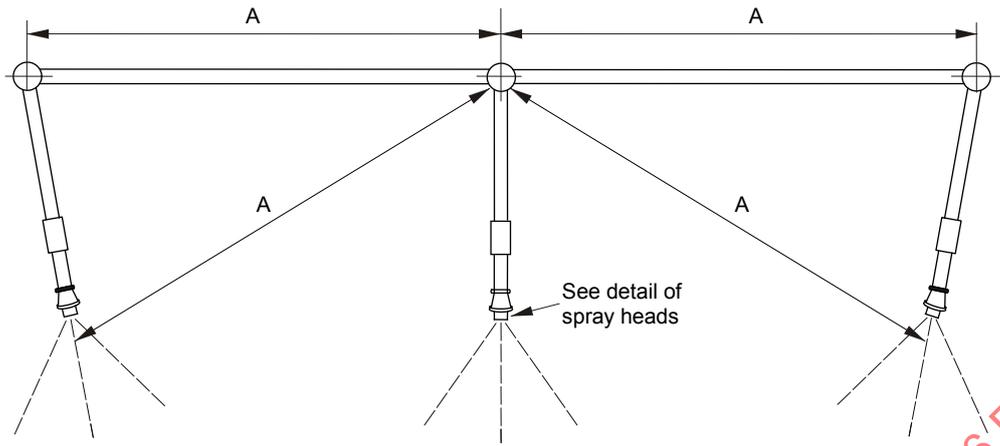
Unless the construction is such that a test on one side of the ENCLOSURE is representative of a test on another side, the test is to be repeated on other sides of the ENCLOSURE as necessary.

The water spray is to produce a uniform spray over the surface or surfaces under test. The various vertical surfaces of an ENCLOSURE may be tested separately or collectively, provided that a uniform spray is applied.

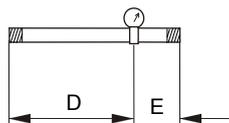
The top surface of the OUTDOOR ENCLOSURE shall be tested by applying a uniform spray from nozzles located at proper heights (see the focal point in Figure B.1), if

- a) there are openings in the top surface, or
- b) from an examination of the construction, it is determined that run-off from the top surface could cause water ingress at a vertical surface which would not be detected by the test of the vertical surface.

If there are openings in a vertical surface, located lower than 250 mm above ground level, such that water ingress from rain bouncing upwards from the ground surface might occur, a test shall be performed, spraying water on the ground surface in front of such openings, over such distance necessary to cause the deflected spray to reach the OUTDOOR ENCLOSURE. This test is not carried out if, from an examination of the construction, it is determined that the test of the vertical surface adequately assures compliance.



