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(IEC 60068-2-18 : 2000)

(RCJ/JSA)

**Environmental testing—Part 2-18 :
Tests—Test R and guidance : Water**

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by Reliability Center for Electronic Components of Japan (RCJ)/Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

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JIS C 60068-2 consists of the following 48 parts;

- JIS C 60068-2-1 *Environmental testing procedures Part 2: Tests, Tests A: Cold*
- JIS C 60068-2-2 *Basic environmental testing procedures Part 2: Tests, Test B: Dry heat*
- JIS C 60068-2-3 *Basic environmental testing procedures Part 2: Tests, Test Ca: Damp heat, steady state*
- JIS C 60068-2-6 *Environmental testing Part 2: Tests—Test Fc: Vibration (sinusoidal)*
- JIS C 60068-2-7 *Basic environmental testing procedures Part 2: Tests—Test Ga and guidance: Acceleration, steady state*
- JIS C 60068-2-11 *Basic environmental testing procedures Part 2: Tests—Test Ka: Salt mist*
- JIS C 60068-2-13 *Basic environmental testing procedures Part 2: Tests, Test M: Low air pressure*
- JIS C 60068-2-17 *Basic environmental testing procedures—Part 2: Tests—Test Q: Sealing*
- JIS C 60068-2-18 *Environmental testing—Part 2-18: Tests—Test R and guidance: Water*
- JIS C 60068-2-20 *Basic environmental testing procedures Part 2: Tests. Test T: Soldering*
- JIS C 60068-2-21 *Environmental testing—Part 2-21: Tests—Test U: Robustness of termination and integral mounting devices*
- JIS C 60068-2-27 *Basic environmental testing procedures Part 2: Tests, Test Ea and guidance: Shock*
- JIS C 60068-2-28 *Environmental testing, Part 2: Tests—Guidance for damp heat tests*
- JIS C 60068-2-29 *Basic environmental testing procedures Part 2: Tests Test Eb and guidance: Bump*
- JIS C 60068-2-30 *Basic environmental testing procedures Part 2: Tests Test Db: Damp heat, cyclic (12 + 12-Hour cycle)*
- JIS C 60068-2-31 *Environmental testing Part 2: Tests. Test Ec: Drop and topple, primarily for equipment-type specimens*
- JIS C 60068-2-32 *Environmental testing Part 2: Tests. Test Ed: Free fall*
- JIS C 60068-2-38 *Basic environmental testing procedures Part 2: Tests Test Z/AD: Composite temperature/humidity cyclic test*
- JIS C 60068-2-39 *Environmental testing—Part 2: Tests. Test Z/AMD: Combined sequential cold, low air pressure, and damp heat test*
- JIS C 60068-2-40 *Environmental testing Part 2: Tests, Test Z/AM: Combined cold/low air pressure tests*
- JIS C 60068-2-41 *Environmental testing Part 2: Tests, Test Z/BM: Combined dry heat/low air pressure tests*

