
Adhesives — Guide to the selection of standard laboratory ageing conditions for testing bonded joints

*Adhésifs — Guide pour la sélection de conditions normales d'essai de
vieillessement en laboratoire des assemblages collés*



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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 9142 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 11, *Products*.

This second edition cancels and replaces the first edition (ISO 9142:1990), of which it constitutes a minor revision.

Adhesives — Guide to the selection of standard laboratory ageing conditions for testing bonded joints

1 Scope

This International Standard describes laboratory ageing conditions under which adhesive joints may be exposed to various environmental influences — climatic or chemical — for the purpose of assessing the effects of such influences on certain properties.

The ageing conditions are applicable to bonded assemblies and may be used to constitute a set of tests for the evaluation of an adhesive.

The results obtained using the procedures described in this International Standard are not necessarily applicable to the determination of the service life of a bonded assembly because there is no direct relation between the test results and the behaviour of a bonded assembly over a period of time under service conditions. However, for certain specific applications, experience with the procedures may enable a correlation to be established.

NOTE The ageing conditions should preferably be related to the specific application of the adhesive.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 175:1999, *Plastics — Methods of test for the determination of the effects of immersion in liquid chemicals*

ISO 291:1997, *Plastics — Standard atmospheres for conditioning and testing*

ISO 483:1988, *Plastics — Small enclosures for conditioning and testing using aqueous solutions to maintain relative humidity at constant value*

ISO 3205:1976, *Preferred test temperatures*

ISO 4587:2003, *Adhesives — Determination of tensile lap-shear strength of rigid-to-rigid bonded assemblies*

ISO 4588:1995, *Adhesives — Guidelines for the surface preparation of metals*

ISO 4892 (all parts), *Plastics — Methods of exposure to laboratory light sources*

ISO 6238:2001, *Adhesives — Wood-to-wood adhesive bonds — Determination of shear strength by compression loading*

ISO 9227:1990, *Corrosion tests in artificial atmospheres — Salt spray tests*

3 Materials

3.1 De-ionized or distilled water, having a conductivity less than 200 $\mu\text{S/m}$.

3.2 Materials for ageing tests under special environmental conditions (see appropriate annex).

4 Apparatus

4.1 Conditioning chamber, meeting the requirements of ISO 483, capable of being maintained at a temperature of $(23 \pm 2)^\circ\text{C}$ and a relative humidity of $(50 \pm 5)\%$.

4.2 Dry-heat chamber, ventilated and adjustable to a temperature between 20°C and 200°C .

4.3 Humid chamber, meeting the requirements of ISO 483, adjustable to a relative humidity between 25 % and 100 %. The chamber shall be equipped with

- a) a device to enable the temperature to be measured to within 1°C ;
- b) a device to enable the relative humidity to be measured to within 3 % R.H.

4.4 Cold chamber, adjustable to temperatures of $(-20 \pm 3)^\circ\text{C}$ and $(-40 \pm 3)^\circ\text{C}$.

4.5 Controlled-pressure chamber, capable of operating at a pressure of 0,6 MPa¹⁾ and at an underpressure of 0,092 MPa.

5 Specimens

5.1 Number and type

The number of test specimens, and the type used, will depend on the properties to be measured and the required ageing conditions. The test specimens shall be prepared in accordance with the requirements of the appropriate ISO standard test method. Prepare a sufficient number of specimens to provide homogeneous sets of samples for testing and to provide control samples. The following International Standards, which do not constitute an exhaustive list, are applicable: ISO 4587, ISO 4588, ISO 6238.

5.2 Conditioning

Specimens shall be conditioned in the conditioning chamber (4.1) for a minimum duration of 24 h before being subjected to ageing. The conditioning shall be carried out after the adhesive has been cured in accordance with the materials specification or the methods specified by the manufacturer of the adhesive.

