SLOVENSKI STANDARD
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Konstrukcijska lepila - Določanje strižnih lastnosti konstrukcijskih spojev - 2. del: Strižno preskušanje debelih lepljencev (ISO 11003-2:2001, spremenjen)

Structural adhesives - Determination of shear behaviour of structural bonds - Part 2: Thick adherends shear test (ISO 11003-2:2001, modified)

Strukturklebstoffe - Bestimmung des Scherverhaltens struktureller Klebungen - Teil 2: Scherprüfung für dicke Fügeteile (ISO 11003-2:2001 Modifiziert)

Adhésifs structuraux - Détermination du comportement en cisaillement d'adhésifs structuraux - Partie 2: Méthode d'essai en traction sur éprouvette épaisse (ISO 11003-2:2001 Modifié)

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Structural adhesives - Determination of shear behaviour of structural bonds - Part 2: Thick adherends shear test (ISO 11003-2:2001, modified)

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Foreword

This document (EN 14869-2:2011) has been prepared by Technical Committee CEN/TC 193 “Adhesives”, the secretariat of which is held by AENOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by November 2011, and conflicting national standards shall be withdrawn at the latest by November 2011.

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1 Scope

This European Standard specifies a test method for determining the shear behaviour of an adhesive in a single lap joint bonded assembly when subjected to a tensile force.

The test is performed on specimens consisting of thick, rigid adherends, with a short length of overlap, in order to obtain the most uniform distribution of shear stresses possible and to minimize other stress states which initiate failure.

This test method may be used to determine:

— the shear-stress against shear-strain curve to failure of the adhesive;

— the shear modulus of the adhesive;

— other adhesive properties that can be derived from the stress/strain curve such as the maximum shear stress and shear strain;

— the effect of temperature, environment, test speed, etc. on these properties.

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.

EN 923:2005+A1:2008, *Adhesives — Terms and definitions*

EN 13887, *Structural Adhesives — Guidelines for surface preparation of metals and plastics prior to adhesive bonding*

EN ISO 291, *Plastics — Standard atmospheres for conditioning and testing (ISO 291:2008)*

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

ISO 683-11, *Heat-treatable steels, alloy steels and free-cutting steels — Part 11: Wrought case-hardening steels*

ISO 1052, *Steels for general engineering purposes*

ISO 4995, *Hot-rolled steel sheet of structural quality*

3 Terms and definitions

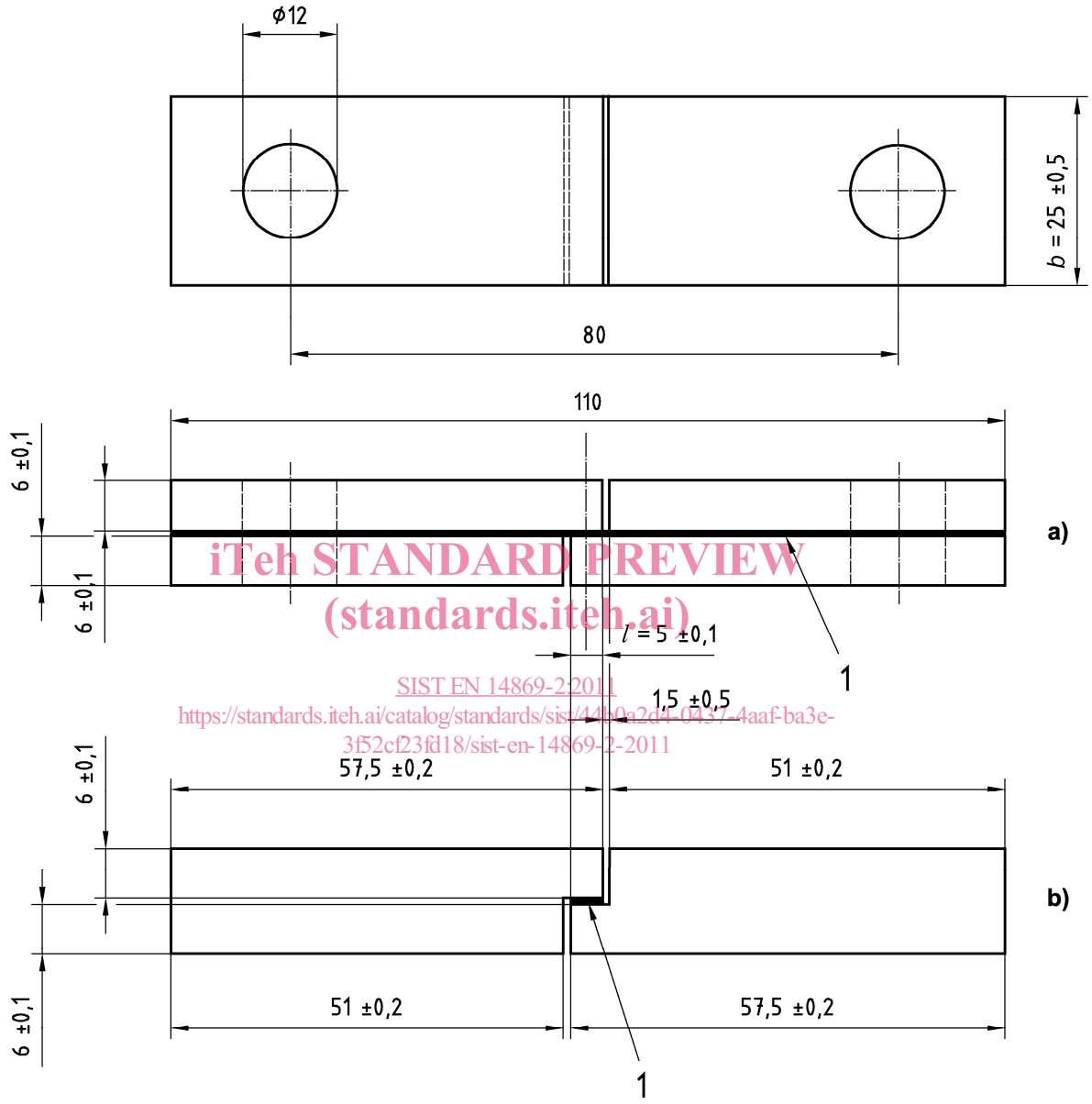
For the purposes of this document, the terms and definitions given in EN 923:2005+A1:2008 apply.

