

ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION R 2063

METAL SPRAYING OF ZINC AND ALUMINIUM
FOR THE PROTECTION OF IRON AND STEEL AGAINST CORROSION

1st EDITION

May 1971

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BRIEF HISTORY

The ISO Recommendation R 2063, *Metal spraying of zinc and aluminium for the protection of iron and steel against corrosion*, was drawn up by Technical Committee ISO/TC 107, *Metallic and other non-organic coatings*, the Secretariat of which is held by the Ente Nazionale Italiano di Unificazione (UNI).

Work on this question led to the adoption of Draft ISO Recommendation No. 2063, which was circulated to all the ISO Member Bodies for enquiry in September 1970. It was approved, subject to a few modifications of an editorial nature, by the following Member Bodies :

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 following Member Body opposed the approval of the Draft :

United Kingdom —

This Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided to accept it as an ISO RECOMMENDATION.

FOREWORD

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 Recommendation R 2063 without this information is insufficient.

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ISO Recommendation

R 2063

May 1971

**METAL SPRAYING OF ZINC AND ALUMINIUM
FOR THE PROTECTION OF IRON AND STEEL AGAINST CORROSION**

1. SCOPE

This ISO Recommendation 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 ISO Recommendation 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. DEFINITIONS

Sprayed metal coatings are defined by their thickness which is measured over a reference surface of about 1 cm².

The measured thickness should 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 supplier and the purchaser.

In the particular case of very large surfaces, it may be considered, by agreement between the purchaser and the supplier, to measure the thickness over a reference surface of about 1 dm² for each portion of the surface of about 10 m².

4. CLASSIFICATION

The zinc or aluminium coatings covered by this ISO Recommendation 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 ISO Recommendation.

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 producer and the purchaser.

5. MANUFACTURE

5.1 Preparation of surfaces

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

In general, one of the following abrasives should 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 should be between 0.5 and 1.5 mm.

Whatever the abrasive used, it should 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 should 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 should be verified by comparison with a reference surface prepared according to specifications agreed between the interested parties.

5.2 Coating metal

The coating metal should comply with the following requirements :

- Zinc * : Zinc having a composition in accordance with type Zn 99.99 of ISO Recommendation R 752, *Zinc ingots*.

In some cases, by agreement between producer and purchaser, the zinc can be of the Zn 99.95 and Zn 99.5 types in ISO Recommendation R 752.

- Aluminium** : Aluminium of a quality at least equal to that of type Al 99.5 of ISO Recommendation R 115, *Classification and composition of unalloyed aluminium ingots for remelting*.

In some cases, by agreement between producer and purchaser, the aluminium may be of type Al 99.0 of ISO Recommendation R 115, the copper content, however, being restricted to 0.05 %.

5.3 Spraying

The metal spraying should 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 hours or even less, but in this case the operation should 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.

5.4 Painting over a sprayed metal coating

When a complex "sprayed metal + paint" coating is used, such a coating should 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.

6. CHARACTERISTICS

6.1 Thickness

The thickness of the coating should at no point be less than the minimum value defining the coating, in accordance with the indications in section 3 and in the Table opposite.

The measurements of thickness should be made by magnetic measuring methods (see clause 7.1.3), which can be used in all cases, provided that the specifications of clause 7.1.2 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 clause 7.1.4).

6.2 Appearance

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

6.3 Adhesion

The coating should satisfy the grid test (see clause 7.2.1), i.e. at the end of the test, no separation from the basis metal should have occurred within the squares cut.

* 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.

** In the case of aluminium powder, the oxide content, measured as Al₂O₃, may reach 1 % provided that the metallic content remains in accordance with the values specified above.

7. METHODS OF TEST

7.1 Measurement of thickness

7.1.1 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 ISO Recommendation 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 should be used only after prior agreement between the interested parties, the test being made according to the requirements of clause 7.1.4.

7.1.2 *Special conventions concerning sprayed metal coatings.* In accordance with the definition in section 3, the following conventions should be adopted for determining the thickness by the magnetic and micrographic cross-section methods :

- (a) **MAGNETIC METHODS.** Within the reference square centimetre* in which the measurement is carried out, the arithmetic mean of three, four or five measurements distributed over this square centimetre should be taken, according to the dimension of the contact surface of the measuring head with the coating.