- JIS C 60068-2-42 *Basic environmental testing procedures Part 2: Tests Test Kc: Sulphur dioxide test for contacts and connections*
- JIS C 60068-2-43 *Basic environmental testing procedures Part 2: Tests Test Kd: Hydrogen sulphide test for contacts and connections*
- JIS C 60068-2-45 *Environmental testing procedures of electronic and electrical resistance to solvents (immersion in cleaning solvents)*
- JIS C 60068-2-46 *Basic environmental testing procedures Part 2: Tests Guidance to Test Kd: Hydrogen sulphide test for contacts and connections*
- JIS C 60068-2-47 *Environmental testing—Part 2-47: Test methods—Mounting of components, equipment and other articles for vibration, impact and similar dynamic tests*
- JIS C 60068-2-48 *Environmental testing—Part 2: Tests. Guidance on the application of the tests of JIS environmental testing series to simulate the effects of storage*
- JIS C 60068-2-49 *Basic environmental testing procedures Part 2: Tests Guidance to Test Kc: Sulphur dioxide test for contacts and connections*
- JIS C 60068-2-50 *Basic environmental testing procedures Part 2: Tests Tests Z/AFc: Combined cold/vibration (sinusoidal) tests for both heat-dissipating and non-heat-dissipating specimens*
- JIS C 60068-2-51 *Basic environmental testing procedures Part 2: Tests Tests Z/BFc: Combined dry heat/vibration (sinusoidal) tests for both heat-dissipating and non-heat-dissipating specimens*
- JIS C 60068-2-52 *Environmental testing—Part 2: Tests—Test Kb: Salt mist, cyclic (sodium, chloride solution)*
- JIS C 60068-2-53 *Basic environmental testing procedures Part 2: Tests Guidance to tests Z/AFc and Z/BFc: Combined temperature (cold and dry heat) and vibration (sinusoidal) tests*
- JIS C 60068-2-54 *Environmental testing Part 2: tests. Test Ta: Soldering. Solderability testing by the wetting balance method*
- JIS C 60068-2-56 *Environmental testing Part 2: Tests. Test Cb: Damp heat, steady state, primarily for equipment*
- JIS C 60068-2-57 *Environmental testing—Electrotechnical products—Time-history vibration test method*
- JIS C 60068-2-58 *Environmental testing—Part 2: Tests—Test Td: Test methods for solderability, resistance to dissolution of metallization and to soldering heat of surface mounting devices (SMD)*
- JIS C 60068-2-59 *Environmental testing—Part 2: Test methods Test Fe: Vibration—Sine-beat method*
- JIS C 60068-2-60 *Environmental testing—Part 2: Tests—Test Ke: Flowing mixed gas corrosion test*
- JIS C 60068-2-61 *Environmental testing Part 2: Test methods Test Z/ABDM: Climatic sequence*
- JIS C 60068-2-64 *Environmental testing Part 2: Test methods—Test Fh: Vibration, broad-band random (digital control) and guidance*
- JIS C 60068-2-65 *Environmental testing—Part 2-65: Vibration, acoustically induced*
- JIS C 60068-2-66 *Environmental testing—Part 2: Test methods—Test Cx: Damp heat, steady state (unsaturated pressurized vapour)*
- JIS C 60068-2-67 *Environmental testing—Part 2: Tests—Test Cy: Damp heat, steady state, accelerated test primarily intended for components*
- JIS C 60068-2-68 *Environmental testing—Electrotechnical products—Dust and sand test*
- JIS C 60068-2-75 *Environmental testing—Part 2-75: Tests—Test Eh: Hammer tests*
- JIS C 60068-2-77 *Environmental testing—Part 2-77: Tests—Test 77: Body strength and impact shock*
- JIS C 60068-2-78 *Environmental testing—Part 2-78: Tests—Test Cab: Damp heat, steady state*
- JIS C 60068-2-81 *Environmental testing—Part 2-81: Shock—Shock response spectrum synthesis*

Environmental testing—Part 2-18 : Tests— Test R and guidance : Water

Introduction

This Japanese Industrial Standard has been prepared based on the second edition of **IEC 60068-2-18** published in 2000 without modifying the technical contents.

The portions given dotted underlines are the matters not stated in the original International Standard.

A number of water tests are described in other Japanese Industrial Standards. Some of them are well established, for example, the test for classification of the second characteristic numeral of the IP Code, **JIS C 0920**.

This Standard incorporates the majority of the most widely used water tests.

1 Scope

This part of **JIS C 60068-2** 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.

NOTE : The International Standard corresponding to this part of **JIS C 60068-2** is as follows.

IEC 60068-2-18:2000 *Environmental testing—Part 2-18: Tests—Test R and guidance: Water* (IDT)

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standard and **JIS** are IDT (identical), MOD (modified), and NEQ (not equivalent) according to **ISO/IEC Guide 21**.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this Standard.

For the normative standard with the year indication, only the edition of the indicated year shall apply but the revision (including amendments) made thereafter shall not apply.

JIS C 0920 *Degrees of protection provided by enclosures (IP Code)*

NOTE : Corresponding International Standard: IEC 60529 : 2001 *Degrees of protection provided by enclosures (IP Code)* (IDT)

3 Definitions

For the purposes of this part of **JIS C 60068-2**, 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.

