

Environmental testing —

Part 2-18: Tests — Tests R and guidance: Water

The European Standard EN 60068-2-18:2001 has the status of a
British Standard

ICS 19.040

National foreword

This British Standard is the official English language version of EN 60068-2-18:2001. It is identical with IEC 60068-2-18:2000. It supersedes BS 2011-2.1R:1990 which is withdrawn.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:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Cross-references

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This European Standard was approved by CENELEC on 2000-11-01. 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

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Foreword

The text of document 104/170/FDIS, future edition 2 of IEC 60068-2-18, 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 60068-2-18 on 2000-11-01.

The following dates were fixed:

- latest date by which the EN has to be implemented
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- latest date by which the national standards conflicting
with the EN have to be withdrawn (dow) 2003-11-01

Annexes designated "normative" are part of the body of the standard.

Annexes designated "informative" are given for information only.

In this standard, annex ZA is normative and annexes A, B, C, D and E are informative.

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 60068-2-18:2001 was approved by CENELEC as a European Standard without any modification.

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INTRODUCTION

It is the intention of this part of IEC 60068 to fulfil the function of a basic publication¹⁾ by making water tests available to product committees.

A number of water tests are described in other IEC publications. Some of them are well established, for example, the test for classification of the second characteristic numeral of the IP Code, clause 4 of IEC 60529.

This standard incorporates the majority of the most widely used tests, as well as making available further methods and increasing the number of severities.

¹⁾ IEC Guide 108:1994, *The relationship between technical committees with horizontal functions and product committees and the use of basic publications*

ENVIRONMENTAL TESTING –

Part 2-18: Tests – Test R and guidance: Water

1 Scope and object

This part of IEC 60068 provides methods of test applicable to products which, during transportation, storage or in service, may be subjected to falling drops, impacting water or immersion. The primary purpose of water tests is to verify the ability of enclosures, covers and seals to maintain components and equipment in good working order after and, when necessary, under a standardized dropfield or immersion in water.

These tests are not corrosion tests and should not be considered and used as such.

The effects of a large temperature difference between the water and the specimen, such as increased water ingress resulting from pressure changes, as well as thermal shock, are not simulated.

Established water tests in other standards are not intended to simulate natural rainfall and their quoted intensities are too high to be adopted for that purpose. Therefore, in addition to the high-intensity severities, Test R includes an artificial rain test based upon natural conditions but not taking into account high wind speeds generally associated with natural rain.

Guidance is given on the applicability of the tests and the severities to be selected.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 60068. For dated references, subsequent amendments to, or revisions of, these publications do not apply. However, parties to agreements based on this part of IEC 60068 are encouraged to investigate the possibility of applying the most recent edition of the normative documents indicated below. For undated references, the latest edition of the normative documents referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards

IEC 60529:1989, *Degrees of protection provided by enclosures (IP Code)*

3 Definitions

For the purposes of this part of IEC 60068, the following definitions apply.

3.1 rain

precipitation in the form of waterdrops. Both the amount that falls and the actual falling action of the waterdrops are often called rainfall

3.2**drizzle**

precipitation in the form of very small, numerous and uniformly dispersed waterdrops that may appear to float while following air currents

3.3**raindrop**

drop of water having a diameter greater than 0,5 mm falling through the atmosphere

3.4**drizzledrop**

drop of water having a diameter of 0,2 mm to 0,5 mm falling through the atmosphere

3.5**rainfall or drizzle intensity (R)**

amount that falls per unit of time. Rainfall intensity (R) is given in millimetres per hour (mm/h) where 1 l/(m².h) equals 1 mm/h

3.6**median volume diameter (D_{50})**

diameter of a drop whose size is such that 50 % of the volume of water reaching the ground is comprised of smaller (or larger) drops:

$$D_{50} = 1,21 R^{0,19} \text{ (mm)}$$

where R is the rainfall intensity, see above

4 Survey of water tests**4.1 General**

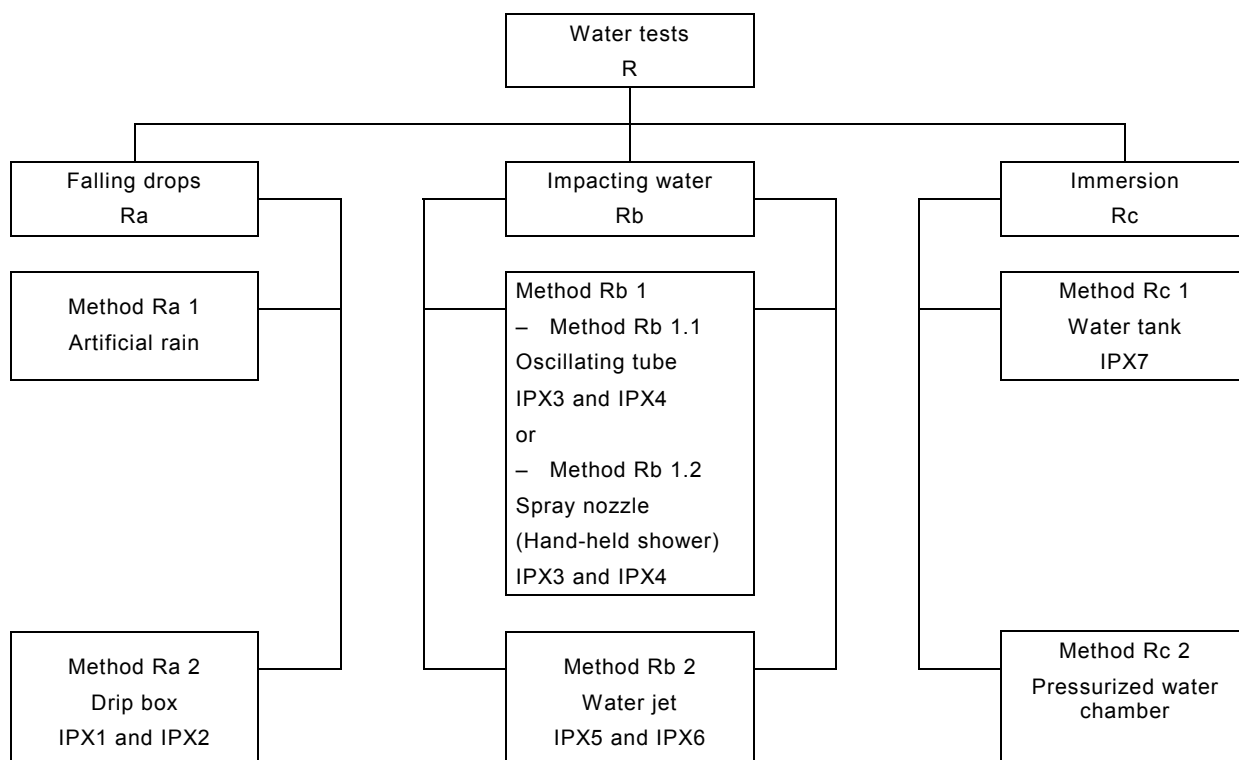
This survey indicates the general structure of the various tests included in this standard.

The structuring of the different tests is given in figure 1.

4.2 Description of Tests R: Water

The water tests are structured into three groups.

- Ra: "Falling drops" which, in principle, is a test with artificial rain and a test simulating falling drops from condensation or leakage.
- Rb: "Impacting water" where water jets impinge upon the test specimen with a certain force and may assume any angle towards the test specimen.
- Rc: "Immersion" where the test specimen is immersed in water to specified depths or equivalent pressures.



IEC 206/2000

Figure 1 – Structuring of test methods and equivalence with the IP Code of IEC 60529

5 Test Ra: Falling drops

5.1 Object

This test is applicable to products which, during transportation, storage or in service may be exposed to vertical falling drops, the origin of these being, for example, natural rain, seepage or condensation. It shall be clearly stated in the relevant specification whether a product hereinafter referred to as a specimen has to function during testing or merely to survive conditions of falling drops. In either case, the relevant specification shall always prescribe the acceptable tolerances in performance.

5.2 Method Ra 1: Artificial rain

5.2.1 General description of the test

The test specimen is mounted on an appropriate fixture or base support. It is then subjected to falling waterdrops, which simulate natural rain.

The basic requirements for the test apparatus are:

- Drop-generating nozzle or nozzles (see C.2.1 and figure C.1).
- Fixture for the specimen

The fixture shall simulate as far as possible the mounting of the specimen when in service; for example, for wall-mounted equipment the fixture shall simulate a wall.

