

Environmental testing —

Part 2-47: Tests — Mounting of specimens for vibration, impact and similar dynamic tests

The European Standard EN 60068-2-47:2005 has the status of a
British Standard

ICS 19.040

National foreword

This British Standard is the official English language version of EN 60068-2-47:2005. It is identical with IEC 60068-2-47:2005. It supersedes BS EN 60068-2-47:2000 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee GEL/104, Environmental conditions, classification and testing, which has the responsibility to:

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- monitor related international and European developments and promulgate them in the UK.

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 36, an inside back cover and a back cover.

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Environmental testing
Part 2-47: Tests - Mounting of specimens for vibration,
impact and similar dynamic tests
(IEC 60068-2-47:2005)

Essais d'environnement
Partie 2-47: Essais –
Fixation de spécimens pour essais
de vibrations, d'impacts et autres essais
dynamiques
(CEI 60068-2-47:2005)

Umgebungseinflüsse
Teil 2-47: Prüfverfahren –
Befestigung von Prüflingen zur Schwing-,
Stoß- und ähnlichen dynamischen
Prüfungen
(IEC 60068-2-47:2005)

This European Standard was approved by CENELEC on 2005-05-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

The text of document 104/359/FDIS, future edition 3 of IEC 60068-2-47, prepared by IEC TC 104, Environmental conditions, classification and methods of test, was submitted to the IEC/CENELEC parallel vote and was approved by CENELEC as EN 60068-2-47 on 2005-05-01.

This European Standard supersedes EN 60068-2-47:1999 + corrigendum June 2000.

The major technical changes with regard to EN 60068-2-47:1999 are related to specific guidance on the testing of packaged products.

The following dates were fixed:

- latest date by which the EN has to be implemented
at national level by publication of an identical
national standard or by endorsement (dop) 2006-02-01
- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2008-05-01

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60068-2-47:2005 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60068-2-6	NOTE	Harmonized as EN 60068-2-6:1995 (not modified).
IEC 60068-2-7	NOTE	Harmonized as EN 60068-2-7:1993 (not modified).
IEC 60068-2-21	NOTE	Harmonized as EN 60068-2-21:1999 (not modified).
IEC 60068-2-27	NOTE	Harmonized as EN 60068-2-27:1993 (not modified).
IEC 60068-2-29	NOTE	Harmonized as EN 60068-2-29:1993 (not modified).
IEC 60068-2-31	NOTE	Harmonized as EN 60068-2-31:1993 (not modified).
IEC 60068-2-32	NOTE	Harmonized as EN 60068-2-32:1993 (not modified).
IEC 60068-2-57	NOTE	Harmonized as EN 60068-2-57:2000 (not modified).
IEC 60068-2-59	NOTE	Harmonized as EN 60068-2-59:1993 (not modified).
IEC 60068-2-64	NOTE	Harmonized as EN 60068-2-64:1994 (not modified).
IEC 60068-2-65	NOTE	Harmonized as EN 60068-2-65:1994 (not modified).
IEC 60068-2-75	NOTE	Harmonized as EN 60068-2-75:1997 (not modified).
IEC 60068-2-81	NOTE	Harmonized as EN 60068-2-81:2003 (not modified).

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ENVIRONMENTAL TESTING –

Part 2-47: Tests – Mounting of specimens for vibration, impact and similar dynamic tests

1 Scope

This part of IEC 60068 provides methods for mounting products, whether packaged or unpackaged, as well as mounting requirements for equipment and other articles, for the series of dynamic tests in IEC 60068-2, that is impact (Test E), vibration (Test F) and acceleration, steady-state (Test G). When they are fastened to the test apparatus and subjected to these tests, whether packaged or unpackaged, they are referred to as specimens.

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 60068-1:1988, *Environmental testing – Part 1: General and guidance*

IEC 60068-2-55:1987, *Environmental testing – Part 2-55: Tests – Test Ee and guidance: Bounce*

ISO 2041:1990, *Vibration and shock – Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions used in ISO 2041 and IEC 60068-1 apply.

3.1

package

result of the packing operation, consisting of the packaging and its contents, for example, electronic devices prepared for transport

3.2

packaging

product made of any material of any nature to be used for the containment, protection, handling and delivery, for example, a corrugated fibreboard box

4 General

The relevant specification shall state whether the effect of gravitational force is important. If so, the specimen shall be mounted in such a way that the gravitational force acts in the same direction as it would in use. Where the effect of gravitational force is not important, the specimen may be mounted in any attitude.

