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Mechanical structures for electronic equipment – Tests for IEC 60917 and IEC 60297 series –

Part 1: Environmental requirements, test set-up and safety aspects for cabinets, racks, subracks and chassis under indoor condition use and transportation

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Structures mécaniques pour équipement électronique – Essais pour les séries IEC 60917 et IEC 60297 –

Partie 1: Exigences environnementales, montage d'essai et aspects liés à la sécurité des baies, bâtis, bacs à cartes et châssis dans des conditions d'utilisation intérieure ou de transport



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**Mechanical structures for electronic equipment – Tests for IEC 60917 and IEC 60297 series –
Part 1: Environmental requirements, test set-up and safety aspects for cabinets, racks, subracks and chassis under indoor condition use and transportation**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**MECHANICAL STRUCTURES FOR ELECTRONIC EQUIPMENT –
TESTS FOR IEC 60917 AND IEC 60297 SERIES –****Part 1: Environmental requirements, test set-up and safety
aspects for cabinets, racks, subracks and chassis under
indoor condition use and transportation**

FOREWORD

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International Standard IEC 61587-1 has been prepared by IEC subcommittee 48D: Mechanical structures for electronic equipment, of IEC technical committee 48: Electrical connectors and mechanical structures for electrical and electronic equipment.

This fourth edition cancels and replaces the third edition published in 2011. This edition constitutes a technical revision.

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

- a) total overhaul of Clause 7 “Mechanical tests”;
- b) compatibility with IEC 61587-5.

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

FDIS	Report on voting
48D/623/FDIS	48D/628/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of the IEC 61587 series, under the general title *Mechanical structures for electronic equipment – Tests for IEC 60917 and IEC 60297 series*, can be found on the IEC website.

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

The purpose of this standard is to provide a common methodology to perform and report conformance tests of IEC 60917 or IEC 60297 compliant cabinets, racks, subracks, chassis with integrated subracks and associated plug-in units under indoor condition use and transportation. Based upon the most recent specification/standard developments in the industry (such as PICMG, ANSI/VITA, ATIS, etc.) and to address new requirements, this edition 4 of IEC 61587-1 includes the following significant technical changes with respect to the previous edition:

- a) Document title change to read: IEC 61587-1: Mechanical structures for electronic equipment – Tests for the IEC 60917 and IEC 60297 series – Part 1: Environmental requirements, test set-up and safety aspects for cabinets, racks, subracks and chassis under indoor condition use and transportation.
- b) Total overhaul of Clause 7 “Mechanical tests” so as to make it compatible with legacy equipment (i.e., equipment commercially available prior to the publication of the standard). In particular:
 - 1) Subclause 7.2 “Tests for subracks or chassis with an integrated subrack and associated plug-in units” has been considerably expanded and provides for a more realistic intended use test environment (simulation of service condition).
 - 2) Subclause 7.2.1 “Static mechanical load tests of a subrack or a chassis with an integrated subrack” cabinet or rack static load test categories such as cabinets or racks with lifting eye test only and cabinets or racks without the use of lifting eyes have been added.
 - 3) Subclause 7.2.3 “Vibration and shock test of a mass loaded plug-in unit” has been updated to be in line with IEC 62262, which defines the way cabinets should be mounted when impact tests are carried out, the atmospheric conditions that should prevail, the number of impacts, and their distribution, and the physical size, dimensions, etc. of the various styles of hammers designed to produce the test energy level required.
- c) Compatibility with IEC 61587-5.

MECHANICAL STRUCTURES FOR ELECTRONIC EQUIPMENT – TESTS FOR IEC 60917 AND IEC 60297 SERIES –

Part 1: Environmental requirements, test set-up and safety aspects for cabinets, racks, subracks and chassis under indoor condition use and transportation

1 Scope

This part of IEC 61587 specifies environmental requirements, test set-up, as well as safety aspects for empty enclosures, i.e., cabinets, racks, subracks, chassis with an integrated subrack, and associated plug-in units under indoor condition use and transportation.

The purpose of this standard is to establish defined levels of physical performance in order to meet certain requirements of storage, transport and final location conditions. It applies in whole or part only to the mechanical structures of cabinets, racks, subracks, chassis with an integrated subrack, and associated plug-in units, but it does not apply to electronic equipment.

2 Normative references

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

IEC 60068-1, *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 60068-2-11, *Environmental testing – Part 2-11: Tests – Test Ka: Salt mist*

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 60068-2-43, *Environmental testing – Part 2-43: Tests – Test Kd: Hydrogen sulphide test for contacts and connections*

IEC 60068-2-49, *Environmental testing – Part 2-49: Tests – Guidance to test Kc: Sulphur dioxide test for contacts and connections*

IEC 60068-2-52, *Environmental testing – Part 2-52: Tests – Test Kb: Salt mist, cyclic (sodium, chloride solution)*

IEC 60068-2-64, *Environmental testing – Part 2-64: Tests – Test Fh: Vibration, broadband random and guidance*

IEC 60297 (all parts), *Mechanical structures for electronic equipment – Dimensions of mechanical structures of the 482,6 mm (19 in) series*

IEC 60297-3-100, *Mechanical structures for electronic equipment – Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 3-100: Basic dimensions of front panels, subracks, chassis, racks and cabinets*

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

IEC 60297-3-107:2012, *Mechanical structures for electronic equipment - Dimensions of mechanical structures of the 482,6 mm (19 in) series - Part 3-107: Dimensions of subracks and plug-in units, small form factor*

IEC 60297-3-107, *Mechanical structures for electronic equipment – Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 3-107: Dimensions of subracks and plug-in units, small form factor*

IEC 60297-3-108, *Mechanical structures for electronic equipment – Dimensions of mechanical structures of the 482,6 mm (19 in) series – Part 3-108: Dimensions of R-type subracks and plug-in units*

IEC 60512-1-1, *Connectors for electronic equipment – Tests and measurements – Part 1-1: General examination – Test 1a: Visual examination*

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

IEC 60654-4, *Operating conditions for industrial-process measurement and control equipment – Part 4: Corrosive and erosive influences*

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

IEC 60721-3-3, *Classification of environmental conditions – Part 3-3: Classification of groups of environmental parameters and their severities – Stationary use at weather protected locations*

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

IEC 60917-2-1, *Modular order for the development of mechanical structures for electronic equipment practices – Part 2-1: Sectional specification – Interface co-ordination dimensions for the 25 mm equipment practice – Detail specification – Dimensions for cabinets and racks*

IEC 60917-2-2, *Modular order for the development of mechanical structures for electronic equipment practices – Part 2-2: Sectional specification – Interface co-ordination dimensions for the 25 mm equipment practice – Detail specification – Dimensions for subracks, chassis, backplanes, front panels and plug-in units*

IEC 60917-2-3, *Modular order for the development of mechanical structures for electronic equipment practices – Part 2-3: Sectional specification – Interface co-ordination dimensions for the 25 mm equipment practice – Extended detail specification – Dimensions for subracks, chassis, backplanes, front panels and plug-in units*

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 61010-1, *Safety requirements for electrical equipment for measurement, control and laboratory use – Part 1: General requirements*

IEC 61373, *Railway applications – Rolling stock equipment – Shock and vibration tests*

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

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

IEC 61587-5, *Mechanical structures for electronic equipment – Tests for IEC 60917 and IEC 60297 – Part 5: Seismic tests for chassis, subracks, and associated plug-in units*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

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

3.1

indoor condition

location at which the product is protected from weather influences

3.2

mezzanine plug-in unit

module installed in a plug-in unit that can be removed from a subrack without removing its host plug-in unit

3.3

test sample

unit under test, dummy loaded where necessary in order to achieve repeatable results

4 Classification of environmental conditions

The climatic conditions are derived from IEC 60721-3-3 and IEC 60654-4.

The shock and vibration conditions are derived from IEC 60721-3-3.

The shock and vibration severity classes per Table 17 have been separated permitting the user to choose either the shock (DLxS) or vibration (DLxV) severity class or any combination thereof. The existing DLx severity classes are maintained. For example: DL1 (IEC 61587-1:2011) = DL1V and DL1S (IEC 61587-1/Ed4).

5 General

The purpose of the mechanical tests is to ensure that cabinets, racks, subracks and chassis will survive the normal handling during manufacture, storage, transportation, installation and in the service environment.

In order to have, for the enclosure itself, some safety margin built-in, all classification parameters are higher than parameters for the overall application itself. This should ensure proper working of a complete unit in an application.

Unless otherwise specified all tests shall be done at an ambient (room) temperature range of nominal +20 °C to +25 °C.

The specified classifications of performance and kinds of tests of this standard can be combined as required. Compliance to individual subclauses and levels is permissible. Individual tests and severities are referred to by letters and numbers (see Table 1 for examples which show a selection of representative values from each subclause and relevant table).

The various tests should be performed using the same sample wherever it is possible. Experience has shown that the sequence of tests listed in this standard (see also IEC 60068-1) enables the test sequence to be performed using the same test sample except where the individual test results preclude further testing of the same sample, i.e., the test has damaged (destroyed) the sample.

