SLOVENSKI STANDARD
SIST EN 60068-2-17:2002

01-maj-2002

Environmental testing - Part 2: Tests - Test Q: Sealing

Environmental testing -- Part 2: Tests - Test Q: Sealing

Umweltprüfungen -- Teil 2: Prüfungen - Prüfung Q: Dichtheit

Essais d'environnement -- Partie 2: Essais - Essai Q: Etanchéité

Ta slovenski standard je istoveten z: EN 60068-2-17:1994

ICS:

19.040	Preskušanje v zvezi z okoljem	Environmental testing

SIST EN 60068-2-17:2002 **en**

EUROPEAN STANDARD

NORME EUROPEENNE

EUROPÄISCHE NORM

EN 60068-2-17

August 1994

UDC 621.3:620.193:620.162.4

Supersedes HD 323.2.17 S4:199

Descriptors: Electricity, components, equipment, mechanical test, definitions, sealing test, procedures, components specifications writing, equipment specifications writing

ENGLISH VERSION

Environmental testing
Part 2: Tests
Test Q: Sealing
(IEC 68-2-17:1994)

Essais d'environnement
Partie 2: Essais
Essai Q: Etanchéité
(CEI 68-2-17:1994)

Umweltprüfungen
Teil 2: Prüfungen
Prüfung Q: Dichtheit
(IEC 68-2-17:1994)

This European Standard was approved by CENELEC on 1994-03-08. 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.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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

Ref. No. EN 60068-2-17:1994 E

FOREWORD

At the request of CENELEC Reporting Secretariat SR 50, the International Standard IEC 68-2-17:1978 and its amendment 4:1991 (incorporating amendments 1:1985, 2:1987 and 3:1989) was submitted to the CENELEC Unique Acceptance Procedure (UAP) in May 1993 for acceptance as a European Standard.

The text of document 50(CO)261, as prepared by IEC Technical Committee 50, Environmental testing, was submitted to the IEC-CENELEC parallel vote in May 1993.

The combined text of the International Standard with its four amendments and 50(CO)261 was approved by CENELEC as EN 60068-2-17 on 1994-03-08.

This European Standard replaces HD 323.2.17 S4:1990.

The following dates were fixed:

- latest date of publication of an identical national standard (dop) 1995-04-01

- latest date of withdrawal of conflicting national standards (dow) 1995-04-01

Annexes designated "normative" are part of the body of the standard. In this standard, annexes A to H are all normative.

IEC 529:1989, Degrees of protection provided by enclosures (IP Code), which is quoted in this standard, has been harmonized by CENELEC as EN 60529:1991.

ENDORSEMENT NOTICE

The text of the International Standard IEC 68-2-17:1994 was approved by CENELEC as a European Standard without any modification.

NORME INTERNATIONALE
INTERNATIONAL STANDARD

CEI
IEC
68-2-17

Quatrième édition
Fourth edition
1994-07

Essais fondamentaux climatiques et de robustesse mécanique –

Partie 2:
Essais – Essai Q: Etanchéité

Basic environmental testing procedures –

Part 2:
Tests – Test Q: Sealing

Bureau Central de la Commission Electrotechnique Internationale 3, rue de Varembé Genève, Suisse

Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

CODE PRIX
PRICE CODE XA

Pour prix, voir catalogue en vigueur
For price, see current catalogue

CONTENTS

Page

FOREWORD 9
Survey of sealing tests 11

Clause

1 Definitions 17
2 Test Qa: Sealing of bushes, spindles and gaskets 19
2.1 Object 19
2.2 Scope 19
2.3 General description of the test 21
2.4 Initial measurements 21
2.5 Conditioning 21
2.6 Final measurements 21
2.7 Information to be given in the relevant specification 21
3 Test Qc: Container sealing, gas leakage 21
3.1 Object 21
3.2 Scope 23
3.3 General description of the test 23
3.4 Test Method 1 23
3.5 Test Method 2 25
3.6 Test Method 3 25
3.7 Information to be given in the relevant specification 27
4 Test Qd: Container sealing, seepage of filling liquid 27
4.1 Object 27
4.2 Scope 29
4.3 General description of the test 29
4.4 Severities 29
4.5 Preconditioning 29
4.6 Initial measurements 29
4.7 Conditioning 29
4.8 Final measurements 29
4.9 Information to be given in the relevant specification 31
5 Test Qf: Immersion 31
5.1 Object 31
5.2 General description of the test 31
5.3 Initial measurements 31
5.4 Preconditioning 31

