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Adhesives — Determination of cleavage strength of bonded joints

Adhésifs — Détermination de la résistance au clivage de joints collés



Reference number
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Foreword

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Adhesives — Determination of cleavage strength of bonded joints

1 Scope

This International Standard describes a method for the determination of the cleavage strength of adhesive joints. The method can only be used for comparing adhesives, and the results cannot be used for design purposes.

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 291:1997, *Plastics — Standard atmospheres for conditioning and testing*.

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

ISO 5893:1993, *Rubber and plastics test equipment — Tensile, flexural and compression types (constant rate of traverse) — Description*.

ISO 7500-1:—¹⁾, *Metallic materials — Verification of static uniaxial testing machines — Part 1: Tensile/compression testing machines*.

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 Definition

For the purposes of this International Standard, the following definition applies:

cleavage strength: The average force per unit width of the bond line required to produce progressive separation, by a wedge or other crack-opening-type action, of two adherends of sufficient thickness to preclude significant bending.

It is expressed in newtons per millimetre of width.

1) To be published. (Revision of ISO 7500-1:1986)

4 Principle

A bonded specimen of specified dimensions is split along the line of cleavage by loading it in a tensile mode. The pins connecting the specimen to the tensile-testing machine are located eccentrically with respect to the centre of the bonded area. The loading induces a mode 1 fracture.

NOTE — A definition of mode 1 fracture is given in ASTM E 1823:1996, *Terminology relating to fatigue and fracture testing*.

5 Apparatus

5.1 Tensile-testing machine, capable of maintaining a pre-determined constant crosshead rate. The machine shall be capable of determining a maximum load. The measured strength shall lie between 15 % and 85 % of the full-scale capacity of the load-measuring device. The machine shall permit the measurement and recording of the applied force with an accuracy of ± 1 %.

The equipment shall be calibrated regularly in accordance with ISO 7500-1 in the case of metal adherends, or with ISO 5893 in the case of rubber or plastic adherends.

NOTE — It is recommended that the machine be autographic, giving a chart that can be read in terms of millimetres of crosshead movement as one coordinate and applied force as the other coordinate. It is also recommended that inertialess equipment be used.

5.2 Specimen-holding fixture, designed to adjust automatically to ensure vertical loading of the bonded joint. An example of a suitable fixture is shown in figure 1.

5.3 Connecting links, designed to hold the specimen between the fixed and moving heads of the tensile-testing machine. They shall be of the self-aligning type. The connecting links shall be attached to the fixed and moving heads and to the specimen in such a way that they will move into alignment as soon as a load is applied, and so that the long axis of the specimen will coincide with the direction of the applied load.