If significant for the test results, the relevant specification shall also state

- a) the temperature limits within which the specimen shall be tested,
- b) the maximum level of magnetic interference which may be imposed on the specimen and/or the orientation of the specimen in relation to the direction of the magnetic field (for example, near an electrodynamic vibration generator),
- c) the relative humidity limits within which the specimen shall be tested.

5 Mounting, where the specimen is a component

The mounting method to be used shall be as stated in the relevant specification.

Where the method of mounting is not specified but is obvious from the design, as in Figure 1, this method shall be used. Where it is not obvious, the mounting methods shall, whenever possible, be chosen in accordance with the principles shown in Figures 2, 3 or 4, bearing in mind whether the intention is to load dynamically the leads and/or the body or to determine the internal robustness.

When the specimen is to be tested with additional leads attached, these shall be so arranged that they impose similar restraint and mass to those when the specimen is used in its normal manner.

In all cases, components shall be fastened to a rigid test fixture or directly to the mounting surface of the test apparatus. The most common failure mode for electronic components as shown in Figures 1, 2 and 3 is not failure of the component itself but of the solder connection due to flexure of the printed circuit board. Testing of the complete printed circuit board is essential.

NOTE A "rigid test fixture" is one where there are no resonances within the test range or where the requirements of the test tolerances can be met at all fixing points.

6 Mounting, where the specimen is equipment and other articles

The specimen shall be mechanically connected to the mounting surface of the test apparatus either directly or by means of a rigid test fixture (see note above), as shown in Figure 5, or as stated in the relevant specification.

NOTE In the case of acoustically induced vibration, the mounting technique is quite different and reference should be made to IEC 60068-2-65.

In cases where the normal mounting structure for the equipment is available, the relevant specification shall state if it shall be used (see also Clause A.2).

Any additional stays or straps shall be avoided. Any connections to the specimen such as cables, pipes, etc. shall be so arranged that they impose similar restraint and mass to those when the specimen is installed in its operational position. In order to achieve this, it may be necessary to fasten the cables, pipes, etc., to the fixture.

The relevant specification shall specify the size, mounting torque and associated tolerance of the fixing bolts.

Specimens intended for use with isolators shall normally be tested with their isolators. If it is not practicable to carry out the test with the appropriate isolators, the specimen may be tested without the isolators at a different severity, as stated in the relevant specification.

The relevant specification may require an additional test on a specimen with the external isolators removed or blocked, in order to demonstrate that minimum acceptable structural resistance has been achieved. In this case, the severity to be applied shall be given in the relevant specification.

Where, operationally, any heating effect on the isolators is likely to be of significance, this shall be taken into account during testing.

7 Mounting, where the specimen is a packaged product

All the relevant requirements in Clauses 5 and 6 above shall be met.

Generally, in order to reproduce the effects of the transportation phase, a product, if normally packaged for that phase, shall be tested in its packaging. However, there are a number of situations to consider, as follows:

7.1 Packaging available (see also Clause B.2)

Unless otherwise stated in the relevant specification, the packaging, if available, shall be used during the testing.

If the method of fastening the packaged product to a transportation vehicle is known, that method shall, where practicable, be replicated and details of this shall be specified in the relevant specification and stated in the test report.

The relevant specification shall specify the size, mounting torque and associated tolerance of the fixing bolts.

If the specimen is capable of being fastened to a transportation vehicle in a number of known ways then, from engineering knowledge of the dynamic behaviour of the product, the worst case(s) shall be selected so that faults are most likely to be revealed.

Where the specimen is fastened to a transportation vehicle but the method varies in an unpredictable way, it shall be mechanically connected to the test apparatus as detailed in the relevant specification. This may be in a manner which only engineering judgement can decide and shall be based upon faults considered most likely to be revealed.

If the specimen is intended, or is likely, to be carried in a transportation vehicle without being fastened down, or with some degree of freedom, it shall be tested in accordance with IEC 60068-2-55. See also B.4.3.

If the packaged product is intended to be fastened to a transportation vehicle but it is considered likely that, in practice, it might not be fastened down, the relevant specification may require the test method stated in the previous paragraph to be applied. This may be in addition to the appropriate test where the product is fastened down.

