
Thermal spraying — Determination of the deposition efficiency for thermal spraying

*Projection thermique — Détermination du rendement de dépôt en
projection thermique*

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by ISO/TC 107, *Metallic and other inorganic coatings*.

This second edition cancels and replaces the first edition (ISO 17836:2004), which has been technically revised.

Introduction

This document includes the definitions for determining the deposition efficiency for thermal spraying. It describes the test procedure to determine the deposition efficiency for an individual spray process and a spray material when using a defined test piece.

The deposition efficiency calculated on a test piece according to this document does not necessarily correspond to the deposition efficiency on a component.

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Thermal spraying — Determination of the deposition efficiency for thermal spraying

1 Scope

This document specifies a test procedure to determine the deposition efficiency for thermal spraying. It provides a reliable comparison method between different spray processes and different feed stock.

It is applicable for all thermal spray processes (see ISO 14917) and all wire, rod, cord and powder spray materials.

It is applicable when data concerning the deposition efficiency of a spray process in connection with a defined spray material are required.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 14232-1, *Thermal spraying — Powders — Part 1: Characterization and technical supply conditions*

ISO 14919, *Thermal spraying — Wires, rods and cords for flame and arc spraying — Classification — Technical supply conditions*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1

deposition efficiency

DE

ratio of the mass of the spray material deposited on the test piece under standard conditions to the mass of the spray material required and fed through for this purpose

Note 1 to entry: Measured in percent.

3.2

mass of spray material fed through

amount of spray material that is supplied from a spray material feeder under the same conditions as operated during the deposition process, but without ignition of a spray gun

3.3

feed rate of the spray material

mass of the spray material fed through (3.2) per unit time

Note 1 to entry: Measured in g/min.

4 Test pieces, equipment, working and auxiliary materials

- a) Test pieces can be selected from the following:
 - 1) a test pipe, dimensions according to [Annex A](#);
 - 2) a test plate, dimensions according to [Annex B](#).
- b) Equipment/working materials:
 - 1) spray equipment;
 - 2) handling system (if spray process is mechanized);
 - 3) metering device (feeder for wire, rod, cord or powder);
 - 4) fuel gases/fuel/electric energy;
 - 5) plasma gases;
 - 6) spray cabin;
 - 7) filter/exhaust system.
- c) Auxiliary materials:
 - 1) clamping device for test piece;
 - 2) scales (minimum accuracy of 0,1 g).

5 Test procedure

The test pieces shall be prepared according to specifications, e.g. degreased and grit-blasted (see also EN 13507). This procedure shall be documented.

The mass of the prepared test piece shall be determined and documented.

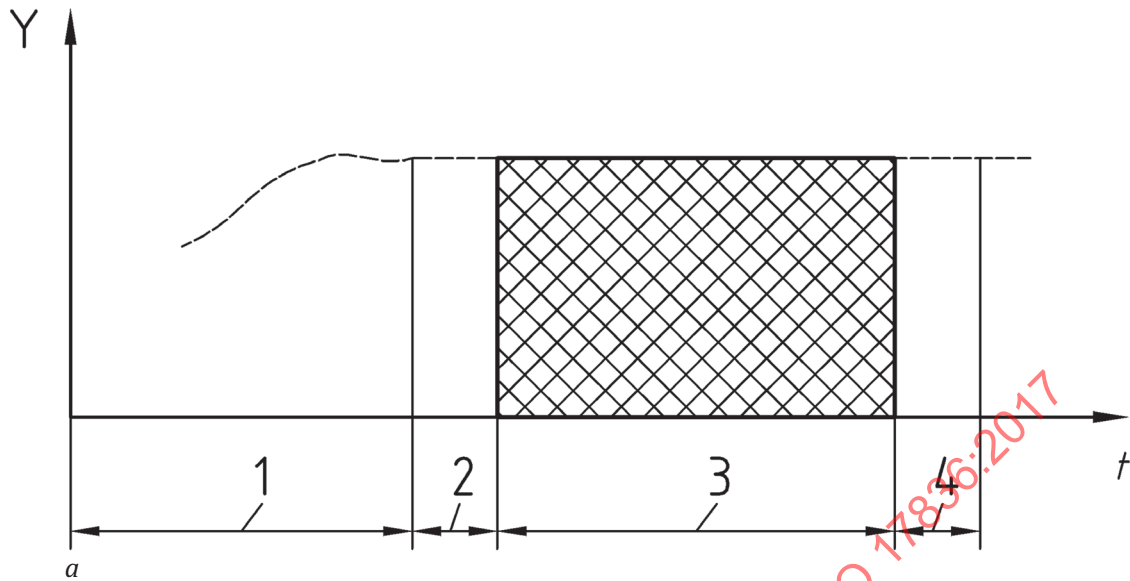
The feed rate of the spray material shall be determined in g/min in at least two run-throughs in order to calculate the mean value.