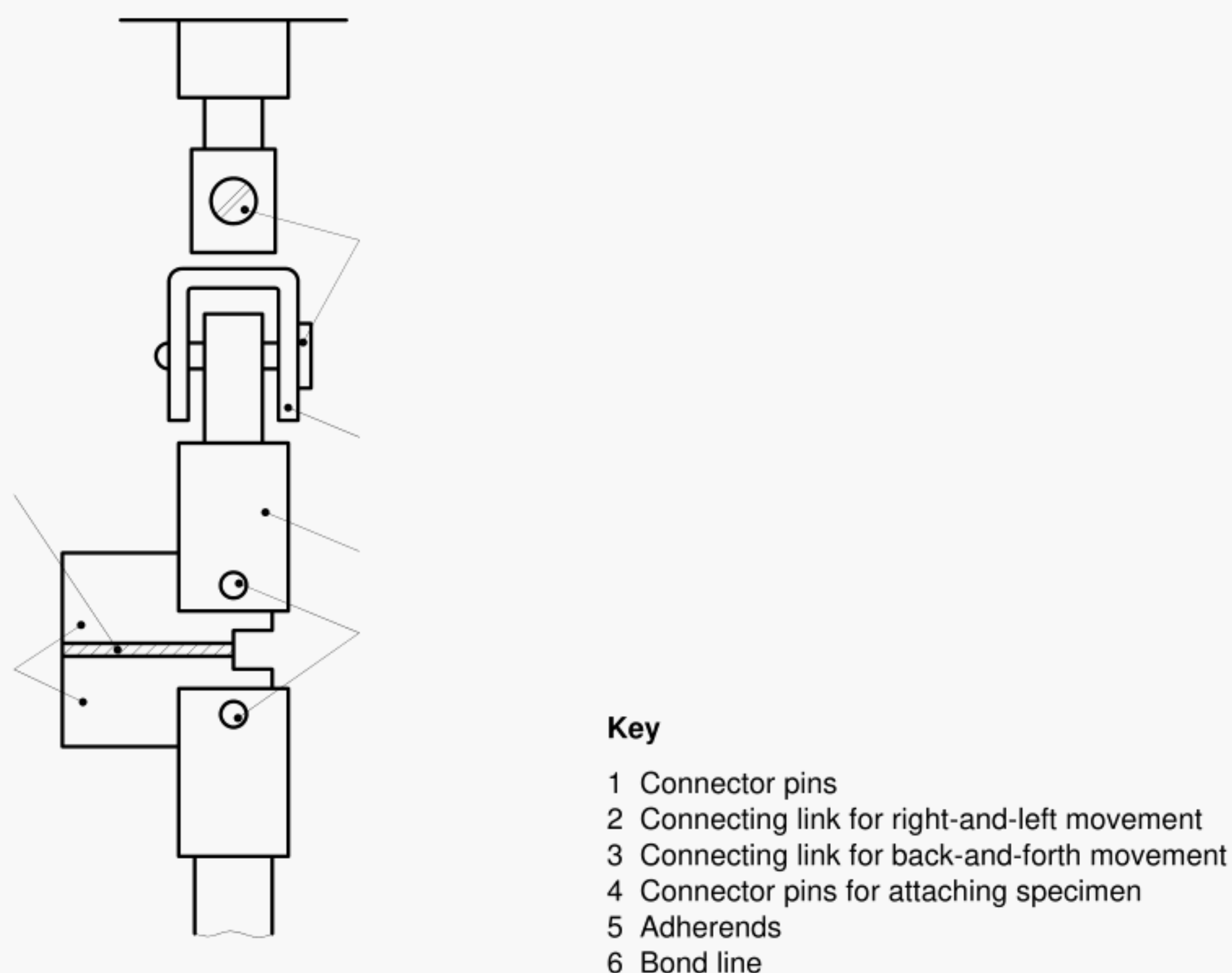


Figure 1 — Example of specimen-holding fixture

6 Specimens

6.1 Adherend material

The adherends shall be made of metal, rigid plastic, rigid fibre-reinforced plastic, wood or wood-based material.

6.2 Shape and dimensions

Specimens shall be as shown in figure 2.

6.3 Cleaning and surface treatment of adherends

The cleaning and surface treatment of the adherends shall be in accordance with the instructions of the adherend manufacturer and/or adhesive manufacturer, and/or shall be chosen from the methods described in ISO 4588 in the case of metals or ISO 13895 in the case of plastics.

