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Adhesives — Determination of the bond strength of engineering-plastic joints

Adhésifs — Détermination de la résistance de joints collés des plastiques industriels

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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 3.

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 International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 15509 was prepared by Technical Committee ISO/TC 61, *Plastics*, Subcommittee SC 11, *Products*.

Introduction

Methods of determining the strength of adhesive joints are well known. Several International Standards describe various methods including the lap-shear test or the butt torsion test. However, these methods are either not suitable for the determination of values which can be used for design purposes, or are restricted to metallic substrates. Because the existing International Standards for the measurement of the strength of bonded plastic materials are derived from test methods for metals and are less suitable for plastic materials due to the bending of substrates and varying modulus of elasticity, a new test method and a new test geometry have been developed and are described in this International Standard.

Adhesives — Determination of the bond strength of engineering-plastic joints

1 Scope

This International Standard describes a test method for measuring the shear and/or tensile strength of an adhesively bonded plastic/plastic specimen of a specific design. This method allows the determination of a combined shear and tensile behaviour of the bond. These shear and tensile values are useful for design purposes.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

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

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

ISO 13895:1996, *Adhesives — Guidelines for the surface preparation of plastics*

3 Principle

A hollow cylindrical test specimen of specific design is used for the determination of the shear and tensile strengths of adhesively bonded plastic/plastic joints. These values can be used in calculation programmes. The rotationally symmetrical specimen allows testing under tensile, torsional or combined tensile/torsional loads if a suitable test machine is used.

NOTE 1 The shear stress is not uniformly distributed as the stress varies by approximately 15 % from the inner radius to the outer radius. Therefore the calculated shear strength represents an “average” value.

NOTE 2 The origin of the stress distribution curve is the deformation of the bond line, as the deformation increases with increasing diameter. The superimposition of shear and tensile stresses is negligible in the bondline of rotationally symmetrical specimen compared to lap-shear specimen as described in ISO 4587, *Adhesives — Determination of tensile lap-shear strength of rigid-to-rigid bonded assemblies*. There are practically no significant peaks in the stress distribution curve compared with the peaks observed in a lap-shear specimen, since the bond is continuous in the direction of the displacement.

4 Specimen

4.1 Preparation

4.1.1 General

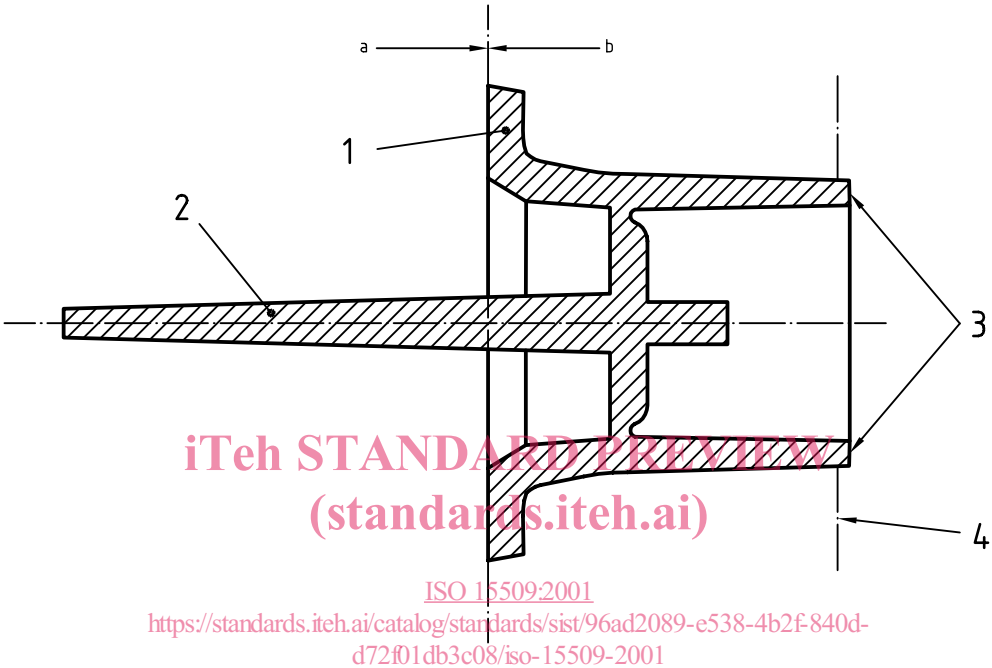
Prepare the adherends by injection moulding as described in 4.1.2 to 4.1.5.

