
Fire detection and alarm systems —
Part 18:
Input/output devices

Systèmes de détection et d'alarme d'incendie —
Partie 18: Dispositifs d'entrée/sortie

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 21, *Equipment for fire protection and fire fighting*, Subcommittee SC 3, *Fire detection and alarm systems*.

This second edition cancels and replaces the first edition (ISO 7240-18:2009), which has been technically revised with the following changes:

- in [5.12](#) (electromagnetic compatibility immunity tests), EN 50130-4 has been replaced by IEC 62599-2;
- marking has been moved to a new [Clause 7](#);
- data and software requirements have been moved to a new [Clause 8](#).

A list of all the parts in the ISO 7240 series can be found on the ISO website.

Introduction

The term input/output devices, used in this document, covers a wide range of different types of devices that are intended for different applications and can, therefore, have different functions. This document does not, therefore, include detailed functional requirements for the input/output devices but requires that their function is sufficiently specified by the manufacturer and that they function correctly in accordance with the manufacturer's specification.

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Fire detection and alarm systems —

Part 18: Input/output devices

1 Scope

This document specifies requirements, test methods and performance criteria for input/output devices connected to a transmission path of a fire detection and alarm system used to receive and/or transmit signals to or from the transmission path, necessary for the operation of the fire detection and fire alarm system and/or fire protection system.

An input/output device can be a physically separate device or its function can be integrated into another device, in which case this document can be used to assess this function.

This document is applicable to input/output devices which include signal amplifiers and signal transfer in separate enclosures.

Control and indicating equipment and ancillary control and indicating equipment (e.g. repeater panels and fire brigade panels) are not covered by this document.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 7240-1, *Fire detection and alarm systems — Part 1: General and definitions*

IEC 60068-1, *Environmental testing — Part 1: General and guidance*

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

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

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

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

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

IEC 60068-2-42, *Environmental testing — Part 2-42: Tests — Test Kc: Sulphur dioxide test for contacts and connections*

IEC 60068-2-75, *Environmental testing — Part 2-75: Tests — Test Eh: Hammer tests*

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

IEC 62599-2, *Alarm systems — Part 2: Electromagnetic compatibility — Immunity requirements for components of fire and security alarm systems*

3 Terms, definitions and abbreviated terms

For the purposes of this document, the terms and definitions given in ISO 7240-1 and the following apply.

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

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

3.1 Terms and definitions

3.1.1 conditioning

exposure of a specimen to environmental conditions in order to determine the effect of such conditions on the specimen

3.1.2 recovery

treatment of a specimen, after *conditioning* (3.1.1), so that the properties of the specimen may be stabilized before measurement

3.2 Abbreviated terms

FDCIE	fire detection control and indicating equipment
EMC	electromagnetic compatibility

4 Requirements

4.1 Compliance

4.1.1 In order to comply with this document, the input/output device shall:

- a) meet the requirements of [Clause 4](#), which shall be verified by visual inspection or engineering assessment,
- b) be tested as specified in [Clause 5](#), and shall meet the requirements of the tests, and
- c) meet the requirements of [Clauses 7](#) and [8](#), which shall be verified by visual inspection.

4.1.2 For input/output devices integrated into another device that is already covered by an existing part of ISO 7240, the environmental conditioning shall be performed in accordance with that part of ISO 7240, with the addition of the functional tests before, during and/or after conditioning, as required in this document. In some detector standards, the dry heat (operational) test is conducted in special test equipment (e.g. in the heat tunnel for heat detectors). The required functional testing of the integrated input/output device before, during and after the dry heat conditioning may be done with this equipment, if this is possible without disrupting the detector measurements. Otherwise, a separate dry heat test, with the same conditioning, shall be conducted. For heat detectors, the test temperature is the maximum application temperature.

4.2 Monitoring of detachable devices

If an input/output device is detachable (i.e. it is attached to a detachable mounting base), then a means shall be provided for a remote monitoring system (e.g. the FDCIE) to detect the removal of the device from the base, in order to give a fault signal.