Dimensions in millimetres

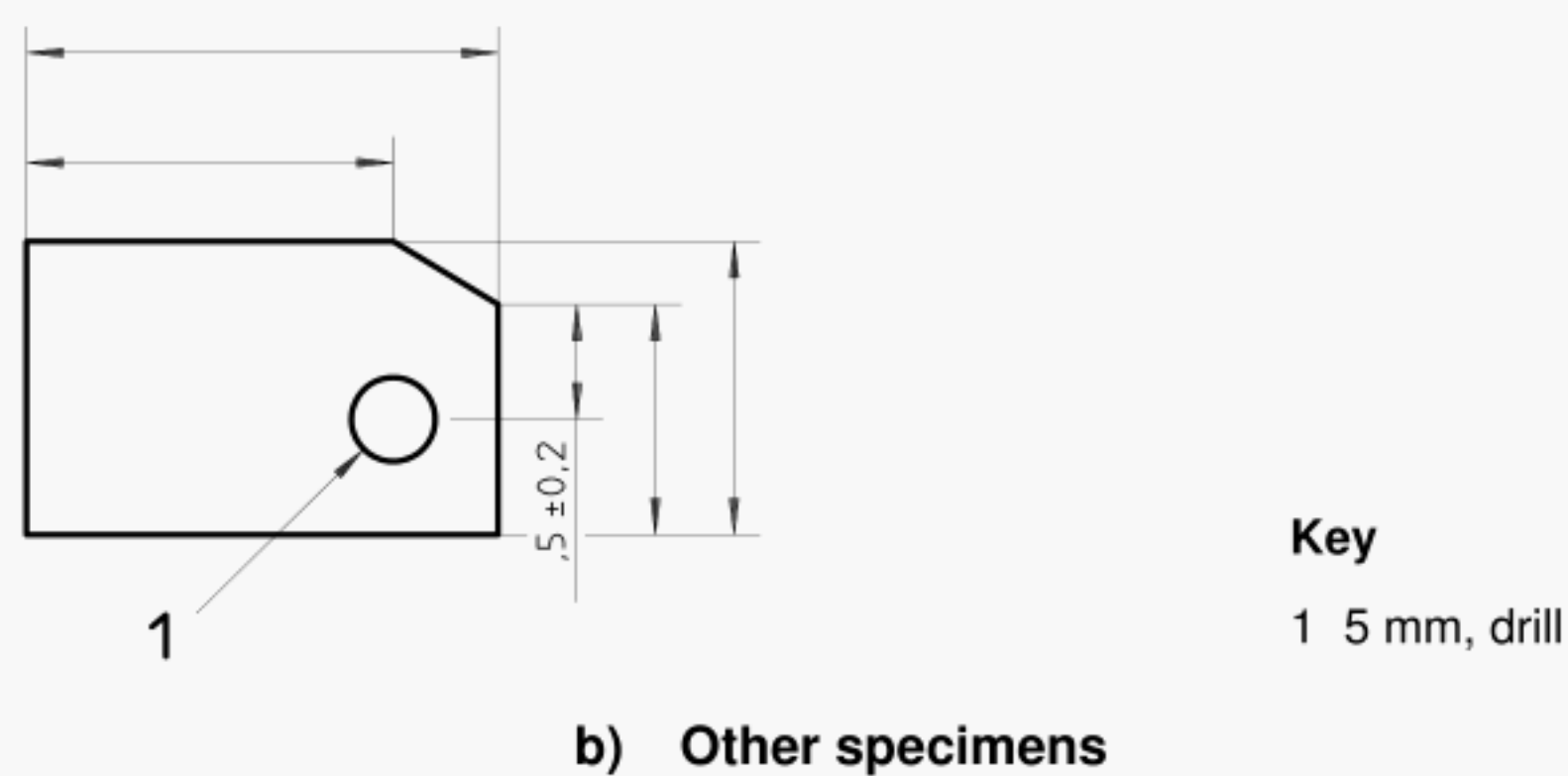
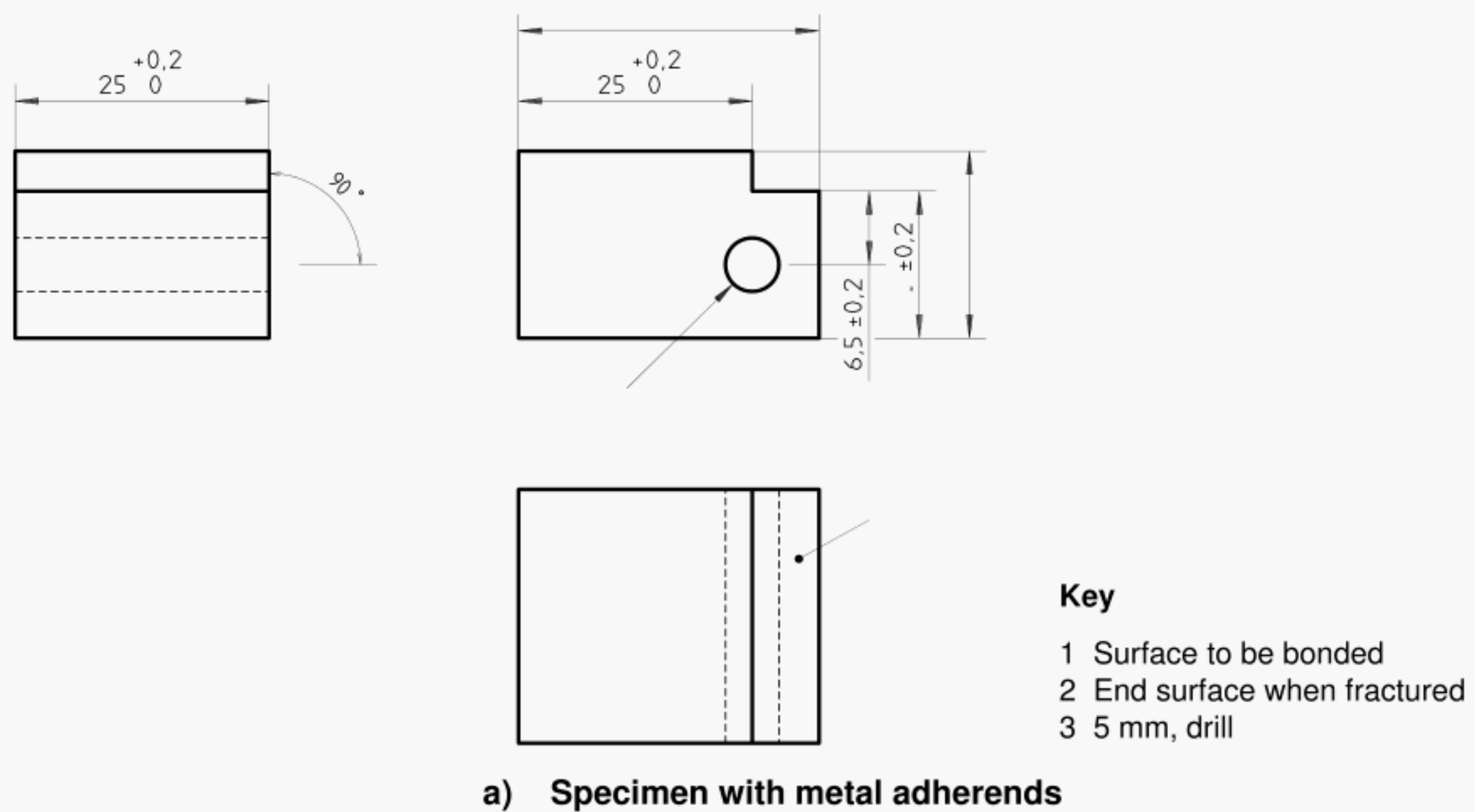