4.1.2 Mould

The mould used shall be of the ejector-pin type with a limitation of one moulding per shot. The mould cavity shall be filled through a cone gate.

NOTE The use of this type of mould avoids weld lines which could lead to symmetry problems with the moulding after cooling, or to a weakening of the mechanical properties in this area.

A schematic drawing of an injection-moulded adherend is shown in Figure 1.



Key

1 Base of adherend
2 Sprue
3 Bonding areas
4 Degassing zone

[a] Injection direction
[b] Ejection direction

Figure 1 — Schematic drawing of one of the adherends after moulding

The mould shall be manufactured in accordance with conventional mould-making processes. It shall be of an adequate size so as to allow the preparation of adherends of the dimensions shown in Figure 2[1)].

4.1.3 Injection-moulding parameters

The parameters shall be agreed upon between the user and the plastic material supplier.

NOTE 1 The injection-moulding parameters will depend on the geometry of the mould and the nature of the plastic material.

1) One possible supplier of such a mould is Rusko-Formen GmbH, Friedrich-List-Straße 10, D-73249 Wernau, Germany.

Dimensions in millimetres

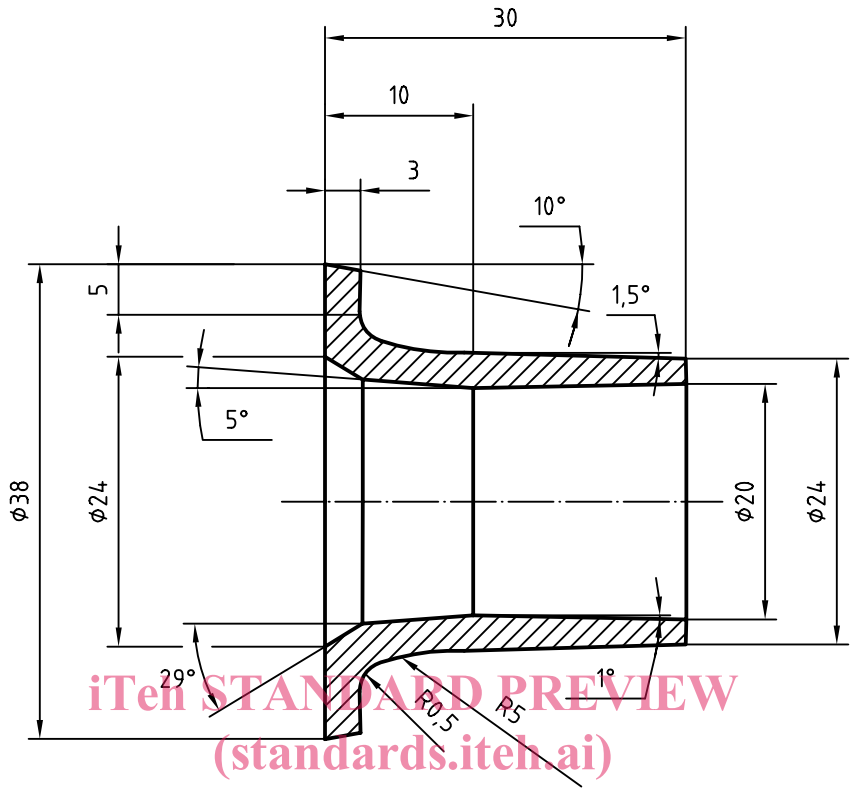


Figure 2 — Dimensions of adherend

The plastic material shall be pre-dried. The temperature and time shall be as agreed upon between the user and the plastic material supplier.

NOTE 2 Temperatures between 100 °C and 150 °C (depending on the type of plastic) over periods of 4 h to 6 h in a vacuum oven are the preferred conditions.

4.1.4 Removal of the sprue

Remove the central part, or sprue, from each of the adherends. A simple method consists of using a chisel while rotating the adherend in a lathe.

Avoid any contact with the bonding area during this operation.

4.1.5 Geometry

The specimen shall consist of two adherends bonded together.

The dimensions of each adherend shall be as given in Figure 2.

4.2 Surface preparation

Prepare the bonding surfaces of the adherends in accordance with ISO 13895.

NOTE Corona discharge at ambient pressure is the preferred method.