4 Principle

An adhesively bonded test specimen (see Figure 1) is subjected to a tensile force so that the adhesive is stressed in shear.

The relative displacement of the adherends is measured using a purpose-built transducer located in the central region of the specimen. Force and displacement are measured from the start of application of the load until fracture of the specimen. The shear stresses and strains are then calculated from the bond dimensions.

Dimensions in millimetres



Key

a) Bonded adherends
b) Machined adherends
1 Adhesive bond
b Width of adhesive
l Length of adhesive

Figure 1 — Specimen dimensions and configuration

5 Apparatus

5.1 Tensile-testing machine, capable of producing fracture in the specimen at a tensile force between 10 % and 80 % of the full-scale range of the force transducer.

5.2 Device for introducing a force into the specimen, so that negligible torque develops when force (*F*) is applied to the specimen.

For this purpose, the simple universal-joint design shown in Figure 2 is satisfactory.

5.3 Force transducer, capable of measuring the force in the specimen with an accuracy of 1 % of the force at a shear strain of 0,01.

5.4 One or two extensometers (see Note 2), for measuring the shear displacement between points of known separation on each adherend in the central region of the bond (see Figure 3 and Annex A).

The points of contact with the adherends shall be within a distance of 2 mm from the bonded faces. The device(s) shall be capable of measuring the shear displacement to an accuracy of 1 µm.

NOTE 1 During loading, each adherend will bend slightly, leading to a small rotation of the central (bonded) region of the test specimen. In order to achieve high accuracy in displacement measurements, the extensometer(s) should rotate with the specimen. This has been achieved in the design shown in Figure 3 by double-pin contact with one of the adherends.

NOTE 2 The use of two extensometers on opposing faces of the specimen is recommended to minimize, by averaging the extensometer readings, any contribution to measurements from a twisting moment applied to the specimen. The use of two extensometers will also serve to indicate any malfunctioning of one of the extensometers as revealed by significantly different readings from the two devices.

5.5 Data-logging equipment, to continuously record the relative displacement of the adherends and the applied load, from the start of application of the load until the specimen breaks.

5.6 Micrometer, having an accuracy of better than 0,002 mm, to measure the dimensions of the adherends.

5.7 Optical microscope, having an accuracy of better than 0,002 mm, to measure the thickness of the adhesive bond when the specimen configuration shown in Figure 1a) is used.

6 Specimen

6.1 Specimen dimensions and configurations

Specimens shall be prepared either by bonding metal plates or strips together to produce the configuration shown in Figure 1a) or by bonding adherends that have been machined to the shape shown in Figure 1b). The dimensions of the specimen are given in Figure 1 and are the same, within variations in the bond thickness, for both preparation methods.

The bond thickness shall not be less than 0,05 mm.

