INTERNATIONAL STANDARD ISO 2063

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Metallic coatings — Protection of iron and steel against corrosion — Metal spraying of zinc and aluminium

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO Member Bodies). The work of developing International Standards is carried out through ISO Technical Committees. Every Member Body interested in a subject for which a Technical Committee has been set up 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.

Draft International Standards adopted by the Technical Committees are circulated to the Member Bodies for approval before their acceptance as International Standards by the ISO Council.

Prior to 1972, the results of the work of the Technical Committees were published as ISO Recommendations; these documents are now in the process of being transformed into International Standards. As part of this process, International Standard ISO 2063 replaces ISO Recommendation R 2063-1971, drawn up by Technical Committee ISO/TC 107, *Metallic and other non-organic coatings.*

The Member Bodies of the following countries approved the Recommendation :

Chile	Israel	South Africa, Rep. of
Czechoslovakia	Italy	Sweden
France	Netherlands	Switzerland
Germany	New Zealand	Thailand
Hungary	Portugal	U.S.S.R.
India	Romania	

The Member Body of the following country expressed disapproval of the Recommendation on technical grounds :

United Kingdom

Printed in Switzerland

Metallic coatings — Protection of iron and steel against corrosion — Metal spraying of zinc and aluminium

0 INTRODUCTION

Sprayed metal coatings are produced by projecting the coating metal, heated to its molten state, in a stream of gas, on to the surface to be coated.

It is essential that the purchaser state the classification symbol of the coating required : merely to ask for metal spraying to be carried out in accordance with ISO 2063 without this information is insufficient.

1 SCOPE

This International Standard defines the characteristic properties and specifies methods of test of coatings obtained by the spraying of zinc and aluminium for the general purpose of corrosion protection, for which these metals are suitable.

It deals firstly with the definition, classification and symbols for these coatings, in relation to their thickness.

It then specifies their characteristic properties : thickness, appearance and adhesion.

Finally, it lays down the methods of test which make it possible to check these properties.

2 FIELD OF APPLICATION

This International Standard applies to sprayed metal coatings intended to protect iron and steel against atmospheric corrosion by applying zinc or aluminium to their surface.

It does not in general apply to coatings obtained by the application of metals other than zinc and aluminium, although for these other metals certain of these specifications are valid and may be adopted by agreement between the interested parties.

3 REFERENCES

ISO/R 115, *Classification and composition of unalloyed aluminium ingots for remelting.*

ISO/R 752, *Zinc ingots.*

ISO 1463, *Metal and oxide coatings — Measurement of the thickness by microscopical examination of cross-sections.*

ISO 2178, *Non-magnetic metallic and vitreous or porcelain enamel coatings on magnetic basis metals — Measurement of coating thickness — Magnetic method.*

4 DEFINITIONS

Sprayed metal coatings are defined by their thickness which is measured over a reference surface of about 1 cm^2.

The measured thickness shall not be lower than the thickness given in the coating symbol.

The thickness may be measured both by supplier and purchaser, at the acceptance of the coated products. The number and distribution of these measurements over the whole surface area treated may be specified by agreement between the interested parties.

In the particular case of very large surfaces, it may be considered, by agreement between the interested parties, to measure the thickness over a reference surface of about 1 dm^2 for each portion of the surface of about 10 m^2.

5 CLASSIFICATION

The zinc or aluminium coatings covered by this International Standard are classified in a scale according to their thickness as shown in the Table below.

TABLE — **Classification of sprayed coatings**

Coating metal	Minimum thickness	Symbol
Zinc	40*	Zn 40
	80	Zn 80
	120	Zn 120
	160	Zn 160
	200**	Zn 200
Aluminium	80*	Al 80
	120	Al 120
	160	Al 160
	200	Al 200
	300**	Al 300

* These coatings are used for certain special applications.

** By special agreement, greater thicknesses may be used if the coating obtained remains in conformity with this International Standard.

In certain cases, additional information on a mean thickness may be considered by agreement between the producer and the purchaser. The mean thickness is the number obtained by taking the arithmetic mean of several measurements, at different places, and in accordance with a procedure determined by agreement between the interested parties.