Clause Page

5.5 Conditioning 31
5.6 Recovery 33
5.7 Final measurements 33
5.8 Information to be given in the relevant specification 33

6 Test Qk: Sealing tracer gas method with mass spectrometer 35

6.1 Object 35
6.2 Scope 35
6.3 General description of the test 35
6.4 Test method 1 (for specimens not filled with helium during manufacturing) 37
6.5 Test Method 2 (for specimens filled with helium during manufacturing or for the requirements of this test) 41
6.6 Test Method 3 (applicable to specimens to be mounted on bulkheads or panels) 43
6.7 Information to be given in the relevant specification 45

7 Test Ql: Bomb pressure test 49

7.1 Object 49
7.2 Scope 49
7.3 General description of the test 49
7.4 Initial measurements 49
7.5 Conditioning 49
7.6 Recovery 51
7.7 Final measurements 51
7.8 Information to be given in the relevant specification 51

8 Test Qm: Tracer gas sealing test with internal pressurization 51

8.1 Object 51
8.2 Scope 53
8.3 General description of the test 53
8.4 Pre-conditioning 53
8.5 Conditioning 55
8.6 Information to be given in the relevant specification 57

9 Test Qy: Pressure rise sealing test 57

9.1 Object 57
9.2 Scope 59
9.3 General description of the test 59
9.4 Calibration of the test equipment 61
9.5 Information to be given in the relevant specification 61

Annexes

A Example of a test chamber for Test Qa 65
B Guidance for Test Qc 71
C Guidance for Test Qd 77
D Interrelation of test parameters for Test Qk 79
E Guidance for Test Qk 85
F Guidance for Test Ql 93
G Guidance for Test Qm 95
H Guidance for Test Qy 101

INTERNATIONAL ELECTROTECHNICAL COMMISSION

BASIC ENVIRONMENTAL TESTING PROCEDURES –

Part 2: Tests – Test Q: Sealing

FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international cooperation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.

2) The formal decisions or agreements of the IEC on technical matters, prepared by technical committees on which all the National Committees having a special interest therein are represented, express, as nearly as possible, an international consensus of opinion on the subjects dealt with.

3) They have the form of recommendations for international use published in the form of standards, technical reports or guides and they are accepted by the National Committees in that sense.

4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.

International Standard IEC 68-2-17 has been prepared by IEC technical committee 50: Environmental testing.

The present edition supersedes the third edition (1978) and the amendments 1 (1985), 2 (1987), 3 (1989) and 4 (1991).

The text of this standard is based on the third edition (1978) and amendments 1 (1985), 2 (1987), 3 (1989), 4 (1991) and on the following documents:

DIS	Report on voting
50(CO)261	50(CO)264

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

Annexes A to H form an integral part of this standard.

Publication quoted in this standard:

IEC 529: 1989, *Degrees of protection provided by enclosures (IP Code).*

SURVEY OF SEALING TESTS

General

This survey indicates the interrelation between the various tests for sealing in Test Q of IEC 68. Other tests of this category are rain and water tests which are to be included as tests R. At the same time the opportunity has been taken to make reference to similar tests in IEC 529.

Tests in IEC 68-2-17

Test Q: Sealing, includes a number of tests which use different conditioning procedures appropriate for different applications.

The family tree of all sealing tests is shown in figure 1.