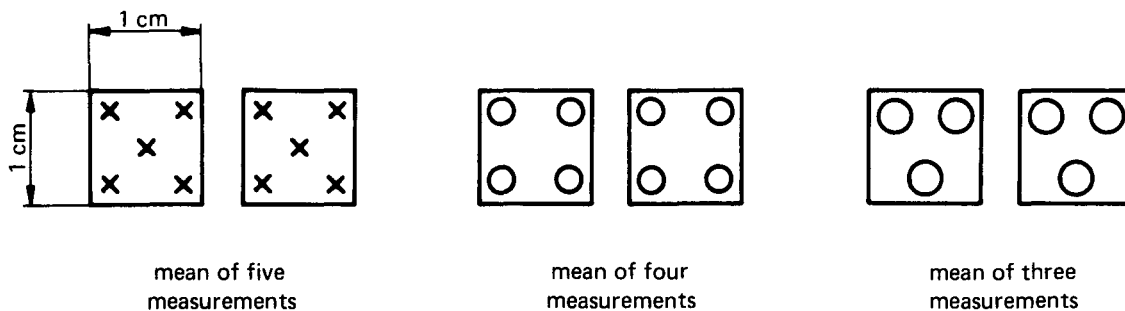


FIGURE 1 - Two-pole measuring head

* In the case of a two-pole measuring head, two squares each 1 cm² 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).

It is assumed that the contact is a point, and five measurements should 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).

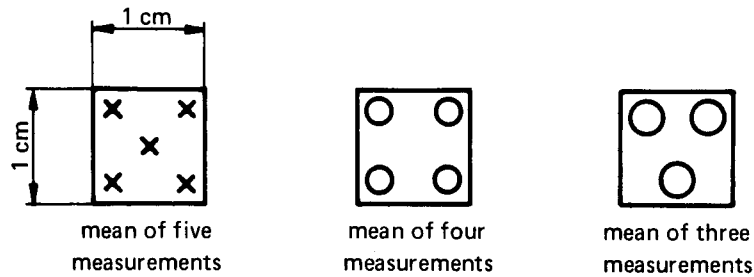


FIGURE 2 - Single measuring head

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 should then be taken at different points, according to the dimension of the contact surface of the measuring head (see Figure 2).

In the special case of a reference area of 1 dm², the arithmetic mean of ten measurements distributed over the reference square decimetre should be taken, in conformity with the diagram in Figure 3, whatever the size of the contact surface of the measuring head of the apparatus.

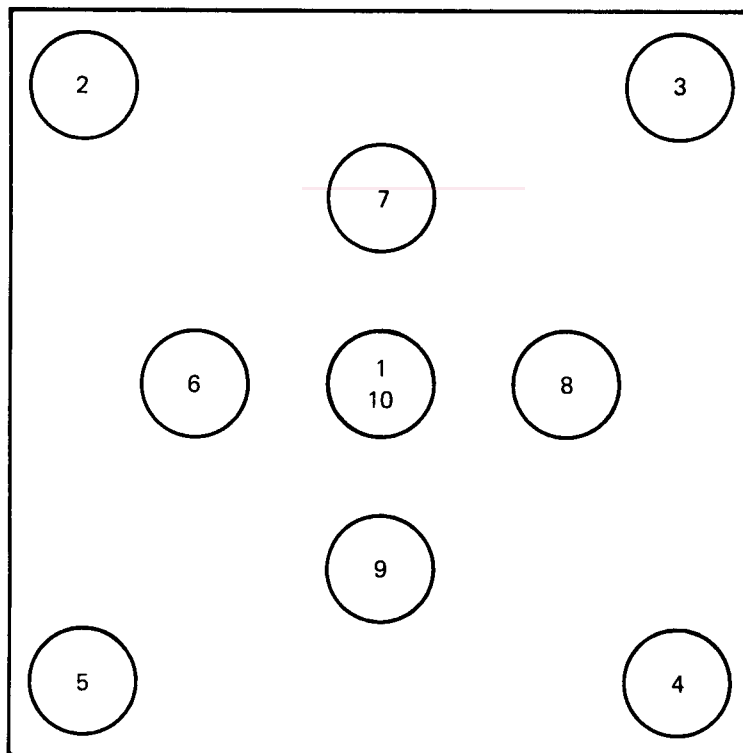


FIGURE 3 - Measurement points in the reference square decimetre

- (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 should 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.