- Support of the test specimen

The support shall have a base area which is smaller than the base area of the specimen. The support shall be either a turntable which has a rotation speed of 1 r/min and the eccentricity (distance between turntable axis and specimen axis) is approximately 100 mm, or a table which does not turn. The support shall be able to hold the specimen in any test position and, if necessary, be tilted to a maximum of 90° from the vertical plane.

- Water supply with controls

The water used for the test shall be fresh tap water of good quality. In order to avoid clogging of the nozzles, the water shall be filtered and may be demineralized. Details of the characteristics of the water are given in annex A. During the test, the water temperature shall not differ by more than 5 K from the temperature of the specimen under test. If the water temperature is more than 5 K below the temperature of the specimen, a pressure balance shall be provided for the specimen.

5.2.2 Severities

The severities, as indicated by intensity (and associated drop-size distribution), duration and tilt angle of specimen shall be prescribed in the relevant specification. The values shall be selected from those given below. Wind-driven rain is not simulated by this test as the wind velocity is not a parameter of test.

- Intensity, mm/h and (associated drop-size distribution, mm):

10 ± 5 ($D_{50} = 1,9 \pm 0,2$); 100 ± 20 ($D_{50} = 2,9 \pm 0,3$); 400 ± 50 ($D_{50} = 3,8 \pm 0,4$).

- Duration, minutes:

10, 30, 60, 120

- Tilt angle α , degrees:

0, 15, 30, 60, 90

NOTE The relevant specification may prescribe a longer duration.

5.2.3 Preconditioning

Preconditioning of the specimen and seals shall be carried out if prescribed in the relevant specification.

5.2.4 Initial measurements

The specimen shall be submitted to the visual, dimensional and functional checks prescribed by the relevant specification. All features of the specimen likely to affect the test result, for example surface treatment, enclosures, covers or seals, shall be inspected to ensure that the instructions of the relevant specification have been followed.

5.2.5 Testing

The specimen shall be mounted on the support either

- in its normal operating position, as prescribed in the relevant specification; or
- tilted from the normal operating position and provision made for rotating the specimen in a plane perpendicular to the tilted axis. The rotation may be achieved by a rotating support table or by repositioning the specimen at regular intervals during the test. Alternatively, the specimen can be oscillated through an arc of 270° to avoid the need for slip-ring contacts.

The relevant specification shall specify the tilt angle or angles, the face or faces to be exposed to the drop field and the duration of exposure for each side, or whether the specimen shall be continuously rotated or oscillated through 270°. See also figure 2.

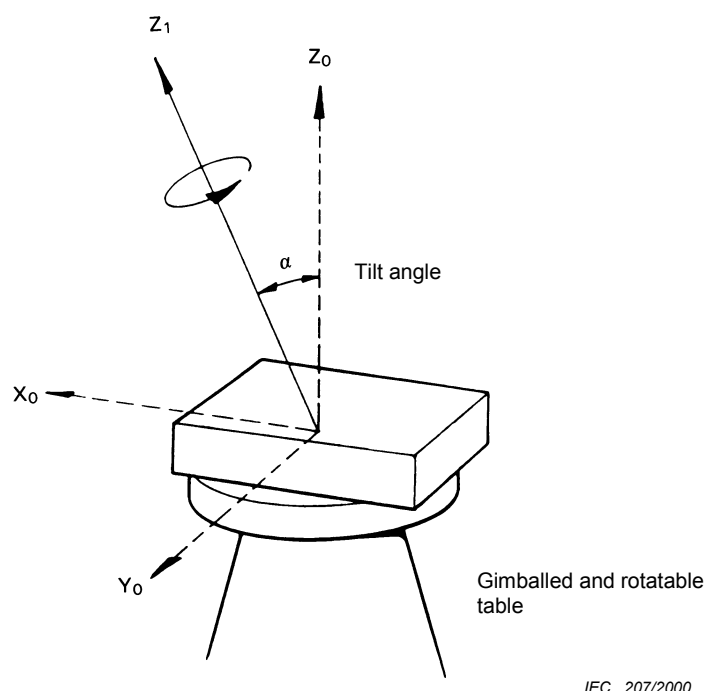
The specimen shall be subjected to artificial rain with severities selected from 5.2.2 and prescribed by the relevant specification.

The relevant specification shall state whether the specimen shall be operated during testing and if intermediate measurements shall be made.

Appropriate safety precautions shall be taken when testing the specimen in the energized condition.

5.2.6 Recovery

Unless otherwise required in the relevant specification, the specimen shall be thoroughly dried externally by wiping or by applying low-velocity forced air at room temperature.



