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Thermal spraying — Zinc, aluminium and
their alloys

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Foreword

This Japanese Industrial Standard has been revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by The Japan Thermal Spray Society (JTSS)/Japanese Standards Association (JSA) with a draft being attached, based on the provision of Article 12, paragraph (1) of the Industrial Standardization Act applied mutatis mutandis pursuant to the provision of Article 16 of the said Act. This edition replaces the previous edition (**JIS H 8300:2011**), which has been technically revised.

However, **JIS H 8300: 2011** may be applied in the **JIS** mark certification based on the relevant provisions of Article 30, paragraph (1), etc. of the Industrial Standardization Act until 21 September 2021.

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Thermal spraying — Zinc, aluminium and their alloys

Introduction

This Japanese Industrial Standard has been prepared based on **ISO 2063-1** : 2019, Edition 2, and **ISO 2063-2** : 2017, Edition 1, with some modifications of the technical contents.

The vertical lines on both sides and dotted underlines indicate changes from the corresponding International Standard. A list of modifications with the explanations is given in Annex JB.

1 Scope

This Standard specifies requirements for the thermal spray coating of zinc, aluminium and their alloys applied on steel surface for the purpose of corrosion protection.

NOTE The International Standards corresponding to this Standard and the symbol of degree of correspondence are as follows.

ISO 2063-1 : 2019 *Thermal spraying — Zinc, aluminium and their alloys — Part 1 : Design considerations and quality requirements for corrosion protection systems*

ISO 2063-2 : 2017 *Thermal spraying — Zinc, aluminium and their alloys — Part 2 : Execution of corrosion protection systems* (Overall evaluation : MOD)

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standards and **JIS** are IDT (identical), MOD (modified), and NEQ (not equivalent) according to **ISO/IEC Guide 21-1**.

2 Normative references

Part or all of the provisions of the following standards, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS G 4404 *Alloy tool steels*

JIS H 8200 *Thermal spraying terms*

JIS H 8250 *Graphical symbol for thermal spraying*

JIS H 8261 *Wires, rods and cords for flame and arc thermal spraying*

JIS H 8401 *Methods of thickness measurement for sprayed coatings*

JIS H 8402 *Test methods of tensile adhesive strength for thermal-sprayed coatings*

JIS Z 0311 *Metallic blast-cleaning abrasives*

JIS Z 0312 *Non-metallic blast-cleaning abrasives*

JIS Z 0313 *Test and assessment of abrasive blast-cleaned substrates before application of paints*

JIS Z 1524 *Pressure sensitive adhesive cloth tapes for packaging*

JIS Z 8401 *Rounding of numbers*

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*

3 Terms and definitions

For the purpose of this Standard, the following terms and definitions, and those given in JIS H 8200 apply.

3.1

significant surface

part covered by or needs to be covered by the coating

3.2

minimum local thickness

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

3.3

protective coating system

sum total of the coats of metal materials, sealant, paints or related products which have been applied to a parent metal to provide corrosion protection

3.4

manufacturing supervisor

person who conducts liaison with the purchaser and the manufacturer, coordinates the thermal spray procedure specification and controls each process of the thermal spray operation

3.5

thermal spray procedure specification

document containing necessary matters for thermal spray coatings for corrosion protection, including coating quality requirements, test items and ranges of test values

3.6

manufacturing sequence plan

work procedure manual that lists thermal spray and test operations step by step

3.7

manufacturing control record

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

3.8

reference specimen

specimen given thermal spraying at the same time as and in the same conditions as the article to be coated, used for assessing the coating quality

3.9

loose spray particle

particles of the thermal spray material sprayed onto the parent metal by thermal spraying that do not form a thermal spray coating due to insufficient adhesion to the parent metal, and remain free on the thermal spray coating

4 Types and symbols

- a) The materials used for thermal spray shall be zinc, aluminium, and their alloys.
- b) Designation by symbol of thermal spray coating shall be in accordance with **JIS H 8250**.
- c) Symbol of type of thermal spray coating shall be in accordance with **JIS H 8261**.

5 Specifications of protective coating system

5.1 Specifications

The manufacturing supervisor shall define the following specifications for the protective coating system based on agreement between the purchaser and the manufacturer.