7.2 Product normally packaged but packaging not available (see also Clause B.3)

If a product is normally packaged but the packaging is not available, it is generally not possible to mount the product on the test apparatus in a truly representative manner and the test becomes one of an empirical nature. However, it is possible to adjust the test severity in order to allow for an element of the protection provided when the packaging is otherwise present. Great care is needed in interpreting the results in this case and such a test should be considered as a development test, not an approval test. It is strongly recommended to test again with the specimen in the packaging.

Two situations exist; firstly, where the packaging performance is known and secondly, where it is not known. These are dealt with separately below.

7.2.1 Packaging performance known

If the packaging performance is known, or can be calculated, this will often enable the applied severity to be modified. Knowledge of the transfer function or transmissibility of the packaging provides the ability to adjust the vibration or shock test levels, see also Annex C.

Where the design of the packaging defines its attitude during transportation, then the attitude of the internal product is also known. It shall be fastened to the mounting surface of the test apparatus in a manner representative of that attitude. Unless otherwise stated by the relevant specification, the modified severity shall be applied (see previous paragraph).

Where the attitude of the package during transportation is variable and hence the attitude of the product can vary, the test shall be conducted in the attitude considered to represent the worst case(s). If engineering judgement does not enable this choice to be made, a number of possible worst case attitudes shall be stated in the relevant specification. Unless otherwise stated in the relevant specification, the modified test severity (see above) shall be applied.

Although the packaging performance may be known and the package is, or might be, carried in an unfastened manner in a transportation vehicle, the absence of the packaging prevents a practicable test from being performed. See Clause B.3 and B.4.3.

7.2.2 Packaging performance not known

Where the packaging is not available and its performance is not known, generalized transmissibility curves are provided in Figure B.1 for use in modifying the applied vibration test severity. The relevant specification should state which transmissibility curve shall be used. Annex C provides a method for adjusting the half-sine shock severity.

8 Information to be given in the relevant specification

When this part of IEC 60068-2 is referred to in a relevant specification, the following details shall be given as far as they are applicable.

- a) Mounting and attitude for testing, gravitational effect (Clause 4)
- b) Maximum or minimum temperature (Clause 4)
- c) Maximum magnetic interference (Clause 4)
- d) Maximum or minimum relative humidity (Clause 4)
- e) Mounting of specimens (components) (Clause 5)

- f) Mounting of specimens (equipment and other articles) (Clause 6)
- g) Mounting of package (stacking)
- h) Transmissibility curve used to modify test severity (Clause 7)