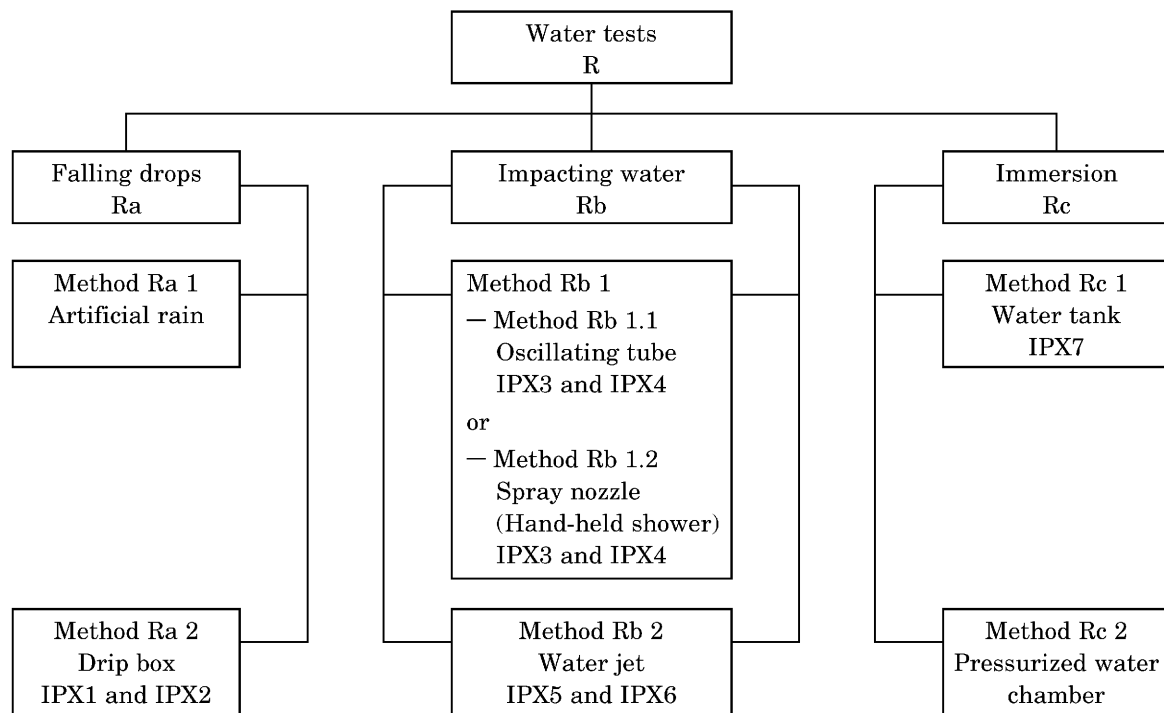


Figure 1 Structuring of test methods and equivalence with the IP Code of (JIS C 0920)

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.

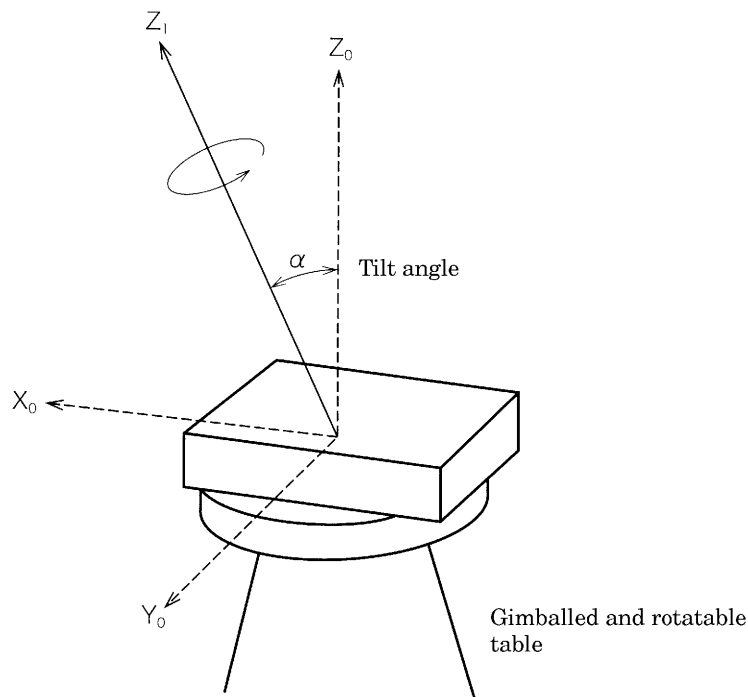


Figure 2 Test Ra, definitions of angles and axes

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