

INTERNATIONAL STANDARD

NORME INTERNATIONALE

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 conditions

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

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



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CONTENTS

FOREWORD.....	4
1 Scope and object.....	6
2 Normative references	6
3 Terms and definitions	7
4 Classification of environmental conditions	7
5 General	8
6 Climatic tests.....	9
6.1 General.....	9
6.2 Cold, dry heat and damp heat (cyclic)	9
6.3 Industrial atmosphere.....	10
7 Mechanical tests.....	11
7.1 General.....	11
7.2 Static and dynamic mechanical load tests for subracks	11
7.2.1 Static mechanical load tests	11
7.2.2 Vibration and shock tests.....	14
7.3 Static and dynamic mechanical load tests for cabinets and racks	17
7.3.1 Lifting tests.....	17
7.3.2 Stiffness tests.....	18
7.3.3 Vibration and shock tests.....	19
7.3.4 Impact tests.....	21
8 Safety aspects.....	22
8.1 General.....	22
8.2 Earth bond	22
8.2.1 General	22
8.2.2 Test procedure	22
8.3 Flammability.....	22
8.4 Degrees of protection provided by enclosures (IP Code)	22
Figure 1 – Test set up for subracks for the static load test	11
Figure 2 – Static load test, single force for subracks IEC 60297 series	12
Figure 3 – Static load test, single force for subracks IEC 60917 series	13
Figure 4 – Test set up for subracks for vibration and shock tests	14
Figure 5 – Lifting test for cabinets and racks.....	17
Figure 6 – Stiffness test for cabinets and racks.....	18
Figure 7 – Test set up for a cabinet for vibration and shock tests	19
Table 1 – Examples showing references to tests.....	8
Table 2 – Classifications for cold, dry heat and damp heat.....	9
Table 3 – Classifications for industrial atmosphere	10
Table 4 – Static mechanical load classifications for subracks of the IEC 60917 series	13
Table 5 – Test set-up for subracks according to the IEC 60297 series	15
Table 6 – Test set-up for subracks according to the IEC 60917 series	15
Table 7 – Vibration and shock classifications for subracks	16
Table 8 – Classifications levels for lifting and stiffness.....	18

Table 9 – Static load distribution within the cabinet..... 19
Table 10 – Vibration and shock classifications for cabinets 20
Table 11 – Impact classifications for cabinets 21
Table 12 – Degrees of protection provided by enclosures (IP Code) 23

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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 conditions**

FOREWORD

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International Standard IEC 61587-1 has been prepared by IEC sub-committee 48D: Mechanical structures for electronic equipment, of IEC technical committee 48: Electromechanical components and mechanical structures for electronic equipment.

This third edition cancels and replaces the second edition published in 2007. This edition constitutes a technical revision.

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

- 1) Rephrasing “performance level” by “classification”.
- 2) Reference to fire hazard testing according to IEC 60695-11-10 in 8.2.1.
- 3) Intended applications replaced by application examples.

- 4) Static load test, distributed dummy load locations for ETSI and 19” removed.
- 5) Table “Static load distribution within the cabinet” IEC 60297-2 changed to IEC 60297-3-100.
- 6) IEC 60917 subrack 625 mm wide has been removed, as it is not a common width.
- 7) Parts of the document relevant to outdoors have been removed (reference to 61969 series).

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

FDIS	Report on voting
48D/481/FDIS	48D/495/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.

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.

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

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

1 Scope and object

This part of IEC 61587 specifies environmental requirements, test set-up, as well as safety aspects for empty enclosures, i.e. cabinets, racks, subracks and chassis under indoor conditions.

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 and chassis, but it does not apply to electronic equipment.

2 Normative references

The following referenced documents are indispensable for the application 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 60068-2-75, *Environmental testing – Part 2-75: Tests – Test Eh: Hammer tests*

IEC 60297 (all parts), *Dimensions of mechanical structures of the 482,6 mm (19 in) series*

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: 50 W horizontal and vertical flame test methods*

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

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

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

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

IEC 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: 2006, *Mechanical structures for electronic equipment – Tests for IEC 60917 and IEC 60297 – Part 3: Electromagnetic shielding performance tests for cabinets, racks and subracks*

IEC 62262, *Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)*

3 Terms and definitions

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

3.1

indoor condition

a location at which the product is protected from weather influences

3.2

test sample

the unit under test, dummy loaded where necessary in order to achieve realistic 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 product specification in accordance with this standard may use the one or other severity class. Combinations are also permitted.

