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Edition 2.0 2014-09

INTERNATIONAL STANDARD

NORME INTERNATIONALE

BASIC SAFETY PUBLICATION

PUBLICATION FONDAMENTALE DE SÉCURITÉ

Environmental testing – Part 2-75: Tests – Test Eh: Hammer tests

Essais d'environnement – Partie 2-75: Essais – Test Eh: Essais au marteau

IEC 60068-2-75:2014-09(en-fr)

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FOREWORD

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International Standard IEC 60068-2-75 has been prepared by IEC technical committee 104: Environmental conditions, classification and methods of test.

This second edition cancels and replaces the first edition, published in 1997, and constitutes a technical revision.

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

– reconsideration of some values in Tables 1 and 2. Although some values are no longer recommended, they have been retained as alternatives for historical consistency purposes.

It has the status of:a basic safety publication in accordance with IEC Guide 104.

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

FDIS	Report on voting
104/635/FDIS	104/637/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 in the IEC 60068 series, published under the general title *Environmental testing*, 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 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- withdrawn,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
- amended.

INTRODUCTION

Mechanical impacts likely to stress electrotechnical equipment in service can be generated by hammers of various types. For standardization purposes, the results of such testing should not depend on the type of testing apparatus and therefore, the characteristics of the various types of test hammers described in this part of IEC 60068 are intended to be as close as practicable for the same severity level.

It is important to note that both Clause 3 and the test method selected from Clauses 4, 5, and 6 need to be complied with in order to satisfy the requirements of this International Standard.

The severity levels are, in general, taken from IEC 60721-1.

For coordination purposes, it has been necessary to change certain fundamental parameters of the previous tests Ef: Impact, pendulum hammer, and Eg: Impact, spring hammer. In all cases, both sets of parameters are shown at the appropriate places in the text. Although some values are no longer recommended, they have been retained as alternatives for historical consistency purposes. This is because they have application in certain industries as historic comparators.

ENVIRONMENTAL TESTING –

Part 2-75: Tests – Test Eh: Hammer tests

1 Scope

This part of IEC 60068 provides three standardized and coordinated test methods for determining the ability of a specimen to withstand specified severities of impact. It is used, in particular, to demonstrate an acceptable level of robustness when assessing the safety of a product and is primarily intended for the testing of electrotechnical items. It consists of the application to the specimen of a prescribed number of impacts defined by their impact energy and applied in the prescribed directions.

This part of IEC 60068 covers energy levels ranging from 0,14 J (joules) to 50 J (joules).

Three types of test apparatus are applicable to perform these tests. Annex C provides some guidance as to this aspect.

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

IEC 60721-1, *Classification of environmental conditions – Part 1: Environmental parameters and their severities*

IEC Guide 104, *The preparation of safety publications and the use of basic safety publications and group safety publications*

IEC Guide 108, *Guidelines for ensuring the coherency of IEC publications – Application of horizontal standards*

ISO 1052, *Steels for general engineering purposes*

ISO 2039-2, *Plastics – Determination of hardness – Part 2: Rockwell hardness*

ISO 2041, *Vibration and shock and condition monitoring – Vocabulary*

ISO 2768-1, *General tolerances – Part 1: Tolerances for linear and angular dimensions without individual tolerances indications*

ISO 6508 (all parts), *Metallic materials – Rockwell hardness test*

3 Terms and definitions

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

3.1
combined mass of the striking element
sum of the masses of the striking element and of the element's fixing system

3.2
fixing point
part of the specimen in contact with the mounting fixture at the point where the specimen is normally fastened in service

3.3
equivalent mass
mass of the striking element and any relevant portions of the test apparatus which, combined with its velocity, provides the impact energy

Note 1 to entry: For the particular application to the pendulum hammer apparatus, mass of the simple pendulum hammer calculated from the measure of the vertical force (in newtons) to be applied in the axis of the striking element to maintain the arm of the pendulum in a horizontal position, divided by the earth's gravity. When the mass of the arm is evenly distributed, the equivalent mass is equal to the sum of the combined mass of the striking element plus half the mass of the arm.

3.4
measuring point
point marked on the surface of the striking element where the line through the point of intersection of the axes of the arms of both of the pendulum and of the striking element, and perpendicular to the plane through both axes, meets the surface (see Figure 2).

