
**Thermal spraying — Determination of
tensile adhesive strength**

Projection thermique — Mesure de l'adhérence par essais de traction



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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.

International standard, ISO 14916, was prepared by the European Committee for Standardization (as EN 582) and was adopted, under a special “fast-track procedure”, by Technical Committee ISO/TC 107, *Metallic and other inorganic coatings* in parallel with its approval by the ISO member bodies.

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Thermal spraying — Determination of tensile adhesive strength

1 Scope

In the test to determine the tensile adhesive strength of thermally sprayed deposits, the specimen is loaded in tension.

The test is conducted to determine the strength of the coating and/or the strength of the bond between the spray deposit and the parent metal.

The test is used to evaluate the effects of parent metal and spray material, preparation of the surface of the workpiece, and the spraying conditions on the bond and adhesive strength of thermally sprayed coatings, or for routine supervision of the spray works.

Comparative statements are to be based in the test report.

NOTE The tensile adhesive test method is not recommended for very thin and porous deposits. In this case, a bend test has proved to be more appropriate.

2 Normative reference

The following normative document contains 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 edition of the normative document listed 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 7500-1, *Metallic materials — Verification of static uniaxial testing machines — Part 1: Tensile testing machines*.

3 Term and definition

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

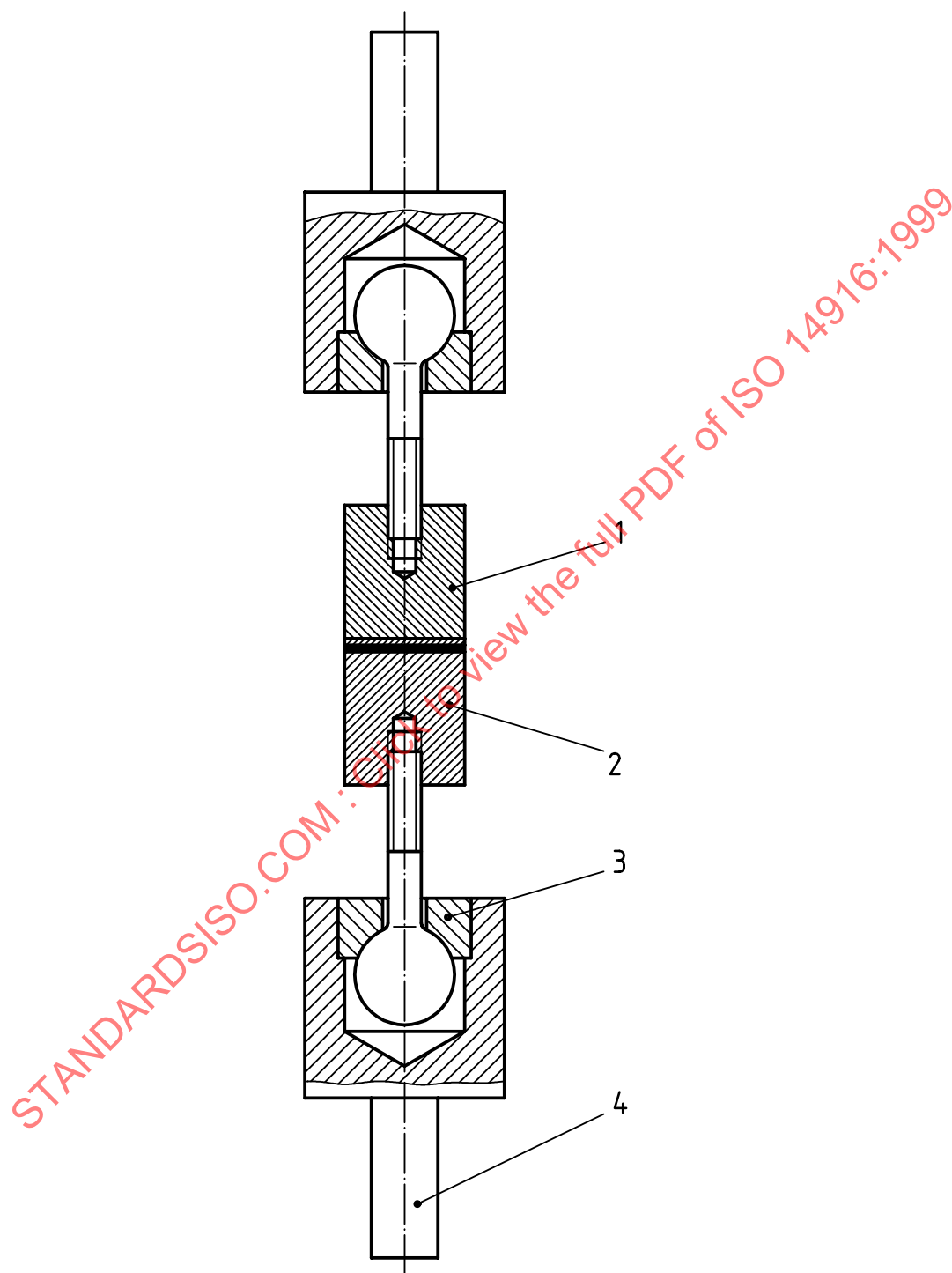
3.1

tensile adhesive strength R_H

strength obtained in the tension test, calculated from the quotient of the maximum load, F_m , and the cross-section at the fractured face

4 Equipment

A tensile testing machine in accordance with ISO 7500-1, class 1, and a clamping system are to be used to ensure concentric clamping and loading of the specimens. See Figure 1.



Key

- 1 Loading block
- 2 Substrate block
- 3 Ball joint
- 4 Clamping part

Figure 1 — Example of a test arrangement with specimen A

5 Specimens

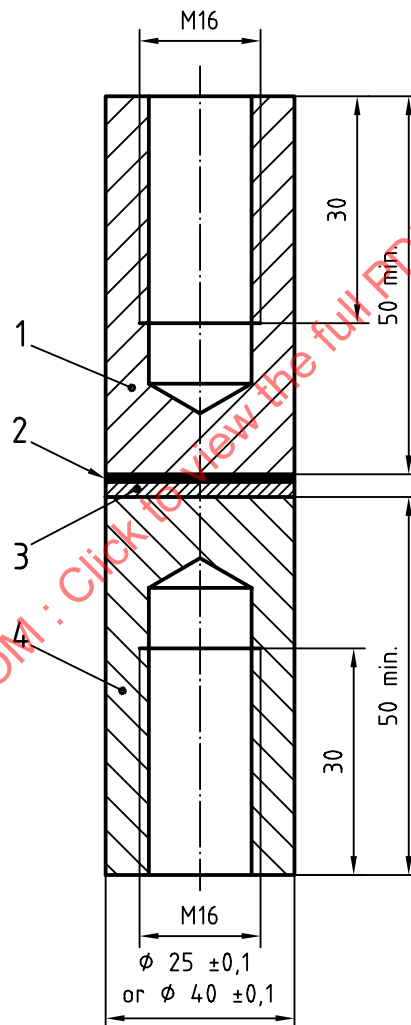
5.1 Shape

For the determination of the tensile strength in the tensile test, specimens of shape A and B and of 25 mm and 40 mm diameter are specified.

Specimen A (see Figure 2) consists of a substrate block to which the deposit is applied at the front face, and the loading block which is adhesive bonded to the flat deposit surface.

Specimen B (see Figure 3) consists of two loading blocks and a disc. Deposit is thermally sprayed to one side of the disc, and the disc is then adhesively bonded to the two loading blocks.