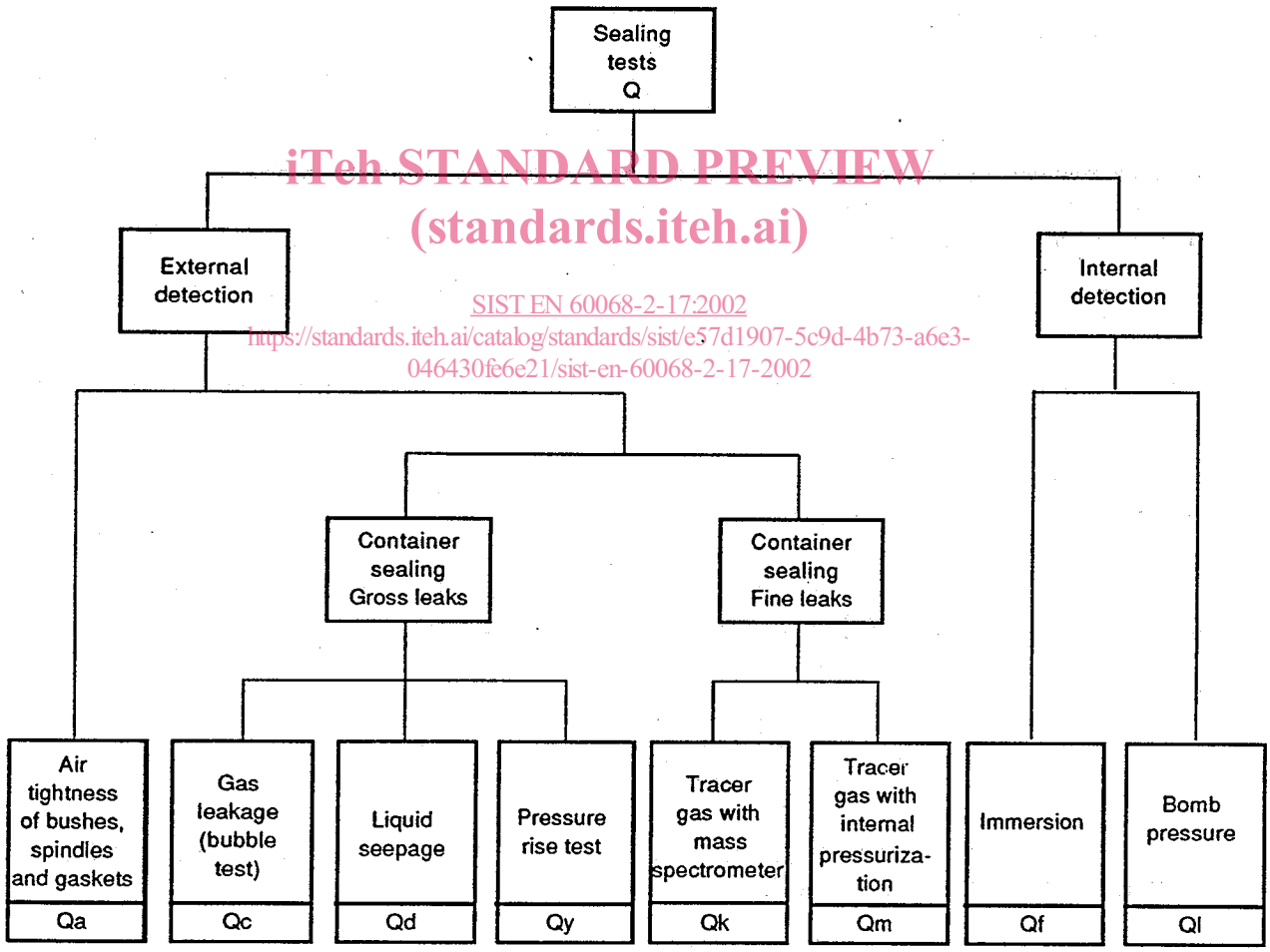

Figure 1

Test Q may be subdivided in the following two sub-groups, distinguished by their detection methods, viz:

- internal detection, which measures changes of electrical characteristics produced by the test medium (liquid or gas) introduced into the specimens through the leak;
- external detection, whereby the escape of the test medium through the leak is observed.

The two tests for internal detection Qf and Ql are very similar. They are very effective for certain components, for example plastic foil capacitors; they are not recommended, however, for components in which electrical changes become effective only after a long time (for instance, after the test is terminated).