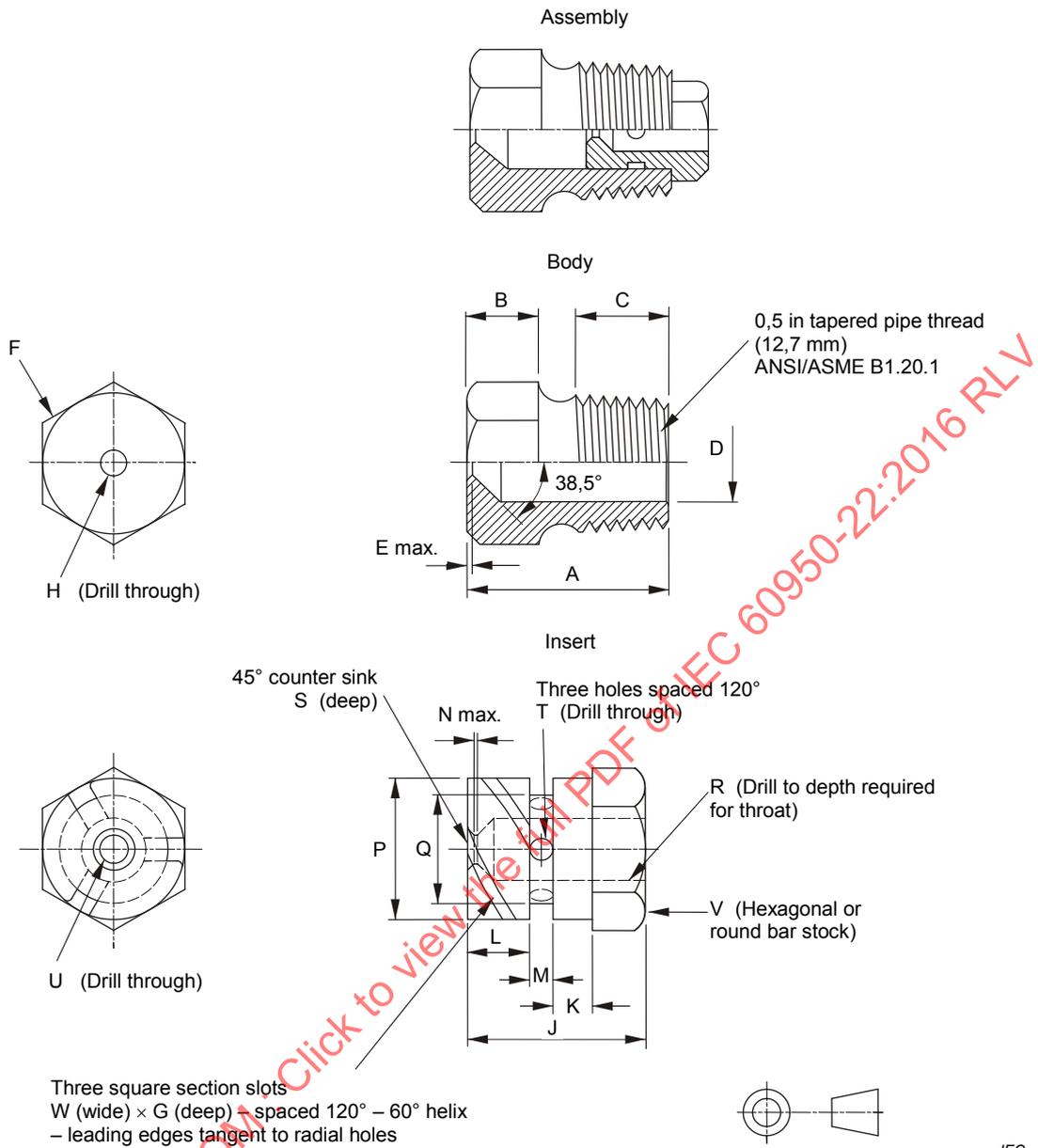
Piezometer assembly  
Detail A



**Key**

Item	mm
A	710
B	1 400
C	55
D	230
E	75

**Figure B.1 – Water-spray test spray-head piping**



Item	mm	Item	mm
A	31,0	N	0,80
B	11,0	P	14,61
C	14,0		14,63
D	14,68	Q	11,51
	14,73		11,53
E	0,40	R	63,5
F	Optional - To serve as a wrench grip	S	0,80
G	1,52	T	2,80
H	5,0	U	2,50
J	18,3	V	16,0
K	3,97	W	16,0
L	6,35		
M	2,38		

Figure B.2 - Water-spray test spray head

## **Annex C** (normative)

### **Ultraviolet light conditioning test** (see 8.2)

#### **C.1 Test apparatus**

Samples are exposed to ultraviolet light by using one of the following apparatus:

- a) a twin enclosed carbon-arc, (see Clause C.3), with continuous exposure for a minimum of 720 h. The test apparatus shall operate with a black-panel temperature of  $(63 \pm 3) ^\circ\text{C}$  in a relative humidity of  $(50 \pm 5) \%$ ; or
- b) a xenon-arc (see Clause C.4), with continuous exposure for a minimum of 1 000 h. The test apparatus shall operate with a 6 500 W, water-cooled xenon-arc lamp, a spectral irradiance of  $0,35 \text{ W/m}^2$  at 340 nm, a black-panel temperature of  $(63 \pm 3) ^\circ\text{C}$  in a relative humidity of  $(50 \pm 5) \%$ .

#### **C.2 Mounting of test samples**

The samples are mounted vertically on the inside of the cylinder of the light exposure apparatus, with the widest portion of the sample facing the arcs. They are mounted so that they do not touch each other.

#### **C.3 Carbon-arc light-exposure apparatus**

The apparatus described in ISO 4892-4, or equivalent, is used in accordance with the procedures given in ISO 4892-1 and ISO 4892-4 using a type 1 filter, with water spray.

#### **C.4 Xenon-arc light-exposure apparatus**

The apparatus described in ISO 4892-2, or equivalent, is used in accordance with the procedures given in ISO 4892-1 and ISO 4892-2 using method A, with water spray.

## Annex D (normative)

### Gasket tests (see 8.5)

#### D.1 Gasket tests

*The relevant tests specified in Clause D.2 or D.3, depending on the type of gasket material used, are applicable to gaskets employed on an ENCLOSURE subjected to water or dust. The additional test of Clause D.4 is applicable to gaskets employed on an ENCLOSURE subjected to oil or coolant. A set of three specimens of the gasket material shall be subjected to the relevant tests.*

#### D.2 Tensile strength and elongation tests

*This test is applicable to gaskets, which can stretch (such as O-rings). Gasket material shall be of such quality that samples subjected to a temperature of 69 °C to 70 °C in circulating air for 168 h have a tensile strength of not less than 75 % and an elongation of not less than 60 % of values determined for unaged samples. At the conclusion of the tests, there shall be no visible deterioration, deformation, melting, or cracking of the material and the material shall not harden as determined by normal hand flexing.*

#### D.3 Compression test

*This test is applicable to gaskets with closed cell construction. The set of specimens of gasket material shall be tested to the requirements of a), b) and c) (see Figure D.1). On completion of each test, the specimens shall not show signs of deterioration or cracks that can be seen with normal or corrected vision.*

- a) *A cylindrical weight sufficient to apply 69 kPa shall be placed on the middle portion of each specimen for a period of 2 h. At the end of that time the weight shall be removed and the specimen allowed to rest at a room temperature of 25 °C ± 3 °C for 30 min. The thickness of the gasket shall then be determined and compared with a measurement obtained before the application of the weight. The compression set shall not exceed 50 % of the initial thickness of the specimen.*
- b) *Following the test specified in a), the same specimens shall be suspended in an air oven at a temperature of 70° C for a period of 5 days. The specimens shall then be tested for compliance with a), approximately 24 h after removal from the oven.*
- c) *Following the test specified in b), the same specimens shall be cooled to the minimum temperature specified by the manufacturer or –33 °C if no minimum ambient temperature is specified for a period of 24 h and then subjected to an impact from a hammer of 1,35 kg mass falling from a height of 150 mm upon removal from the cold chamber. The hammer head shall be steel, 28,6 mm in diameter and have a flat striking surface, 25,4 mm in diameter with slightly rounded edges. The specimens being tested shall be placed on short lengths of 50 mm by 100 mm minimum wooden pieces (clear spruce) when being impacted. Following the impact the specimens shall be examined for evidence of cracking or other adverse effects. The test shall be continued and the specimens impacted every 24 h for two more days. The specimens shall then be removed from the cold chamber, allowed to rest at a room temperature of 25 °C ± 3 °C for approximately 24 h, and then again tested for compliance with a).*

NOTE For requirements in Finland, Norway and Sweden, see 4.1, Note 3.

### D.4 Oil immersion test

Gasket material shall not swell more than 25 % or shrink more than 1 % as a result of immersion in oil for 70 h at a room temperature of  $25 \text{ }^{\circ}\text{C} \pm 3 \text{ }^{\circ}\text{C}$ . Specifications are provided in ISO 18173:2005 or ASTM D471-98.

NOTE In Canada and United States, IRM Immersion Oil No. 903 is accepted.