IEC 207/2000

Figure 2 – Test Ra, definitions of angles and axes

5.2.7 Final measurements

The specimen shall be examined for ingress of water and submitted to visual, dimensional and functional checks prescribed by the relevant specification.

Any ingress of water should be quantified if possible and reported.

5.2.8 Information to be given in the relevant specification

Where this test is included in the relevant specification, the following details shall be given in so far as they are applicable. The relevant specification shall supply information as required in the clauses listed below, paying particular attention to the items marked with an asterisk (*) as this information is always required.

	Subclause
a) Severities*	5.2.2
b) Preconditioning	5.2.3
c) Initial measurements*	5.2.4
d) Mounting of specimen*	5.2.5
e) Specimen position or positions during testing*	5.2.5
f) State of the specimen during testing*	5.2.5
g) Intermediate measurements	5.2.5
h) Recovery	5.2.6
i) Final measurements*	5.2.7

5.3 Method Ra 2: Drip box

5.3.1 General description of the test

The test specimen is mounted on an appropriate fixture placed under the drip box. The test specimen is subjected to water drops, which simulate water falling as a result of condensation or leakage.

The basic requirements for the test apparatus are:

- Drip box

The drip box shall normally have a base area larger than the projected area of the specimen. If the base of the drip box is smaller than that of the specimen under test, the latter may be divided into several sections, the area of each section being large enough to be covered by the dripping water. The test is continued until the whole area of the specimen has been sprinkled for the specified time. The drip box shall be capable of providing a uniform dropfield with a precipitation of the specified intensity.

The grid pattern of the nozzles shall be 20 mm (for IP Code tests) or 25 mm. The distance from the bottom of the drip box to the highest point of the specimen shall be adjustable to either 0,2 m or 2 m. A suitable drip-box layout is described in C.2.2 and figure C.2.

- Fixture for the specimen

The fixture shall simulate as far as possible the mounting of the specimen when in service; for example, for wall-mounted equipment the fixture shall simulate a wall.

- Support of the test specimen

The support shall have a base area which is smaller than the base area of the specimen. The support shall either be a turntable which has a rotation speed of 1 r/min and the eccentricity (distance between turntable axis and specimen axis) is approximately 100 mm, or a table which does not turn. The support shall be able to hold the specimen in any test position and, if necessary, be tilted to a maximum of 45° from the vertical plane.

– Water supply with controls

The water used for the test shall be fresh tap water of good quality. In order to avoid clogging of the nozzles, the water shall be filtered and may be demineralized. Details of the characteristics of the water are given in annex A. During the test, the water temperature shall not differ by more than 5 K from the temperature of the specimen under test. If the water temperature is more than 5 K below the temperature of the specimen, a pressure balance shall be provided for the specimen.

5.3.2 Severities

The severities, as indicated by drop falling height, tilt angle of specimen, duration and water intensity, shall be prescribed in the relevant specification. The values shall be selected from the following:

- Drop falling height, (h), m: 0,2; 2
- Tilt angle α , degrees: 0; 15; 30; 45
- Duration, minutes: 3; 10; 30; 60

NOTE The 3 min duration applies only when a tilt angle of 0° is specified.

- Water intensity, mm/h: 60^{+30}_{-0} ; 180^{+30}_{-0}

5.3.3 Preconditioning

Preconditioning of the specimen and seals shall be carried out if prescribed in the relevant specification.

5.3.4 Initial measurements

The specimen shall be submitted to the visual, dimensional and functional checks prescribed by the relevant specification. All the features of the specimen likely to affect the test result, for example, surface treatment, covers or seals, shall be inspected to ensure that the instructions of the relevant specification have been followed.

5.3.5 Testing

The specimen shall be mounted on the support in its normal operating position under the drip box. The support shall then either be rotated or tilted to the specified angle in each of the four positions of tilt. These positions are on either side of the vertical in two mutually perpendicular planes. If a special mounting condition is required (for example, wall or ceiling), it shall be prescribed by the relevant specification.

In both cases, the test shall be carried out in the conditions specified in 5.3.1 and severity selected from 5.3.2.

In the case of tilted support, the duration shall be divided equally between the four positions.

The relevant specification shall state whether the specimen shall be operated during testing and if intermediate measurements shall be made. Appropriate safety precautions shall be taken when testing the specimen in the energized condition.