4.3 Requirements for software controlled devices

4.3.1 General

For input/output devices that rely on software control in order to fulfil the requirements of this document, the requirements of 4.3.2 and 4.3.3 shall be met.

4.3.2 Software design

In order to ensure the reliability of the device, the following requirements for software design shall apply.

- a) The software shall have a modular structure.
- b) The design of the interfaces for manually and automatically generated data shall not permit invalid data to cause error in the program operation.
- c) The software shall be designed to avoid the occurrence of deadlock of the program flow.

4.3.3 Storage of programs and data

4.3.3.1 The program necessary to comply with this document and any preset data, such as manufacturer's settings, shall be held in non-volatile memory. Writing to areas of memory containing this program and data shall be possible only by the use of some special tool or code and shall not be possible during normal operation of the device.

4.3.3.2 Site-specific data shall be held in memory that can retain data for at least two weeks without external power to the device, unless provision is made for the automatic renewal of such data, following loss of power, within 1 h of power being restored.

5 Tests

5.1 General

5.1.1 Atmospheric conditions for tests

5.1.1.1 Unless otherwise stated in a test procedure, carry out the testing after the test specimen has been allowed to stabilize in the standard atmospheric conditions for testing as specified in IEC 60068-1 as follows:

- temperature: (15 to 35) °C;
- relative humidity: (25 to 75) %;
- air pressure: (86 to 106) kPa.

5.1.1.2 The temperature and humidity shall be substantially constant for each environmental test where the standard atmospheric conditions are applied.

5.1.2 Mounting arrangements

The specimen shall be mounted by its normal means of attachment in accordance with the manufacturer's instructions. If these instructions describe more than one method of mounting, then the method considered to be most unfavourable shall be chosen for each test.

5.1.3 Operating conditions for tests

5.1.3.1 If a test method requires that a specimen be operational, then the specimen shall be connected to suitable supply and monitoring equipment with characteristics as required by the manufacturer's data. Unless otherwise specified in the test method, the supply parameters applied to the specimen shall be set within the manufacturer's specified range(s) and shall remain substantially constant throughout the tests. The value chosen for each parameter shall normally be the nominal value or the mean of the specified range.

5.1.3.2 The details of the supply and monitoring equipment used shall be given in the test report (see [Clause 6](#)).

5.1.4 Tolerances

5.1.4.1 Unless otherwise stated, the tolerances for the environmental test parameters shall be as given in the basic reference standards for the test, e.g. the relevant parts of IEC 60068-2.

5.1.4.2 If a requirement or test procedure does not specify a tolerance or deviation limits, then deviation limits of $\pm 5\%$ shall be applied.

5.1.5 Functional test

Each function of the input/output device shall be activated by a suitable means in accordance with the manufacturer's specification and appropriate observations or measurements shall be made to confirm the correct operation of the device.

NOTE The variety and the diversity of the equipment within the scope of this document make it difficult to define the precise details of this functional test. This functional test is intended to exercise each function of the device in a simple way. A more complete assessment of the performance of these functions, in accordance with the manufacturer's specification, is made in the performance and variation in supply voltage test (see [5.2](#)).

5.1.6 Provision for tests

5.1.6.1 Twelve specimens are required to conduct the tests as indicated in the test schedule (see [5.1.7](#)). These specimens shall be numbered 1 to 12 arbitrarily.

5.1.6.2 The number of specimens may be reduced to a minimum of nine if the same specimen is used for more than one EMC test (see footnote in [Table 1](#)).

5.1.6.3 The specimens submitted shall be representative of the manufacturer's normal production with regard to their construction.

5.1.7 Test schedule

The specimens shall be tested according to the test schedule in [Table 1](#).