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 room temperature (+20 °C – 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 and well-known 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 damages (destroys) the sample.

Table 1 – Examples showing references to tests

Test	Subrack IEC 60297 series	Subrack IEC 60917 series	Cabinet
Climatic		C1 C2 C3	
Industrial atmosphere		A1 A2 A3	
Static load	SL1	SL1 SL2 SL3	SL4 SL5 SL6
Dynamic load (shock and vibration)		DL1 DL2 DL3	DL4 DL5 DL6
Impact	–	–	K1 K2 K3
Protection (IP)	IP20	IP20	IP20 IP30 IP42 IP54
Seismic performance		–	Ref IEC 61587-2
Shielding performance			Ref IEC 61587-3

Application example:

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

- climatic: C2 (see Table 2);
- industrial atmosphere: A1 (see Table 3);
- static load: SL2 (see Table 4);
- shock and vibration: DL1 (see Table 7);
- safety aspects: 8.2.1;
- protection to: IP30 (see Table 12).

6 Climatic tests

6.1 General

It is the objective of the climatic tests to ensure that cabinets, racks and subracks 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 and subracks.

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 2×), variant 2, upper limit
		Temperature °C	Duration (see Note) h	Temperature °C	Duration (see Note) 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

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

Assessment following the tests:

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

NOTE The tests may be performed on individual components and sample units or component assemblies instead of the original units (subracks, cabinets) 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 Static and dynamic mechanical load tests for subracks

7.2.1 Static mechanical load tests

7.2.1.1 General

The purpose of the test is to evaluate the load bearing capability of the structural parts of subracks or the subrack as part of the chassis. The deflection of the horizontal members is used as an indirect measure of the load bearing capability of the subrack and shall be less than the defined value. This will prevent disengagement of the plug-in units from the guide rails.

Test set up and test sample fixture:

- The test sample shall be mounted in a test fixture via the standard subrack mounting flanges as shown in Figure 1.

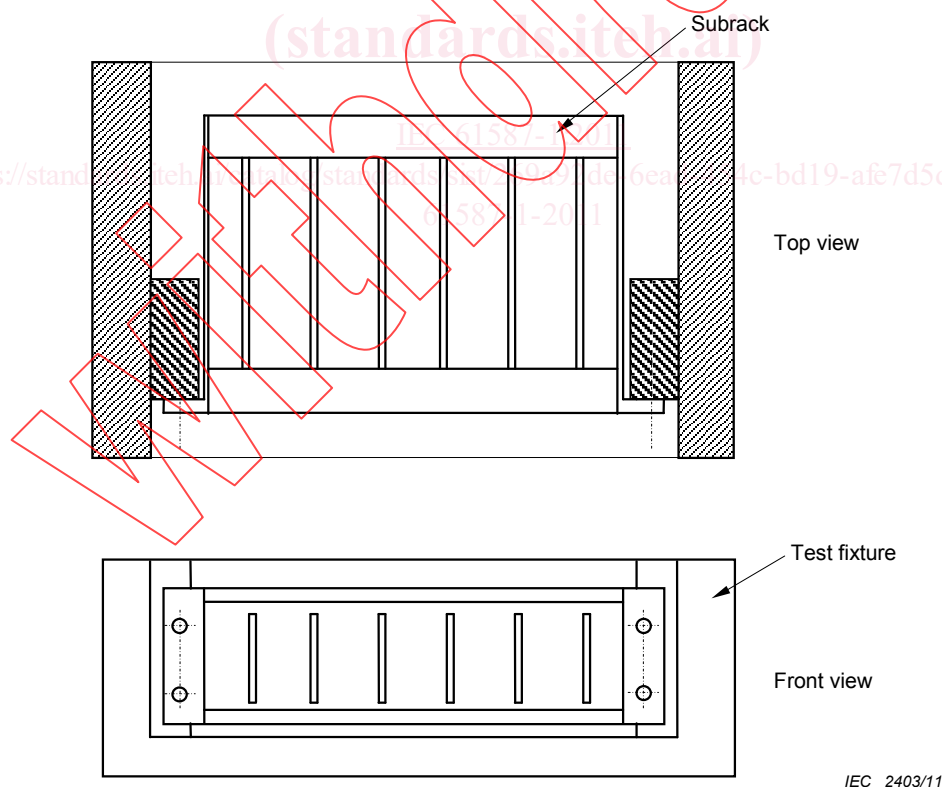
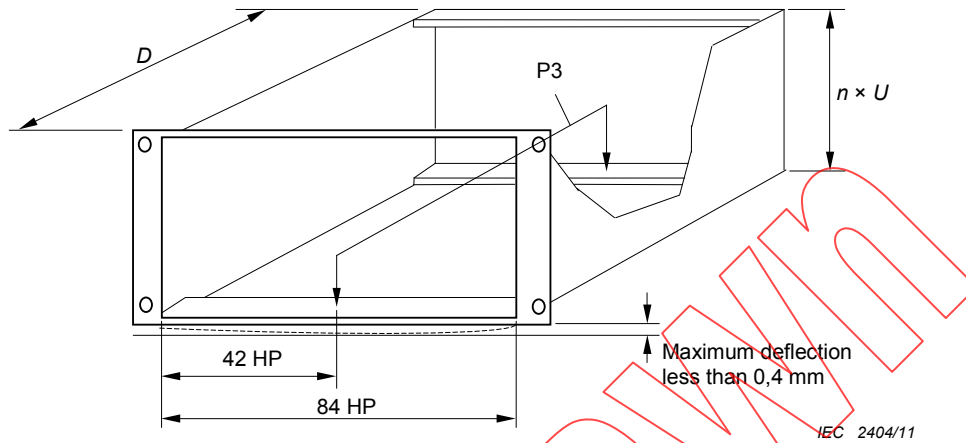