Dimensions in millimetres

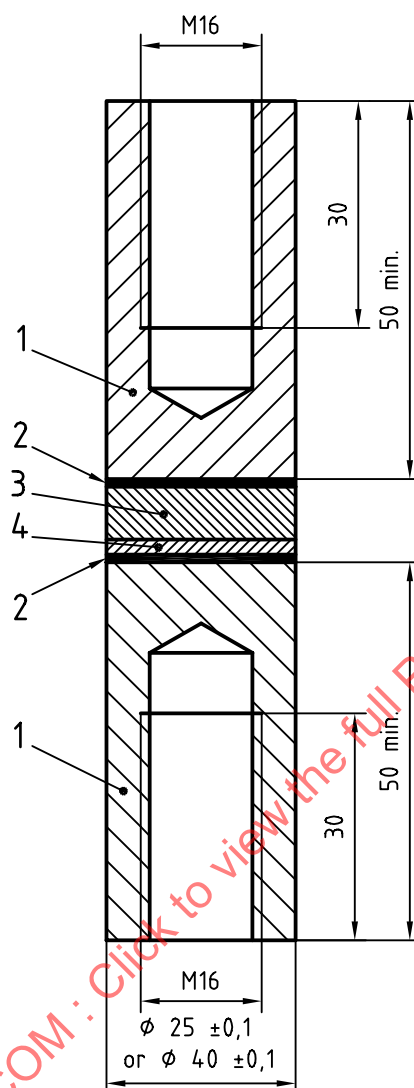


Key

- 1 Loading block
- 2 Adhesive bond
- 3 Spray deposit
- 4 Substrate block

Figure 2 — Specimen A for tensile test

Dimensions in millimetres

**Key**

- 1 Loading block
- 2 Adhesive bond
- 3 Disc
- 4 Spray deposit

Figure 3 — Specimen B for tensile test

When preparing the specimens, care shall be taken to avoid any bending load. For a cylindrical bonding, the assembly shall be inserted in a suitable fixture and the axis of the specimen shall be perpendicular to the deposited front face. In the event of low-strength parent metal being used for the test, thread lengths and diameters shall be varied accordingly, and provided with screw sockets, if required.

5.2 Preparation

The flat end of the substrate block is made of the specified metal and the deposit applied to it in such a way that no spray material can deposit on the cylindrical specimen.

The specimens shall be prepared in the same way as the workpiece in practice. Spray conditions shall be equal to those of practical work. Then the spray deposit shall be prepared appropriate for subsequent adhesive bonding. Care shall be taken to ensure the perpendicularity of deposit surface and specimen axis.

The loading block is adhesively bonded to the spray deposit (specimen A), or to the disc deposited at one side (specimen B).

For the adhesive bonding procedure and storage of specimens for setting of the adhesive, the specifications of the adhesive manufacturer are to be followed. For the setting of the adhesive, the parts of the test assembly shall be in the vertical position in the clamping device, and loaded vertically. All details for preparation of the specimens are an integral part of the test report.

5.3 Number of specimens to be tested

At least three specimens, spray deposited in one cycle, shall be tested.

6 Procedure

The specimen with the clamping device is inserted in the tensile testing machine and loaded in tension at a constant rate and without jerks until fracture occurs. The increase in tension per second should not exceed $1\,000 \pm 100$ N.

Testing is to be performed at ambient temperature.

For a series of tests, equal test conditions shall be maintained.

7 Evaluation

The diameter of the substrate block shall be measured to an accuracy of 0,1 mm. From this, the specimen cross-section at the adhesion surface area of the spray deposit may be calculated.

Only results from those specimens that exhibit a fracture in the bonding area of the spray deposit with the parent metal or in the spray deposit itself are used for the calculation. When a fracture is found in the zone of the adhesive, this specimen shall not be included for the calculation of tensile adhesive tensile strength mean values.

For routine supervision of thermal spraying in fabrication, the fracture may also be located in the adhesive bond, provided that minimum bond strength requirements have been met.

The statistical mean value for the tensile strength, R_H , shall be calculated.

8 Test report

The test report shall contain the following information about factors for every specimen tested in accordance with this International Standard:

- a) inspection body, inspector, date;
- b) parent metal;
- c) preheat;
- d) preparation of the surface of the parent metal (blasting parameter, roughness);