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INTERNATIONAL STANDARD

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Second edition
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Adhesives — Determination of peel resistance of high-strength adhesive bonds — Floating roller method

Adhésifs — Détermination de la résistance au pelage des assemblages à forte cohésion — Méthode des galets mobiles

Reference number
ISO 4578 : 1990 (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 approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 4578 was prepared by Technical Committee ISO/TC 61, *Plastics*.

This second edition cancels and replaces the first edition (ISO 4578 : 1979), of which it constitutes a minor revision.

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Adhesives — Determination of peel resistance of high-strength adhesive bonds — Floating roller method

1 Scope

This International Standard specifies a floating roller method for the determination of the peel resistance of high-strength adhesive bonds between one rigid metallic adherend and one flexible metallic adherend when tested under specified conditions of preparation and testing.

NOTE — The use of the floating roller produces more constant numerical data than other peel methods, but it should not be expected that the flexible metallic adherend will conform to the surface of the roller.

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 4588 : 1989, *Adhesives — Preparation of metal surfaces for adhesive bonding.*

3 Definition

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

peel resistance: The average force per unit test specimen width, measured along the bond line, required to separate progressively the two metallic members of a bonded test specimen under specified conditions of test. It is expressed in kilonewtons per metre of width.

4 Apparatus

4.1 Tensile testing machine,[1] capable of maintaining a pre-determined constant crosshead rate to be reported in the test report (preferred rate 100 mm/min). It shall be provided with a suitable self-aligning grip to hold the test specimen. The jaws of this grip shall firmly engage the outer 25 mm of the end of the flexible adherend. The grip and attachments shall be so constructed that they will move into alignment with the test specimen as soon as the force is applied, so that the flexible member of the test specimen will coincide with the direction of the applied pull through the centre line of the grip assembly. The machine shall 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. All equipment shall be calibrated regularly. It is recommended that inertialess equipment be used for this test.

The machine shall permit the measurement and recording of the applied force with an accuracy of ± 2 %.

4.2 Peel test fixture, for supporting the test specimen (see figure 1). The fixture shall be attached to one of the cross-arms of the testing machine (4.1). The 25 mm diameter rollers on the test fixture shall roll freely. The angle determined by the rollers and the use of dual roller bearings are critical and the rollers shall therefore be carefully maintained.

5 Test specimens

5.1 Test specimens of the dimensions shown in figure 2 may be prepared individually or cut from bonded panels. Laminated test panels, or individual test specimens, shall consist of two adherends properly prepared and bonded together.

5.2 Surface treatment shall be such as to obtain optimum strength in the bonded assembly. The preparation of the surface shall be in accordance with either the adhesive manufacturer's instructions or ISO 4588 and shall be stated in the test report.

The adhesive shall be applied in accordance with the manufacturer's recommendations to obtain an optimum bond with a minimum of variations.

NOTE — Direct comparison of different adhesives can be made only when test specimen construction, adherend materials and dimensions, and test conditions are identical.

1) See for instance ISO 5893 : 1985, *Rubber and plastics test equipment — Tensile, flexural and compression types — Description.*

5.3 The thickness of the flexible adherend shall be 0,5 mm ± 0,02 mm and that of the rigid adherend shall be 1,6 mm ± 0,1 mm.

5.4 Test specimens shall be cut from the bonded panels (see figure 2) by a means that is not deleterious to the bond.

The width shall be either

a) 25 mm (the preferred width) or

b) any other convenient width, provided that the test equipment is suitably adapted and the width is stated in the test report.

NOTE — The method of cutting the test specimens is dependent upon the adherend and adhesive compositions and the tolerance specified in figure 2. Milling and band-sawing are two methods commonly used for this purpose.

5.5 The unbonded end of the flexible adherend shall be bent perpendicular to the rigid adherend for clamping in the grip of the testing machine.

5.6 The number of specimens to be tested shall be as specified in the material specification or, if not so specified, shall be not less than five.

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

7.1 Insert the test specimen into the peel test fixture (4.2) as shown in figure 1, with the unbonded end of the flexible adherend gripped in the jaw of the testing machine (4.1). Peel the specimen at a constant crosshead separation rate of 100 mm/min ± 5 mm/min, unless otherwise specified. If the rigid adherend bends or is distorted during the test, it is recommended that the specimen be redesigned with a rigid adherend stiff enough to ensure even peeling.

7.2 During the peel test, make an autographic recording of force versus crosshead movement (force versus distance peeled) over a length of at least 115 mm of the bond line disregarding the first 25 mm of peel.

7.3 Disregard the results if failure occurs outside the peeling zone as defined in figure 1.

8 Expression of results

Determine from the autographic curve, for at least 115 mm of peeling (disregarding the first 25 mm and the last 20 mm), the average peeling force, in kilonewtons per metre of the test specimen width, required to separate the adherends. The average force may be determined from the curve by one of the following methods:

a) a planimeter;

b) a gravimetric method, as follows:

Cut out the area of the chart paper surrounded by the curve and the base line (abscissa) and weigh it. Determine the area by dividing its mass by the previously determined mass per surface area of the chart paper. Divide the area thus found by the length of the base line (corresponding to 80 mm peeling length) to obtain the average height of the curve (and hence the average peeling force);

c) by drawing the best straight line through the peeling curve using a straight edge.

