
**Thermal spraying — Zinc, aluminium
and their alloys —**

**Part 2:
Execution of corrosion protection
systems**

iTeh STANDARD PREVIEW
*Projection thermique — Zinc, aluminium et alliages de ces métaux —
Partie 2: Exécution des système de protection contre la corrosion*
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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).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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 Technical Committee ISO/TC 107, *Metallic and other inorganic coatings*.

This document, together with ISO 2063-1:2017, cancels and replaces ISO 2063:2005, which has been technically revised.

A list of all the parts in the ISO 2063 series can be found on the ISO website.

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Thermal spraying — Zinc, aluminium and their alloys —

Part 2: Execution of corrosion protection systems

1 Scope

This document specifies requirements for corrosion protection of steel structures, components or parts, which are coated by thermal spraying of zinc, aluminium or their alloys.

This document specifies requirements for coating manufacturers of surface preparation, thermal spraying, testing and post treatments, e.g. sealing of the coating. This document applies to metallic corrosion protection coatings in the case of new fabrication in the workshop, as well as on-site and for repair on-site after assembly.

Requirements for coating thickness, minimum adhesive strength and surface conditions, specified in a coating specification, are given.

Recommendations are given for suitable process steps and quality assurance measures for new production and maintenance and for supervising of corrosion protection works.

This document covers the application of thermal sprayed zinc, aluminium and their alloys for protection against corrosion in the temperature range between $-50\text{ }^{\circ}\text{C}$ to $+200\text{ }^{\circ}\text{C}$. Heat-resistant protective coatings of aluminium are covered by ISO 17834 and are not in the scope of this document.

This document specifies requirements for the equipment, the working place and the qualification of the spray and testing personnel.

NOTE ISO 2063-1:2017 is addressed to the designer and to the planning engineer of corrosion protection system.

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 1463, *Metallic and oxide coatings — Measurement of coating thickness — Microscopical method*

ISO 2063-1, *Thermal spraying — Zinc, aluminium and their alloys — Part 1: Design considerations and quality requirements for corrosion protection systems*

ISO 2178, *Non-magnetic coatings on magnetic substrates — Measurement of coating thickness — Magnetic method*

ISO 4624, *Paints and varnishes — Pull-off test for adhesion*

ISO 8044, *Corrosion of metals and alloys — Basic terms and definitions*

ISO 8501-1:2007, *Preparation of steel substrates before application of paints and related products — Visual assessment of surface cleanliness — Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings*

ISO 8503-1, *Preparation of steel substrates before application of paints and related products — Surface roughness characteristics of blast-cleaned steel substrates — Part 1: Specifications and definitions for ISO surface profile comparators for the assessment of abrasive blast-cleaned surfaces*

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

ISO 14917, *Thermal spraying — Terminology, classification*

ISO 14918, *Thermal spraying — Approval testing of thermal sprayers*

ISO 14922-1, *Thermal spraying — Quality requirements of thermally sprayed structures — Part 1: Guidance for selection and use*

ISO 14923, *Thermal spraying — Characterization and testing of thermally sprayed coatings*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 14917, ISO 8044 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 <http://www.iso.org/obp>

3.1 minimum local thickness

lowest value of the local thickness found on surface of a single article

3.2 dew point

temperature to which a volume of humid air should be cooled, at constant barometric pressure, for water vapour to condense into liquid water on a solid surface

3.3 local repair

restoring of the thermal-sprayed metallic corrosion protection coating by applying a suitable corrosion protection system on small defective areas, such as are caused by damage on transport, erection or by destructive tests

3.4 manufacturing sequence plan

manufacturing and test operations listed step by step

3.5 job control record JCR

manufacturing sequence plan used for control that each single operation step is really carried out

3.6 job reference specimen JRS

specimen simulating production conditions and which represents the part to be coated and is comparable in material and size

3.7 job reference qualification JRQ

qualification of an application or of a thermal sprayer applying a job reference specimen for the test

3.8

pre-production spraying test

thermal spraying test having the same function as a spray procedure test, but is based on a job reference specimen (non-standard test piece, simulating production conditions)

4 Requirements for the manufacturer

4.1 General

The manufacturer of thermal spray coating shall possess a quality management system, which can fulfil the necessary quality requirements in accordance with this document or to the quality assurance system in accordance with ISO 14922-1 (A, B or C), shall employ qualified personnel, is responsible to keep the function of the spray and necessary ancillary equipment in proper condition and shall fulfil applicable requirements concerning health and safety and environment protection. For that purpose, the instructions and information provided by the CEN/TR 15339 series may be helpful.

