

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE



Environmental testing – **STANDARD PREVIEW**  
Part 2-18: Tests – Test R and guidance: Water  
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Essais d'environnement –  
Partie 2-18: Essais – Essai R et guide: Eau  
IEC 60068-2-18:2017  
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## ENVIRONMENTAL TESTING –

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

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International Standard IEC 60068-2-18 has been prepared by IEC technical committee 104: Environmental conditions, classification and methods of test.

This third edition cancels and replaces the second edition published in 2000. This edition constitutes a technical revision.

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

- a) addition of the new test method Rb 3.

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

FDIS	Report on voting
104/719/FDIS	104/722/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.

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## INTRODUCTION

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, of IEC 60529.

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

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## ENVIRONMENTAL TESTING –

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

#### 1 Scope

This part of IEC 60068 provides methods of test applicable to products which, during transportation, storage or in service, can be subjected to falling water drops, impacting water, immersion or high pressure water impact. 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 drop field or immersion in water.

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

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

There are no normative references in this document.

#### 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 standardisation 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

##### **rain**

precipitation in the form of water drops

Note 1 to entry: Both the amount that falls and the actual falling action of the water drops are often called rainfall.

##### 3.2

##### **drizzle**

precipitation in the form of very small, numerous and uniformly dispersed water drops 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*****R*****rainfall or drizzle intensity**

amount that falls per unit of time

Note 1 to entry: Rainfall intensity (*R*) is given in millimetres per hour (mm/h) where 1 l/(m<sup>2</sup> · h) equals 1 mm/h.

**3.6*****D*<sub>50</sub>****median volume diameter**

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

Note 1 to entry: Median volume diameter can be calculated using the formula:

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

where *R* is the rainfall intensity (see 3.5).

**4 Survey of water tests****4.1 General**

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

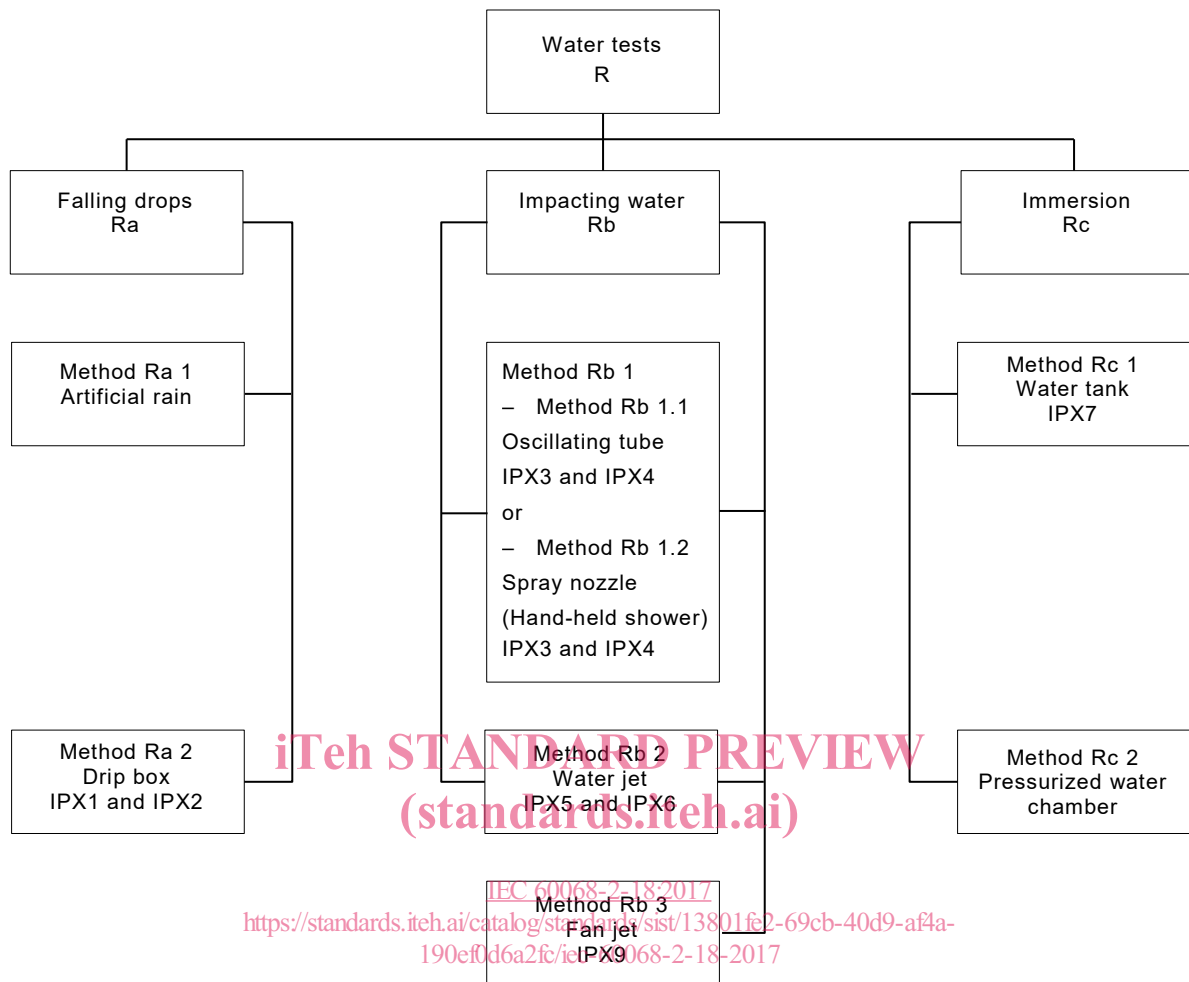
The structuring of the different tests is given in Figure 11.

