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Adhesives — Determination of tensile strength of butt joints

Adhésifs — Détermination de la résistance en traction des joints à bout

Reference number
ISO 6922:1987 (E)

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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 6922 was prepared by Technical Committee ISO/TC 61, *Plastics*.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

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Adhesives — Determination of tensile strength of butt joints

1 Scope and field of application

This International Standard specifies a method for determining the bond strength of a butt joint when subjected to tensile force. The method can be applied to all types of adhesives. Although primarily intended for use under ambient conditions, the basic method can also be applied to testing under a wide range of temperature and other environmental conditions. The method requires rigid adherends that can be produced to the required dimensional tolerances and that will withstand the forces applied to them during the test.

2 References

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

ISO/R 527, *Plastics — Determination of tensile properties.*

ISO 3534, *Statistics — Vocabulary and symbols.*

ISO 5893, *Rubber and plastics test equipment — Tensile, flexural and compression types (constant rate of traverse) — Description.*

ISO 6354, *Adhesives — Vocabulary.*

3 Principle

A joint formed from two bar or rod adherends bonded by faces normal to their length is stressed to rupture by a tensile force, applied through the long axis of the test specimen. The reported result is the observed force at rupture.

4 Apparatus

4.1 Testing machine, so selected that the rupture of the specimen falls between 10 % and 90 % of the full-scale capacity. In addition, the response time of the machine shall be short enough not to affect the accuracy with which the force applied at the time of rupture can be measured. The recorded force shall not differ from the true applied force by more than 1 %. The machine shall be capable of applying a tensile force that increases at a steady rate (see the note). It shall be provided with a suitable pair of self-aligning grips to hold the specimen. The grips shall be so constructed that they will move into alignment with the test specimen as soon as the load is applied so that the long axis of the test specimen will coincide with the direction of the applied force through the centre-line of the grip assembly.

NOTE — If the equipment does not allow for constant rate of load application, use a rate of jaw separation that approximates the rate of loading (see ISO/R 527).

4.2 Jig, for accurately aligning the adherends during bonding. An example of a simple jig is shown in the figure.

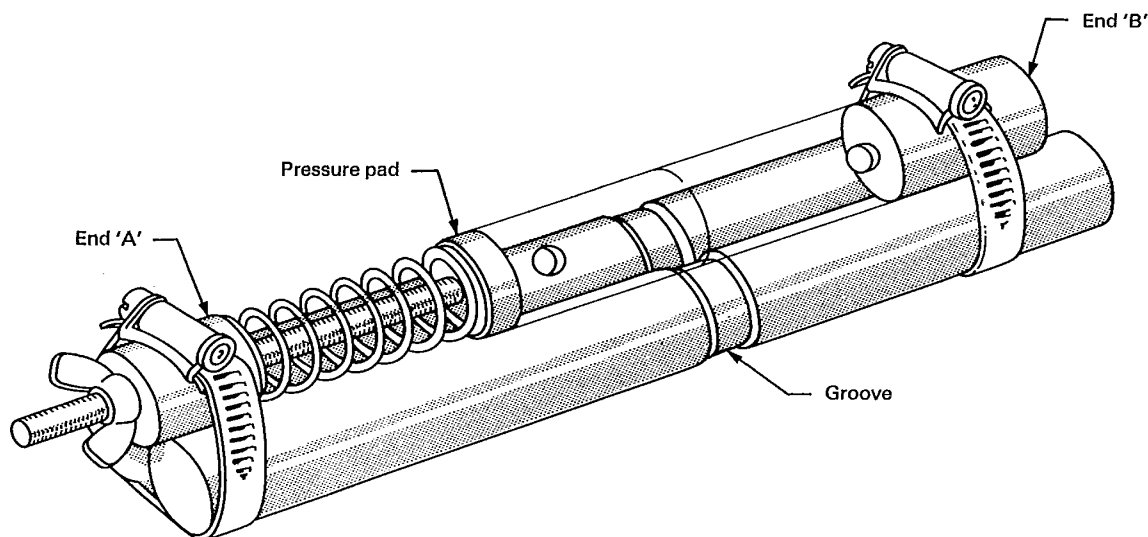


Figure — Example of suitable simple jig for butt joint assembly

NOTES

- 1 In the jig shown, first adjust the position of end 'B' so that any fillet of adhesive forced from the joint coincides with the groove.
- 2 Then adjust end 'A' so that, with the joint in position, the spring will exert the required pressure.
- 3 Then withdraw the pressure pad by turning the wing nut and insert the joint. Slacken the wing nut so that the full spring pressure is applied to the joint.

5 Test specimens

5.1 Adherends

5.1.1 For purposes of comparison of adhesives and for inter-laboratory testing, the two adherends shall be of identical material and shall be strong enough to prevent appreciable deformations. For other purposes, the two adherends may differ.

