

Australian Standard™

**Environmental testing**

**Part 2.17: Tests—Test Q: Sealing**

This Australian Standard was prepared by Committee EL-026, Protective Enclosures and Environmental Testing for Electrical/Electronic Equipment. It was approved on behalf of the Council of Standards Australia on 10 April 2003 and published on 16 May 2003.

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The following are represented on Committee EL-026:

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Australian Electrical and Electronic Manufacturer's Association  
Electrical Compliance Testing Association  
Electrical Regulatory Authorities Council  
Electricity Supply Association of Australia  
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**Environmental testing**

**Part 2.17: Tests—Test Q: Sealing**

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## PREFACE

This Standard was prepared by the Standards Australia Committee EL-026, Protective Enclosures and Environmental Testing for Electrical/Electronic Equipment.

The objective of this Standard is to provide the electrotechnology industry with a complete set of environmental test procedures published as a series under AS 60068 *Environmental testing*. This Standard is Part 2.17 of that series.

This Standard is identical with, and has been reproduced from, IEC 60068-2-17:1994, *Environmental testing - Part 2-17: Tests—Test Q: Sealing*.

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- requirements proper: in arial type;
- *test specifications: in italic type;*
- explanatory matter: in smaller arial type.

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The terms ‘normative’ and ‘informative’ are used to define the application of the annex to which they apply. A normative annex is an integral part of a standard, whereas an informative annex is only for information and guidance.

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## SURVEY OF SEALING TESTS

### General

This survey indicates the interrelation between the various tests for sealing in Test Q of IEC 60068. 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 60529.

### Tests in IEC 60068-2-17

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.

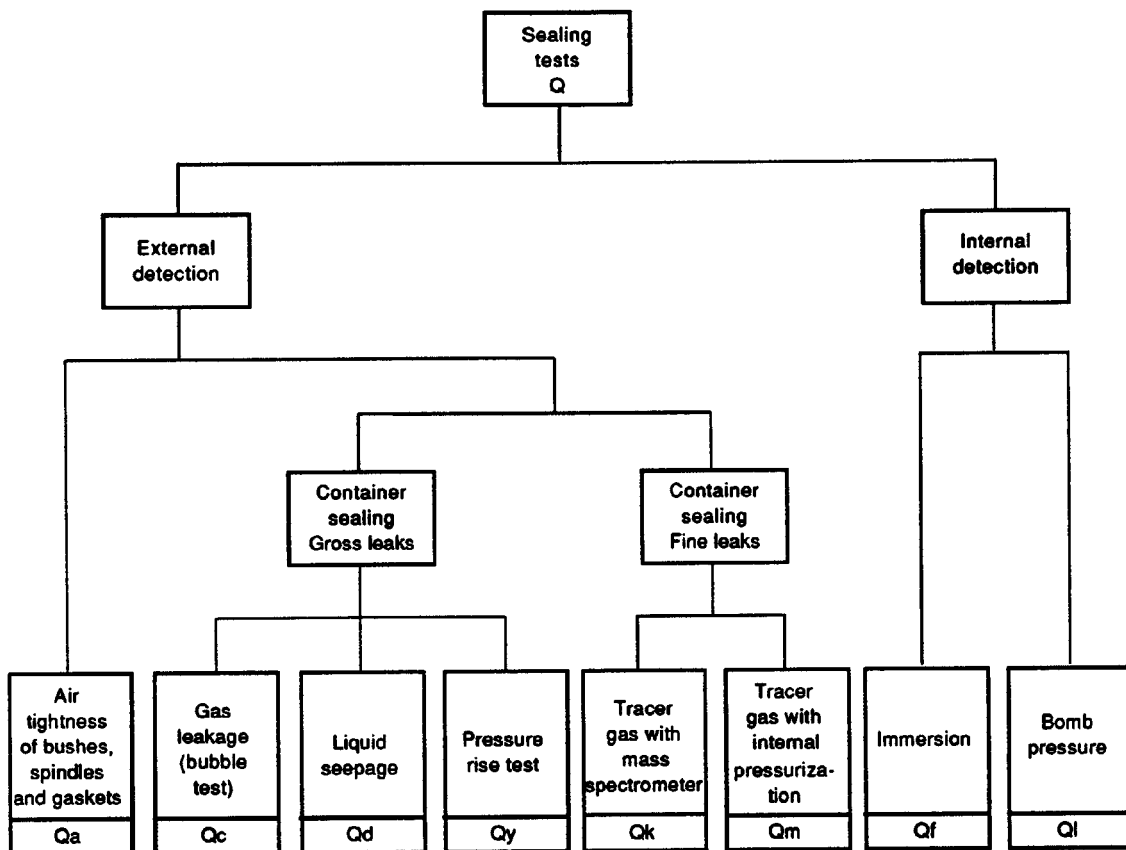


Figure 1

Test Q may be subdivided in the following two subgroups, 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 airtightness 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  $1 \text{ Pa} \cdot \text{cm}^3/\text{s}$  ( $10^{-5} \text{ bar} \cdot \text{cm}^3/\text{s}$ )).

Test Qk and Qm are the most sensitive of this series. Their sensitivity ranges from  $1 \text{ Pa} \cdot \text{cm}^3/\text{s}$  ( $10^{-5} \text{ bar} \cdot \text{cm}^3/\text{s}$ ) to about  $10^{-6} \text{ Pa} \cdot \text{cm}^3/\text{s}$  ( $10^{-11} \text{ bar} \cdot \text{cm}^3/\text{s}$ ). 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 60529

In IEC 60529, 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 objects 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 2,5 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 characteristic 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

## STANDARDS AUSTRALIA

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**Australian Standard****Environmental testing**  
**Part 2.17: Tests—Test Q: Sealing**

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**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 ( $\text{Pa} \cdot \text{m}^3/\text{s}$ )”. The derived units “ $\text{Pa} \cdot \text{cm}^3/\text{s}$ ” and “ $\text{bar} \cdot \text{cm}^3/\text{s}$ ” are used in this standard as they better conform with the orders of magnitude used in common industrial practice.

It is recalled that:  $1 \text{ Pa} \cdot \text{m}^3/\text{s} = 10^6 \text{ Pa} \cdot \text{cm}^3/\text{s} = 10 \text{ bar} \cdot \text{cm}^3/\text{s}$ .

**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  $10^5 \text{ Pa}$  (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  $10^5 \text{ Pa}$  (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) ( $\theta$ )**

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  $1 \text{ Pa} \cdot \text{cm}^3/\text{s}$  ( $10^{-5} \text{ bar} \cdot \text{cm}^3/\text{s}$ ).