4.2 Qualification of the manufacturer

4.2.1 Qualification of the equipment

The manufacturer shall provide blasting and spraying equipment and ancillary equipment which is fit for the purpose. The continued proper functioning of the equipment shall be proven through inspection reports or results of successfully applied tests (e.g. if a component related procedure qualification has passed). Testing may be carried out in accordance with the appropriate part of the standard series EN 1395-1 to EN 1395-3, EN 1395-6 or EN 1395-7.

The manufacturer is also responsible for providing an adequate calibration and validation of the instruments for measuring, testing and for supervision. The results of the tests, calibration and maintenance shall be documented.

4.2.2 Qualification of supervision personnel

The manufacturer of the thermal-sprayed coating shall employ qualified supervisors according to the requirements of the component and of the required quality in accordance with ISO 2063-1 and to this document. The education and qualification of the supervisor should be carried out in accordance with ISO 12690.

When an additional coating with organic materials is part of the order, an adequate qualified person shall be available for supervision of this part of the corrosion protection, e.g. with the scope of responsibility in accordance with ISO 12944-7.

4.2.3 Qualification of spraying personnel

In case of manual spraying, the manufacturer of the thermal-sprayed coating shall employ qualified thermal sprayers in accordance with ISO 14918 or sprayers who are instructed and trained adequately (e.g. with long lasting and proved experience in thermal spraying). This requirement shall be in accordance with the requirements of the component, the quality assurance system in accordance with ISO 14922-1 and of this document or of the contract.

4.2.4 Qualification of test personnel

The manufacturer of the thermal-sprayed coating shall only employ inspectors who possess the required qualification for the test procedure concerned in accordance with the requirements of the component and the required quality in accordance with ISO 2063-1 and this document.

When an additional coating with organic materials is part of the order, an adequate qualified person shall be available for supervision of this part of the corrosion protection, e.g. with the responsibility in accordance with ISO 12944-7.

4.3 Coating specification for the thermal-sprayed coating

The manufacturer of the thermal-sprayed coating of a component shall fulfil any requirements, which are stipulated in the contract and/or coating specification. If neither a coating specification is present nor rated values of the minimum coating thickness, minimum tensile adhesive strength, admissible imperfections, post treatments, e.g. sealing, and tests and their scope are specified in the coating specification or in the manufacturing instructions, they shall be agreed upon between the contracting parties or be taken from this document.

Test specifications shall be prepared by the manufacturer of the coating, if required in agreement with the contractor, when they are not part of the coating specification.

4.4 Assessment of the coating on the basis of reference areas

If in the case of a thermal-sprayed coating for very large surfaces, representative areas can be coated. Location and size of the areas shall be unambiguously defined and documented.

5 Quality assurance measures for the manufacturer

5.1 General

This clause describes the measures that shall be taken by the coating manufacturer, in order to ensure an adequate order management, quality assurance and reproducibility of manufacturing.

5.2 Assessment of the design to coatability

In the frame of the contract and design review, the coatability of the component shall be checked. Checking is necessary for working in the workshop, as well as for working on-site and repairs, in the case of maintenance work. If the main principles are considered when executing the constructive design (dealt in ISO 2063-1) and the questions of the check list (see [Annex F](#)) can be positively answered, the work piece would be considered coatable.

5.3 Establishing the manufacturing instructions — Manufacturing sequence plan

The manufacturer of spray coatings shall establish manufacturing instructions, detailing all single work and test steps listed in chronological order, including the surface preparation, thermal spraying, post-treatments, e.g. smoothing or sealing of the coating and establishing the documentation. Spray procedure specifications necessary for each single process shall be indicated. This manufacturing sequence plan can be used as a job control record (JCR).