5.1.2 Unless otherwise specified, the dimensions of the adherends shall be as follows:

- for circular sections: diameter 10, 15, 25 or 50 mm;
- for square sections: length of side of square 10, 15, 25 or 50 mm.

The tolerance on all the above dimensions shall be $\pm 0,1$ mm.

The length of the adherends may be 50 mm or three times the diameter (or side), whichever is the smaller.

5.1.3 The surfaces for bonding shall be plane and normal to the long axis of the prism. The opposite ends of the adherends shall be machined to fit the grips or adaptors of the test machine (4.1).

5.1.4 Before bonding, the surfaces of the adherends shall be prepared in accordance with the recommendations of the adhesive manufacturer or as specified when this method is called up.

5.2 Dimensions of joint

The size of joint used depends on the following:

- a) the strength of the adhesive under examination;
- b) the range of capabilities of the test machine;
- c) the nature of the adherend material;
- d) the nature of the environmental tests to be applied to the joint.

5.3 Bonding

Apply the adhesive to the adherends and perform the bonding operation under conditions recommended by the manufacturer of the adhesive or as specified when this method is called up. In the absence of such recommendations, the procedure shall be such as to obtain an optimum bond. In any case use the jig (4.2) to ensure accurate alignment of the adherends.

Apply sufficient adhesive to avoid a starved joint and to provide a slight surplus around the edge of the joint. Removal of the surplus adhesive is not usually necessary, but when it is necessary do this before the adhesive has set. At the conclu-

sion of the setting time in the jig, allow the bonded assembly to condition (see clause 6) for a suitable period without applied pressure.

NOTE — Starved joint is defined as a "joint that has an insufficient amount of adhesives to produce a satisfactory bond" in ISO 6354.

5.4 Number of test specimens

The number of specimens to be tested shall be as specified in the adhesive specification or, if not so specified, shall be not less than five and sufficient to provide five valid test results (see 7.2).

6 Conditioning and test atmosphere

Adherends shall be prepared, stored and bonded, and the test specimens conditioned and tested, under standard conditions of temperature and humidity. In the absence of specified requirements, the recommended conditions are 23 ± 2 °C and (50 ± 5) % relative humidity as described in ISO 291.

7 Procedure

7.1 Locate the test specimen symmetrically in the grips. Operate the machine so that the test joint is subjected to a force that increases at a constant (i.e. steady) rate. This rate shall be such that the joint is broken in 60 ± 20 s.

NOTES

1 The machine should be operated under substantially constant conditions throughout the test, although a stress-strain diagram may indicate non-linearity at the beginning and end of the test (see ISO 5893).

2 If no previous experience is available for the type of joint under test, preliminary tests should be carried out to establish suitable operating conditions.

7.2 Record the highest force during rupture as the breaking force of the test specimen. Discard results from test specimens that show starved joints or which fail in the adherend [see 7.3 c)] unless the breaking force meets the minimum requirements of the adhesive specification.

7.3 Record the type of failure for each test specimen; for example:

- a) cohesion failure in the adhesive;
- b) adhesion failure at the adhesive/adherend interfaces;

c) cohesion failure in the adherend close to the adherend/adhesive interface.

8 Expression of results

Express the results of the tests as the arithmetic mean of the breaking force of five valid test results unless otherwise specified in the adhesive specification.

NOTE — It is suggested that the following criteria (see ISO 3534) for repeatability and reproducibility should normally be observed for test results obtained using this International Standard. It is emphasized that these criteria are offered for guidance only. Failure to meet one or both criteria does not itself imply failure to comply with this International Standard.

a) the **repeatability**, i.e. the difference between any two mean breaking forces of groups of tests, obtained with one sample of adhesive on the same adherend system by the same operator in a given test room or laboratory, should be less than 2,5 times the standard deviation for five tests; and

b) the **reproducibility**, i.e. the difference between the mean breaking forces of groups of tests obtained with one sample of adhesive on the same adherend system in different test rooms or laboratories, should be less than 15 % of the arithmetic mean of the individual mean values.

9 Test report

The test report shall include the following particulars:

- a) reference to this International Standard;
- b) identification of the adhesive tested, including type, source, manufacturer's code number, batch or lot number, form, etc.;
- c) identification of the adherends, including test specimen dimensions and surface preparation;
- d) the method of applying the adhesive, open assembly time, details of the bonding pressure, temperature, relative humidity and time, and conditioning time of the bonded specimens before test;
- e) average thickness (as precise as possible) of the adhesive layer after formation of the bond, or the amount of adhesive used per unit area of the joint;
- f) the rate of application of the force;
- g) the number of specimens tested and the mean breaking force, together with information about the spread of results (including maximum and minimum breaking forces);
- h) the type of failure for each test specimen.

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