Table 1 – Examples showing references to tests

Test	Subrack, chassis IEC 60917 or IEC 60297 series	Plug-in unit IEC 60917 series	Plug-in unit IEC 60297 series	Cabinet, rack IEC 60917 or IEC 60297 series
Climatic	C1 C2 C3 C4 C5 C6			
Industrial atmosphere	A1 A2 A3			
Static load	SL1 SL2 SL3 SL7 SL8 SL9 SL10 – SLH1 SLH2 SLH3 SLH4 SLH5 SLH6 SLH7 SLH8 SLH9	-		SL4 SL5 SL6 SL11 SL12 – LT1 LT2 LT3 LT4 LT5 – ST1 ST2 ST3 ST4 ST5 – NL1 NL2 NL3 NL4 NL5
Dynamic load (vibration)	DL1V DL2V DL3V DL11V DL12V	PA12 PA21 PA31 PA32	PA11 PA12 PA13 PA21 PA22 PA31 PA32 PA41	DL4V DL5V DL6V
Dynamic load (shock)	DL1S DL2S DL3S DL11S	PA41		DL4S DL5S DL6S
Impact	-			IK04 IK07 IK08
Protection (IP)	IP20			IP20 IP30 IP42 IP54
Seismic performance	Reference IEC 61587-5			Reference IEC 61587-2
Shielding performance	Reference IEC 61587-3			

Application example:

A subrack in accordance with IEC 60917-2-3 complies with the following test requirements:

- climatic: C2 (see Table 2);
- industrial atmosphere: A1 (see Table 3);
- static load: SL2 (see Table 4);
- vibration: DL1V (see Table 17);
- shock: DL1S (see Table 17);
- safety aspects: 8.2.1;
- protection to: IP30 (see Table 30).

6 Climatic tests

6.1 General

It is the objective of the climatic tests to ensure that cabinets, racks, subracks, chassis with an integrated subrack and associated plug-in units will survive the particular environment in which they will normally operate without degradation or creating a hazard.

Climatic tests shall be selected by reference to the application examples given in Table 2 for cabinets, racks, subracks or chassis with an integrated subrack and associated plug-in units.

In order to claim compliance at a given level, all test criteria for that requirement level shall be met.

6.2 Cold, dry heat and damp heat (cyclic)

Table 2 – Classifications for cold, dry heat and damp heat

Classification	Application examples	Cold according to IEC 60068-2-1		Dry heat according to IEC 60068-2-2		Damp heat according to IEC 60068-2-30 (cyclic 2x), variant 2, upper limit °C
		Temperature °C	Duration ^a h	Temperature °C	Duration ^a h	
C1	Enclosed spaces without particular stresses (for example office, laboratory) with temperatures between -10 °C and +55 °C, 20 % to 80 % RH: non-condensing	-10	16	55	16	55
C2	Enclosed spaces subject to climatic stress (for example production halls) with temperatures between -25 °C and +70 °C, 20 % to 80 % RH: non-condensing	-25	16	70	16	55
C3	Extreme climatic stresses (for example open air, tropical climate) with temperatures between -40 °C and +85 °C, 20 % to 95 % RH: non-condensing	-40	16	85	16	55

^a The duration shall be measured from the moment temperature stability of the test sample is reached.

Assessment following the tests:

- a) Visual examination (see IEC 60512-1-1, test 1a).
- b) Earth bond continuity check to be carried out in accordance with 8.2.
- c) For shielding performance examination, see IEC 61587-3:2013 (Table 1).

6.3 Industrial atmosphere

Table 3 – Classifications for industrial atmosphere

Classification	Application examples	Test conditions			Assessment following the test
		Sulphur dioxide test and hydrogen sulphide test, at 25 °C and 75 % RH (extended range at 40 °C and 80 % RH) according to IEC 60068-2-42, IEC 60068-2-43 and IEC 60068-2-49		Salt mist test Ka according to IEC 60068-2-11 at 35 °C (extended range as IEC 60068-2-52)	
		SO ₂	H ₂ S	NaCl	
A1	Moderate concentration of harmful substances, general industrial use with low chemical emissions (for example enclosed spaces) and concentrations according to IEC 60654-4, namely: SO ₂ : mean 0,1 cm ³ /m ³ maximum 0,5 cm ³ /m ³	10 cm ³ /m ³ 4 days	1 cm ³ /m ³ 4 days	–	Visual examination (for example alteration in surface finish, traces of corrosion, colour, degree of lustre) For shielding gasket performance examination see IEC 61587-3
A2	Heavy concentration of harmful substances, with considerable chemical emissions (for example chemical industry, field work) and concentrations according to IEC 60654-4 namely: SO ₂ : mean 5 cm ³ /m ³ maximum 15 cm ³ /m ³ H ₂ S: mean 10 cm ³ /m ³ maximum 50 cm ³ /m ³	25 cm ³ /m ³ 4 days	10 cm ³ /m ³ to 15 cm ³ /m ³ 4 days	–	Visual examination (for example alteration in surface finish, traces of corrosion, colour, degree of lustre). Variation in resistance of earthing conductor junctions, see 8.2 For shielding gasket performance examination see IEC 61587-3
A3	Heavy concentration of harmful substances combined with stress due to maritime climate (for example seaborne chemical processing technology, drilling rigs) and concentrations according to IEC 60654-4, namely: SO ₂ : mean 5 cm ³ /m ³ maximum 15 cm ³ /m ³ H ₂ S: mean 10 cm ³ /m ³ maximum 50 cm ³ /m ³	25 cm ³ /m ³ 4 days	10 cm ³ /m ³ to 15 cm ³ /m ³ 4 days	5 % 96 h at 35 °C Extended range: 5% 1 cycle: 146 h at 35 °C	Visual examination (for example alteration in surface finish, traces of corrosion, colour, degree of lustre) Variation in resistance of earthing conductor junctions, see 8.2 For shielding gasket performance examination see IEC 61587-3