Dimensions in millimetres

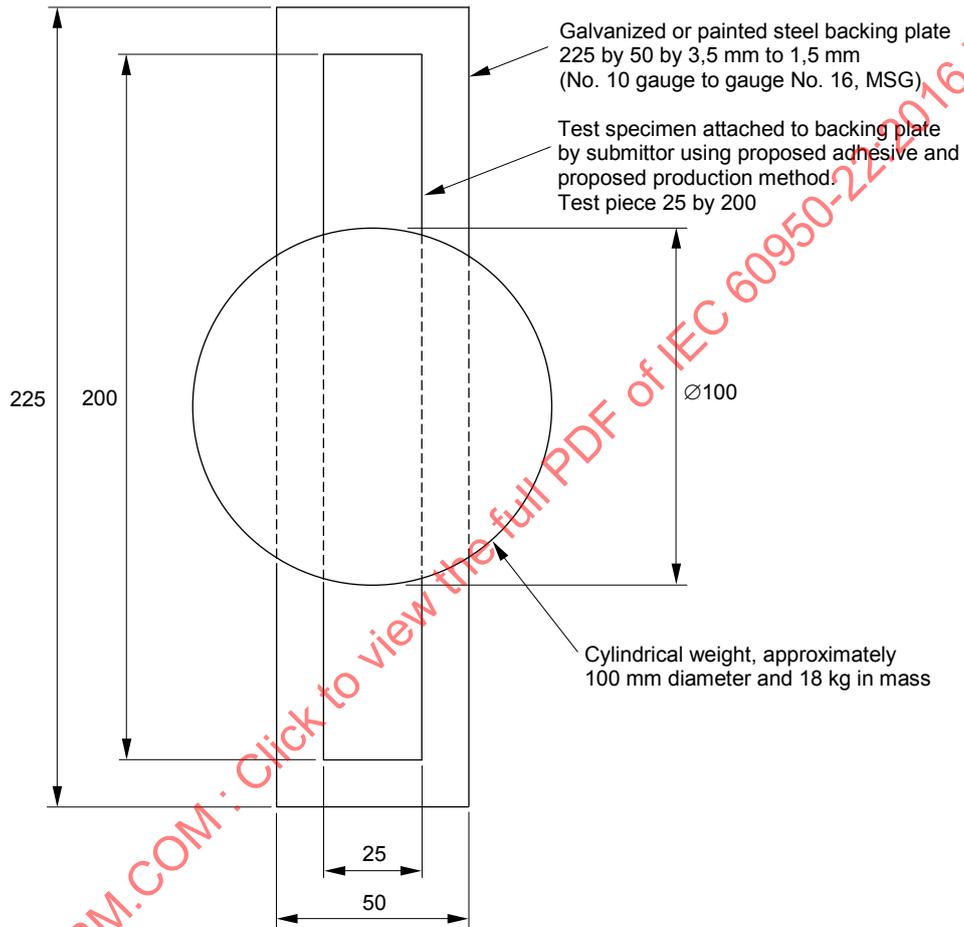


Figure D.1 – Gasket test

## **Annex E** (informative)

### **Rationale**

#### **E.1 General**

In preparing this part of IEC 60950, it has been assumed that:

- exterior to the OUTDOOR EQUIPMENT there should be no hazards, just as is the case with other information technology equipment;
- protection against vandalism and other purposeful acts will be treated as a product quality issue (for example, IEC 60950 should not contain requirements for the security of locks, types of acceptable screw head, forced entry tests, etc.).

#### **E.2 Electric shock**

It is believed that most aspects relating to protection against the risk of electric shock are adequately covered by IEC 60950-1:2005 including current proposals, and in some cases, quoted safety standards (in particular, the IEC 60364 series), and with the exception of the following, do not require modification. Specific requirements not already suitably addressed in IEC 60950-1 were considered as follows:

- clearing of earth faults for remotely located (exposed) information technology equipment;
- the degree of protection provided by the enclosure to rain, dust, etc.;
- the effect of moisture and pollution degree on the insulation of the enclosed parts;
- the possible consequences of ingress by plants and animals (since these could bridge or damage insulation);
- the maximum permissible touch voltage and body contact impedance for wet conditions.

It is noted that the voltage limits of USER-accessible circuits and parts in OUTDOOR LOCATIONS only are applicable to circuits and parts that are actually "USER-accessible". If the circuits and parts are not USER accessible (determined via application of accessibility probes) and are enclosed in ELECTRICAL ENCLOSURES, connectors and cable suitable for the outdoor application, including being subject to all relevant OUTDOOR ENCLOSURE testing, voltage limits for indoor locations may be acceptable based on the application. For example, a Power over Ethernet (PoE) surveillance camera mounted outdoors supplied by 48 V d.c. from PoE would be in compliance with Clause 6 if the ELECTRICAL ENCLOSURE met the applicable requirements for OUTDOOR ENCLOSURES.

#### **E.3 Energy related hazards**

It is believed that most aspects relating to protection against energy hazards for humans are adequately covered by IEC 60950-1. However, the level of available fault current at the point of mains supply to the equipment can be significantly higher and hence the rating of components would need to take this into account (underrating of components in this area can also result in a fire hazard).

#### **E.4 Fire**

It is believed that most aspects relating to protection against fire emanating from within the equipment are adequately covered by IEC 60950-1. However, certain measures that may be acceptable for equipment located inside a building would not be acceptable outdoors because they would permit the entry of rain, etc.

For certain types of OUTDOOR EQUIPMENT it could be appropriate to allow the 'no bottom FIRE ENCLOSURE required if mounted on a concrete base' exemption that presently can be used for equipment for use within a RESTRICTED ACCESS LOCATION.

### **E.5 Mechanical hazards**

It is believed that all aspects relating to protection against mechanical hazards emanating from the equipment are adequately covered by IEC 60950-1.

### **E.6 Heat related hazards**

It is believed that most aspects relating to protection against direct heat hazards are adequately covered by IEC 60950-1. However, it may be appropriate to permit higher limits for equipment that is unlikely to be touched by passers by (for example, equipment that is only intended to be pole mounted out of reach).

A default nominal ambient temperature range for OUTDOOR EQUIPMENT has been proposed. The effects of solar heating have not been addressed.

In addition to direct thermal hazards, there is a need to consider consequential hazards. For instance, some plastics become brittle as they become cold. An ENCLOSURE made from such brittle plastic could expose users to other hazards (for example, electrical or mechanical) if it were to break.

### **E.7 Radiation**

It is believed that most aspects relating to direct protection against radiation hazards are adequately covered by IEC 60950-1. However, there may be consequential hazards to consider.