Table 1 — Test schedule for input/output devices

Test	Subclause	Specimen number
Performance and variation of supply parameters	5.2	1
Dry heat (operational)	5.3	2
Cold (operational)	5.4	2
Damp heat, cyclic (operational)	5.5	3
Damp heat, steady-state (endurance)	5.6	4
Sulfur dioxide (SO ₂) corrosion (endurance)	5.7	5
Shock (operational)	5.8	6
Impact (operational)	5.9	7
Vibration, sinusoidal (operational)	5.10	8
Vibration, sinusoidal (endurance)	5.11	8
Electromagnetic compatibility (EMC), immunity tests	5.12	9, 10, 11, 12 ^a

^a In the interests of test economy, it is permitted to use the same specimen for more than one EMC test. In that case, intermediate functional test(s) on the specimen(s) used for more than one test may be deleted and the functional test conducted at the end of the sequence of tests. However, it should be noted that in the event of a failure, it might not be possible to identify which test exposure caused the failure (see of IEC 62599-2).

5.2 Performance and variation in supply parameters

5.2.1 Object of test

To demonstrate the ability of the input/output device to function correctly in accordance with the manufacturer's specifications, at the upper and lower limits of the supply parameters specified by the manufacturer.

5.2.2 Test procedure

5.2.2.1 Mount the specimen to be tested as specified in [5.1.2](#) and connect to the supply and monitoring equipment specified in [5.1.3](#).

5.2.2.2 Test the performance of each function of the specimen according to the manufacturer's specification, at the upper and at the lower limits of the supply parameter (e.g. voltage) range(s).

5.2.2.3 Include tests and measurements in all operating modes with the maximum and minimum parameters and parameter settings specified by the manufacturer for the input and/or output lines (see [4.3.2](#)).

5.2.2.4 If it is not possible to adjust the input/output device's supply voltage to the upper and lower limits, then test the performance at the worst-case conditions of the supply voltage to the supply and monitoring equipment and of the line impedance allowed by the manufacturer's specifications.

5.2.3 Requirements

The specimen shall function correctly within the manufacturer's specifications.

5.3 Dry heat (operational)

5.3.1 Object of test

To demonstrate the ability of the specimen to function correctly at high ambient temperatures that can occur for short periods in the service environment.

5.3.2 Test procedure

5.3.2.1 General

Use the test apparatus and perform the procedure as specified in IEC 60068-2-2, Test Bb, and in [5.3.2.2](#) to [5.3.2.6](#).

5.3.2.2 Initial measurements

Before conditioning, conduct the functional test as specified in [5.1.5](#).

5.3.2.3 State of the specimen during conditioning

Mount the specimen as described in [5.1.2](#) and connect it to supply and monitoring equipment as described in [5.1.3](#).

5.3.2.4 Conditioning

Apply the following conditioning:

- temperature: $(55 \pm 2) ^\circ\text{C}$;
- duration: 16 h.

5.3.2.5 Measurements during conditioning

5.3.2.5.1 Monitor the specimen during the conditioning period to detect any unwanted or unspecified functioning.

5.3.2.5.2 During the last hour of the conditioning period, conduct a functional test as specified in [5.1.5](#).

5.3.2.6 Final measurements

After a recovery period of at least 1 h at the standard laboratory conditions, conduct the functional test as specified in [5.1.5](#).

5.3.3 Requirements

5.3.3.1 No unwanted or unspecified function shall occur during conditioning.

5.3.3.2 In the functional tests, the specimen shall function correctly as specified by the manufacturer.

5.4 Cold (operational)

5.4.1 Object of test

To demonstrate the ability of the specimen to function correctly at low ambient temperatures appropriate to the anticipated service environment.

5.4.2 Test procedure

5.4.2.1 General

Use the test apparatus and perform the procedure in IEC 60068-2-1, Test Ab, and in [5.4.2.2](#) to [5.4.2.6](#).

5.4.2.2 Initial measurements

Before conditioning, conduct the functional test as specified in [5.1.5](#).

