
Thermal spraying — Qualification testing of thermal sprayers

*Projection thermique — Qualification des agents 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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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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. (standards.iteh.ai)

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

This second edition cancels and replaces the first edition (ISO 14918:1998), which has been technically revised.

Introduction

This document examines the principles of qualification testing of sprayer performance for thermal spraying.

The quality of work involved in thermal spraying depends on the skill, operation of the spray equipment and job knowledge of the thermal sprayer.

The ability of the thermal sprayer to follow verbal and written instructions and the testing of his/her skill and operation of the spray equipment are therefore important factors in ensuring the quality of the thermally sprayed product.

This document is intended to provide the basis for mutual recognition by examining bodies for qualification relating to thermal sprayer's competence in the various fields of application. Tests can be carried out in accordance with this document, unless more severe tests are specified by the relevant application standards in which case these can be applied.

The thermal sprayer's skill and job knowledge continues to be classified as qualified as long as the thermal sprayer works with reasonable continuity on thermal spraying work within the extent of qualification.

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Thermal spraying — Qualification testing of thermal sprayers

1 Scope

This document specifies procedural instructions for qualification testing of thermal sprayers. It defines requirements, ranges of qualification, test conditions, acceptance requirements and certification for qualification testing of thermal spray performance.

This document is applicable when the thermal sprayer's qualification is required by this document, the purchaser, by inspection authorities or by other organizations.

The thermal spraying processes referred to in this document include those spraying processes which are designated as manual or mechanized.

The test for mechanised application includes the use of automatically controlled thermal spraying, e.g. robotics, scan units.

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 14916, *Thermal spraying — Determination of tensile adhesive strength*

ISO 14917, *Thermal spraying — Terminology, classification*

ISO 2063-2, *Thermal spraying — Zinc, aluminium and their alloys — Part 2: Execution of corrosion protection systems*

EN 15340, *Thermal spraying — Determination of shear load resistance of thermally sprayed coatings*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 14917 and the following 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 <https://www.iso.org/obp>

3.1

thermal sprayer

person who performs thermal spraying with a manual or mechanized system

3.2

manual thermal spraying

process in which the spraying gun or torch is manipulated by hand

3.3

mechanized thermal spraying

process in which some aspects are mechanized, i.e. with the gun/torch not manipulated by hand

3.4

automatic thermal spraying

process in which all operations typical of the spraying process are fully mechanized including all handling, e.g. workpiece loading and unloading, and which are integrated in a programmed system

Note 1 to entry: For examination, it is equal to *mechanized thermal spraying* (3.3).

3.5

examiner

person who verifies compliance with the application standard

3.6

examining body

organization who verifies compliance with the application standard

3.7

specific acceptance criteria

document providing in detail the criteria by which a *thermal sprayer* (3.1) can be tested to be qualified for a particular spraying technique or application area

3.8

test piece

thermal spray workpiece used for the qualification *test* (3.10)

3.9

test specimen

portion cut from the *test piece* (3.8) in order to perform a specified analytical *test* (3.10)

3.10

test

series of operations which include the making of a thermally sprayed *test piece* (3.8), subsequent non-destructive and/or destructive testing and reporting of results

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4 Essential requirements for qualification testing

4.1 General

The criteria specified in this clause shall be examined in order to identify the ability of the thermal sprayer in these areas.

The thermal sprayer's qualification test shall be carried out on test pieces of comparable geometry.

The thermal sprayer shall be tested on both basic job knowledge and specific knowledge related to the process for all thermal spraying processes and operations, see [Annex A](#).

4.2 Equipment operation

The thermal sprayer shall be tested to determine his/her knowledge of the equipment, as described in [A.4.3](#).

4.3 Masking procedure

The thermal sprayer shall be tested to determine his/her knowledge of proper masking procedures for both surface preparation and spraying.

4.4 Surface preparation

The thermal sprayer shall verify that the surface of the thermal spray test piece which is used for qualification is acceptable. S/he should also maintain a properly prepared surface during the qualification testing.

4.5 Environmental conditions

The thermal sprayer shall verify the acceptability of environmental conditions, such as temperature, humidity and dew point, as being suitable for spraying the test pieces if called up by the specific coating process and method of application being evaluated.

4.6 Application equipment

The test results used for the qualification testing shall come from work or test pieces sprayed with production equipment or equipment similar to it. The certifying examining body shall agree that equal equipment used to perform the testing is representative of the said equipment's quality.