Just as polymeric materials can be affected by low temperatures, they can also become embrittled due to the effect of UV radiation. An ENCLOSURE made from such brittle plastic could expose USERS to other hazards (for example, electrical or mechanical) if it were to break.

### **E.8 Chemical hazards**

It is believed that certain types of OUTDOOR EQUIPMENT need to have measures relating to chemical hazards originating within, or external to, the equipment.

Exposure to chemicals in the environment (for example, salt used to clear roads in the winter) can also cause problems.

### **E.9 Biological hazards**

These are not presently addressed in IEC 60950-1.

As with radiation hazards and chemical hazards, it is thought that there is not likely to be any direct biological hazard. However, plastics and some metals can be attacked by fungi or bacteria and this could result in weakening of protective ENCLOSURES. As stated under 'electric shock', the ingress of plants and animals could result in damage to insulation.

## E.10 Explosion hazards

OUTDOOR EQUIPMENT may need to be weather-tight, in such cases there is an increased probability that an explosive atmosphere can build up as a result of:

- hydrogen being produced as a result of charging lead-acid batteries within the equipment and;
- methane and other 'duct gasses' entering the equipment from the outdoors.

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ISO 14993, *Corrosion of metals and alloys – Accelerated testing involving cyclic exposure to salt mist, "dry" and "wet" conditions*

ISO 21207, *Corrosion tests in artificial atmospheres – Accelerated corrosion tests involving alternate exposure to corrosion-promoting gases, neutral salt-spray and drying*

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## COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

## MATÉRIELS DE TRAITEMENT DE L'INFORMATION – SÉCURITÉ –

## Partie 22: Matériels destinés à être installés à l'extérieur

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La Norme internationale IEC 60950-22 a été établie par le comité d'études 108 de l'IEC: Sécurité des appareils électroniques dans le domaine de l'audio, de la vidéo, du traitement de l'information et des technologies de la communication.

Cette deuxième édition annule et remplace la première édition parue en 2005. Cette édition constitue une révision technique.

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

- exigences plus détaillées pour la ventilation des batteries.

Le texte de cette norme est issu des documents suivants:

FDIS	Rapport de vote
108/615/FDIS	108/634/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à l'approbation de cette norme.

Cette publication a été rédigée selon les Directives ISO/IEC, Partie 2.

La présente Partie 22 de l'IEC 60950 est destinée à être utilisée avec l'IEC 60950-1:2005. Les paragraphes de l'IEC 60950-1 s'appliquent pour autant que cela soit raisonnable. Lorsque les aspects liés à la sécurité sont semblables à ceux de la Partie 1, l'article ou le paragraphe de la Partie 1 correspondant est présenté entre parenthèses à titre de référence après le titre de l'article ou du paragraphe de la Partie 22. Lorsqu'une exigence de la Partie 22 fait référence à une exigence ou à un critère de la Partie 1, une référence spécifique à l'IEC 60950-1 est faite.

Une liste de toutes les parties de la série IEC 60950, publiées sous le titre général *Matériels de traitement de l'information – Sécurité*, peut être consultée sur le site web de l'IEC.

Dans la présente norme, les caractères d'imprimerie suivants sont employés:

- exigences proprement dites et annexes normatives: caractères romains;
- *critères de conformité et modalités d'essais: caractères italiques;*
- notes dans le corps du texte et dans les tableaux: petits caractères romains;
- termes qui sont définis à l'Article 3 et dans l'IEC 60950-1: PETITES CAPITALES.

Les différentes pratiques suivantes, à caractère moins permanent, existent dans les pays indiqués ci-après:

- 4.1: Les matériels pour installation extérieure nécessitent une conception spéciale pour des températures pouvant descendre jusqu'à  $-50\text{ °C}$  (Finlande, Norvège, Suède),
- 4.3: Exigences d'élévation du potentiel de terre (États-Unis, Canada),
- 8.5.1: Exigences de types d'enveloppes (États-Unis, Canada),
- D.4: Au Canada et aux États-Unis, une huile d'immersion IRM No. 903 est acceptée (États-Unis, Canada).

Le comité a décidé que le contenu de cette publication 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 à la publication recherchée. À cette date, la publication sera

- reconduite,
- supprimée,
- remplacée par une édition révisée, ou
- amendée.

## INTRODUCTION

La présente norme propose des exigences de sécurité pour les matériels de traitement de l'information destinés à être installés, lorsqu'ils sont exposés entièrement ou partiellement, dans un endroit où la protection contre les intempéries et autres influences extérieures telles que la pluie, la poussière, etc., qui est en principe assurée par un bâtiment ou une autre structure, est limitée ou inexistante. Il existe de nombreux exemples de matériels de traitement de l'information utilisés à travers le monde, qui sont logés dans des ENVELOPPES spéciales situées sur le trottoir, montées dans des ensembles de matériels de télécommunications et situées sous terre. Actuellement, l'IEC 60950 ne propose pas d'exigences pour de tels matériels et cette proposition a pour objet de rectifier cette omission. Les exigences proposées ne s'appliquent pas aux matériels portables ou transportables qui peuvent être utilisés occasionnellement à l'extérieur, mais qui ne sont pas destinés à être installés dans des conditions de mauvais temps.

Il est prévu que le comité d'études 108 de l'IEC continue à coordonner les résultats de ses travaux avec d'autres comités d'études traitant des matériels installés à l'extérieur, tels que le comité d'études 70 de l'IEC (Degrés de protection procurés par les enveloppes, responsable de l'IEC 60529) et le comité d'études 48 de l'IEC (Connecteurs électriques et structures mécaniques pour les équipements électriques et électroniques).

L'Annexe E décrit les justifications à l'origine du traitement des aspects liés à la sécurité dans la présente norme.

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## MATÉRIELS DE TRAITEMENT DE L'INFORMATION – SÉCURITÉ –

### Partie 22: Matériels destinés à être installés à l'extérieur

#### 1 Domaine d'application

##### 1.1 Matériels couverts

La présente partie de l'IEC 60950 s'applique aux matériels de traitement de l'information destinés à être installés dans un EMBLEMMENT POUR INSTALLATION EXTERIEURE.