5.4 Establishing the thermal spray procedure specification

The coating manufacturer is responsible for establishing and following the thermal spray procedure specification (TSPS). This procedure should include information on the coating specification and to the manufacturing instructions, as well as parts lists, substrate and spray materials data, drawings and test instructions. All relevant information should be available for the thermal sprayer in written form, if appropriate.

The TSPS shall contain all parameters of the procedure required for the spray process.

The required spray parameters shall be determined using sprayed specimens or can be taken from similar applications. The TSPS can be qualified by a procedure qualification in accordance with

EN 15648, if this is required by the quality management system of the manufacturer generally, or by the contractor.

The preparation of the surface to be coated shall be specified in the TSPS, together with the required cleanliness level. For further instructions, see [6.2](#).

Any changing of a parameter or the spray materials, ancillary substances, the design, the spray procedure or the spray equipment requires a checking of the coating quality. If necessary, the TSPS shall be corrected or prepared again.

5.5 Qualification of the TSPS and scope of the TSPS

Coating manufacturers can achieve qualification of the TSPS by a component-related procedure qualification in accordance with EN 15648 or by testing on test sheets, if the requirements are fulfilled, which are stipulated in the coating specification for the respective part.

The scope can also be agreed upon by the contracting parties for similar parts, if the substrate material is comparable in its technological, metallurgical, physical and chemical properties. Comparability is given to the level of difficulty for the thermal spraying.

5.6 Qualification of the TSPS by a specific job reference qualification

Due to shape and dimension of very large components the qualification of a spray procedure specification (TSPS) by a component related qualification maybe too complicated and expensive. A job reference qualification (JRO) can be used to assess the suitability of the application process. By that way job reference specimens (JRSs) shall represent the spray positions to be performed and shall be comparable to the level of difficulty on preparation and thermal spraying of the component. The procedure shall be agreed upon between contracting parties.

5.7 Special job qualification by performance on mock-ups, if required

If required by the contractor, a referencing mock-up shall be manufactured to simulate the angles for steel assemblies exhibiting acute angles between structural members to be sprayed after welding or assembly. Details of the acceptance criteria should be agreed upon.

6 Manufacturing of thermal-sprayed coatings

6.1 General

This clause deals with the operations and measures of the applicator of the spray coating, which belong to a conforming manufacturing route for the deposition of a thermal-sprayed coating. This procedure applies to the component as well as to accompanying specimens, if they are required.

It may be helpful to check accessibility for preparation, spraying, post treatments and testing, and to follow the design considerations of the area to be sprayed according to general requirements, e.g. EN 15520. A useful checklist is presented in [Annex F](#).

If possible, very large surfaces should be separated into sectors to be coated, in order to fulfil the requirement to start with the thermal spraying immediately without any delay after finishing the surface preparation.

NOTE 1 The term “immediately without any delay” means without any culpable delay.

NOTE 2 Usually, such a section would not exceed 40 m² to 45 m². In some cases, such a sectioning will be impossible, especially in long beams. The surface preparation in overlapping zones needs special attention so as not to damage the coating already partially applied by blasting of the next section. Usually, a time period of 4 h is adequate in zones with temperate climate.

For climate zones with a high continuous humidity, this rule is not valid. In such cases, the size of sections and the 4 h period should be significantly reduced and special measures for drying should be applied. Otherwise, thermal spraying cannot be applied without loss in quality.

6.2 Preparation of the surface to be coated

6.2.1 Masking of areas not to be coated

Areas of the part that are not to be coated shall be masked prior to blasting and prior to spraying.

The masking material should withstand the grit when blasting and the hot spray particles when spraying. Otherwise, separate masking should be applied for each process.

Precautionary measures should be taken to avoid contamination of the surfaces to be coated by a masking material.

6.2.2 Preparation of the surface to be coated by blasting

EN 13507 (or similar) should be followed in the preparation of the surface to be coated when no instructions are stipulated in the TSPS. The blasting parameter shall be determined using a plate as a test specimen if no parameter is stipulated in the TSPS or in the manufacturing instructions.