5 Range of qualification

5.1 General

Thermal sprayers shall be qualified for thermal spraying to a specific coating process and method of application. The qualification shall only be valid for that specific coating process and method of application. The thermal spraying processes and methods of application covered by this document are identified in [5.2](#).

5.2 Thermal spraying processes ISO 14918:2018

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5.2.1 Grouping of thermal spraying processes

This document covers the following thermal spraying processes according to ISO 14917:

- arc spraying;
- plasma spraying;
- high velocity oxy fuel flame spraying, cold spraying, detonation spraying;
- powder flame spraying, plastic flame spraying;
- wire/rods/cords flame spraying;
- powder flame spraying with fusing, laser spraying, plasma transferred arc spraying (PTA).

5.2.2 Application methods

This document covers the following application methods:

- manual;
- mechanized.

5.2.3 Spray materials

5.2.3.1 General

The spray materials that shall be used in the qualification test are split into material groups.

The materials listed in [5.2.3.2](#) to [5.2.3.5](#) are given for information only to show which material is generally appropriate for each process.

5.2.3.2 Flame spraying (powder, wire, cords or rods)/arc spraying

- Metals and alloys (for engineering purposes).
- Zinc, aluminium and their alloys and plastic (for corrosion protection).

5.2.3.3 Flame spraying (powder, wire, cords or rods, PTA, laser spraying and flame sprayed and fused)

- Self-fluxing alloys, cobalt based alloys, hard-facing.

5.2.3.4 Plasma spraying, plasma spraying in a chamber under vacuum

- Metals and alloys.
- Metal based hard material.
- Ceramics, hydroxyl-apatite.

5.2.3.5 High velocity flame spraying

- Metals and alloys.
- Metal based hard material.

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5.3 Qualification scope

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The requirements for initial thermal sprayer qualification are different for each of the classifications in [5.2](#). Qualification in one category (process and application method) does not imply any ability or experience in practising the specific thermal spraying technique in any other category.

The thermal sprayer qualification level shall be indicated by the thermal spray process, followed by the application method. For example, manual operation of arc spraying equipment can be written as "Arc spraying – Manual". In addition, information on the spray material (material group) sprayed for qualification shall be available upon request to the certifying examining body.

5.4 Supervision

The thermal spraying and testing of the test pieces shall be witnessed by the licensed examiner, or by the responsible thermal spraying coordinator.

5.5 Shapes and dimensions of test pieces

Shapes and dimensions of test pieces and test specimens are defined in [Annex B](#).

5.6 Test methods

The test methods are specified in [Annex B](#).

5.7 Acceptance requirements for test pieces

The acceptance requirements for test pieces are specified in [Annex B](#).

5.8 Spray consumables for the test

For any process group mentioned in 5.2.1 there are various material groups possible, see 5.2.3. The sprayer can choose the material according to the group to use for the test. The coating properties of the materials used should be in accordance with Annex C. Tables C.1 and C.2 include basic points for the testing of materials (e.g. tensile bond test values).

A plasma sprayer can choose a ceramic material for the test, e.g. $\text{Al}_2\text{O}_3/\text{TiO}_2$, Cr_2O_3 , ZrO_2 or an equivalent metallic material, e.g. WCCo.

6 Examination and testing

6.1 General

The thermal sprayer shall be tested in two ways:

- s/he shall complete a job knowledge test to determine his/her knowledge of the process;
- s/he shall undergo a practical test to demonstrate his/her skill and ability to operate the equipment in the appropriate area.

6.2 Job knowledge test

The thermal sprayer shall satisfactorily complete a test covering the appropriate coating process, application method and material. The test shall be prepared by the certification body. For the particular aspects to be tested see Annex A.

6.3 Practical test

The practical test serves the purpose of determining if the thermal sprayer has the necessary practical skills, as detailed in the specific acceptance criteria (according to Annex A and Annex B).

When practically testing more than one sprayer (mechanized) using the same equipment, the same spray material and the same parameter, the assessment of the material in question can be reduced to a 20 % sample random test provided no unacceptable coatings are produced. In the case of imperfection all specimens shall be tested.

7 Re-tests

7.1 General

In the event of the thermal sprayer's failure to meet the requirements of this document, a re-test may be scheduled at the discretion of the examiner, but not without additional training and not usually within three months of the initial test.

7.2 Additional tests

If during spraying the thermal sprayer can show that there is some extraneous fault preventing spraying a good test piece, a new attempt may be made when the fault has been corrected.

8 Period of validity

8.1 Initial qualification

The validity of the thermal sprayer's qualification begins from the date when all the required tests are satisfactorily completed. This date may be different to the date of issue marked on the certificate.