The tests for external detection are further subdivided according to their application. Test Qa is a bubble test which is used to determine the air tightness of bushes, spindles and gaskets. The other tests, Qc, Qd, Qk and Qm are used to determine leaks in containers (metallic cases, housings, etc.); Test Qc is a bubble test again including three methods with different sensitivities (leaks not less than 1 Pa · cm^3/s (10^{-5} bar · cm^3/s)).

Test Qk and Qm are the most sensitive of this series. Their sensitivity ranges from 1 Pa · cm^3/s (10^{-5} bar · cm^3/s) to about 10^{-6} Pa · cm^3/s (10^{-11} bar · cm^3/s). Test Qd is a liquid seepage test which may be applied to specimens filled during manufacture with a liquid or a product becoming liquid at the test temperature.

Tests in IEC 529

In IEC 529, degrees of protection are established by tests and identified by numerals as follows:

Table 1 – Degrees of protection indicated by the first characteristic numeral

First characteristic numeral	Degree of protection	
	Short description	Definition
0	Non-protected	No special protection
1	Protected against solid objects greater than 50 mm	A large surface of the body, such as a hand (but no protection against deliberate access). Solid objects exceeding 50 mm in diameter
2	Protected against solid objects greater than 12 mm	Fingers or similar objects not exceeding 80 mm in length. Solid objects exceeding 12 mm in diameter
3	Protected against solid greater than 2,5 mm	Tools, wires, etc., of diameter or thickness greater than 2,5 mm. Solid objects exceeding 2,5 mm in diameter
4	Protected against solid objects greater than 1,0 mm	Wires or strips of thickness greater than 1,0 mm. Solid objects exceeding 1,0 mm in diameter
5	Dust-protected	Ingress of dust is not totally prevented but dust does not enter in sufficient quantity to interfere with satisfactory operation of the equipment
6	Dust-tight	No ingress of dust

Table 2 – Degrees of protection indicated by the second characteristic numeral

Second charac-teristic numeral	Degree of protection	
	Short description	Definition
0	Non-protected	No special protection
1	Protected against dripping water	Dripping water (vertically falling drops) shall have no harmful effect
2	Protected against dripping water when tilted up to 15°	Vertically dripping water shall have no harmful effect when the enclosure is tilted at any angle up to 15° from its normal position
3	Protected against spraying water	Water falling as a spray at an angle up to 60° from the vertical shall have no harmful effect
4	Protected against splashing water	Water splashed against the enclosure from any direction shall have no harmful effect
5	Protected against water jets	Water projected by a nozzle against the enclosure from any direction shall have no harmful effect
6	Protected against heavy seas	Water from heavy seas or water projected in powerful jets shall not enter the enclosure in harmful quantities
7	Protected against the effects of immersion	Ingress of water in a harmful quantity shall not be possible when the enclosure is immersed in water under defined conditions of pressure and time
8	Protected against submersion	The equipment is suitable for continuous submersion in water under conditions which shall be specified by the manufacturer NOTE – Normally, this will mean that the equipment is hermetically sealed. However with certain types of equipment it can mean that water can enter but only in such a manner that it produces no harmful effects

BASIC ENVIRONMENTAL TESTING PROCEDURES –

Part 2: Tests – Test Q: Sealing

1 Definitions

For the purpose of this standard the following definitions apply:

1.1 *Leak rate*

The quantity of a dry gas at a given temperature that flows through a leak per unit of time and for known difference of pressure across the leak.

NOTE – The basic SI unit for leak rate is "pascal cubic metre per second (Pa · m^3/s)". The derived units "Pa · cm^3/s" and "bar · cm^3/s" are used in this standard as they better conform with the orders of magnitude used in common industrial practice.

It is recalled that: 1 Pa · m^3/s = 10^6 Pa · cm^3/s = 10 bar · cm^3/s.

1.2 *Standard leak rate*

The leak rate under standard conditions of temperature and pressure difference.

For the purpose of this test, the standard conditions are 25 °C and 10^5 Pa (1 bar).

1.3 *Measured leak rate (R)*

The leak rate of a given device as measured under specified conditions and employing a specified test gas.