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**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.



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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 specify 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 as follows.

- 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 specified in the relevant specification. The values shall be selected from those given below, a longer duration may be specified in the relevant specification. 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):  
 $10 \pm 5$  ( $D_{50} = 1,9 \pm 0,2$ );  $100 \pm 20$  ( $D_{50} = 2,9 \pm 0,3$ );  $400 \pm 50$  ( $D_{50} = 3,8 \pm 0,4$ ).
- Duration, min:  
 10, 30, 60, 120.
- Tilt angle  $\alpha$ , degrees:  
 0, 15, 30, 60, 90.

### 5.2.3 Preconditioning

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

### 5.2.4 Initial measurements

The specimen shall be submitted to the visual, dimensional and functional checks specified in 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 specified 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.

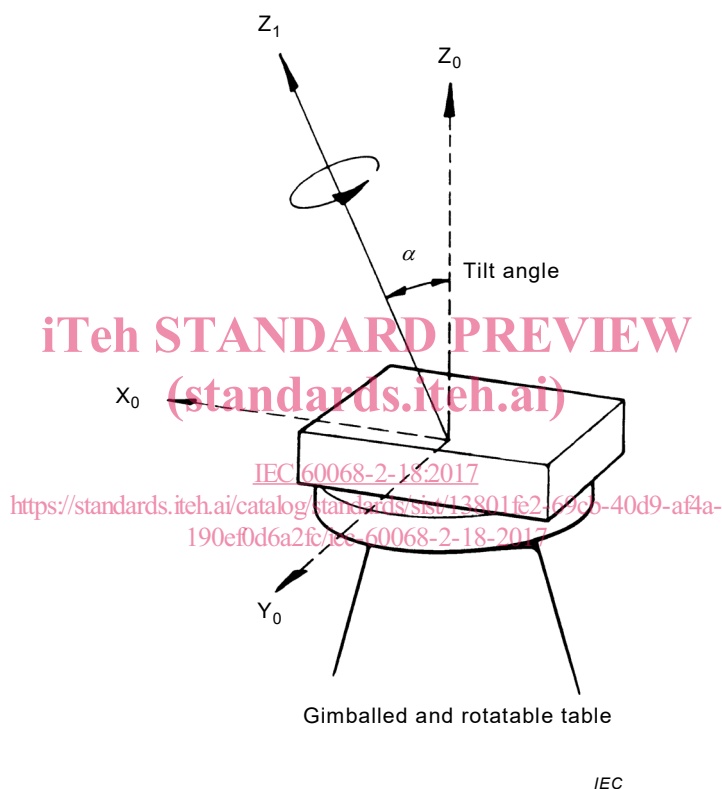
The specimen shall be subjected to artificial rain with severities selected from 5.2.2 and specified in the relevant specification.

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.



**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 specified in 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 subclauses 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 as follows.

- 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 drop field 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 in 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 an eccentricity (distance between turntable axis and specimen axis) of 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 specified in the relevant specification. The values shall be selected from the following: