# SLOVENSKI STANDARD
# oSIST prEN ISO 2063-1:2018

**01-december-2018**

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**Vroče brizganje - Cink, aluminij in njune zlitine - 1. del: Projektiranje in zahteve glede kakovosti korozijskega zaščitnega sistema (ISO/FDIS 2063-1:2018)**

Thermal spraying - Zinc, aluminium and and their alloys - Part 1: Design considerations and quality requirements for corrosion protection systems (ISO/FDIS 2063-1:2018)



Thermisches Spritzen - Zink, Aluminium und ihre Legierungen - Teil 1: Bauteilgestaltung und Qualitätsanforderungen für Korrosionsschutzsysteme (ISO/FDIS 2063-1:2018)

Projection thermique - Zinc, aluminium et alliages de ces métaux - Partie 1: Considérations de conception et exigences de qualité pour les systèmes de protection contre la corrosion (ISO/FDIS 2063-1:2018)



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# Thermal spraying — Zinc, aluminium and their alloys —

## Part 1: Design considerations and quality requirements for corrosion protection systems



*Projection thermique — Zinc, aluminium et alliages de ces métaux —*

*Partie 1: Considérations de conception et exigences de qualité pour les systèmes de protection contre la corrosion*



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# Foreword

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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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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 2063-1:2017), of which it constitutes a minor revision.



The changes compared to the previous edition are as follows:

— Table C.1 has been corrected;

— citations for Annex E, Annex F and Annex G have been added in the text.

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

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

 

# Introduction

In order to protect iron- and steel-based structures (e.g. for steel construction, bridge construction, steel structures for water construction, onshore and offshore wind energy constructions, petrol and natural gas industry) against corrosion, protective coatings are usually deposited. Corresponding to type, shape and required functionality of the part, numerous procedures are available. The deposition of corrosion protection coatings or coating systems can be done by applying hot-dip galvanizing, organic coatings or thermal spraying of zinc, aluminium and their alloys. Using combinations of metallic and organic coatings, duplex corrosion protection coating systems can be produced.

Thermal-sprayed corrosion protection coatings made of zinc, aluminium and their alloys can be sprayed onto all steels which make up the components used in the relevant industrial application. This may be carried out on-site, as well as in the workshop, regardless of the article's size. Due to the usually low heat input into the surface of the part, only a slight thermal loading of the substrate occurs, so that changes in steel properties and deformation of the part do not occur.

Corrosion protection coatings can be used as repairs or rework of defects of other coatings (e.g. uncoated hot-dip zinc galvanized areas) or worn coatings where thermal spraying can be applied on the spot. Due to relative low investment costs, thermal spraying can also be economically applied for single parts.

The ISO 2063 series applies to thermal-sprayed metallic coatings to protect iron and steel against corrosion by deposition of zinc, aluminium or their alloys onto the uncoated surface to be protected.

This document targets designers of components. It covers the planning engineering of the corrosion protection system and deals with the basic rules for planning of corrosion protection systems and for the constructive design of the components to be protected, if the protection system is based upon a thermal-sprayed metallic coating.

ISO 2063-2 targets manufacturers of corrosion protection systems. It deals with the requirements for the execution of the corrosion protection works by thermal spraying in the workshop and on-site.



 

# Thermal spraying — Zinc, aluminium and their alloys —

# Part 1: Design considerations and quality requirements for corrosion protection systems

## 1 Scope

This document specifies requirements for the protection of iron and steel surfaces against corrosion by applying thermal-sprayed metallic coatings of zinc, aluminium or their alloys.

In this document, requirements for the planning of the corrosion protection system and for the constructive design of the component to be protected are specified, where thermal spraying is intended to be the process for the deposition of the metallic corrosion protection.

Some field-related basic terms are defined and instructions for corrosion behaviour of the zinc and aluminium materials under different environment conditions are provided.

Characteristic properties of the coating, e.g. coating thickness, minimum adhesive strength and surface appearance, are specified and test procedures for thermal-sprayed corrosion protection coatings of zinc, aluminium or their alloys are determined.



This document is valid for applying thermal-sprayed zinc and aluminium protection coatings against corrosion in the temperature range between −50 °C to +200 °C, taking into consideration the service conditions of any sealants used. Heat-resistant protective coatings of aluminium are covered by ISO 17834 and are not in the scope of this document.



Other corrosion protection processes, e.g. hot-dip galvanizing (galvanic coating), sherardizing, electroplating or selection and deposition of organic coatings/paints are not in the scope of this document.

Requirements for the manufacturing of thermal-sprayed coatings are specified in ISO 2063-2.

## 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 2063-2:2017, *Thermal spraying — Zinc, aluminium and their alloys — Part 2: Execution of 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, *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 8501-3, *Preparation of steel substrates before application of paints and related products — Visual assessment of surface cleanliness — Part 3: Preparation grades of welds, edges and other areas with surface imperfections*

ISO 12671, *Thermal spraying — Thermally sprayed coatings - Symbolic representation on drawings*

ISO 14232-1, *Thermal spraying — Powders — Part 1: Characterization and technical supply conditions*

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

ISO 14917, *Thermal spraying — Terminology, classification*

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

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

EN 10163-2, *Delivery requirements for surface conditions of hot-rolled steel plates, wide flats and sections — Part 2: Plate and wide flats*

EN 10163-3, *Delivery requirements for surface condition of hot-rolled steel plates, wide flats and sections — Part 3: Sections*

## 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:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/



**3.1**
**service life**
expected lifetime of a product (e.g. a structure, component or part) or the acceptable period of use in service

Note 1 to entry: It is also the time that any manufactured item can be expected to be serviceable.