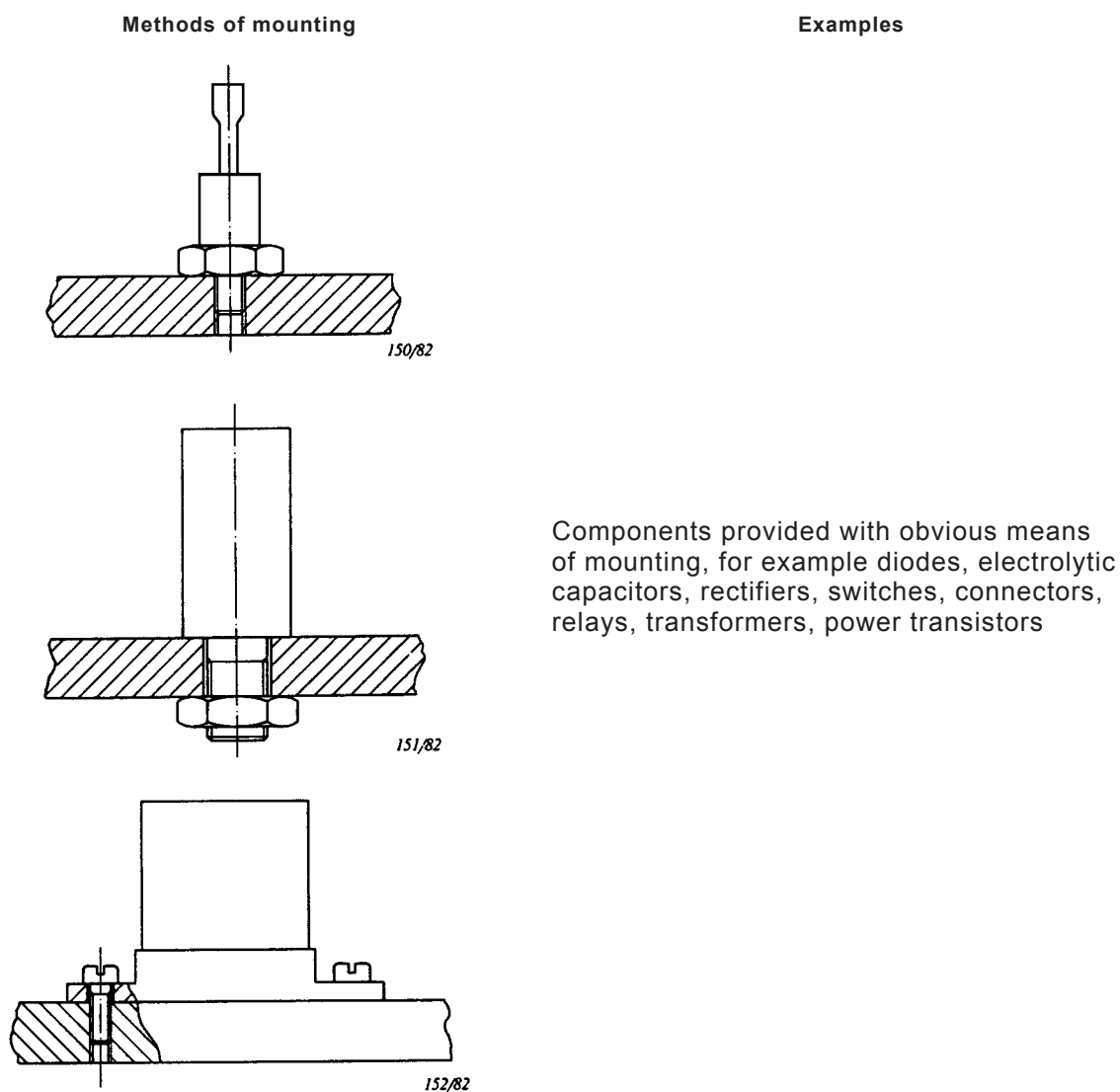


Figure 1 – Examples of obvious means of mounting components

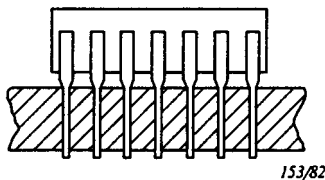
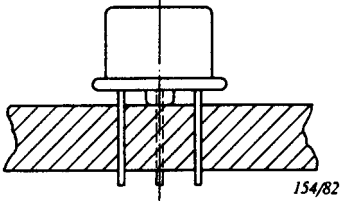
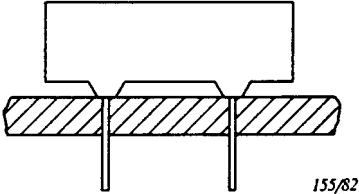
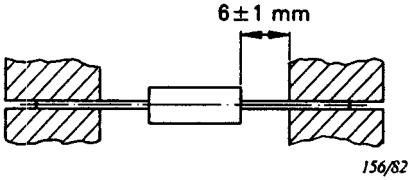
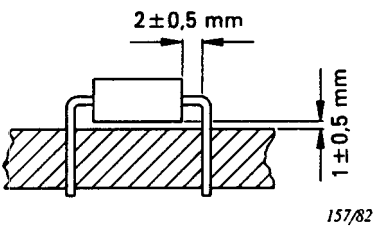
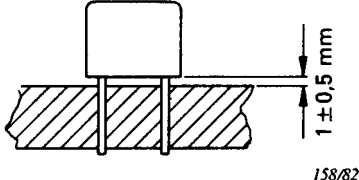
Methods of mounting	Examples
 153/82	Components such as transistors, integrated circuits, relays and others where the distance to the fixture is limited by design
 154/82	
 155/82	Resistors, capacitors
 6 ± 1 mm 156/82	Resistors, capacitors, inductors, diodes
 2 ± 0,5 mm 1 ± 0,5 mm 157/82	Resistors, capacitors, inductors, diodes, transistors
 1 ± 0,5 mm 158/82	NOTE It is important that the relevant specification states whether or not the component is in contact with the mounting surface.

Figure 2 – Examples of mounting of components by the leads only