INTERNATIONAL STANDARD

ISO 4587

Second edition
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Adhesives — Determination of tensile lap-shear strength of rigid-to-rigid bonded assemblies

Adhésifs — Détermination de la résistance au cisaillement d'assemblages collés rigide sur rigide à recouvrement simple

Reference number
ISO 4587:1995(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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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.

International Standard ISO 4587 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 11, *Products*.

This second edition cancels and replaces the first edition (ISO 4587:1979), which has been technically revised.

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Adhesives — Determination of tensile lap-shear strength of rigid-to-rigid bonded assemblies

1 Scope

This International Standard specifies a method for determining the tensile lap-shear strength of rigid-to-rigid bonded assemblies when tested using a standard specimen and under specified conditions of preparation and testing.

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 applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 291:1977, *Plastics — Standard atmospheres for conditioning and testing.*

ISO 527-1:1993, *Plastics — Determination of tensile properties — Part 1: General principles.*

ISO 4588:—[1], *Adhesives — Guidelines for the preparation of metal surfaces for adhesive bonding.*

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

ISO 13895:—[2], *Adhesives — Guidelines for the surface preparation of plastics.*

1) To be published. (Revision of ISO 4588:1989)

2) To be published.

3 Principle

The adhesive lap-shear bond strength is determined by stressing a single-overlap joint between rigid adherends in shear by the application of a tensile force parallel to the bond area and to the major axis of the specimen.

NOTES

1 Single-lap specimens are economical, practical and easy to make. They are the most widely used specimens for development, evaluation and comparative studies involving adhesives and bonded products, including manufacturing quality control.

2 The strength values obtained from single-lap specimens should not be used as allowable design-stress values for structural joints.

4 Apparatus

4.1 Testing machine, so selected that the rupture of the specimen falls between 10 % and 80 % of the full-scale capacity. The response time of the machine shall be short enough so as to enable the force applied at the time of rupture to be measured accurately. The recorded force shall not differ from the true applied force by more than 1 %. The machine shall be capable of maintaining the constant speeds of testing specified in clause 7 (see ISO 527-1). It shall be provided with a suitable pair of self-aligning grips to hold the specimen. The grips and attachments shall be so constructed that they will move into alignment with the specimen as soon as the load is applied, so that the long axis of the specimen will coincide with the direction of the applied force through the centreline of the grip assembly.

A machine which gives a constant rate of load application may be used.

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

5 Test specimens

5.1 Test specimens shall conform to the shape, dimensions and alignment of the adherends as shown in figure 1. The length of overlap shall be 12,5 mm ± 0,25 mm. The major axis of the specimens shall correspond to the rolling direction in the case of metal adherends.

NOTES

3 The choice of dimensions other than those shown in figure 1 would result in difficulties in the interpretation of results because direct comparison of the strengths of adhesive bonds would not be possible.

4 The use of a jig for accurately locating adherends during bonding is strongly recommended.

5.2 The test joints may be prepared either individually or from slotted or unslotted panels (see figure 1). In choosing the type of preparation, account shall also be taken of whether the test joint will be damaged by mechanical working, including overheating. Special care shall be taken in preparing individual specimens to ensure proper alignment and to ensure that bond thicknesses are as uniform and constant as possible.

NOTE 5 A typical thickness is 0,2 mm. Thicknesses can be controlled by adding a calibrated wire spacer or small glass spheres in the bond area.

5.3 The adhered surface shall be properly treated to obtain an optimum bond. Surface treatments shall be in accordance with manufacturer's instructions or the appropriate International Standard (ISO 4588 or ISO 13895). The adhesive shall be applied and cured in accordance with the recommendations of the adhesive manufacturer or the applicable material standard. The excess of adhesive squeezed out during the formation of the joint shall be removed immediately after assembling.

For all adherends, the method used for surface preparation shall be reported.

5.4 Measure the specimen dimensions to within ± 0,1 mm.

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

6 Conditioning

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

7 Procedure

Locate the specimen symmetrically in the grips, with each grip 50 mm ± 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 at a constant test speed so that the average joint will be broken in a period of 65 s ± 20 s.

If a machine working at constant rate of loading is used, apply the load at the rate of 8,3 MPa to 9,7 MPa per minute.

Record the highest force during rupture as the breaking force for that specimen.

Record the type of failure in accordance with ISO 10365.

8 Expression of results

Express the results of the tests as the arithmetic mean of the breaking force, in newtons, or the breaking stress, in megapascals, of the valid specimens. The lap shear strength in megapascals is calculated by dividing the breaking force, in newtons, by the shear area, in square millimetres.

9 Precision

This test is widely used and accepted. However, the precision is not known because interlaboratory data are not available.

