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Thermal spraying — Determination of the deposition efficiency for thermal spraying

Projection thermique — Détermination du rendement de dépôt en projection thermique

Reference number
ISO 17836:2004(E)

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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 document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 17836 was prepared by the European Committee for Standardization (CEN) in collaboration with Technical Committee ISO/TC 107, *Metallic and other inorganic coatings*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

Throughout the text of this document, read “...this European Standard...” to mean “...this International Standard...”.

Annex ZA provides a list of corresponding International and European Standards for which equivalents are not given in the text.

Contents

Foreword

This document (EN ISO 17836:2004) has been prepared by Technical Committee CEN/TC 240 “Thermal spraying and thermally sprayed coatings”, the secretariat of which is held by DIN, in collaboration with Technical Committee ISO/TC 107 “Metallic and other inorganic coatings”.

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of an identical text or by endorsement, at the latest by May 2005, and conflicting national standards shall be withdrawn at the latest by May 2005.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard : Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Introduction

This document includes the definitions for determining the deposition efficiency for thermal spraying. The document describes the test implementation 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 needs not to correspond to the deposition efficiency on a component.

1 Scope

It is essential to apply this document if data concerning the deposition efficiency of a spray process in connection with a defined spray material are required.

This document defines the procedure for determining the deposition efficiency for a thermal spray process in connection with a spray material and related equipment and auxiliary materials. It is applicable for all thermal spray processes (see EN 657) and all wire, rod, cord and powder spray materials.

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 657, *Thermal spraying — Terminology, classification.*

EN 1274, *Thermal spraying — Powders — Composition — Technical supply conditions.*

EN 13507, *Thermal spraying — Pre-treatment of surfaces of metallic parts and components for thermal spraying.*

EN ISO 14919, *Thermal spraying — Wires, rods and cords for flame and arc spraying — Classification — Technical supply conditions (ISO 14919:2001).*

3 Terms and definitions

For the purposes of this document, the following term and definition applies.

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 in %

4 Test pieces, equipment, working and auxiliary materials

a) Test pieces can be selected from:

   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 mechanised);

   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 1 g).

5 Test implementation

— 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.

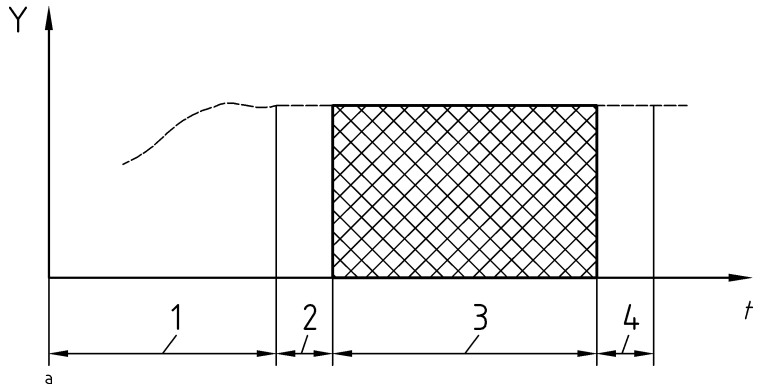
— The feed rate of the spray material shall be determined in g/min in at least two run-throughs in order to calculate the mean value.

— The test pieces shall be coated applying the spray parameters selected. 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. Here 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 stabilised (see Figure 1).

— After each spray test the change in mass of the test pieces shall be determined and documented (see 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

Y Feed rate
t Time
a Torch position
1 Stabilisation
2 Swing in
3 on test piece
4 Swing out

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 calculated.

$$\eta_{\mathrm{D}} = \frac{\Delta m_{\mathrm{tp}}}{m_{\mathrm{sm}}} \times 100\%$$

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) type of spray equipment and gun;

b) feed mechanism of spray material;

c) type of spray process;

d) relevant spray parameters depending on the spray process (see spray record number);

e) type of test piece;

f) preparation of test pieces;

g) spray material depending on type of alloy in accordance with EN 1274 for powders or EN ISO 14919 for wires, rods and cords, as applicable;

h) mean value of feed rate;

i) mean value of deposition efficiency.

8 Designation

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

1) Document number;

2) Test piece (A or B according to Annex A or B) with mean value of deposition efficiency in %.