5.4.2.3 State of the specimen during conditioning

Mount the specimen as described in [5.1.2](#) and connect it to supply and monitoring equipment as described in [5.1.3](#).

5.4.2.4 Conditioning

Apply the following conditioning:

- temperature: (-10 ± 3) °C;
- duration: 16 h.

5.4.2.5 Measurements during conditioning

5.4.2.5.1 Monitor the specimen during the conditioning period to detect any unwanted or unspecified functioning.

5.4.2.5.2 During the last hour of the conditioning period, conduct a functional test as specified in [5.1.5](#).

5.4.2.6 Final measurements

After a recovery period of at least 1 h at the standard laboratory conditions, conduct the functional test as specified in [5.1.5](#).

5.4.3 Requirements

5.4.3.1 No unwanted or unspecified function shall occur during conditioning.

5.4.3.2 In the functional tests, the specimen shall function correctly as specified by the manufacturer.

5.5 Damp heat, cyclic (operational)

5.5.1 Object of test

To demonstrate the ability of the specimen to function correctly at high relative humidity (with condensation) that can occur for short periods in the anticipated service environment.

5.5.2 Test procedure

5.5.2.1 General

Use the test apparatus and perform the procedure as specified in IEC 60068-2-30, Test Db, using the variant 1 test cycle and controlled recovery conditions, and in [5.5.2.2](#) to [5.5.2.6](#).

5.5.2.2 Initial measurements

Before conditioning, conduct the functional test as specified in [5.1.5](#).

5.5.2.3 State of the specimen during conditioning

Mount the specimen as described in [5.1.2](#) and connect it to supply and monitoring equipment as described in [5.1.3](#).

5.5.2.4 Conditioning

Apply the following conditioning:

- lower temperature: (25 ± 3) °C at >95 % RH;
- upper temperature: (40 ± 2) °C;
- relative humidity at upper temperature: (93 ± 3) %;
- number of cycles: 2.

5.5.2.5 Measurements during conditioning

5.5.2.5.1 Monitor the specimen during the conditioning period to detect any unwanted or unspecified functioning.

5.5.2.5.2 During the last hour of the conditioning period, conduct a functional test as specified in [5.1.5](#).

5.5.2.6 Final measurements

After the recovery period, conduct the functional test as specified in [5.1.5](#).

5.5.3 Requirements

5.5.3.1 No unwanted or unspecified function shall occur during conditioning.

5.5.3.2 In the functional tests, the specimen shall function correctly as specified by the manufacturer.

5.6 Damp heat, steady-state (endurance)

5.6.1 Object of test

To demonstrate the ability of the specimen to withstand the long-term effects of humidity in the service environment, e.g. changes in electrical properties of materials, chemical reactions involving moisture and galvanic corrosion.

5.6.2 Test procedure

5.6.2.1 General

Use the test apparatus and perform the procedure as specified in IEC 60068-2-78, Test Cab, and in [5.6.2.2](#) to [5.6.2.5](#).

5.6.2.2 Initial measurements

Before conditioning, conduct the functional test as specified in [5.1.5](#).

5.6.2.3 State of the specimen during conditioning

Mount the specimen as described in [5.1.3](#) but do not supply it with power during the conditioning.

5.6.2.4 Conditioning

Apply the following conditioning:

- temperature: (40 ± 2) °C;
- relative humidity: (93 ± 3) %;
- duration: 21 d.

5.6.2.5 Final measurements

After a recovery period of at least 1 h at the standard laboratory conditions, conduct the functional test as specified in [5.1.5](#).

5.6.3 Requirements

In the functional tests, the specimen shall function correctly as specified by the manufacturer.

5.7 Sulfur dioxide (SO₂) corrosion (endurance)

5.7.1 Object of test

To demonstrate the ability of the specimen to withstand the corrosive effects of sulfur dioxide as an atmospheric pollutant.

