

Adhesives — Determination of tensile strength of butt joints (ISO 6922:1987 modified)

ICS 83.180

National foreword

This British Standard is the UK implementation of EN 15870:2009. It supersedes BS EN 26922:1993 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee PRI/52, Adhesives.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Adhesives - Determination of tensile strength of butt joints (ISO 6922:1987 modified)

Adhésifs - Détermination de la résistance en traction des joints bout à bout (ISO 6922:1987 modifiée)

Klebstoffe - Bestimmung der Zugfestigkeit von Stumpfklebungen (ISO 6922:1987 modifiziert)

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Foreword

This document (EN 15870:2009) has been prepared by Technical Committee CEN/TC 193 “Adhesives”, the secretariat of which is held by AENOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 2009, and conflicting national standards shall be withdrawn at the latest by October 2009.

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

This document supersedes EN 29622:1993.

Safety statement

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Environmental statement

It is understood that some of the material permitted in this standard may have negative environmental impact. As technological advantages lead to better alternatives for these materials, they will be eliminated from this standard to the extent possible.

At the end of the test, the user of the standard shall take care to carry out an appropriate disposal of the wastes, according to local regulation.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European 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 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.

EN 13887 - *Structural Adhesives - Guidelines for surface preparation of metals and plastics prior to adhesive bonding*

EN ISO 291, *Plastics - Standard atmospheres for conditioning and testing (ISO 291:2008)*

EN ISO 7500-1, *Metallic materials – Verification of static uniaxial testing machines – Part 1: Tension/compression testing machines – Verification and calibration of the force-measuring system (ISO 7500-1:2004)*

EN ISO 10365, *Adhesives - Designation of main failure patterns (ISO 10365:1992)*

3 Principle

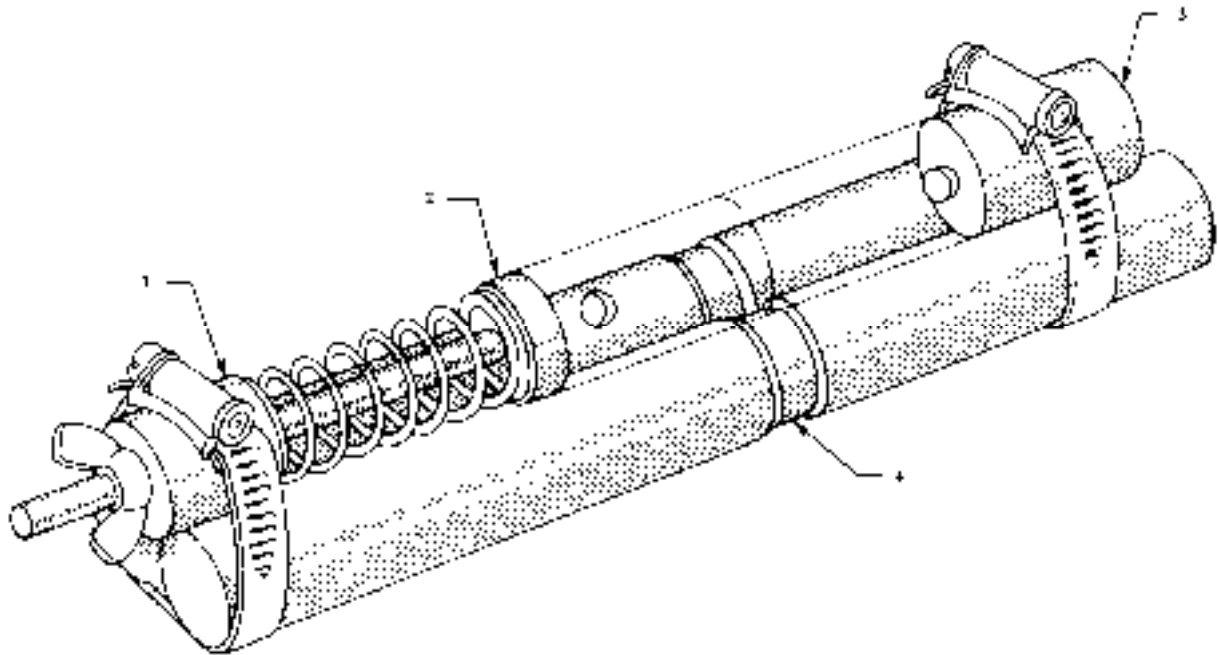
A joint formed from two bar or rod adherends bonded by faces normal to their length is stressed to rupture by a tensile force, applied through the long axis of the test specimen. The reported result is the observed force at rupture.

4 Apparatus

4.1 Testing machine, the testing machine shall comply with Class 1 of EN ISO 7500-1. 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 EN ISO 527).

4.2 Jig, for accurately aligning the adherends during bonding. An example of a simple jig is shown in the Figure 1.



Key

- 1 End 'A'
- 2 Pressure pad
- 3 End 'B'
- 4 Groove

Figure 1 — Example of suitable simple jig for butt joint assembly

- NOTE 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.
- NOTE 2 Then adjust end 'A' so that, with the joint in position, the spring will exert the required pressure.
- NOTE 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:

- a) For circular sections: diameter 10 mm, 15 mm, 25 mm or 50 mm;
- b) For square sections: length of side of square 10 mm, 15 mm, 25 mm 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 specimen. 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 according to recommended methods in EN 13887.

5.2 Dimensions of joints

The size of joints 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 test 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. Other bonding conditions shall be included in the test report. 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. After completion 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 EN ISO 472.

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 EN 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 rate of 10 mm/min. This rate shall be such that the joint is broken in (60 ± 20) s.

NOTE 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).

NOTE 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 obtained for test specimens that show starved joints or which fail in the adherend unless the breaking force meets the minimum requirements of the adhesive specification.

7.3 Record the type of failure of each test specimen, as described in EN ISO 10365.

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 European 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 European Standard.

- a) **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) **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 Tests report

The test report shall include, at least, the following:

- a) reference to this European Standard (i.e. EN 15870);
- 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 number of specimens tested and the mean breaking force, together with information about the spread of results (including maximum and minimum breaking forces and the rate of application of the force);
- g) the type of failure for each test specimen.

Bibliography

- [1] EN ISO 527 (all parts), *Plastics - Determination of tensile properties*
- [2] ISO 3534 (all parts), *Statistics - Vocabulary and symbols*
- [3] ISO 5893, *Rubber and plastics test equipment - Tensile, flexural and compression types (constant rate of traverse) – Specification*
- [4] EN ISO 472, *Plastics - Vocabulary (ISO 472:1999)*

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