Also record the maximum and minimum forces for each individual specimen.

9 Test report

The test report shall include the following particulars:

a) a reference to this International Standard;

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

c) identification of adherends, including material thickness, width and surface preparation;

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

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

f) a complete description of the test specimen, whether individual or panel, including dimensions and construction of the test specimen, conditions used for cutting individual test specimens, number of test panels represented and number of individual test specimens (when edge specimens are tested they shall be designated "edge specimens");

g) the conditioning procedure prior to testing and the test conditions;

h) if the crosshead separation rate is other than 100 mm/min, the actual crosshead separation used;

i) the method of determining the average force;

j) the average, maximum and minimum peeling force values, in kilonewtons per metre of test specimen width, for each individual specimen (edge samples shall be reported separately);

k) the type of failure.

Dimensions in millimetres

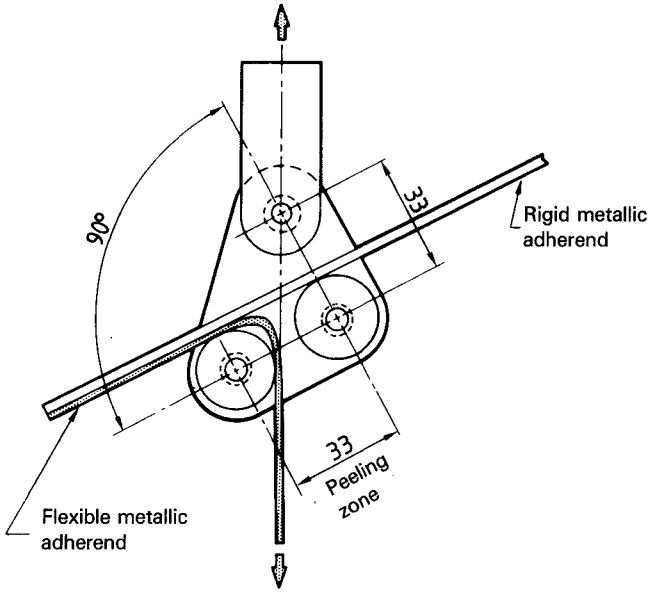
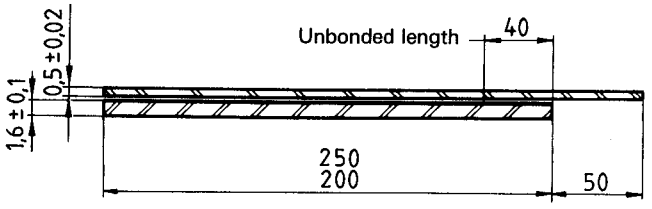


Figure 1 — Peel test fixture for supporting test specimen

Dimensions in millimetres



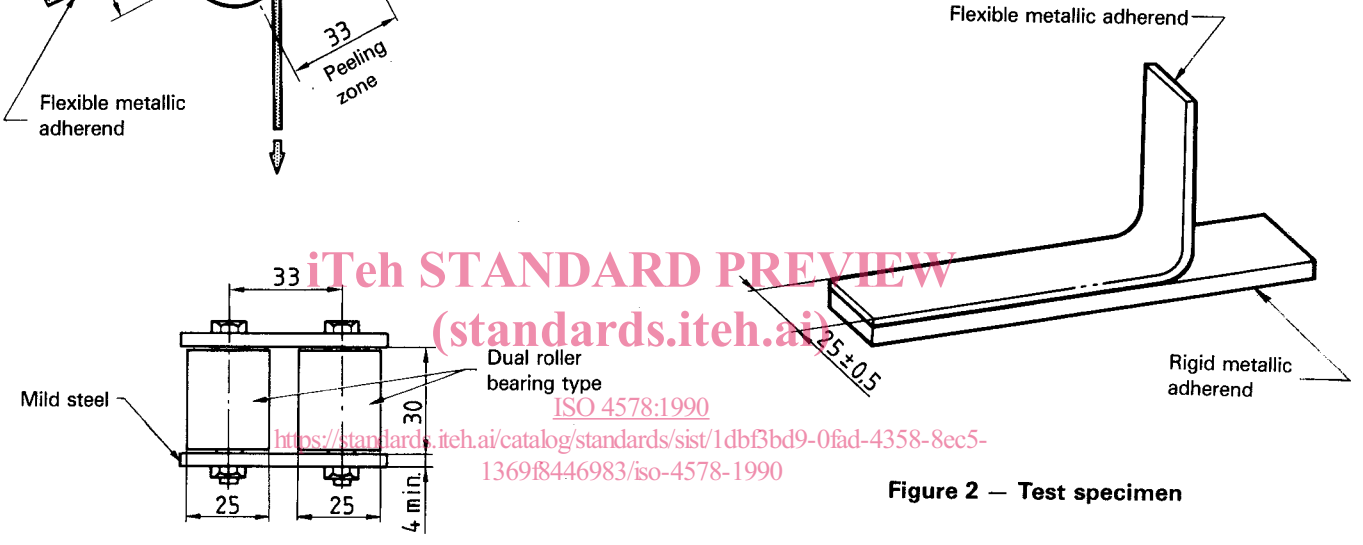


Figure 2 — Test specimen

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Descriptors : plastics, adhesives, adhesive bonded joints, tests, adhesion tests, peel tests.

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