5.7.2 Test procedure

5.7.2.1 General

Use the test apparatus and procedure as generally specified in IEC 60068-2-42, and in [5.7.2.2](#) to [5.7.2.5](#), except for the relative humidity of the test atmosphere, which shall be maintained at (93 ± 3) % instead of (75 ± 5) %.

5.7.2.2 Initial measurements

Before conditioning, conduct the functional test as specified in [5.1.5](#).

5.7.2.3 State of the specimen during conditioning

Mount the specimen as described in [5.1.3](#). Do not supply it with power during the conditioning, but equip it with untinned copper wires of the appropriate diameter, connected to a sufficient number of terminals to allow making the final measurement without making further connections to the specimen.

5.7.2.4 Conditioning

Apply the following conditioning:

- temperature: (25 ± 2) °C;
- relative humidity: (93 ± 3) %;
- SO₂ concentration: (25 ± 5) µl/l;
- duration: 21 d.

5.7.2.5 Final measurements

5.7.2.5.1 Immediately after the conditioning, subject the specimen to a drying period of 16 h at $(40 \pm 2) ^\circ\text{C}$, + 50 % RH, followed by a recovery period of at least 1 h at the standard laboratory conditions.

5.7.2.5.2 After the recovery period, conduct the functional test as specified in [5.1.5](#).

5.7.3 Requirements

In the functional tests, the specimen shall function correctly as specified by the manufacturer.

5.8 Shock (operational)

5.8.1 Object of test

To demonstrate the immunity of the specimen to mechanical shocks that are likely to occur, albeit infrequently, in the anticipated service environment.

5.8.2 Test procedure

5.8.2.1 General

Use the test apparatus and perform the procedure generally as described in IEC 60068-2-27, Test Ea, except that the conditioning shall be as specified in [5.8.2.4](#) and in [5.8.2.2](#) to [5.8.2.6](#).

5.8.2.2 Initial measurements

Before conditioning, conduct the functional test as specified in [5.1.5](#).

5.8.2.3 State of the specimen during conditioning

Mount the specimen as described in [5.1.2](#) to a rigid fixture and connect it to supply and monitoring equipment as described in [5.1.3](#).

5.8.2.4 Conditioning

5.8.2.4.1 For specimens with a mass $<4,75$ kg, apply the following conditioning:

- shock pulse type: half sine;
- pulse duration: 6 ms;
- peak acceleration: $10(100 - 20M)$ m/s² (where M is the mass of the specimen in kilograms);
- number of directions: six;
- pulses per direction: three.

5.8.2.4.2 Do not test specimens with a mass $>4,75$ kg.

5.8.2.5 Measurements during conditioning

Monitor the specimen during the conditioning period and for a further 2 min to detect any unwanted or unspecified functioning.

5.8.2.6 Final measurements

After the conditioning and the further 2 min, conduct the functional test as specified in [5.1.5](#).

5.8.3 Requirements

5.8.3.1 No unwanted or unspecified function shall occur during the conditioning period or the further 2 min.

5.8.3.2 In the functional tests, the specimen shall function correctly as specified by the manufacturer.

5.9 Impact (operational)

5.9.1 Object of test

To demonstrate the immunity of the specimen to mechanical impacts upon its surface that it can sustain in the normal service environment and that it can reasonably be expected to withstand.

5.9.2 Test procedure

5.9.2.1 General

Use the test apparatus and perform the procedure as described in IEC 60068-2-75 and in [5.9.2.2](#) to [5.9.2.6](#).

5.9.2.2 Initial measurements

Before conditioning, conduct the functional test as described in [5.1.5](#).

5.9.2.3 State of the specimen during conditioning

Mount the specimen as described in [5.1.2](#) to a rigid structure and connect it to supply and monitoring equipment as described in [5.1.3](#).

5.9.2.4 Conditioning

5.9.2.4.1 Apply the impacts to all accessible surfaces of the specimen. For all such surfaces, apply three blows to any point(s) considered likely to cause damage to or impair the operation of the specimen.