Les exigences pour les MATERIELS POUR INSTALLATION EXTERIEURE s'appliquent également, s'il y a lieu, aux ENVELOPPES POUR INSTALLATION EXTERIEURE adaptées pour une installation directe sur le terrain et fournies pour loger les matériels de traitement de l'information destinés à être installés dans un EMBLEMMENT POUR INSTALLATION EXTERIEURE.

##### 1.2 Exigences complémentaires

Chaque installation peut avoir des exigences particulières. Certains exemples sont donnés en 4.2. De plus, les exigences pour la protection des MATERIELS POUR INSTALLATION EXTERIEURE contre les effets des coups de foudre directs ne sont pas couvertes par la norme. Pour obtenir des informations concernant ce sujet, voir l'IEC 62305-1.

#### 2 Références normatives

Les documents suivants sont cités en référence de manière normative, en intégralité ou en partie, dans le présent document et sont indispensables pour son application. 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 60068-2-11, *Essais fondamentaux climatiques et de robustesse mécanique – Partie 2-11: Essais – Essai Ka: Brouillard salin*

IEC 60364 (toutes les parties), *Installations électriques à basse tension*

IEC 60529:1989, *Degrés de protection procurés par les enveloppes (Code IP)*

IEC 60529:1989/AMD1:1999

IEC 60529:1989/AMD2:2013

IEC 60950-1:2005, *Matériels de traitement de l'information – Sécurité – Partie 1: Exigences générales*

IEC 60950-1:2005/AMD1:2009

IEC 60950-1:2005/AMD2:2013

IEC 62368-1:2014, *Équipements des technologies de l'audio/vidéo, de l'information et de la communication – Partie 1: Exigences de sécurité*

ISO 178, *Plastiques – Détermination des propriétés en flexion*

ISO 179 (toutes les parties), *Plastiques – Détermination des caractéristiques au choc Charpy*

ISO 180, *Plastiques – Détermination de la résistance au choc Izod*

ISO 527(toutes les parties), *Plastiques – Détermination des propriétés en traction*

ISO 3231, *Peintures et vernis – Détermination de la résistance aux atmosphères humides contenant du dioxyde de soufre*

ISO 4892-1, *Plastiques – Méthodes d'exposition à des sources lumineuses de laboratoire – Partie 1: Guide général*

ISO 4892-2, *Plastiques – Méthodes d'exposition à des sources lumineuses de laboratoire – Partie 2: Lampes à arc au xénon*

ISO 4892-4, *Plastiques – Méthodes d'exposition à des sources lumineuses de laboratoire – Partie 4: Lampes à arc au carbone*

ISO 8256, *Plastiques – Détermination de la résistance au choc-traction*

ISO/TS 18173:2005, *Essais non destructifs – Termes généraux et définitions*

ASTM D471-98, *Standard Test Method for Rubber Property-Effect of Liquids* (disponible en anglais seulement)

### 3 Termes et définitions

Pour les besoins du présent document, les termes et définitions donnés dans l'IEC 60950-1 ainsi que les suivants s'appliquent.

#### 3.1

##### **EMPLACEMENT POUR INSTALLATION EXTERIEURE**

emplacement pour un matériel où la protection contre les intempéries et autres influences extérieures, assurée par un bâtiment ou une autre structure, est limitée ou inexistante

#### 3.2

##### **MATERIEL POUR INSTALLATION EXTERIEURE**

matériel spécifié par le fabricant pour être installé, lorsqu'il est exposé entièrement ou partiellement aux conditions, dans un EMPLACEMENT POUR INSTALLATION EXTERIEURE

Note 1 à l'article: Les MATERIELS TRANSPORTABLES, par exemple un ordinateur portable ou un ordinateur bloc-notes, ou encore un téléphone, ne sont pas des MATERIELS POUR INSTALLATION EXTERIEURE, à moins qu'ils ne soient spécifiés par le fabricant pour une utilisation continue dans un EMPLACEMENT POUR INSTALLATION EXTERIEURE.

#### 3.3

##### **ENVELOPPE POUR INSTALLATION EXTERIEURE**

partie du MATERIEL POUR INSTALLATION EXTERIEURE qui est exposée aux conditions défavorables dans un EMPLACEMENT POUR INSTALLATION EXTERIEURE et qui est destinée à protéger l'intérieur du matériel de ces conditions

Note 1 à l'article: Une ENVELOPPE POUR INSTALLATION EXTERIEURE peut également remplir une ou plusieurs des fonctions suivantes: ENVELOPPE CONTRE LE FEU, ENVELOPPE ELECTRIQUE, ENVELOPPE MECANIQUE.

Note 2 à l'article: Une enceinte ou un boîtier séparé(e) dans laquelle (lequel) le matériel est placé peut remplir la fonction d'une ENVELOPPE POUR INSTALLATION EXTERIEURE.

## 4 Conditions applicables aux matériels pour installation extérieure

### 4.1 Température ambiante

Les MATERIELS POUR INSTALLATION EXTERIEURE et les ENVELOPPES POUR INSTALLATION EXTERIEURE doivent être adaptés à une utilisation à une température quelconque dans la

plage spécifiée par le fabricant. Si elle n'est pas spécifiée par le fabricant, la plage doit être considérée comme:

- température ambiante minimale: –33 °C;
- température ambiante maximale: +40 °C.

*La conformité est vérifiée par examen et par évaluation des données fournies par le fabricant.*

NOTE 1 Les valeurs des températures sont basées sur la Classe 4K2 de l'IEC 60721-3-4. Ces températures ne prennent pas en compte les environnements sévères (par exemple extrêmement froids ou extrêmement chauds), et elles n'incluent pas les dispositions pour le chauffage par les rayonnements émis par le soleil (charge solaire).

NOTE 2 L'attention est attirée sur l'IEC 61587-1 pour des informations complémentaires sur les niveaux de performance C1, C2 et C3.

NOTE 3 En Finlande, en Norvège et en Suède, les températures en hiver peuvent être extrêmement basses. Pour les MATÉRIELS POUR INSTALLATION EXTERIEURE, cela nécessite une conception spéciale, de sorte que le matériel puisse supporter le transport, le montage et la mise en service à des températures pouvant descendre jusqu'à –50 °C.