6 MANUFACTURE

6.1 Preparation of surfaces

Particular attention shall be given to the preparation of the surface before spraying. This preparation shall be carried out by blasting, with abrasive (compressed air or centrifuge).

In general, one of the following abrasives shall be used to produce suitable surface preparation :

- hematitic chilled cast iron grit;
- corundum grit.

In some cases, crushed shingle, sharp siliceous sand or steel grit may be used, but with special precautions to achieve sufficient roughness to ensure the adhesion of the sprayed metal.

The grit size shall be between 0,5 and 1,5 mm.

Whatever the abrasive used, it shall be perfectly clean and dry and, in particular, free from soluble salts. In the case of abrasive blasting with the aid of compressed air, the air shall be sufficiently clean and dry to avoid contaminating the abrasive or the surface to be metal sprayed.

In all cases, the quality of the geometrical condition of the surface shall be verified by comparison with a reference surface prepared according to specifications agreed between the interested parties.

6.2 Coating metal

The coating metal shall comply with the following requirements :

- Zinc[1] : Zinc having a composition in accordance with type Zn 99,99 of ISO/R 752.

  In some cases, by agreement between the interested parties, the zinc can be of the Zn 99,95 and Zn 99,5 types in ISO/R 752.

- Aluminium[2] : Aluminium of a quality at least equal to that of type Al 99,5 of ISO/R 115.

  In some cases, by agreement between the interested parties, the aluminium may be of type Al 99,0 of ISO/R 115, the copper content, however, being restricted to 0,05 %.

6.3 Spraying

The metal spraying shall be carried out after the surface has been prepared by abrasive blasting, within a period such that the metal is sprayed onto a sanded (or blasted) surface which is still completely clean, dry and not oxidized.

In good weather, in a not too humid atmosphere, this period may be as much as a few hours. In rainy weather or in a humid or marine atmosphere, it may have to be reduced to 2 h or even less, but in this case the operation shall be carried out under cover.

If an appreciable deterioration in the surface to be coated is observed, by comparison with a metal surface of similar quality which has undergone the same preparation, the preparation treatment must be repeated on the surface to be coated.

6.4 Painting over a sprayed metal coating

When a complex "sprayed metal + paint" coating is used, such a coating shall be regarded as a coherent whole in which the paint system is selected in relation to its compatibility with the sprayed metal and with the corrosive medium to which it is to be exposed.

7 REQUIRED CHARACTERISTICS

7.1 Thickness

The thickness of the coating shall at no point be less than the minimum value defining the coating, in accordance with the indications in section 4 and in the Table.

The measurements of thickness shall be made by magnetic measuring methods (see 8.1.3), which can be used in all cases, provided that the specifications of 8.1.2 are observed concerning the number of measurements which must be used for the arithmetic mean.

In the case of dispute, use may be made of the micrographic cross-section method, when this is possible (see 8.1.4).

7.2 Appearance

The surface of the coating shall be of uniform appearance, without blisters or bare patches, and free from non-adhering metal.

7.3 Adhesion

The coating shall satisfy the grid test (see 8.2.1), i.e. at the end of the test, no separation from the basis metal shall have occurred within the squares cut.

1) In the case of zinc powder, the oxide content, measured as ZnO, may reach 1 % provided that the metallic content remains in accordance with the values specified above.

2) In the case of aluminium powder, the oxide content, measured as Al_2O_3, may reach 1 % provided that the metallic content remains in accordance with the values specified above.

8 METHODS OF TESTS

8.1 Measurement of thickness

8.1.1 *Field of application of the methods*

a) Magnetic measurements have the advantage of being non-destructive, rapid and capable of being carried out directly at any point on the surface to be checked. Furthermore, the nature of the coating (zinc, aluminium) sprayed onto a ferrous metal, and the values of the standard thicknesses, contribute to the achievement of satisfactory precision. As a result, in conformity with the specifications of this International Standard and by agreement between the interested parties on the correct calibration of magnetic instruments for a given sample, magnetic measurements make it possible to carry out effective and accurate acceptance checks.

b) The micrographic cross-section method, used as a reference method for metallic coatings, is difficult to perform correctly for a sprayed metal coating, and its interpretation may not give the required precision, in view of the geometrical irregularities of the surface presented by the basis metal at the interface and the coating metal at the surface. Therefore, this method shall be used only after prior agreement between the interested parties, the test being made according to the requirements of 8.1.4.