NOTE The tests can be performed on individual components and sample units or component assemblies instead of the original units (cabinets, racks and subracks, chassis) if the replacement items and the original sample share the same materials and surface treatments.

7 Mechanical tests

7.1 General

Mechanical tests shall be selected from the following subclauses according to the required application. Compliance to a given subclause is only achieved when all test criteria from that subclause are met.

7.2 Tests for subracks or chassis with an integrated subrack and associated plug-in units according to IEC 60917 or IEC 60297

7.2.1 Static mechanical load tests of a subrack or a chassis with an integrated subrack

7.2.1.1 Load bearing – General

The purpose of the test is to evaluate the load bearing capability of the structural parts of the IEC 60917 or IEC 60297 series of subracks or chassis with an integrated subrack. This includes subracks per IEC 60297-3-101 (conventional 19 in subrack), IEC 60297-3-107 (small form factor 19 in subrack), and IEC 60297-3-108 (R-type 19 in subrack).

7.2.1.2 Static mechanical load test fixture for subracks or chassis with an integrated subrack

An IEC 60917 or IEC 60297 series compliant subrack or chassis with an integrated subrack shall be mounted in a rigid test fixture via the standard mounting flanges as shown in Figure 1. This applies to subracks designed for either vertically or horizontally oriented plug-in units.

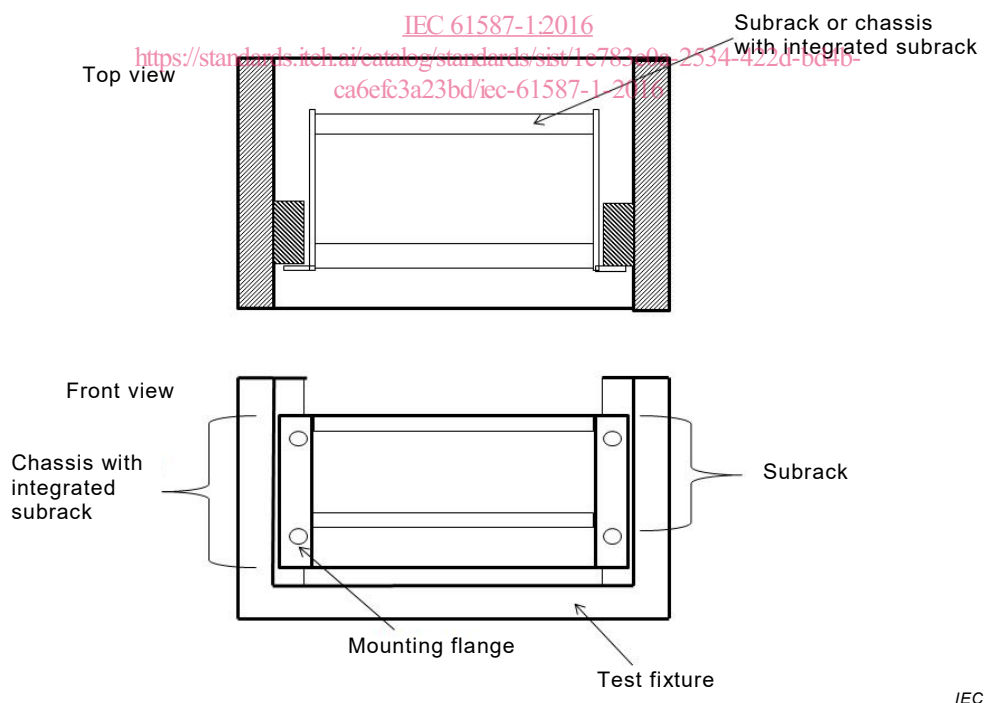


Figure 1 – Static mechanical load test fixture for a subrack or a chassis with an integrated subrack