- a) Thermal spray material
- b) Minimum local thickness
- c) Adhesion
- d) Permissible degree of defects
- e) Post-treatments, including sealing
- f) Testing and range of test results
- g) Other matters agreed between the purchaser and the manufacturer

5.2 Types of thermal spray material

Four materials, Zn99.99, Al99.5, AlMg5 and ZnAl15, each satisfying the following, shall be used for thermal spray.

- a) Zn99.99, in accordance with code number 2.1 in Table 3 of **JIS H 8261**.
- b) Al99.5, in accordance with code number 3.2 in Table 4 of **JIS H 8261**.

- c) AlMg5, in accordance with code number 3.3 in Table 4 of **JIS H 8261**.
- d) ZnAl15, in accordance with code number 2.3 in Table 3 of **JIS H 8261**.

5.3 Selection of thermal spray material

The manufacturing supervisor shall select, as part of specifications, a suitable material for thermal spray based on the service condition, corrosivity of the service environment and expected service life of the parts to be sprayed.

NOTE ISO 2063-1 provides a table of corrosive categories of environment conditions, as well as characteristics and corrosion behaviour of thermal spray materials of zinc, aluminium and their alloys. These contents are given in Annex A and Annex B of this Standard for information.

5.4 Supervision of thermal spray material

The manufacturing supervisor shall check the delivery slip and marked symbol of the thermal spray material upon delivery of the material, and use the correct thermal spray material for the manufacture. The manufacturing supervisor shall also follow the instructions of the manufacturer and supplier of the thermal spray material for the handling and storage of the thermal spray material.

5.5 Selection of minimum local thickness

- a) The manufacturing supervisor shall select, as part of specifications, a suitable minimum local thickness based on the service condition, corrosivity of the service environment and expected service life of the parts to be sprayed.
- b) The minimum local thickness shall be selected from the range shown by a double line in Table 1 for each thermal spray material. When a thickness outside the said range is required due to special conditions (purpose of use, environment and service life of the article to be sprayed), the minimum local thickness may be selected from the range shown by a broken line in Table 1 for each thermal spray material based on the agreement between the purchaser and the manufacturer.
- c) When the minimum local thickness is specified by the agreement between the purchaser and the manufacturer, the thermal spraying method, use of a sealant, test method and designation of a median value for ensuring the uniformity of the coating thickness may be agreed on.

Table 1 Types and minimum local thicknesses of thermal spray materialsUnit: μm

Type of thermal spray material	Range of minimum local thickness ^{a)}						
	Minimum local thickness						
	50	100	150	200	250	300	
Zn99.99							
Al99.5							
AlMg5							
ZnAl15							
NOTE ISO 2063-1 contains recommended values for thickness of thermal spray coating corresponding to the combinations of corrosion protection systems for each spray material (thermal spray coating only, thermal spray coating + sealing, or thermal spray coating + sealing + organic coating) and various environmental conditions. These contents are given in Annex C of this Standard for information. Note ^{a)} The minimum local thickness range includes the values at both ends of the line showing the range.							

6 Manufacturing process

6.1 Manufacturing supervision

- The manufacturing supervisor shall supervise the manufacturing process so that the thermal spray coating fulfils the quality requirements specified in the thermal spray procedure specification.
- The manufacturing supervisor shall establish a manufacturing sequence plan detailing all single work and test steps, including the surface preparation e.g. cleaning and roughening, thermal spraying, post-treatments e.g. sealing of the coating, and shall execute each operation according to the plan.
- The abrasive material used for cleaning and surface roughening, blasting conditions, rust removal grade, surface roughness, spray distance, minimum local thickness and other conditions to be specified in the manufacturing sequence plan shall be determined based on the characteristics of the thermal spray coating applied on specimens prepared beforehand. Alternatively, these conditions may be adopted from similar cases of thermal spray operations.
- The manufacturing supervisor shall, whenever a change is to be made in parameters of surface preparation or spraying, or the spray equipment used, verify that the new parameters will achieve the required coating quality based on a thermal spray coating applied on a specimen using the new parameters.
- The spray personnel shall record in the manufacturing control record, in each step of the process, the operations actually executed according to the items specified in

the manufacturing sequence plan, such as the abrasive material used for cleaning and surface roughening, blasting conditions, rust removal grade, surface roughness, spray distance, minimum local thickness and so forth.