5.9.2.4.2 Care shall be taken to ensure that the results from a series of three blows do not influence subsequent series. In case of doubt, the defect shall be disregarded and a further three blows shall be applied to the same position on a new specimen.

5.9.2.4.3 Use the following test parameters during the conditioning:

- impact energy: $(0,5 \pm 0,04)$ J;
- number of impact points: 3.

5.9.2.5 Measurements during conditioning

Monitor the specimen during the conditioning period and for a further 2 min to detect any unwanted or unspecified functioning.

5.9.2.6 Final measurements

After the conditioning and the further 2 min, conduct the functional test as specified in [5.1.5](#).

5.9.3 Requirements

5.9.3.1 No unwanted or unspecified function shall occur during the conditioning period or the further 2 min.

5.9.3.2 In the functional tests, the specimen shall function correctly as specified by the manufacturer.

5.10 Vibration, sinusoidal (operational)

5.10.1 Object of test

To demonstrate the immunity of the specimen to vibration at levels considered appropriate to the normal service environment.

5.10.2 Test procedure

5.10.2.1 General

Use the test apparatus and perform the procedure as specified in IEC 60068-2-6, Test Fc, and in [5.10.2.2](#) to [5.10.2.6](#).

5.10.2.2 Initial measurements

Before conditioning, conduct the functional test as described in [5.1.5](#).

5.10.2.3 State of the specimen during conditioning

5.10.2.3.1 Mount the specimen as described in [5.1.2](#) on a rigid fixture and connect it to supply and monitoring equipment as described in [5.1.3](#).

5.10.2.3.2 Apply the vibration in each of three mutually perpendicular axes, in turn, and so that one of the three axes is perpendicular to its normal mounting plane.

5.10.2.4 Conditioning

5.10.2.4.1 Apply the following conditioning:

- frequency range: (10 to 150) Hz;
- acceleration amplitude: 5 m/s^2 (approximately $0,5 g_n$);
- number of axes: three;
- sweep rate: 1 octave/min;
- number of sweep cycles: 1.

5.10.2.4.2 The vibration (operational) and vibration (endurance) tests may be combined such that the specimen is subjected to the operational test conditioning followed by the endurance test conditioning in one axis before changing to the next axis. It is necessary to make only one final measurement.

5.10.2.5 Measurements during conditioning

Monitor the specimen during the conditioning period to detect any unwanted or unspecified functioning.

5.10.2.6 Final measurements

After the conditioning, conduct the functional test as specified in [5.1.5](#).

5.10.3 Requirements

5.10.3.1 No unwanted or unspecified function shall occur during conditioning.

5.10.3.2 In the functional tests, the specimen shall function correctly as specified by the manufacturer.

5.11 Vibration, sinusoidal (endurance)

5.11.1 Object of test

To demonstrate the ability of the specimen to withstand the long-term effects of vibration at levels appropriate to the service environment.

5.11.2 Test procedure

5.11.2.1 General

Use the test apparatus and perform the procedure as specified in IEC 60068-2-6, Test Fc, and in [5.11.2.2](#) to [5.11.2.5](#).

5.11.2.2 Initial measurements

Before conditioning, conduct the functional test as specified in [5.1.5](#).

5.11.2.3 State of the specimen during conditioning

5.11.2.3.1 Mount the specimen as described in [5.1.2](#) on a rigid fixture. Apply the vibration in each of three mutually perpendicular axes, in turn, and so that one of the three axes is perpendicular to its normal mounting plane of the specimen.

5.11.2.3.2 Do not supply the specimen with power during conditioning.

5.11.2.4 Conditioning

5.11.2.4.1 Apply the following conditioning:

- frequency range: (10 to 150) Hz;
- acceleration amplitude: 10 m/s² (approximately 1,0 g_n);
- number of axes: three;
- sweep rate: 1 octave/min;
- number of sweep cycles: 20 /axis.