NOTE Important parameters are type and grain size of the blasting material, state of wear (sharp or rounded edges), blasting time, distance and angle, air pressure and type of the spray equipment.

The surface to be prepared, including occasional weld areas (if available) shall be cleaned and blasted using pressurized air blast equipment and an adequate blasting material, until the part's surface gives a metallic appearance with uniform structure in accordance with ISO 8501-1, Sa 2 ½ G for Zn/ZnAl15 and Sa 3 G for Al/AlMg5. This state shall be confirmed by visual comparison to the reference sample G (grit) in accordance with ISO 8503-1, if no other commitment is agreed upon between the contracting parties.

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Usually, surface roughness (R_z) should be in the range of 50 µm to 100 µm, depending on the spray process and spray material.

Safe access and sufficient lighting of the surface to be blasted and adequate work conditions (low humidity, sufficient temperature of environment and component for instance not falling below the dew point, protection against ice, rain and wind) shall be ensured for blasting and subsequent testing. Specific measures shall be taken in the case of working on-site.

The blasting material shall be adequately stored and protected from pollution.

Sufficient cleaning of the blasted surface from grit residues should be carried out in accordance with EN 13507 (or similar). For further details, see [Annex H](#).

After blasting, spraying shall be started as soon as possible to avoid any contamination and build-up of moisture on the surface.

6.2.3 Testing of the prepared surface

The condition of the surface to be coated shall be checked for cleanliness in accordance with ISO 8501-1 and to the desired uniform roughness by visual comparison. Reference samples in accordance with ISO 8503-1 are adequate aids.

6.3 Thermal spraying

6.3.1 General

Before spraying, the surface prepared for coating shall be visually checked. If imperfections on the surface to be coated are visible the surface preparation shall be repeated.

6.3.2 Spray material

The spray material stipulated in the TSPS shall be applied. Proof shall be delivered on the conformity of the spray material by comparison with the accompanying supply instructions and designations. The instructions of the manufacturer/supplier for storage and use of the spray material shall be considered.

6.3.3 Pre-conditions for the execution of thermal spraying process

When the spray equipment is not in operation, checking of the parameter setting should be carried out. Applying a bend test (or, if required, an adhesion test in accordance with ISO 4624) can be helpful. For details, see [Annex G](#).

After finishing the surface preparation (blasting and masking, if appropriate, and testing) spraying shall be started immediately. The spray coating shall be produced using the parameter stipulated in the TSPS in one manufacturing step without interruption.

An assessment of the atmospheric conditions (humidity, dew point and ambient air temperature) shall be carried out and recorded before thermal spray application begins. When large components are to be thermally coated, these conditions shall be checked in adequate periods of time while spraying is running. Spraying should not be performed unless the ambient requirements for thermal spraying or sealing are met. If the general climate conditions allow (temperate climate zones), the following environmental conditions should be present prior to thermal spraying:

- surface temperature: > 3 °C above the dewpoint of the air (determined in accordance with ISO 8502-4);
- relative humidity: < 85 %;
- air temperature: > 5 °C (determined in accordance with ISO 8502-4).

6.3.4 Execution of thermal spraying

Thermal spraying shall be carried out according to the instructions of the TSPS. For further details, see [5.4](#).

The following spraying parameters shall be supervised in adequate periods of time by the spray coordinator/supervisor or the sprayer:

- values of current, voltage, gas flows;
- motion rate in the case of mechanical spraying;
- component's surface temperature;
- right use of the spray material applied;
- dimensional and visual inspection of the coating.

Spray dust shall be exhausted, as thoroughly as possible. Entrapment of dust in the coating shall be minimized. An intermediate cleaning of the sprayed layers during interruption of the spray process may be necessary, especially when spraying in vertical or downward position. In that way, dust and loose particles can be removed by exhausting or blowing oil-free and dry compressed air.

6.3.5 Inspection after spraying

The as-sprayed coating and the accompanying specimen, if applicable, shall be inspected according to the following aspects:

- measuring of the coating thickness (see [7.3](#));