7.1.3 *Magnetic measurements.* The tests should be carried out according to ISO Recommendation R 2178, *Metallic coatings – Measurement of the thickness – Magnetic method (Non-magnetic coating on magnetic basis metal)*, taking account of the special conventions concerning sprayed metal coatings described in clause 7.1.2 (a).

7.1.4 *Micrographic cross-section*

7.1.4.1 **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 Recommendation R 1463, *Measurement of metal and oxide coating thicknesses by microscopical examination of cross-sections.*

7.1.4.2 **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 should be mounted in an appropriate mounting material such as a plastic or a low melting point alloy. The surface to be examined should be carefully polished with a suitable medium.
- (b) Ten measurements should 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 should be taken.

7.2 **Adhesion test***

7.2.1 *Grid test*

7.2.1.1 **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 should occur.

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

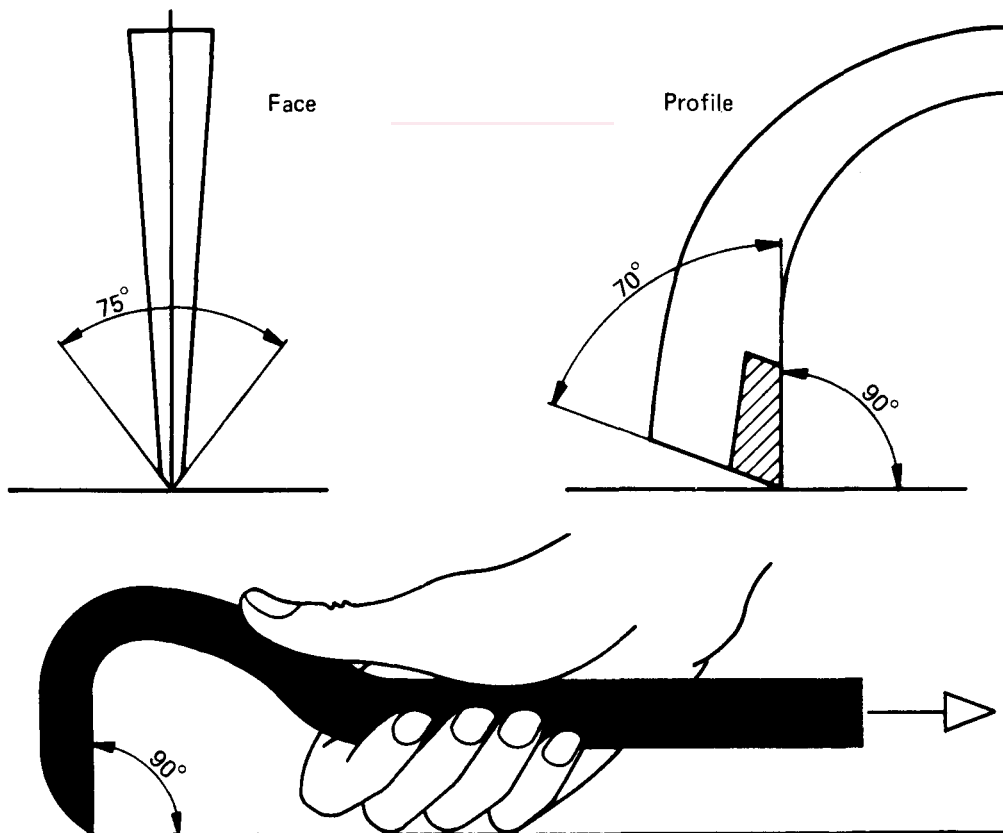


FIGURE 4 – Cutting tool

* This clause is valid until the adoption of an ISO Recommendation (currently under consideration) applying to all metal coatings.