Note 1 to entry: In some IEC standards which include a pendulum hammer test, the term "checking point" has been used but it has not been used here in order to avoid confusion with "check point " in other parts of IEC 60068-2.

Note 2 to entry: Theoretically, the centre of gravity of the striking element should be the measuring point. In practice, the centre of gravity is either difficult to determine or inaccessible, and the measuring point is therefore defined as above.

3.5
height of fall
vertical distance between the position of the measuring point when the pendulum is released and its position at the moment of impact (see Figure D.1).

4 Provisions common to all hammer test methods

4.1 Severities

4.1.1 General

The severity is defined by the impact energy value chosen from 4.1.2, and the number of impacts according to 4.1.3.

4.1.2 Impact energy value

The impact energy value shall be one of the following, as prescribed by the relevant specification:

0,14 – 0,2 – (0,3) – 0,35 – (0,4) – 0,5 – 0,7 – 1 – 2 – 5 – 10 – 20 – 50 J (joules).

NOTE Figures in brackets appear in previous IEC 60068-2 standards, although no longer recommended, they may be used for historic consistency.

4.1.3 Number of impacts

Unless otherwise prescribed by the relevant specification, the number of impacts shall be three per location.

4.2 Test apparatus

4.2.1 Description

Three types of test apparatus are available to perform these tests:

– the pendulum hammer;
– the spring hammer;
– the vertical hammer.

The types of test apparatus are defined in Clauses 5, 6 and 7 as tests Eha, Ehb and Ehc, respectively. The coordinated characteristics of the striking element are, in principle, similar in all three cases and are stated in Table 1 in relation to the outline shown in Figure 1.

Dimensions are in millimetres. Tolerances are as per class m of ISO 2768-1, unless otherwise stated.

Table 1 – Coordinated characteristics of the striking elements

Energy value J	≤1 ±10 %	2 ±5 %	5 ±5 %	10 ±5 %	20 ±5 %	50 ±5 %
Equivalent mass ±2 % kg	0,25 (0,2)	0,5	1,7	5	5	10
Material	Polyamide [a]	Steel [b]				
R mm	10	25	25	50	50	50
D mm	18,5 (20)	35	60	80	100	125
f mm	6,2(10)	7	10	20	20	25
r mm	–	–	6	–	10	17
l mm	To be adjusted to match the equivalent mass, see Annex A.					

[a] 85 ≤ HRR ≤100, Rockwell hardness according to ISO 2039-2.

[b] Fe 490-2, according to ISO 1052: Rockwell hardness: HRE 80...85 according to ISO 6508.

NOTE The values shown in brackets for the equivalent mass and the diameter of the striking element for the energy value equal to or less than 1 J are those in the current test Ef. The values currently in test Eg are also shown for these two parameters. Although, for coordination reasons, these values are no longer recommended, they are used by some industries for historical comparison purposes.

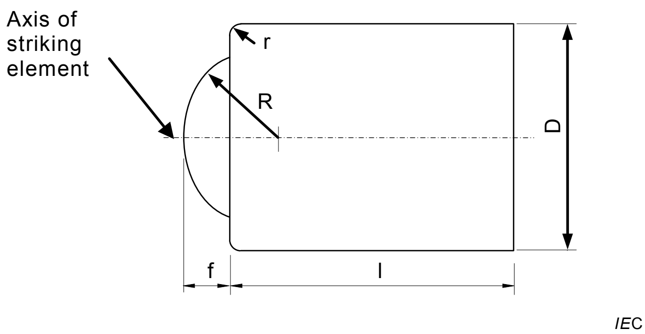

Figure 1 – Example sketch of a striking element

The striking surface shall be visually examined before each impact in order to ensure that there is no damage that might affect the result of the test.

4.2.2 Mounting

As prescribed by the relevant specification, the specimen shall either

a) be mounted by its normal means on a rigid plane support, or

b) be placed against a rigid plane support.

In order to ensure that the specimen is rigidly supported, it may be necessary when performing the test to place the specimen against a plane solid support, for example a wall or a floor made of brick or concrete, covered by a sheet of polyamide which is tightly fixed to the support.

