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Adhesives — Determination of shear strength of adhesive bonds between rigid substrates by the block-shear method

Adhésifs — Détermination de la résistance au cisaillement de joints collés entre éléments rigides par la méthode de cisaillement entre blocs massifs

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

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

ISO 13445 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 11, *Products*.

This second edition cancels and replaces the first edition (ISO 13445:1995), which has been technically revised.

Adhesives — Determination of shear strength of adhesive bonds between rigid substrates by the block-shear method

1 Scope

This International Standard specifies a method for the determination of the shear strength of adhesives used to bond materials with elastic moduli higher than the elastic modulus of the adhesive. The method provides an estimate of the shear strength of an adhesive on various machinable and non-machinable substrate materials.

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.

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

ISO 7500-1:—[1], *Metallic materials — Verification of static uniaxial testing machines — Part 1: Tension/compression testing machines — Verification and calibration of the force-measuring system*

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

EN 13887:—[2], *Structural adhesives — Guidelines for surface preparation of metals and plastics prior to adhesive bonding*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
shear stress
force applied parallel to a flat adhesive joint, divided by the bond area of the joint

3.2
shear strength
maximum shear stress sustained by an adhesive joint during a shear test

1) To be published. (Revision of ISO 7500-1:1999)

2) To be published.

4 Principle

Blocks, plates or discs are bonded together, and the maximum force required to shear them apart is determined. The method is particularly applicable to the testing of bonds between ceramic parts, glass parts, magnet mouldings and plastic parts having one flat face where machining would be difficult or impractical.

5 Apparatus

5.1 Tensile-testing machine, with a capacity of not less than 45 kN in tension. The machine shall conform to the requirements of ISO 7500-1.

5.2 Shearing fixture, consisting of a specimen-holding block and a shearing tool (see Figures 1 and 2). Adherends measuring up to 80 mm × 80 mm × 13 mm can be held in the block, while the shearing tool can be used with adherends measuring up to 30 mm × 30 mm × 13 mm. A test specimen with adherends approximating to these dimensions is shown in Figure 3a). For test specimens having two smaller adherends as shown in Figure 3b), an adapter plate can be inserted into the specimen-holding block (see Figure 4) to keep the shearing tool in its guides and to ensure the specimen is located under the clamp.

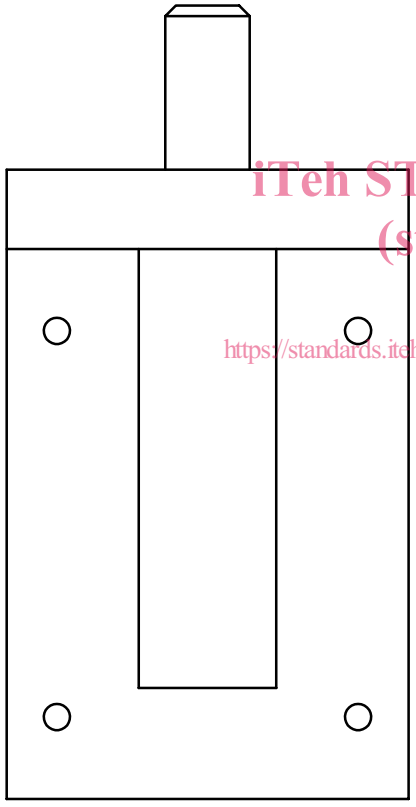
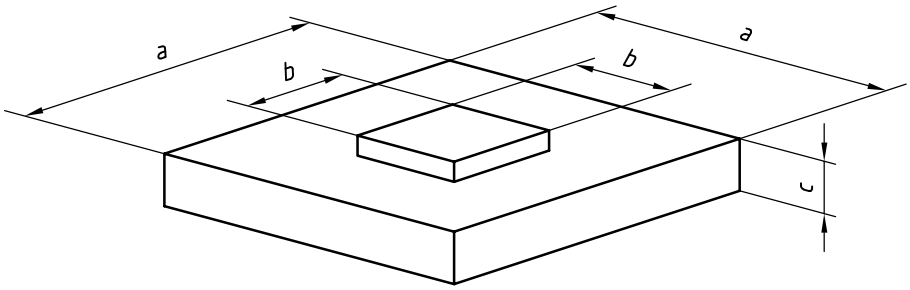
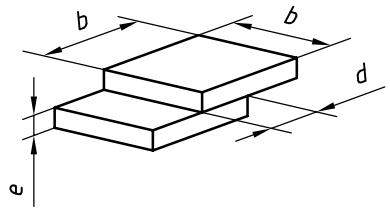


Figure 1 — Specimen-holding block

Figure 2 — Shearing tool



a) Plastic, metal, ceramic or wood to glass



b) Plastic, metal, ceramic or wood to the same material or to one of the other materials

Key

a 75 mm ± 1 mm
b 25 mm ± 0,2 mm
c 13 mm ± 1 mm
d 12 mm < *d* ± 0,2 mm < 13 mm
e 6 mm for metals, 13 mm for others

Figure 3 — Typical specimens after assembly

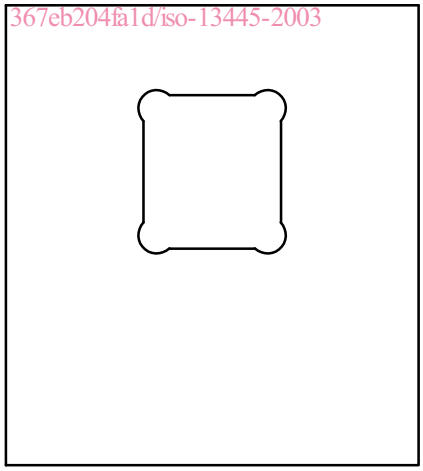


Figure 4 — Adapter for small specimens of the size shown in Figure 3b)

6 Test specimens

6.1 Adherend sizes shall be as follows:

a) metal blocks: 25 mm × 25 mm × 6 mm;

b) glass plates: 75 mm × 75 mm × 13 mm;

c) other materials: 25 mm × 25 mm × 13 mm.