**3.2**
**design life**
period of time during which the item (e.g. a structure, component, part or product) is expected by its designers to work within its specified parameters

Note 1 to entry: In the case of series production, it is the period of time between the putting into service of a single item and that item's onset of wearing out.

**3.3**
**life to first maintenance**
**durability**
expected life of a coating system until first maintenance

Note 1 to entry: It is also the time interval that elapses after the initial coating before coating deterioration reaches the point that maintenance is necessary to restore protection of the base metal in accordance with ISO 12944-1.

 

**3.4**
**protective coating system**
sum total of the coats of metal materials and/or paints (duplex coatings) or related products which are to be applied or which have been applied to a substrate to provide corrosion protection in accordance with ISO 12944-1

**3.5**
**pre-fabrication primer**
fast-drying paint that is applied to blast-cleaned steel to provide temporary protection during fabrication while still allowing welding and cutting in accordance with ISO 12944-5

Note 1 to entry: In many languages, the term "pre-fabrication primer" does not have the same meaning in English.

**3.6**
**maintenance**
sum of all measures to ensure that function of protection of the steel structure against corrosion is maintained

Note 1 to entry: Maintenance includes, but is not limited to, paintwork. Such paintwork can be patch painting (repair included spots/areas of the coating system), patch painting followed by over-painting of the structure or total repairing in accordance with ISO 12944-8.

# 4 Criteria for corrosion and corrosion protection by thermal-sprayed coatings

## 4.1 General



Thermal-sprayed coatings of zinc, aluminium and their alloys can significantly increase the effectiveness of the corrosion protection and the service life of the parts. Thermal-sprayed coatings are to be applied preference, if a long time effective corrosion protection is required.

## 4.2 Corrosivity categories and environment conditions

The corrosivity category provides a basic rule for selecting materials and corrosion protection measures in relation to requirements for the individual application, especially for the service life. Definitions of corrosivity categories and environment conditions are given in ISO 9223 and ISO 12944-2. Additional notes for measuring relevant environment parameters are given in ISO 9225.

Annex A contains a list of typical environments related to the estimation of corrosivity categories.

## 4.3 Corrosion rate

The corrosion rate of a material is given by the medium and by the exposure time of moisture, air pollution, temperature and contamination of the surface.

ISO 9224 contains information about corrosion rates for different metals. Additional information for metallic materials related to the likelihood of corrosion in the atmosphere environment is given in ISO 9223.

## 4.4 Coating materials and corrosion behaviour

### 4.4.1 General

The coating material and the required coating thickness are to be selected and specified in relation to the expected corrosivity, the required design life and construction design.

The corrosion rate of metals and alloys, are not constant over the course of the exposure time. For most metals and alloys, it decreases with time of the exposure due to the accumulation of corrosion products on the surface of the exposed metal.

 

The corrosion rates of thermal-sprayed coatings are different from bulk materials and other types of metallic coatings due to porosity of thermal-sprayed coatings.

### 4.4.2 Zinc and zinc alloys

Zinc possesses a high resistance to corrosion due to its passive behaviour against atmospheric attack. However, the corrosion rate per year is affected by the composition of the atmosphere.

The rate of corrosion of zinc or zinc coatings in water depends mainly on the pH value, the carbon dioxide value and the salt and oxygen content of the water. In neutral or slightly alkaline water, zinc corrodes insignificantly only.

Alloying of aluminium up to a content of 15 mass % to the zinc base metal generates a higher corrosion resistance in maritime atmosphere compared to pure zinc metal in the case of lower pH values. It is evidently shown that the passive protection of the aluminium due to its oxidation can be combined with the cathodic protection of zinc.

NOTE Many applications of zinc and zinc alloys in the atmosphere indicate their favourable corrosion behaviour, e.g. the frequent use of thermal-sprayed zinc and zinc alloys for coatings on steel structures in industrial and marine environments and also in form of solid material for roofs and gutters and cast tubes in soils.

Details of the corrosion behaviour of zinc materials (Zn99,99 and ZnAl15) are shown in Annex B.

Further details for zinc, zinc alloys and their corrosion behaviour can be taken from ISO 14713-1.

### 4.4.3 Aluminium and aluminium alloys



The corrosion behaviour of aluminium materials is characterized by the protection behaviour of the electrical isolating aluminium oxide layer, which is rebuilt spontaneously even after mechanical damage to the surface. Aluminium shows a very high corrosion resistance in slightly acidic to slightly basic media and is particularly suitable for the corrosion protection of steel structures in $SO_2$-containing industrial atmospheres, as well as in marine environments.

Further details for aluminium, aluminium alloys and their corrosion behaviour in sea water and maritime atmosphere are to be taken from the literature.

A summary of the details for the corrosion behaviour of aluminium materials (Al and AlMg5) are shown in Annex B.

NOTE Aluminium coatings are successfully used in the building industry, where they are applied by electrolytic anodizing or thermal spraying. They have been proven in industrial and marine environments, as well as in seawater immersion.

## 5 Requirements for the corrosion protection systems and their planning

### 5.1 General rules — Technical requirements

Application of the thermal-sprayed corrosion protection system requires counter-intuitive design considerations as compared to other coating processes such as hot-dip galvanizing, which are not in the scope of this document. The most adequate corrosion protection system for the specific application should be specified according to the material used and the coating process before starting the design at any time. In the case of a more serious corrosion attack, an additional organic coating should be applied to the spray coating (duplex system), which can increase the corrosion protection significantly.

The following points of view shall be considered and stipulated in a specification, where required.

a) The corrosion protection system, e.g. a thermal-sprayed coating, sealed and covered by an organic coating, shall be selected in such a way that it complies with the required design life of the component. This is especially valid for surfaces, which are not accessible after assembly. A coating

 