8.1.2 *Special conventions concerning sprayed metal coatings*

In accordance with the definition in section 4, the following conventions shall be adopted for determining the thickness by the magnetic and micrographic cross-section methods :

a) Magnetic methods

Within the reference square centimetre[1] in which the measurement is carried out, the arithmetic mean of three, four or five measurements distributed over this square centimetre shall be taken, according to the dimension of the contact surface of the measuring head with the coating.

It is assumed that the contact is a point, and five measurements shall be carried out at five different points on the square centimetre, the contact being measured by the tangency of a curved surface of the measuring head with the surface of the coating (see Figure 1).

When the contact is made through a flattened part of the measuring head, this flat must have an area which is smaller than that of a circle 3 mm in diameter (two circles 3 mm in diameter in the case of two-pole measuring heads). Three or four measurements shall then be taken at different points, according to the dimension of the contact surface of the measuring head (see Figure 2).

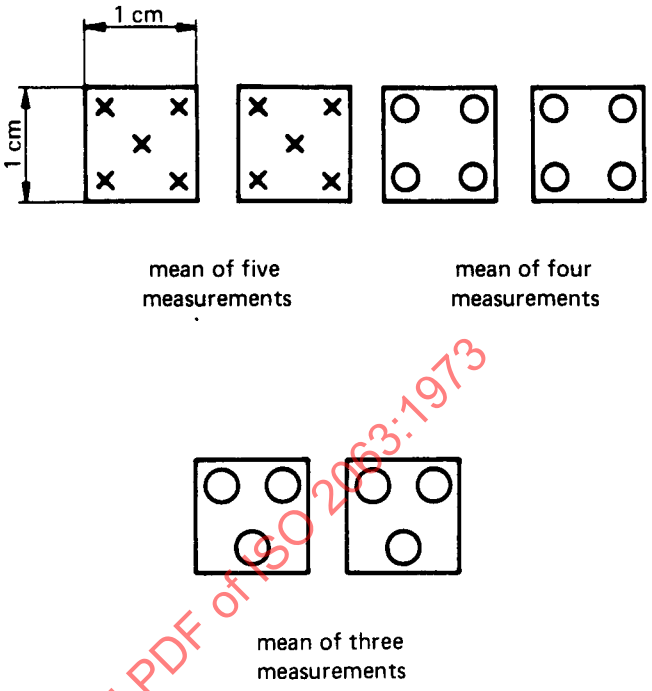

FIGURE 1 — **Two-pole measuring head**

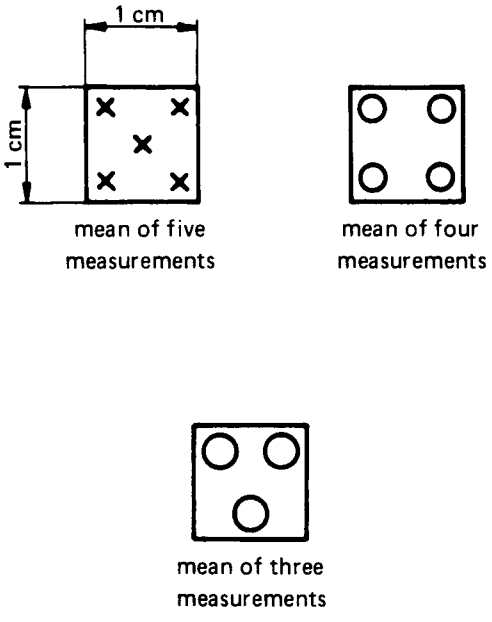

FIGURE 2 — **Single measuring head**

1) In the case of a two-pole measuring head, two squares each 1 cm^2 are considered for reference purposes, which are separated by the distance between the two arms of the measuring head. Furthermore, in the case of each measurement, it is recommended to take the mean of the two readings obtained by reversing the poles (see Figure 1).