10 Test report

The test report shall include the following information:

a) a reference to this International Standard;

b) all details necessary for identification of the adhesive tested, including type, source, manufacturer's code number, batch or lot number, form;

c) all details necessary for identification of the adherends, including material thickness and surface preparation;

d) a description of bonding process, including the method of application of the adhesive, the drying and precuring conditions (where applicable), the curing or setting time, and the temperature and pressure for curing or setting;

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

f) a complete description of the specimens, including the dimensions and construction, the nominal overlap of the joint, whether the adherends were prepared individually or from panels, if the adherends were prepared from panels the number of panels used and whether slotted or unslotted panels were used, the procedure and conditions used to cut out the adherends, and the number of specimens tested;

g) the conditioning parameters prior to testing, and the test atmosphere;

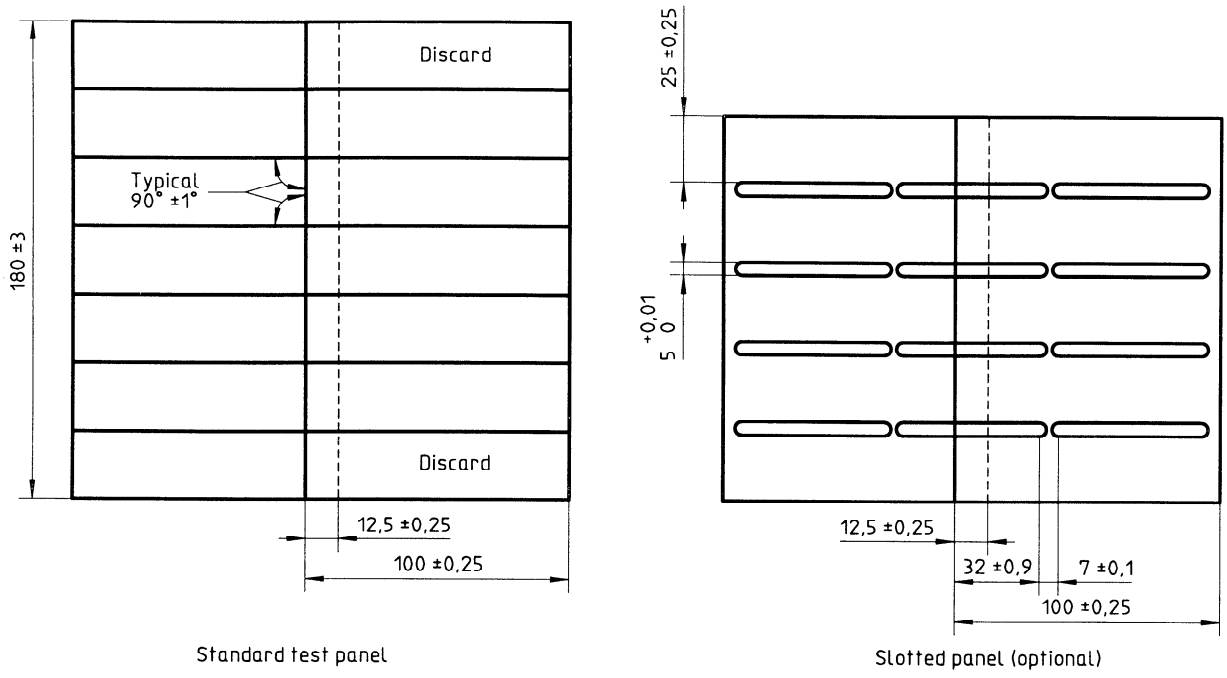
h) the speed of testing (or the rate of loading in the case of constant rate of loading machines);

i) the breaking force or breaking stress for each specimen, the arithmetic mean and the standard deviation;

j) the type of failure, recorded in accordance with ISO 10365;

k) details of any deviations from the procedure specified and of any incidents that may have affected the results.

Dimensions in millimetres



Standard test panel

Slotted panel (optional)

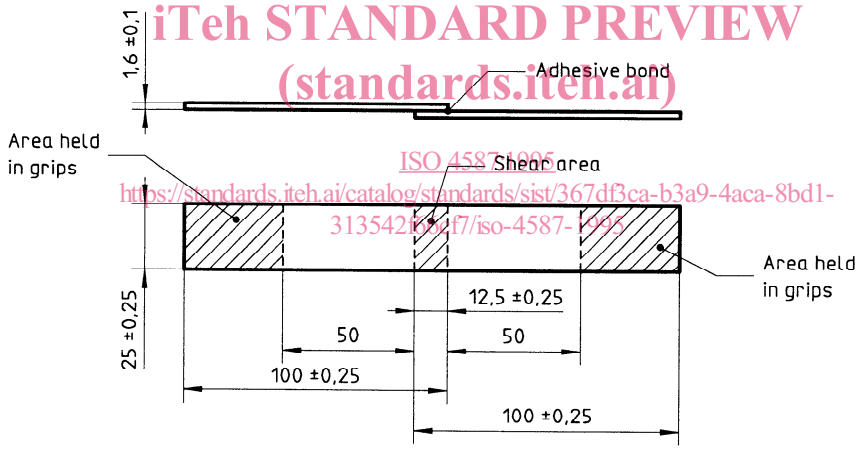


Figure 1 — Shape and dimensions of test panels

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ICS 83.180

Descriptors: plastics, adhesives, adhesive bonded joints, tests, adhesion tests, tension tests, determination, shear strength.

Price based on 4 pages