The test pieces shall be coated applying the spray parameters selected. The spraying angle shall be within $(90 \pm 10)^\circ$. If risk of overheating exists, suitable cooling steps shall be taken. All parameters shall be documented in a record.

The coating shall be carried out on a minimum of two test pieces of the same type with a coating time for each test piece of 30 s. A spray time longer than 30 s may be applicable if necessary to test under practical conditions. The torch shall be swung in and swung out at high speed using the shortest possible way. The swing-in shall not take place until the spray jet is fully formed and stabilized (see [Figure 1](#)).

After each spray test, the change in mass of the test pieces shall be determined and documented (see the example given in [Annex C](#)).

The mass of the spray material required is calculated using the spray time and feed rate. The mass shall be documented (see [Annex C](#)).

**Key**

- 1 stabilization
- 2 swing in
- 3 on test piece
- 4 swing out

- Y feed rate
- t time
- a torch position

Figure 1 — Test procedure**6 Determination of deposition efficiency**

The calculation of the deposition efficiency shall be carried out for each individual test piece and the mean value shall be calculated, as shown by [Formula \(1\)](#):

$$\eta_D = \frac{\Delta m_{tp}}{m_{sm}} \times 100 \% \quad (1)$$

where

- η_D deposition efficiency, in %;
- Δm_{tp} mass difference of test piece, in g;
- m_{sm} mass of spray material fed through, in g.

(It is the product of feed rate, in g/min, and spray time, in s, divided by 60.)

7 Test report

The test results shall be entered in the record (see [Annex C](#)). The mean value shall be calculated from the test results.

The test report for determining the deposition efficiency shall include the following minimum of information:

- a) a reference to this document, i.e. ISO 17836;
- b) type of spray equipment and gun;

- c) feed mechanism of spray material;
- d) type of spray process;
- e) relevant spray parameters depending on the spray process (see spray record number);
- f) type of test piece;
- g) preparation of test pieces;
- h) spray material depending on type of alloy in accordance with ISO 14232-1 for powders or ISO 14919 for wires, rods and cords, as applicable;
- i) mean value of feed rate;
- j) mean value of deposition efficiency.
- k) any deviation from the procedure;
- l) any unusual features observed;
- m) date of the test.

8 Designation

The designation of the deposition efficiency for the pipe (A) or the plate (B) shall consist of the following parts:

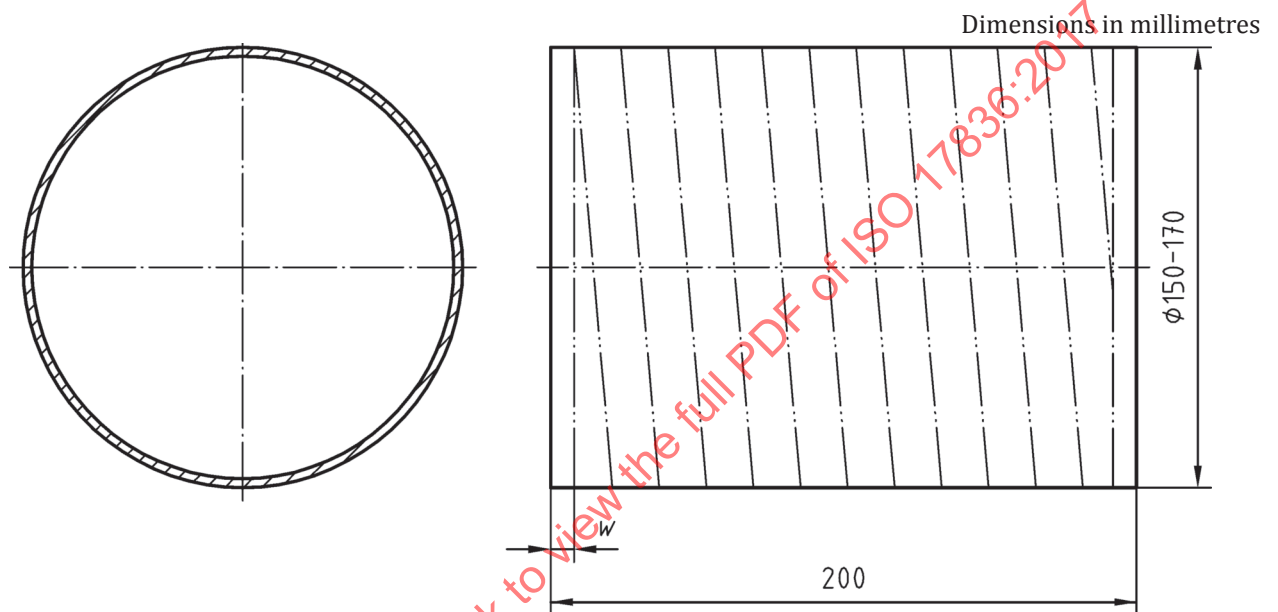
- a) document number;
- b) test piece (A or B according to [Annex A](#) or [B](#)) with mean value of deposition efficiency in %.