NOTE 1 Other adherend dimensions, within the limits of the shearing-fixture capacity, may be used depending on the application, provided the specimens are thick enough to avoid deformation occurring.

NOTE 2 This method is not applicable to thin adherends with which deformation of the specimen would occur.

6.2 Prepare the surface of the specimen in accordance with EN 13887.

6.3 Prepare the adhesive and apply it in accordance with the adhesive manufacturer's recommendations. Bond the adhesive-coated adherends in accordance with the procedure under investigation. Assemble straight-sided adherends such that the thrust surfaces of the specimen are parallel to within ± 5 µm/mm. Determine the thickness of the adhesive layer to within 0,02 mm using suitable equipment.

6.4 Remove immediately any excess adhesive squeezed out during assembly. Figure 3 shows typical specimens after bonding.

6.5 Test a minimum of five specimens.

7 Conditioning

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

8 Procedure

8.1 Mount the shearing fixture in the test machine with the specimen-holding block on top.

8.2 Place an assembled specimen in the shearing fixture in such a way that one of the adherends is held by the holding block and the other engaged by the shearing tool (see Figure 5). Centre the specimen in the shearing tool so that no turning moment is applied to the specimen during shearing. Close the toggle clamp on the rear of the specimen-holding block to keep the specimen (or adapter) located against the shearing tool.

8.3 Test the specimen using a crosshead speed of 1,5 mm/min. Record the maximum force sustained by the specimen.

8.4 Examine the adherends after the test to determine the failure pattern in accordance with ISO 10365.

8.5 Repeat the procedure for the remaining specimens.

9 Expression of results

Calculate the maximum shear stress for each specimen by dividing the maximum force by the bond area. Average the maximum shear stresses for all replicates to determine the average shear strength. Express the shear stress and shear strength in megapascals.

10 Precision

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

11 Test report

The test report shall include the following information:

a) a reference to this International Standard;

b) all details necessary for complete identification of the adhesive tested, including type, source and manufacturer's code number;

c) all details necessary for complete identification of the adherends used, including dimensions and orientation in the shearing fixture, conditioning of specimens, and the method of cleaning and preparing the surfaces prior to bonding;

d) the quantity of adhesive applied and the bonding conditions used;

e) the average thickness of the adhesive layer after formation of the bond, to within 0,02 mm, and the way in which the thickness was measured;

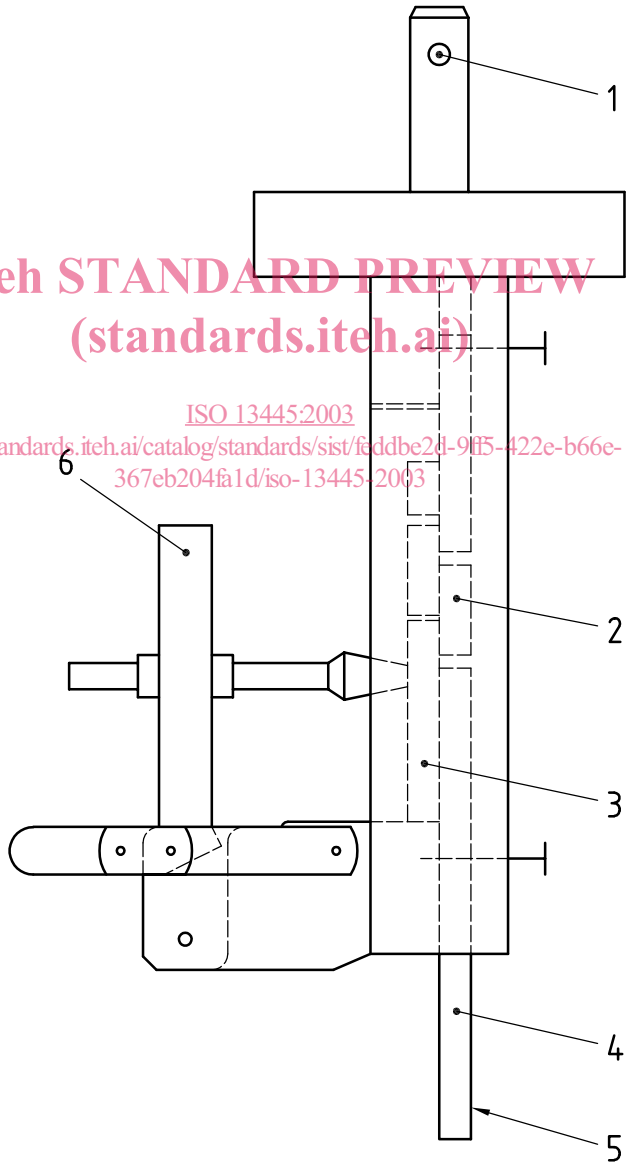
f) the temperature at which the test was performed;

g) the number of specimens tested;

h) the maximum shear stress for each specimen;

i) the average shear strength;

j) the failure-pattern designation for each specimen, in accordance with ISO 10365.



Key

1	pinhole for mounting	4	shearing tool
2	specimen	5	end for clamping
3	adapter	6	toggle clamp

Figure 5 — Side view of shearing fixture with specimen