6.2 Blasting

6.2.1 Surface preparation

The parent metal surface shall be thoroughly cleaned and roughened using a suitable abrasive material. Recommended considerations for blasting are given in **D.2** for information.

6.2.2 Masking

Areas of the part that are not to be coated shall be masked prior to blasting and prior to spraying. The masking material shall withstand the grit when blasting and the hot spray particles when spraying. The most suitable masking material should be separately selected for blasting and spraying.

6.2.3 Finishing quality of blasted surface

The finishing quality of blasted surface shall be in accordance with Clause 4 of **JIS Z 0313** and satisfy the rust removal grade Sa 2^{1/2} or better for zinc spray and zinc-aluminium alloy spray, and Sa 3 for aluminium spray and aluminium-magnesium alloy spray. Surface roughness (*Rz*) should be 50 µm or greater, depending on the spray process and spray material.

6.2.4 Abrasive material

Blasting shall be performed using one of the following abrasive materials.

- a) Chilled-iron grit or high-carbon cast-steel grit specified in **JIS Z 0311**, or those equivalent in the surface roughening property thereto.
- b) Nickel slag, ferronickel slag or steelmaking slag specified in **JIS Z 0312**, or those equivalent in the surface roughening property thereto.
- c) Fused alumina oxide specified in **JIS Z 0312**, or those equivalent in the surface roughening property thereto.
- d) Abrasive materials other than a) to c) may be used based on the agreement between the purchaser and the manufacturer provided that they are capable of achieving a parent metal surface with enough cleanliness and roughness for ensuring necessary adhesion of the thermal spray coating.
- e) Abrasive materials having a grit size between 0.5 mm and 1.5 mm shall be normally used. The abrasive material used, whatever its type, shall be clean, dry and free from foreign materials.

6.2.5 Blasting operation

- a) Sufficient lighting of the surface to be blasted and adequate work conditions including temperature of component surface not falling below the dew point, and protection against rain and snow shall be ensured for blasting.

- b) Immediately before the spraying, the manufacturing supervisor or spray personnel shall make sure that the surface to be sprayed is dry and free from dust, grease, oxide scale, rust and other contaminants.
- c) For a blasting operation using compressed air, the air to be used shall be sufficiently clean and dry to prevent contamination of the abrasive material and the parent metal surface to be sprayed.

6.2.6 Testing of the blasted surface

- a) **Testing of rust removal grade** The manufacturing supervisor shall, before spraying, check the rust removal grade of the blasted parent metal surface in accordance with Clause 4 of **JIS Z 0313** and visually observe the surface to see if it has the desired clean and uniform roughness.
- b) **Testing of surface roughness** The manufacturing supervisor shall check the roughness of the blasted surface of the parent metal in accordance with Clause 7 of **JIS Z 0313** before spraying. Unless otherwise specified by agreement between the purchaser and the manufacturer, reference samples specified in **ISO 8503-1** shall be used.

6.3 Thermal spraying

The thermal spraying shall be performed according to the following. Details of thermal spraying are given in D.1 to D.5 for information.

- a) If imperfections on the surface to be coated are visible the surface preparation shall be repeated.
- b) Spraying shall be performed while the blasted surface of the component is still clean and dry, and free of visible oxidation. Normally, it is preferable to perform thermal spraying within 4 h after blasting depending on the environment conditions.
- c) If condensation on the component surface can occur, the component surface temperature shall be maintained 3 °C above the dew point. The relative humidity of the atmosphere should be 85 % or lower.
- d) The following spraying parameters shall be supervised in adequate periods of time by the manufacturing supervisor or spray personnel :
 - 1) values of current, voltage, gas flowrate and gas pressure;
 - 2) motion rate of the spray gun in the case of mechanical spraying;
 - 3) component's surface temperature;
 - 4) right use of the spray material specified in the thermal spray procedure specification;
 - 5) thickness and visual inspection of the coating.
- e) Dust and loose spray particles generated near the component surface during thermal spraying shall be removed as thoroughly as possible to minimize entrapment of