NOTE The adherends shown in Figure 1a) have a lower bending stiffness than the continuous geometry shown in Figure 1b). Consequently, the peel stresses at the ends of the adhesive in the specimen in Figure 1a) will be higher than those in the specimen in Figure 1b). However, these differences in stiffness are likely to cause a trivial deviation in the comparative results.

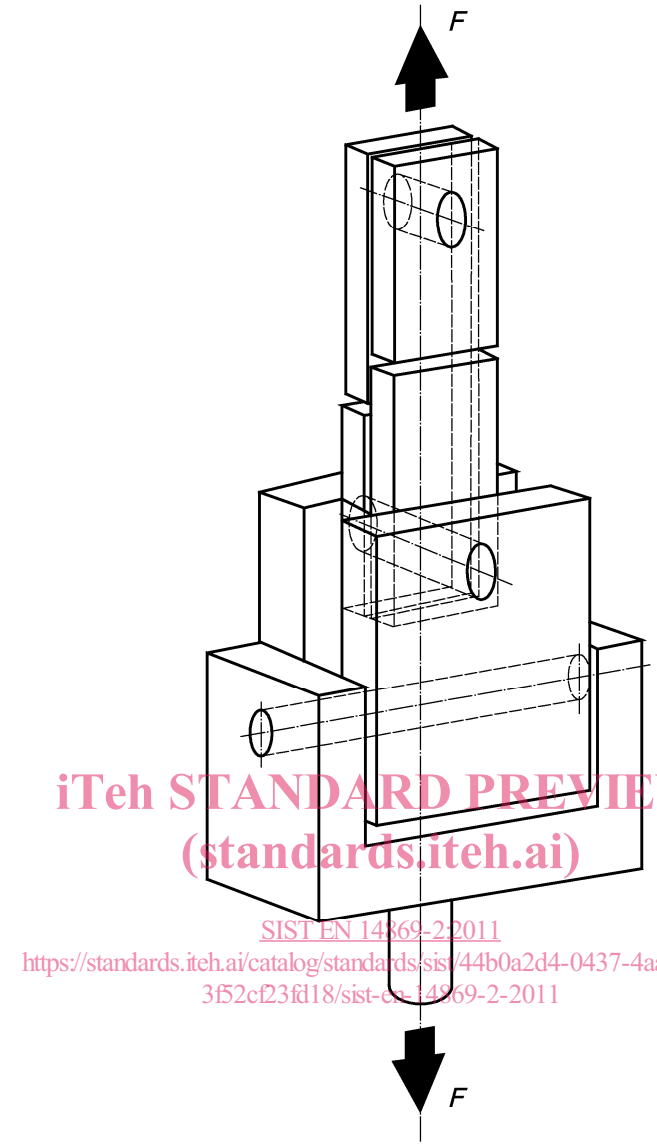


Figure 2 — Example of device for loading the specimen in a tensile-testing machine