Care shall be taken to ensure that there is no appreciable air gap between the sheet and the support. The sheet shall have a Rockwell hardness of 85 ≤HRR ≤100 according to ISO 2039-2, a thickness of approximately 8 mm and a surface area such that no parts of the specimen are mechanically over-stressed due to the supporting area being insufficient.

The mounting arrangement is deemed to be sufficiently rigid if the displacement of the impact surface of the plane support does not exceed 0,1 mm when struck by an impact applied directly to it with the same level of energy as for the specimen.

NOTE 1 For specimens to be subjected to impact energies not exceeding 1 J, some examples of mounting and support are shown in Figures D.3, D.4 and D.5.

NOTE 2 When the mass of the mounting is at least 20 times that of the specimen, the rigidity of the mounting is likely to be sufficient.

4.3 Preconditioning

The relevant specification may call for preconditioning; it shall then prescribe the conditions.

4.4 Initial measurements

The specimen shall be submitted to the visual, dimensional and functional checks prescribed by the relevant specification.

4.5 Testing

4.5.1 General

Secondary impacts, i.e. rebounds, shall be avoided.

4.5.2 Attitudes and impact locations

The relevant specification shall prescribe the attitudes of the specimen and the locations on the specimen corresponding to where damage is most likely to occur in practice and at which the impacts are to be applied. Unless otherwise specified by the relevant specification, the blows shall be applied perpendicularly to the tested surface.

4.5.3 Preparation of the specimen

The relevant specification shall state any requirements for the securing of bases, covers and similar items before the specimen is subjected to the impacts.

NOTE Account may need to be taken of requirements for functional monitoring (see 4.5.4 b)).

4.5.4 Operating mode and functional monitoring

The relevant specification shall state:

a) whether the specimen is required to operate during impact;

b) whether any functional monitoring is required.

In both cases, the relevant specification shall provide the criteria upon which the acceptance or rejection of the specimen is to be based.

NOTE Attention is drawn to the fact that, in case of breakage of the specimen, internal parts may become hazardous.

4.6 Recovery

The relevant specification may call for recovery and shall then prescribe the conditions.

4.7 Final measurements

The specimen shall be submitted to the visual, dimensional and functional checks prescribed by the relevant specification.

The relevant specification shall prescribe the criteria upon which the acceptance or rejection of the specimen is to be based.

4.8 Information to be given in the relevant specification

When one of the tests in this part of IEC 60068 is included in a relevant specification, the following details shall be given as far as they are applicable, paying particular attention to the items marked with an asterisk (*) as this information is always required:

		Subclause
a)	Impact energy *	4.1.2
b)	Number of impacts, if other than three per location	4.1.3
c)	Type(s) of test apparatus to be used	4.2.1
d)	Method of mounting *	4.4.2
e)	Preconditioning	4.3
f)	Initial measurements*	4.4
g)	Attitude and impact locations *	4.5.2
h)	Securing of bases, covers and similar components	4.5.3
i)	Operating mode and functional monitoring*	4.5.4
j)	Acceptance and rejection criteria *	4.5.4 and 4.7
k)	Conditions for recovery	4.6

l) Final measurements* 4.7

5 Test Eha: Pendulum hammer

5.1 Test apparatus

5.1.1 General

The test apparatus consists basically of a pendulum rotating at its upper end in such a way as to be kept in a vertical plane. The axis of the pivot is at 1 000 mm above the measuring point. The pendulum is composed of a nominally rigid arm and of a striking element complying with the requirements of Table 1.

For testing heavy, voluminous or difficult-to-handle specimens, a portable pendulum may be used. It shall comply with the above description but its pivot may be fixed directly on the specimen or on a movable structure. In this case, it shall be ensured that, before the tests, the axis of the pendulum is horizontal, that its fixing is sufficiently rigid and that the impact point is in the vertical plane passing through the axis.

In all cases, when the pendulum is released, it shall be allowed to fall only under the influence of gravitational force.

5.1.2 Test apparatus for severities not exceeding 1 J

The striking element comprises a steel body with a polyamide insert having a hemispherical face. Its combined mass is 200 g (150 g) ± 1 g so that the equivalent mass complies with Table 1. Annex D gives an example of a test apparatus.