In the special case of a reference area of 1 dm^2, the arithmetic mean of ten measurements distributed over the reference square decimetre shall be taken, in conformity with the diagram in Figure 3, whatever the size of the contact surface of the measuring head of the apparatus.

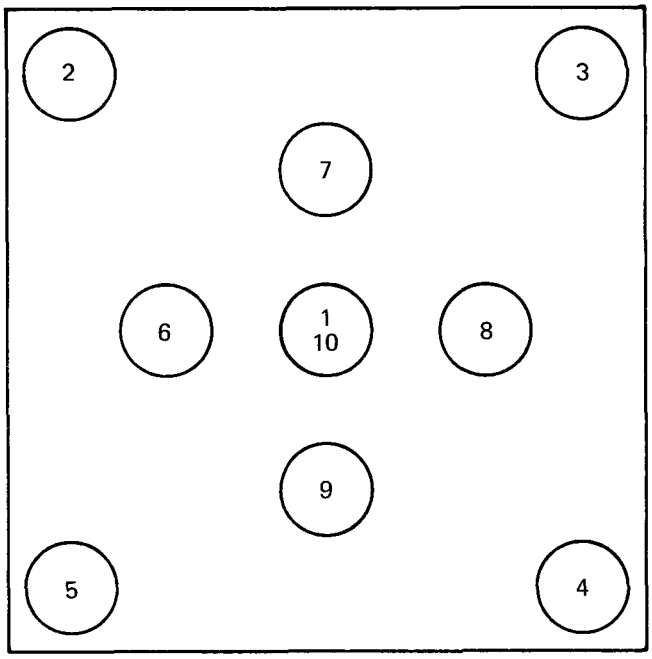

FIGURE 3 — **Measurement points in the reference square decimetre**

b) Micrographic cross-section method

Since the micrographic cross-section has a length of 10 to 20 mm, the value of the thickness corresponding to this cross-section shall be taken to be the arithmetic mean of ten individual readings taken at ten points regularly distributed over the total length of 10 to 20 mm of the section.

8.1.3 *Magnetic measurements*

The tests shall be carried out according to ISO 2178, taking account of the special conventions concerning sprayed metal coatings described in 8.1.2 a).

8.1.4 *Micrographic cross-section*

8.1.4.1 Principle

Micrographic examination by means of a microscope on the cross-section of a test piece cut from the sample in accordance with the specifications given in ISO 1463.

8.1.4.2 Comments

a) For the special case of coatings obtained by spraying, and in order to prevent the separation of the coating from the substrate, and the rounding of the edges, the test piece shall be mounted in an appropriate mounting material such as a plastic or a low melting point alloy. The surface to be examined shall be carefully polished with a suitable medium.

b) Ten measurements shall be made uniformly distributed along one of the sides of the test piece and covering approximately the 20 mm length of the cross-section (object surface), and the arithmetic mean of these shall be taken.

8.2 Adhesion test[1)]

8.2.1 *Grid test*

8.2.1.1 Principle

The coating is cut through to the basis metal to give a lattice pattern. The squares of the lattice having given dimensions, no separation of the coating shall occur.

8.2.1.2 Equipment

Cutting tool with a hard edge of a type similar to that shown in Figure 4.

8.2.1.3 Procedure

Using the tool defined in 8.2.1.2, cut a lattice of the following dimensions :

Approximate surface covered by the lattice	Distance between cuts mm	Thickness of coating verified μm
15 mm × 15 mm	3	up to 200
25 mm × 25 mm	5	over 200

The depth of the cuts shall be such that the coating is cut through to the basis metal.

Where possible, after the lattice has been cut, a suitable adhesive tape, agreed between the interested parties, shall be applied to this part by means of a roller with a loading of 500 g. The adhesive tape shall then be pulled off in a quick and abrupt manner, in a direction perpendicular to the surface.

If this is not possible, a method of scribing the coating must be agreed between the interested parties.

8.2.1.4 Interpretation of results

No part of the coating shall separate from the basis metal. The adhesion shall be considered satisfactory if, in each square of the grid, part of the coating still adheres while the remainder is stuck to the adhesive tape, breakage having occurred within the layer of coating metal and not at the interface.

1) This clause is valid until the adoption of an International Standard (currently under consideration) applying to all metal coatings.