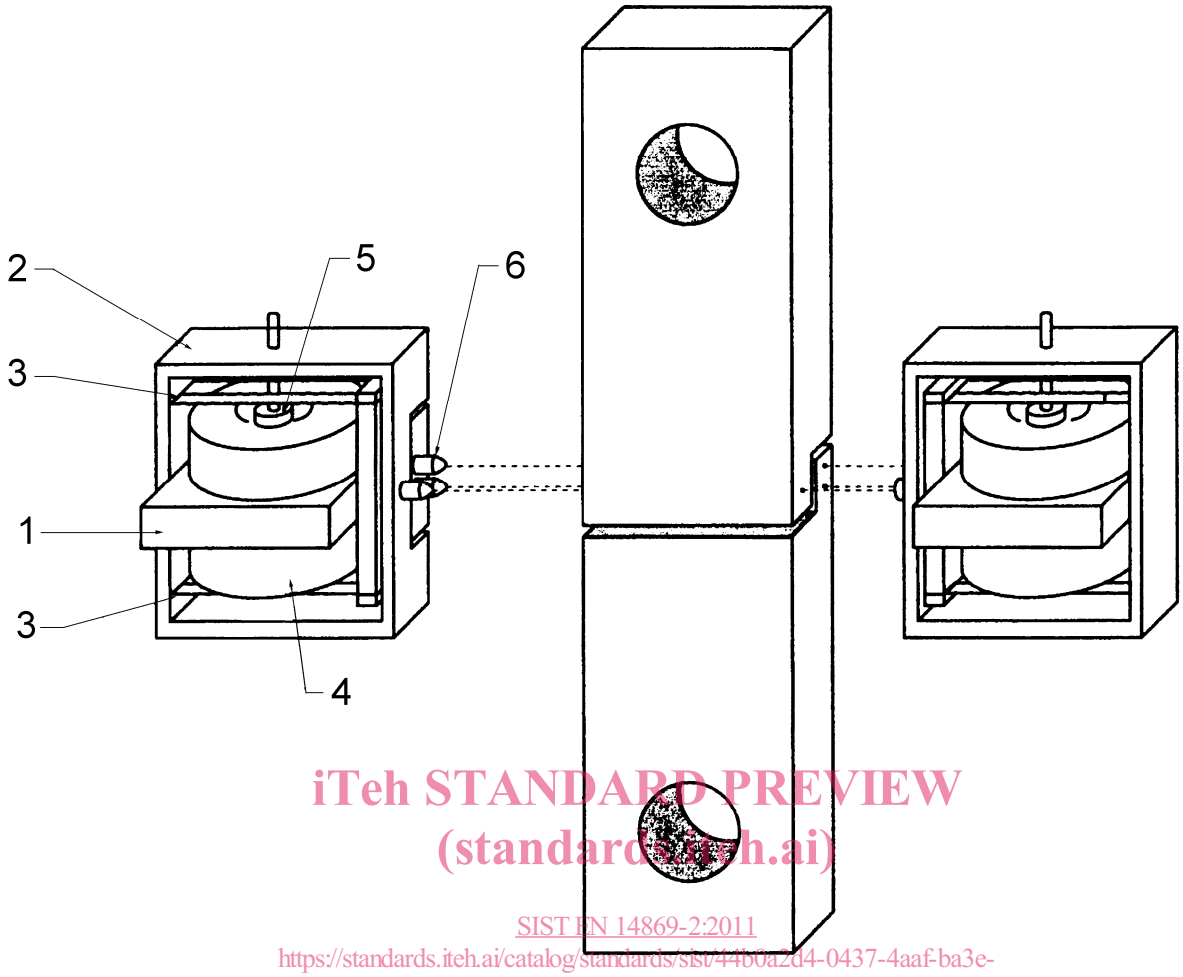
6.2 Adherends

For the purpose of the measurement of the properties of the adhesive, steel adherends are recommended because of their high modulus.

Machine the panels or bars to be used for the adherends in accordance with ISO 683-11, ISO 1052 and ISO 4995 to the dimensions given in Figure 1a) or 1b) depending on which specimen configuration is chosen.

6.3 Preparation of surfaces before bonding

The surfaces to be bonded shall be prepared in accordance with EN 13887 or by any other method leading to cohesive failure within the adhesive layer.



Key

1 Mobile inner part
2 Rigid outer frame
3 Steel leaf spring
4 Transducer coil
5 Transducer core
6 Turgsten pins

Figure 3 — Example of extensometer positioning

7 Test specimen

7.1 Preparation

7.1.1 Specimens with flat-ended adherends

7.1.1.1 General

Specimens with flat-ended adherends shall have the configuration shown in Figure 1a) and may be prepared from uncut panels, from pre-cut panels or as individual specimens from machined plates.

7.1.1.2 Uncut panels

The panels from which the specimens are cut shall consist of two sheets with dimensions in accordance with Figure 4, bonded together in accordance with the adhesive manufacturer's instructions.

In order to define the thickness of the adhesive, shims or spacers (metal foil) or calibrated metal wires may be incorporated outside the area which will become the overlap zone.

Cut the bonded panels into specimens using a suitable tool such as a band saw. Then subject the specimens to the required machining. Perform the last pass on the edge of the specimen parallel to the longitudinal direction of the specimen so as to avoid any metal burrs along the bonded joint.

Drill holes at the ends of each specimen for pins to hold the specimen to the tensile-testing machine.

Delineate the overlap zone by milling two grooves as shown in Figure 5.

When the specimens are machined, care shall be taken to ensure that the assembly is not heated above 50 °C. No liquid shall be used for cooling.

7.1.1.3 Pre-cut panels

Proceed as in 7.1.1.2, using two pre-cut sheets so as to obtain a panel in accordance with Figure 6.

Two holes shall be provided in each sheet so that the two sheets can be superposed correctly using an assembly with two centring lugs.

Cut out and machine specimens as explained in 7.1.1.2.

7.1.1.4 Individual specimens

Bond two plates of dimensions 110 mm × 25 mm × 6 mm in accordance with the adhesive manufacturer's instructions, defining the thickness of the adhesive joint as indicated in 7.1.1.2. Ensure that the sides of the adherends are parallel to the nearest 0,1 mm.

Machine each specimen to the required size.

Drill holes for applying the load.

Make two grooves by milling to delineate the overlap.

Take the same precautions as in 7.1.1.2.