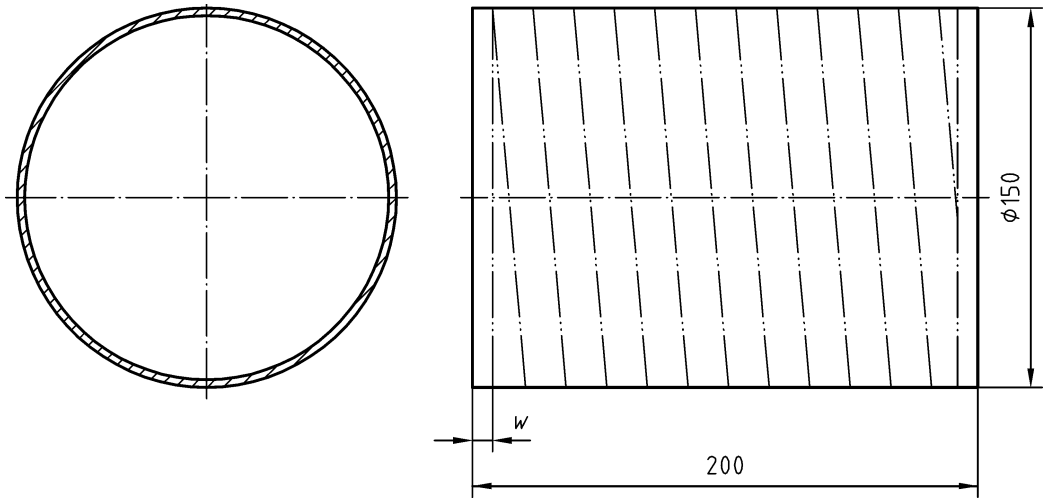
EXAMPLE: **EN ISO 17836 – A 50**

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.

Dimensions in millimetres



Key

w Spray jet width

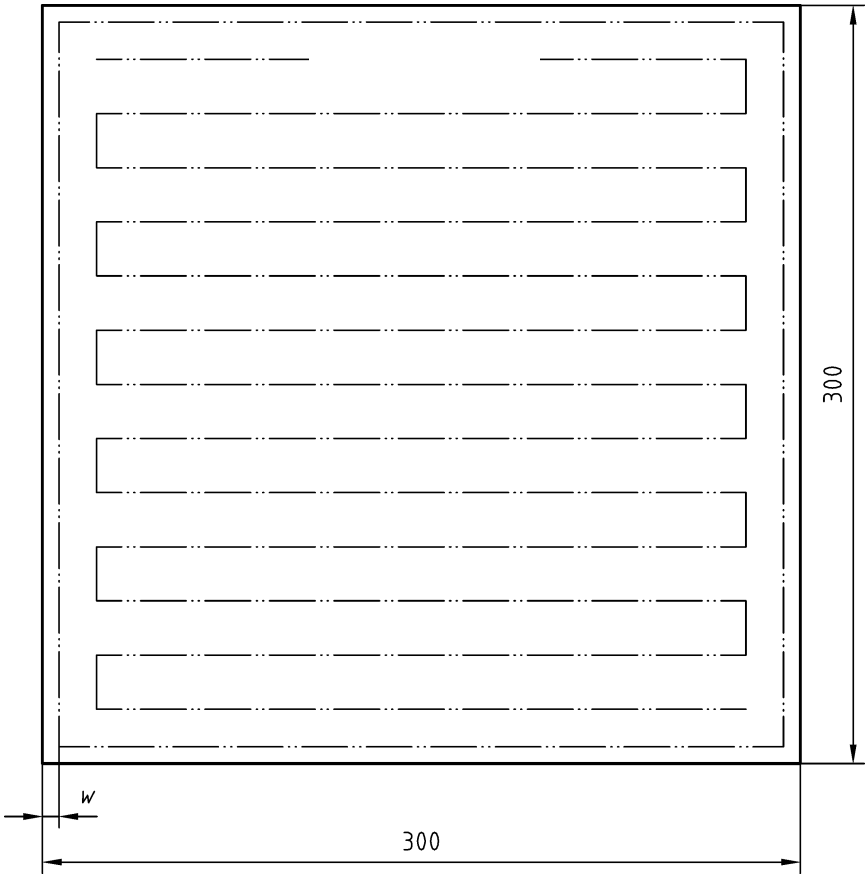
Figure A.1 — Pipe, 150 mm × 200 mm × 3 mm

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.

Dimensions in millimetres



Key

w Spray jet width

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

Annex C
(informative)

Record for the determination of the deposition efficiency rate – Example

Installation: ..... **Gun:** .....

Feed mechanism: ..... **Nozzle:** .....

Spray process according to EN 657: .....

Spray parameters: .....

Test piece: **Pipe according to EN ISO 17836, Annex A**

Plate according to EN ISO 17836, Annex B

Preparation of the test piece: .....

Spray material according to EN ISO 14919 / EN 1274: .....

Lot no.: .....

Powder feed rate/Wire feed rate: .....

Determination of feed rate mean value:

Value	Unit	Test 1	Test 2
Feed rate	(g/min)		
Mean value	(g/min)		

Determination of deposition efficiency mean value:

Value	Symbol	Unit	Test 1	Test 2
Pre-test mass of test piece	m_{tp1}	g		
Post-test mass of test piece	m_{tp2}	g		
Mass difference of the test piece	Δm_{tp}	g		
Feed rate mean value	–	(g/min)		
Spray time	t_S	s		
Mass of the spray material fed through	m_{sm}	g		
Deposition efficiency	η_{Di}	%		
Mean value of the deposition efficiency	η_D	%		

Date: ..... Name: .....Signature: .....

Annex ZA
(normative)

Normative references to international publications with their relevant European publications

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

Publication	Year	Title	EN	Year
ISO 14917	1999	Thermal spraying — Terminology, classification	EN 657	1994
ISO 14232	2000	Thermal spraying — Powders — Composition and technical supply conditions	EN 1274	1996
ISO 14919	2001	Thermal spraying — Wires, rods and cords for flame and arc spraying — Classification — Technical supply conditions	EN ISO 14919	2001

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