EXAMPLE ISO 17836 — A 50

Annex A (normative)

Test piece — Pipe (A)

The test piece shall be traversed by the spray jet, whereby the surface to be coated is reduced by at least one spray jet width from the edges.



Key

w spray jet width

Figure A.1 — Pipe, (150 to 170) mm $\times$ 200 mm $\times$ (3 to 5) mm

Annex B (normative)

Test piece — Plate (B)

The test piece shall be traversed by the spray jet, whereby the surface to be coated is reduced by at least one spray jet width from the edges.

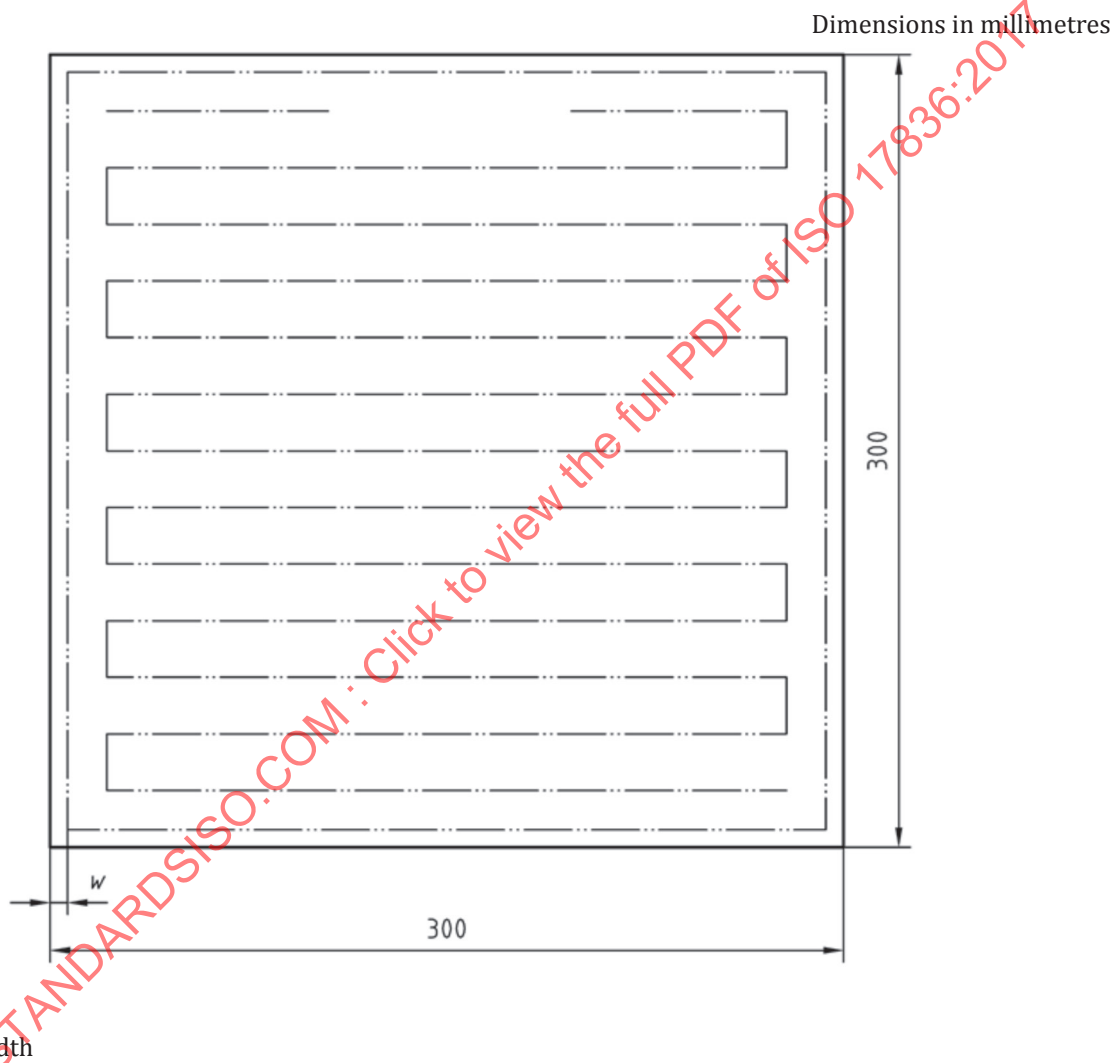


Figure B.1 — Plate, 300 mm × 300 mm × 1 mm