
Adhesives — Durability of structural adhesive joints — Exposure to humidity and temperature under load

*Adhésifs — Durabilité des joints adhésifs structuraux — Exposition à
l'humidité et à la température sous contrainte*



Foreword

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Adhesives – Durability of structural adhesive joints – Exposure to humidity and temperature under load

1 Scope

This International Standard describes the equipment and the test procedure used to evaluate the durability of adhesive-bonded joints exposed simultaneously to heat, humidity and load.

This method is intended for the evaluation of structural and semi-structural adhesives used in hot and/or humid environments. It is particularly suitable for metal, composite and plastic adherends.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of using the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

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

ISO 9142:1990, *Adhesives - Guide to the selection of standard laboratory ageing conditions for testing bonded joints*.

ISO 10365:1992, *Adhesives - Designation of main failure patterns*.

ISO 13895:1996, *Adhesives - Guidelines for the surface preparation of plastics*.

3 Principle

This method consists of testing lap-shear or T-joint specimens under static load at elevated temperature and high humidity. The specimens are placed in a tube equipped with a pre-calibrated spring system for loading the specimens. The times to failure of the loaded specimens are recorded.

4 Apparatus

4.1 Humidity cabinet

The cabinet shall be such that the relative humidity can be maintained at 95% to 100% and that the temperature can be cycled between 42°C and 48°C (see 4.2). The cabinet shall be insulated and shall have an open, heated water reservoir in the base from which distilled or deionised water is pumped to spray bars at each side of the cabinet. The top of the cabinet shall have holes through which an appropriate number of specimen-loading tubes can be inserted so that they hang within 100 mm of the cabinet walls.

4.2 Heater and cooling unit

The heater shall be of sufficient capacity to raise the cabinet temperature from 42°C to 48°C in 30 min. The radiator-type cooling unit shall be of sufficient capacity to lower the cabinet temperature from 48°C to 42°C in 30 min.

The heater and a cooling fan mounted on the radiator shall be regulated by a programmed controller linked to a temperature sensor located inside the cabinet at least 100 mm from the cabinet walls.

The controller shall be such that the temperature in the operating range is accurate to $\pm 0,25^{\circ}\text{C}$ and the temperature gradient in the cabinet does not exceed $\pm 0,5^{\circ}\text{C}$.

4.3 Water circulation system

The heated water from the reservoir shall be circulated through the radiator into two spray bars mounted on opposite sides near the top of the cabinet (see figure 1), from where it is sprayed on to the cabinet walls.

The water level in the reservoir shall be maintained at a constant level.

Note 1: It is therefore desirable to have an automatic self-fill system and overflow alarm.

Note 2: It is recommended that equipment be fitted to prevent the growth of harmful bacteria. For example, the water could be made to circulate through a UV-irradiation unit (see figure 2) consisting of two concentric tubes. The outer tube is made of UPVA or stainless steel. The inner tube consists of a short-wavelength UV source of appropriate wattage in a quartz envelope to ensure maximum penetration of the UV light. The tubes are changed at 4000 h intervals or earlier if so specified by the manufacturer.

4.4 Specimen-loading tube

The specimen-loading tube shall have a tubular main body, which contains the specimens to be tested, and a spring assembly which can be compressed and locked in place to apply the desired load. The tubular body shall be perforated for ease of inspection of the specimens and to allow moisture to enter.

The spring assembly shall consist of a main spring and a secondary spring and is normally designed to apply loads from approximately 1 MPa to 7 MPa to the specimens. However, for some types of testing different load ranges may be appropriate.