Figure 1 – Test set up for subracks for the static load test

7.2.1.2 Subracks IEC 60297 series

Load distribution for classification SL1 (Figure 2).

For *U* see IEC 60297-1, for *D* and *HP* see IEC 60297-3-101.



Single point load $P3 = 46\text{ N}$

NOTE A single point load shall be applied equally to all lower horizontal members along the centre line of the subrack.

Figure 2 – Static load test, single force for subracks IEC 60297 series

Classification SL1 = 46N for subrack tested with single load (see Table 4).

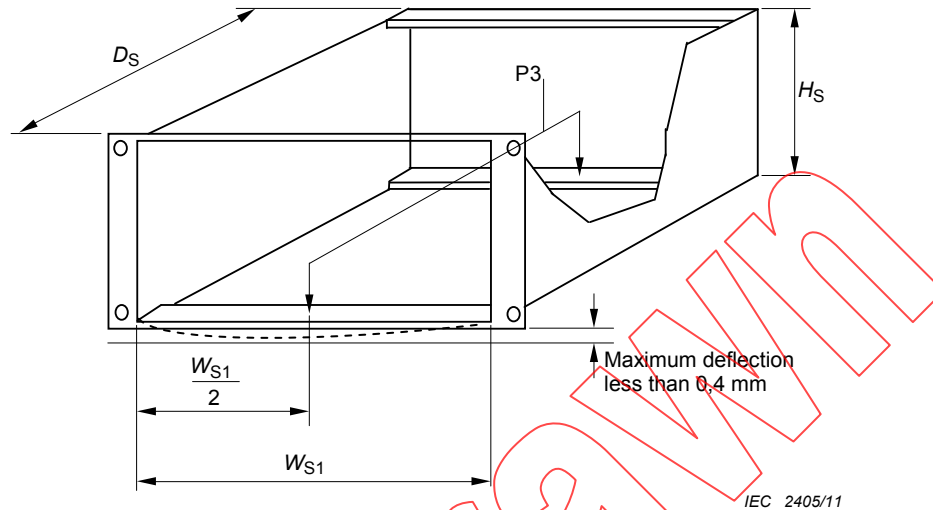
Assessment following the test

The acceptance criteria is that the maximum deflection shall be less than 0,4 mm.

7.2.1.3 Subracks IEC 60917 series

Load distribution for classification SL1, SL2 and SL3.

For D_s , W_{S1} and H_s see IEC 60917-2-2.



NOTE Single point load tests shall be applied equally to all lower horizontal members along the centre line of the subrack as detailed in Figure 3 and Table 4.

Figure 3 – Static load test, single force for subracks IEC 60917 series

Table 4 – Static mechanical load classifications for subracks of the IEC 60917 series

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Performance level	Single point load P3 (see Note of Figure 3) N
SL 1	46
SL 2	69
SL 3	92

Assessment following the tests

The acceptance criteria is that the maximum deflection shall be less than 0,4 mm.