## 4.2 Réseau d'alimentation

### 4.2.1 Généralités

Les MATÉRIELS POUR INSTALLATION EXTERIEURE alimentés par le réseau doivent être adaptés à la TENSION TRANSITOIRE SUR LE RESEAU la plus élevée prévue dans l'emplacement de l'installation.

Les éléments suivants doivent être pris en considération:

- le courant de défaut présumé de l'alimentation des MATÉRIELS POUR INSTALLATION EXTERIEURE peut être plus élevé que pour les matériels pour installation intérieure, voir l'IEC 60364-4-43; et
- la TENSION TRANSITOIRE SUR LE RESEAU pour les MATÉRIELS POUR INSTALLATION EXTERIEURE peut être plus élevée que pour les matériels pour installation intérieure.

Dans une certaine catégorie de surtension, les composants à l'intérieur des MATÉRIELS POUR INSTALLATION EXTERIEURE qui nécessitent la TENSION TRANSITOIRE SUR LE RESEAU ou le courant de défaut présumé doivent être conformes aux exigences de la série IEC 61643.

NOTE 1 La catégorie de surtension des MATÉRIELS POUR INSTALLATION EXTERIEURE est en principe considérée comme étant l'une des suivantes:

- s'ils sont alimentés par l'installation électrique normale des bâtiments, catégorie de surtension II;
- s'ils sont alimentés directement par le système de distribution réseau, catégorie de surtension III;
- s'ils sont situés au niveau ou à proximité de l'origine de l'installation électrique, catégorie de surtension IV.

NOTE 2 Pour des informations supplémentaires concernant la protection contre les surtensions, voir l'IEC 60364-5-53.

*La conformité est vérifiée par examen du matériel et des instructions d'installation.*

### 4.2.2 Tension transitoire de réseau sur le réseau d'alimentation en courant alternatif

Les matériels qui sont des parties de l'installation du bâtiment ou qui peuvent être soumis à des surtensions transitoires dépassant celles de la catégorie de surtension II doivent être conçus pour la catégorie de surtension III ou IV, à moins qu'une protection supplémentaire ne soit prévue à l'intérieur ou à l'extérieur du matériel. Dans ce cas, les instructions d'installation doivent indiquer la nécessité d'une telle protection supplémentaire. Les distances dans l'air dans les matériels conçus pour la catégorie de surtension III ou IV doivent être conformes à l'Annexe G de l'IEC 60950-1:2005. Le système d'isolation utilisé dans ces matériels doit être capable de résister à la tension d'essai indiquée dans le Tableau 5C de l'IEC 60950-1:2005/AMD2:2013.

### 4.2.3 Tension transitoire de réseau sur le réseau d'alimentation en courant continu

Le transitoire sur un RESEAU D'ALIMENTATION EN COURANT CONTINU dépend de la source et de l'installation du RESEAU D'ALIMENTATION EN COURANT CONTINU. Lors de la détermination de la TENSION TRANSITOIRE SUR LE RESEAU EN COURANT CONTINU, l'installation et la source du RESEAU EN COURANT CONTINU doivent être prises en compte. Si celles-ci ne sont pas connues, la TENSION TRANSITOIRE SUR LE RESEAU sur le RESEAU D'ALIMENTATION en courant continu doit être considérée de 1,5 kV.

Le fabricant doit déclarer la TENSION TRANSITOIRE SUR LE RESEAU sur le RESEAU D'ALIMENTATION en courant continu dans les instructions d'installation.

### 4.3 Élévation du potentiel de terre

L'attention est attirée sur le fait que pendant les conditions de suppression des défauts, des TENSIONS DANGEREUSES peuvent exister et être accessibles pendant des périodes plus longues que pour les matériels pour installation intérieure et des conditions de mise à la terre particulières peuvent être nécessaires. Celles-ci sont généralement spécifiées dans les réglementations locales d'installation.

NOTE Aux États-Unis, ces exigences sont regroupées dans le Code électrique national ("National Electrical Code"). Au Canada, elles sont regroupées dans le Code électrique canadien ("Canadian Electrical Code").

*La conformité est vérifiée par évaluation des instructions d'installation.*

## 5 Marquages et instructions

Les instructions d'installation pour les MATÉRIELS POUR INSTALLATION EXTERIEURE doivent inclure les détails de toutes les caractéristiques spéciales nécessaires pour la protection contre les conditions dans les EMPLACEMENTS POUR INSTALLATION EXTERIEURE (voir 1.7.2 de l'IEC 60950-1:2005).

Si un fabricant d'ENVELOPPE POUR INSTALLATION EXTERIEURE classe un produit conformément à l'IEC 60529, le code IP doit être déclaré; cependant, il n'est pas nécessaire qu'il marque le code IP sur l'ENVELOPPE POUR INSTALLATION EXTERIEURE. Il n'est pas nécessaire de faire une telle déclaration pour les MATÉRIELS POUR INSTALLATION EXTERIEURE.

*La conformité est vérifiée par examen.*

## 6 Protection contre les chocs électriques dans un emplacement pour installation extérieure

### 6.1 Limites de tension des parties accessibles à l'utilisateur dans les emplacements pour installation extérieure

Les parties conductrices accessibles à l'UTILISATEUR dans un EMPLACEMENT POUR INSTALLATION EXTERIEURE doivent satisfaire aux exigences pour un CIRCUIT TBTS de 2.2.2 et 2.2.3 de l'IEC 60950-1:2005/AMD2:2013, à l'exception que les limites de tension ne doivent pas dépasser:

- 15 V en courant alternatif, 21,2 V en valeur de crête, ou 30 V en courant continu, dans les conditions normales de fonctionnement (voir 2.2.2),
- 15 V en courant alternatif, 21,2 V en valeur de crête, ou 30 V en courant continu, pendant une durée supérieure à 0,2 s, dans les conditions de premier défaut (voir 2.2.3). De plus, la tension ne doit pas dépasser 30 V en courant alternatif, 42,4 V en valeur de crête, ou 60 V en courant continu.

L'exception de 2.2.3 de l'IEC 60950-1:2005/AMD2:2013 relative à 2.3.2.1 b) de la même publication ne s'applique pas aux parties conductrices accessibles à l'UTILISATEUR.