NOTES

1 Measured leak rates are often determined with helium employed as the test gas under a pressure difference of 10^5 Pa (1 bar) at 25 °C.

2 For the purpose of comparison with leak rates determined by other methods of testing, the leak rates must be converted to equivalent standard leak rates.

1.4 *Equivalent standard leak rate (L)*

The standard leak rate of a given device, with air as the test gas.

1.5 *Time constant (of leakage) (θ)*

The time required for equalization of partial pressure difference across a leak if the initial rate of change of that pressure difference were maintained. For the purpose of this test, the time constant is equal to the quotient of the internal volume of the specimen and the equivalent standard leak rate.

1.6 *Gross leak*

Any leak the equivalent standard leak rate of which is greater than 1 Pa · cm^3/s (10^{-5} bar · cm^3/s).

1.7 *Fine leak*

Any leak the equivalent standard leak rate of which is smaller than 1 Pa · cm^3/s (10^{-5} bar · cm^3/s).

1.8 *Virtual leak*

The semblance of a leak caused by slow release of absorbed, adsorbed or occluded gas.

1.9 *Leakage meter (Test Qm)*

Apparatus consisting of a hand probe for taking a sample of gas mixture and a meter providing a graduated display of the concentration of a predetermined type of gas in the sample.

1.10 *Volume of measurement [V_m] (Test Qm)*

Volume contained between the gastight sheath collecting the leakage and the specimen.

NOTE – The tracer gas concentration being small in that volume, the sealing of its sheath does not generally need to be perfect.

1.11 *Leak detector (Test Qm)*

Apparatus consisting of a hand probe for taking a sample of gas mixture and a device sensitive to the presence of a predetermined type of gas and emitting a signal, either acoustic or visual, when the concentration of a predetermined type of gas reaches a preset threshold level.

1.12 *Probing [sniffing: deprecated term] (Test Qm)*

Action of slowly moving the probe of a leak detector along a specimen in order to locate the leaks.

2 Test Qa: Sealing of bushes, spindles and gaskets

2.1 *Object*

To determine the effectiveness of seals of bushes, spindles and similar features.

NOTE – For the purpose of this test, two types of seals shall be considered:

- Type A: 100 kPa (10 N/cm^2) to 110 kPa (11 N/cm^2) in the direction specified in the relevant specification.
- Type B: 100 kPa (10 N/cm^2) to 110 kPa (11 N/cm^2) in each direction.

2.2 *Scope*

This test can be used for the detection of gross leaks.

2.3 *General description of the test*

The specimen is mounted on the lid of a pressurized test chamber which is submerged in a liquid. If the specimen leaks, the air escaping is collected. The amount of air collected per unit time is a measure of the air leakage. A suitable test apparatus is described in annex A.

2.4 *Initial measurements*

Not required.

2.5 *Conditioning*

2.5.1 Unless otherwise specified, an air pressure difference, as specified below, shall be applied across each seal or simultaneously across a group of seals forming an assembly.

Type A: 100 kPa (10 N/cm^2) to 110 kPa (11 N/cm^2) in the direction specified in the relevant specification.

Type B: 100 kPa (10 N/cm^2) to 110 kPa (11 N/cm^2) in each direction.

Where a higher pressure is required, it shall be 340 kPa (34 N/cm^2) to 360 kPa (36 N/cm^2).

NOTE – The test apparatus described in annex A may not be suitable for these higher pressures.

2.5.2 Type B seals shall be tested both in a static condition and while being mechanically operated as required by the relevant specification.

2.6 *Final measurements*

The rate of leakage shall be measured. The limit shall be prescribed in the relevant specification.

2.7 *Information to be given in the relevant specification*

When this test is included in the relevant specification, the following details shall be given as far as they are applicable:

	Sub-clause
a) Requirements for pressure	2.5.1
b) Direction of application of pressure difference	2.5.1
c) Mechanical operation during conditioning	2.5.2
d) Requirements for leakage rate	2.6

3 Test Qc: Container sealing, gas leakage

3.1 *Object*

To determine the effectiveness of seals of specimens having an included gas-filled space (e.g. specimens not completely filled with impregnant).