
INTERNATIONAL STANDARD



4587

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Adhesives — Determination of tensile lap-shear strength of high-strength adhesive bonds

Adhésifs — Détermination de la résistance au cisaillement d'assemblages réalisés avec des adhésifs structuraux, collés à recouvrement simple

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up 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.

International Standard ISO 4587 was developed by Technical Committee ISO/TC 61, *Plastics*, and was circulated to the member bodies in November 1976.

It has been approved by the member bodies of the following countries:

Australia	Hungary	Poland
Belgium	India	Portugal
Brazil	Israel	Romania
Bulgaria	Japan	Sweden
Canada	Korea, Rep. of	Switzerland
Czechoslovakia	Mexico	Turkey
Finland	Netherlands	United Kingdom
France	New Zealand	U.S.A.
Germany, F.R.	Peru	Yugoslavia

The member body of the following country expressed disapproval of the document on technical grounds:

Ireland

Adhesives — Determination of tensile lap-shear strength of high-strength adhesive bonds

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies a method for determining the tensile lap-shear strength of high-strength adhesive bonds for metallic adherends when tested on a standard specimen and under specified conditions of preparation and testing.

2 REFERENCES

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

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

ISO 3534, *Statistics — Vocabulary and symbols*.

3 PRINCIPLE

Adhesive lap-shear bond strength is determined by stressing in shear of a single overlap joint (see the figure) between metallic adherends by applying to the adherends a tensile force which is parallel to the bond area and to the major axis of the specimen. The reported result is the observed force or stress at rupture.

4 APPARATUS

4.1 Testing machine, so selected that the rupture of the specimen falls between 10 and 80 % 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 note 1). It shall be provided with a suitable pair of self-aligning grips to hold the specimen. The grips and attachments (see note 2) 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.

NOTES

1 Where equipment does not allow for constant rate of load application, a rate of jaw separation shall be used which approximates the rate of loading (see ISO 527).

2 Grips that operate by bolting through the adherends shall be avoided since such grips give rise to undesirable stress concentration.

4.2 Jig, for accurately locating adherends during bonding.

5 TEST SPECIMENS

5.1 Unless otherwise specified, test specimens shall conform to the form, dimensions, and alignment as shown in the figure. The recommended length (L) of overlap is $12,5 \pm 0,25$ mm.

NOTES

1 The choice of dimensions other than those shown in the figure may result in difficulties in the interpretation of results.

2 This overlap is intended for aluminium alloys and materials of similar or higher moduli of elasticity (E) and tensile yield strength.

Example : For AA 2024-T3 or AECMA AL-P 13 PL (T3)
 $E = 68\,000$ MPa

Tensile yield strength at 0,2 % offset = 290 MPa

5.2 The test joints may be prepared either individually or from slotted or unslotted panels (see the figure). Each method is equally suitable either for development or for comparative tests. If strength values are to be determined for design calculations of flat bonded joints, it is preferable to prepare the test joints from unslotted panels. In choosing the type of preparation, account should also be taken of whether the test joint will be damaged by mechanical working. Special care shall be taken in preparing individual specimens to ensure proper alignment.

5.3 The adherend surface shall be properly treated to obtain an optimum bond. Surface treatments shall be in accordance with manufacturers' instructions or the appropriate International Standard (see note below). The adhesive shall be applied and cured according to the recommendations of the manufacturer of the adhesive. In the absence of such recommendations, the procedure shall be such as to achieve an optimum bond with minimum variations. In any case, the use of a jig to ensure the correct overlap and accurate alignment of the adherends is recommended.

NOTE — An International Standard concerning the preparation of metallic surfaces for adhesive bonding is now being prepared.

5.4 The number of test specimens will depend on the precision required, but reliance should not be placed on fewer than six observations.

6 CONDITIONING AND TESTING ATMOSPHERE

The test specimens shall be conditioned and tested in one of the standard laboratory atmospheres specified in ISO 291.

7 PROCEDURE

Locate the test specimen symmetrically in the grips, with each grip 50 ± 1 mm from the nearest edge of the overlap. A shim may be used in the grips so that the applied force will be in the plane of the adhesive bond.

Operate the machine so that the stress or strain on the test joint increases at a constant (i.e. steady) rate. This rate shall be such that the average joint will be broken in a period of 65 ± 20 s.

Record the highest force during rupture as the breaking force of that specimen. Results from test specimens that rupture in the adherend shall be discarded except for routine testing.

8 EXPRESSION OF RESULTS

Express the results of the tests as the arithmetic mean and coefficient of variation of the breaking force in newtons or the breaking stress in megapascals of the valid test specimens.

NOTE — It is suggested that the following criteria for repeatability and reproducibility should normally be observed for test results obtained using this International Standard :

a) the repeatability (see ISO 3534) (i.e. the difference between any two breaking forces obtained with one sample of adhesive by the same operator in a given test room or laboratory) should be less than 2,5 times the standard deviation.

b) the reproducibility (see ISO 3534) (i.e. the difference between the mean breaking forces obtained with one sample of adhesive on the same system in different test rooms or laboratories) should be less than 20 % of the arithmetic mean of the individual mean values.

It is stressed that these criteria are offered for guidance; failure to meet one or other of the requirements does not of itself imply failure to comply with this International Standard.

9 TEST REPORT

The test report shall include reference to this International Standard and the following particulars :

a) identification of the adhesive tested, including type, source, manufacturer's code number, batch or lot number, form, etc.;

b) identification of the adherends, including material thickness and surface preparation;

c) description of bonding process, including method of application of adhesive, drying or precuring conditions (where applicable), and curing time, temperature and pressure;

d) the average thickness (as precisely as practical) of the adhesive layer after formation of the bond;

e) complete description of the test specimen, including dimensions and construction of the test specimen, with nominal overlap of the joint, whether individual or of panel construction, whether slotted or unslotted panels, conditions used for cutting individual test specimens, number of test panels represented, and number of individual test specimens;

f) conditioning procedure prior to testing, and test atmosphere;

g) the rate of loading or rate of jaw separation;

h) the individual breaking force or stress test results, the arithmetic mean and the coefficient of variation of the mean, together with information about the spread of results;

j) type of failure;

k) any operating deviations or difficulties that may have affected the results.