NOTE 1 Des limites de tension inférieures s'appliquent parce que la résistance de contact du corps est réduite lorsqu'il est soumis à des conditions humides.

NOTE 2 Au Danemark, les règles d'installation exigent que la tension nominale sûre au toucher maximale soit de 6 V en courant alternatif en valeur efficace ou de 15 V en courant continu sans ondulation pour l'environnement extérieur, où l'installation peut être en principe humide ou mouillée en raison des conditions météorologiques y compris les zones équipées d'abris, mais pas dans des murs protégés, par exemple les abris d'autos.

*La conformité est vérifiée par mesurage.*

## **6.2 Circuits à limitation de courant dans les emplacements pour installation extérieure**

Les exigences de 2.4 de l'IEC 60950-1:2005/AMD1:2009/AMD2:2013 s'appliquent sans modification.

## **6.3 Protection du socle de prise de courant dans les emplacements pour installation extérieure**

Un Dispositif de protection à courant Différentiel Résiduel (DDR) avec un courant de fonctionnement résiduel assigné ne dépassant pas 30 mA doit être utilisé dans le RESEAU D'ALIMENTATION pour les socles de prises de courant destinés à une utilisation générale et avec un courant assigné ne dépassant pas 20 A.

Le DDR doit être une partie intégrante du matériel ou de l'installation du bâtiment. Si le DDR fait partie de l'installation du bâtiment, des instructions pour les installations du DDR doivent être fournies avec le matériel.

## **7 Bornes pour les conducteurs externes**

Les connexions du réseau d'alimentation pour les MATERIELS POUR INSTALLATION EXTERIEURE qui sont destinés à être alimentés:

- par l'installation électrique normale des bâtiments doivent être telles que spécifiées en 3.3 de l'IEC 60950-1:2005/AMD2:2013;
- directement par le système de distribution réseau doivent être telles que spécifiées dans la série IEC 60364.

NOTE Pour les autres bornes, l'IEC 60950-1 s'applique.

*La conformité est vérifiée par examen.*

## **8 Exigences de construction pour les enveloppes pour installation extérieure**

### **8.1 Généralités**

La protection contre la corrosion doit être fournie par l'utilisation de matériaux adaptés ou par l'application d'un revêtement de protection appliqué sur la surface exposée, en prenant en considération les conditions prévues d'utilisation.

Les parties, telles que les cadrans ou les connecteurs qui servent de partie fonctionnelle d'une ENVELOPPE POUR INSTALLATION EXTERIEURE doivent être conformes aux mêmes exigences de protection de l'environnement que pour l'ENVELOPPE POUR INSTALLATION EXTERIEURE.

NOTE 1 Les aspects affectant la sécurité qui exigent l'intégrité de l'ENVELOPPE POUR INSTALLATION EXTERIEURE pendant toute la durée de vie du produit comprennent:

- une protection continue contre l'accès aux parties dangereuses, y compris après des essais de résistance mécanique;
- une protection continue contre la pénétration de poussières et d'eau;
- une disponibilité sans interruption de la continuité de terre.

Une ENVELOPPE POUR INSTALLATION EXTERIEURE ne doit pas être utilisée pour transporter du courant au cours d'un fonctionnement normal, si cela peut entraîner une corrosion qui compromettrait la sécurité. Cela n'exclut pas la connexion d'une partie conductrice d'une ENVELOPPE POUR INSTALLATION EXTERIEURE à la terre de protection dans le cadre du transport des courants de défaut.

NOTE 2 L'action d'un courant circulant à travers un joint peut augmenter la corrosion dans des conditions humides.

Lorsqu'une partie conductrice d'une ENVELOPPE POUR INSTALLATION EXTERIEURE est connectée à la terre de protection dans le cadre du transport des courants de défaut, la connexion résultante doit satisfaire aux exigences de 2.6 de l'IEC 60950-1:2005/AMD1:2009/AMD2:2013, après les essais appropriés de conditionnement atmosphérique, voir 8.3.

*La conformité est vérifiée par examen et, si nécessaire, par les essais de 2.6 de l'IEC 60950-1:2005/AMD1:2009/AMD2:2013 et de 8.3 de la présente norme.*

## 8.2 Résistance aux rayonnements ultraviolets

Les pièces non métalliques d'une ENVELOPPE POUR INSTALLATION EXTERIEURE exigées pour la conformité à la présente norme doivent être suffisamment résistantes à la dégradation par les rayonnements ultraviolets (UV).

**Tableau 1 – Limites minimales de rétention des propriétés après exposition UV**

Pièces à soumettre à l'essai	Propriété	Norme à appliquer pour la méthode d'essai	Rétention minimale après essai
Pièces fournissant un support mécanique	Résistance à la traction <sup>a</sup> ou	ISO 527	70 %
	Résistance à la flexion <sup>a, b</sup>	ISO 178	70 %
Pièces fournissant une résistance aux chocs	Choc de Charpy <sup>c</sup> ou	ISO 179	70 %
	Choc Izod <sup>c</sup> ou	ISO 180	70 %
	Choc de traction <sup>c</sup>	ISO 8256	70 %
Toutes les pièces	Classification d'inflammabilité	1.2.12 et Annexe A de l'IEC 60950-1:2005	voir <sup>d</sup>

<sup>a</sup> Les essais de résistance à la traction et de résistance à la flexion doivent être effectués sur des éprouvettes dont l'épaisseur n'est pas supérieure à l'épaisseur réelle.

<sup>b</sup> La face des échantillons exposés au rayonnement UV doit être en contact avec les deux points de charge quand la méthode aux trois points de charge est utilisée.

<sup>c</sup> Les essais sont effectués sur des éprouvettes de 3,0 mm d'épaisseur pour l'essai de choc Izod et l'essai de traction et sur des éprouvettes de 4,0 mm d'épaisseur pour l'essai au choc de Charpy. Ils sont considérés comme représentatifs d'autres épaisseurs, descendant jusqu'à 0,8 mm.

<sup>d</sup> La classification vis-à-vis de l'inflammabilité peut changer tant qu'elle ne tombe pas en dessous de ce qui est spécifié à l'Article 4 de l'IEC 60950-1:2005/AMD1:2009/AMD2:2013.