6 Procedure

6.1 Tests before ageing

Determine the properties required for the sample under test by the appropriate test method, using specimens conditioned in accordance with 5.2.

1) 1 MPa = 10 bar

6.2 Ageing

Expose conditioned specimens to the environmental conditions as defined in Annex A to Annex F, as required.

6.3 Tests after ageing

Determine the properties after ageing in accordance with the procedure(s) of the appropriate standard(s). Unless there are indications to the contrary in the Annexes, condition test specimens in the conditioning chamber (4.1)

- for (3 ± 1) h in the case of specimens exposed at a relative humidity higher than 50 %,
- for at least 24 h for all other specimens,

before determining the properties.

In addition to the test results, all changes visible during the ageing and testing periods, including mode of failure, shall be noted.

6.4 Controls

For control purposes, a representative group of specimens shall be kept in the conditioning chamber (4.1) for the period of time covered by the ageing conditions selected.

7 Expression of results

For properties that can be measured, the results obtained are expressed as either

- absolute values or
- a relative variation with respect to the initial value.

For properties that cannot be measured, the nature of the effects observed shall be noted, e.g. rupture between the substrate and adhesive, failure of cohesion of the adhesive joint due to partial or total corrosion of the substrate beneath the adhesive, etc.

NOTE It may be worth verifying that the variation in a measured property is caused only by the ageing process from the following three values:

- A* the value of the property measured before accelerated ageing;
- B* the value of the same property measured on the control specimen which has undergone only intrinsic ageing at $(23 \pm 2) ^\circ\text{C}$ and $(50 \pm 5) \% \text{ R.H.}$ (see 6.4);
- C* the value of the property measured after ageing.

This can be done by calculating the following ratios:

- a) $[(A - B)/A] \times 100$ (this ratio represents the intrinsic ageing during the period concerned);
- b) $[(A - C)/A] \times 100$ (this ratio represents the overall ageing due to intrinsic ageing and the accelerated ageing under the conditions specified in this International Standard);
- c) $[(B - C)/A] \times 100$ (this ratio represents the degree of ageing due to ageing under the conditions specified in this International Standard).

8 Test report

The test report shall include the following information:

- a) a reference to this International Standard;
- b) a description of the type of ageing carried out, with reference to the relevant Annex(es) and the duration of exposure and number of test cycles;
- c) the results of observations made in accordance with 6.3 (last paragraph) and Clause 7;
- d) details of any operations not laid down in this International Standard, as well as any incidents liable to have had an effect on the results.

Annex A (normative)

General conditions of ageing

A.1 General

Whatever the type of ageing carried out, the temperature and duration of exposure, as well as the relative humidity, shall, as far as possible, be selected from the preferred values given below. Other values may be used if this is absolutely essential for technical reasons, but they shall be selected initially from the values given in ISO 291 or ISO 3205 (the latter gives temperatures only).

A.2 Preferred temperature

Preferred temperatures are given, together with tolerances, in Table A.1.

A.3 Preferred exposure periods

Hours: 1 — 2 — 3 — 4 — 6 — 16 — 24 — 48 — 72 — 96

Weeks: 1 — 2 — 3 — 4 — 6 — 8 — 12 — 16 — 26 — 52

The number of cycles shall be selected to approach, as closely as possible, these preferred exposure periods.

A.4 Preferred relative humidities

15 %; (25 ± 5) %; (50 ± 5) %; (65 ± 5) %; 90 % to 100 %.

Table A.1 — List of preferred temperatures and tolerances

Values in degrees Celsius

Temperature	Tolerances (to be used only in the absence of special indications calling, in particular, for stricter tolerances)
– 40	± 3
– 20	± 3
+ 20	± 2
+ 23	± 2
+ 30	± 2
+ 40	± 2
+ 50	± 2
+ 55	± 2
+ 60	± 2
+ 70	± 2
+ 90	± 2
+ 100	± 2
+ 105	± 3
+ 125	± 3
+ 175	± 3

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