5.1.3 Test apparatus for severities of 2 J and above

The ratio of the mass of the arm to the combined mass of the striking element shall not be greater than 0,2 and the centre of gravity of the striking element shall be as close as is practicable to the axis of the arm.

For some particular applications, the pendulum arm is replaced by a cord and the striking element by a spherical steel ball. This is not recommended as the ball does not conform to the geometry of the striking element specified in this part of IEC 60068.

5.2 Height of fall

To produce impacts of the required severity, the striking element shall be released from a height depending on the equivalent mass of the pendulum, according to Table 2.

Table 2 – Height of fall

Energy J	0,14	0,2		(0,3)	0,35	(0,4)	0,5		0,7	1	2	5	10	20	50
Equivalent mass kg	0,25	(0,2)	0,25	(0,2)	0,25	(0,2)	(0,2)	0,25	0,25	0,25	0,5	1,7	5	5	10
Height of fall mm ± 1 %	56	(100)	80	(150)	140	(200)	(250)	200	280	400	400	300	200	400	500

NOTE 1 Figures in brackets appear in previous IEC 60068-2 standards; although no longer recommended, they may be used for historic consistency.

NOTE 2 In this part of IEC 60068, the energy, J, is calculated taking the standard acceleration due to the earth's gravity (g_n), rounded up to the nearest whole number, that is 10 m/s^2.

5.3 Testing

In order to avoid secondary impacts, i.e. rebounds, the hammer shall be retained after the initial impact by grasping the striking element whilst avoiding the arm so that distortion is prevented.

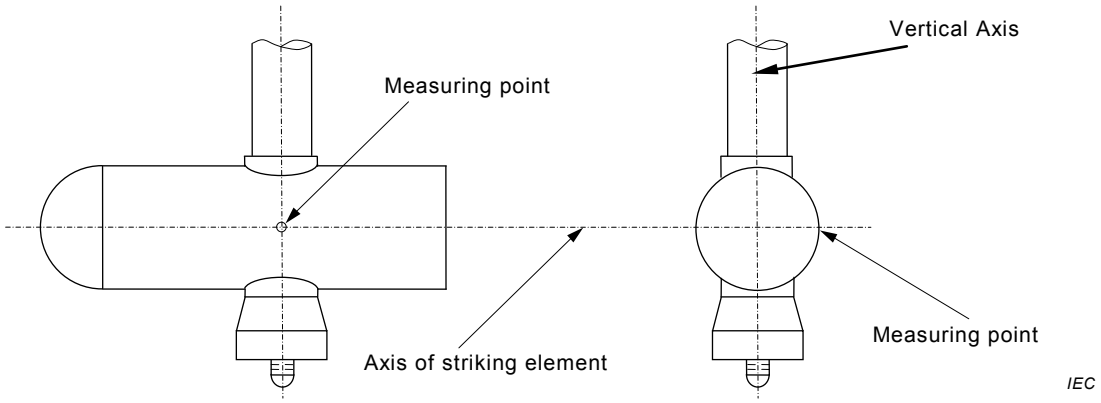

Figure 2 – Derivation of measuring point

6 Test Ehb: Spring hammer

6.1 Test apparatus

The spring hammer consists of three principal parts: the body, the striking element and the release system.

The body comprises the housing, the guide for the striking element, the release mechanism and all rigidly fixed parts.

The striking element comprises the hammer head, the hammer shaft and the cocking knob. The mass of this assembly is 250 g (200 g) for severities not exceeding 1 J, and 500 g for 2 J (see Table 1 for tolerances).

The force to release the striking element shall not exceed 10 N.

The configuration of the hammer shaft, the hammer head and the means for the adjustment of the hammer spring is such that the hammer spring has released all its stored energy approximately 1 mm before the tip of the hammer head reaches the plane of impact. For the last millimetre of its travel, prior to impact, the striking element is thus, apart from friction, a freely moving mass having only kinetic energy and no stored energy. Moreover, after the tip of the hammer head has passed the plane of impact, the striking element is free to travel, without interference, over a further distance of between 8 mm and 12 mm. Annex E gives an example of a test apparatus.

In order to comply with Table 1, the shape of the release head for 2 J shall be cylindrical for a length of 23 mm with a diameter of 35 mm (see Figure 3).