*La conformité est vérifiée par examen de la construction et des données disponibles concernant les caractéristiques de la résistance au rayonnement UV du matériau d'ENVELOPPE*

et de tout revêtement de protection associé. Si de telles données ne sont pas disponibles, les essais du Tableau 1 sont effectués sur ces pièces.

Les échantillons prélevés sur les pièces, ou constitués d'un matériau identique, sont préparés en conformité avec la norme pour l'essai à effectuer. Ils sont alors conditionnés selon l'Annexe C. Après conditionnement, les échantillons ne doivent pas présenter de signes d'une détérioration significative, telles des craquelures ou des fissures. Ils sont alors maintenus dans les conditions de température ambiante de la pièce pendant au moins 16 h et pas plus de 96 h, après quoi ils sont soumis à l'essai applicable, en conformité avec la norme qui définit cet essai.

De manière à évaluer le pourcentage de rétention des propriétés après essai, les échantillons qui n'ont pas été conditionnés selon l'Annexe C sont soumis aux essais en même temps que les échantillons conditionnés. La rétention doit être telle que spécifiée dans le Tableau 1.

### 8.3 Résistance à la corrosion

#### 8.3.1 Généralités

Les pièces métalliques des ENVELOPPES POUR INSTALLATION EXTERIEURE, avec ou sans revêtement de protection, doivent être résistantes aux effets des contaminants d'origine hydrique.

La conformité est vérifiée:

- par examen et par évaluation des données fournies par le fabricant; ou
- par les essais et les critères spécifiés de 8.3.2 à 8.3.4; ou
- par le niveau de performance applicable (A1, A2 ou A3) de l'IEC 61587-1.

#### 8.3.2 Appareillage d'essai

L'appareillage pour l'essai au brouillard salin doit comprendre une chambre d'essai et des pulvérisateurs tels que décrits dans l'IEC 60068-2-11.

L'appareillage pour l'essai dans une atmosphère contenant du dioxyde de soufre saturée d'eau doit comprendre une chambre inerte, scellée hermétiquement, renfermant une atmosphère contenant du dioxyde de soufre saturée d'eau (voir Annexe A) dans laquelle les éprouvettes d'essai et leurs supports sont maintenus. La chambre est telle que décrite dans l'ISO 3231.

#### 8.3.3 Procédure d'essai

L'essai doit comprendre deux périodes de 12 jours identiques et successives.

Chaque période de 12 jours comprend l'essai a) suivi de l'essai b):

essai a) – 168 h d'exposition à l'atmosphère de brouillard salin. La concentration de la solution saline formant l'atmosphère de brouillard salin est de  $5\% \pm 1\%$  en masse et la température de la chambre d'essai est maintenue à  $35\text{ °C} \pm 2\text{ °C}$ .

essai b) – 5 cycles d'exposition, chacun d'entre eux consistant en une exposition de 8 h à une atmosphère riche en dioxyde de soufre saturée d'eau (voir Annexe A), au cours de laquelle la température de la chambre d'essai est maintenue à  $40\text{ °C} \pm 3\text{ °C}$ , suivie d'une période de repos de 16 h, avec la porte de la chambre d'essai ouverte.

Après chaque période de 12 jours, les éprouvettes d'essai sont nettoyées avec de l'eau déminéralisée.

*En variante, les procédures d'essai décrites dans les normes suivantes peuvent être utilisées pour démontrer la conformité:*

- *Méthode B de l'ISO 21207; ou*
- *ISO 14993; ou*
- *toute autre norme équivalente.*

#### **8.3.4 Critères de conformité**

*La conformité est vérifiée par examen visuel. Le matériel ne doit pas présenter de traces de rouille, autre que la corrosion superficielle du revêtement de protection, de craquelures ni autres détériorations qui compromettent les aspects de sécurité suivants:*

- *la protection continue contre l'accès aux parties dangereuses, y compris après des essais de résistance mécanique; et*
- *la protection continue contre la pénétration de poussières et d'eau; et*
- *la disponibilité sans interruption de continuité de terre.*

*Cependant, la corrosion superficielle du revêtement de protection est permise.*

#### **8.4 Fonds des enveloppes contre le feu**

Le fond d'une ENVELOPPE CONTRE LE FEU d'un MATERIEL POUR INSTALLATION EXTERIEURE doit être conforme à 4.6.2 de l'IEC 60950-1:2005, sauf s'il n'y a aucune exigence pour les fonds des ENVELOPPES CONTRE LE FEU d'un MATERIEL POUR INSTALLATION EXTERIEURE, à condition que les instructions d'installation spécifient que le matériel doit être monté directement et en permanence sur une surface non combustible (par exemple en béton ou en métal). Il n'y a pas de nécessité de marquage sur le matériel.

*La conformité est vérifiée par examen.*

#### **8.5 Joints d'étanchéité**

##### **8.5.1 Généralités**

Lorsque des joints sont utilisés comme méthode de protection contre la pénétration de contaminants potentiels, les paragraphes 8.5.1 à 8.5.3 doivent s'appliquer selon ce qui est approprié.

NOTE Au Canada et aux États-Unis, les types d'ENVELOPPES sont spécifiés dans le Code électrique canadien et le Code électrique national américain.

Les joints pour tous les dispositifs fermant les ouvertures dans la cavité du matériel d'une ENVELOPPE soumise à une éclaboussure ou une fuite d'huile, ainsi que toute porte ou couvercle pour une telle ENVELOPPE, doivent inclure un joint d'étanchéité sur toute la longueur du joint.

Un joint d'étanchéité en matériau thermoplastique ou en élastomère ou un joint d'étanchéité utilisant une composition de matériaux élastomère qui est fourni sur une ENVELOPPE soumise à de l'eau ou de la poussière doit satisfaire aux exigences de la présente norme.

*La conformité est vérifiée par examen et en appliquant les essais correspondants de l'Annexe D.*

##### **8.5.2 Résistance à l'huile**

Un joint d'étanchéité fourni sur une ENVELOPPE soumise à de l'huile ou à un fluide frigorigène doit être résistant à l'huile.