Figure 2 — Specimen shape and dimensions

6.4 Preparation of specimens

Apply and cure the adhesive in accordance with the manufacturer's recommendations. Control the bond line thickness by appropriate means, such as glass spheres or wire spacers. When using glass spheres, the content shall not exceed 0,5 % of the mass of the adhesive. When using wire spacers, prepare the specimens in such a way that the final test piece does not include the area containing the wire.

The bond line thickness shall be reported in the test report.

6.5 Conditioning and testing atmosphere

Condition and test the specimens in one of the standard atmospheres specified in ISO 291.

6.6 Number of specimens

Prepare and test at least five specimens.

NOTE — With metals, it may be possible in some cases to re-use the specimen after complete removal of the adhesive and appropriate cleaning.

6.7 Ageing

If specimens are aged prior to testing, use ISO 9142.

7 Procedure

Attach a specimen to the specimen-holding fixture as shown in figure 1. Load the specimen at a constant crosshead rate in the range of 0,1 mm/min to 10 mm/min until the specimen ruptures.

NOTE — The preferred crosshead rate is 1 mm/min.

Make an autographic recording for each specimen.

Record the maximum load reached during the test.

Determine the failure pattern in accordance with ISO 10365.

8 Expression of results

For each specimen, determine the cleavage strength as the maximum load, in newtons, divided by the width of the bond line, in millimetres. Calculate the average cleavage strength for all the specimens.

9 Precision

The precision of this test method is not known because inter-laboratory data are not available. When inter-laboratory data are obtained, a precision statement will be added at the following revision.

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 and manufacturer's code number;

- c) all details necessary for identification of the adherends used, including their dimensions and the method of preparing the surfaces prior to bonding;
- d) the bond line thickness;
- e) the atmosphere used for conditioning and testing;
- f) the number of specimens tested;
- g) the crosshead rate;
- h) the average cleavage strength, expressed in newtons per millimetre of width;
- i) the failure pattern for each specimen;
- j) any additional information obtained from the autographic recording;
- k) the date of the test.

ICS 83.180

Descriptors: plastics, adhesives, adhesive bonded joints, tests, adhesion tests, mechanical tests, determination, cleavage.

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