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Steel wire and wire products — Non-ferrous metallic coatings on steel wire —

Part 2: Zinc or zinc-alloy coating

*Fils et produits tréfilés en acier — Revêtements métalliques non ferreux sur fils d'acier —
Partie 2: Revêtements de zinc ou d'alliages de zinc*

ICS: 77.140.65; 25.220.40

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

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Contents

	Page
Foreword	iv
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Coating requirements	2
4.1 Requirements for the coating material	2
4.2 Requirements relating to coating on the wire	2
4.2.1 Coating mass per unit area	2
4.2.2 Coating requirements to salt-spray test	3
4.2.3 Appearance of coating	4
4.2.4 Dipping test	4
4.2.5 Special finishes	5
4.2.6 Adherence of coating	5
5 Test conditions	6
5.1 Selection of samples	6
5.2 Determination of coating mass per unit area	7
5.2.1 General	7
5.2.2 Gravimetric method	7
5.2.3 Gaseous volumetric method	8
5.3 Dipping test	13
5.3.1 Principle	13
5.3.2 Reagents	13
5.3.3 Preparation of test piece	13
5.3.4 Test procedure	13
5.3.5 Interpretation of results	14
Bibliography	15

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.

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The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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ISO 7989-2 was prepared by Technical Committee ISO/TC 017 *Steel*, Subcommittee SC 17, *Steel wire rod and wire products*.

This second edition cancels and replaces the first edition (ISO 7989-2:2007-02-01), which has been technically revised.

ISO 7989 consists of the following parts, under the general title *Introductory element — Main element*:

- *Part 1: General principles*
- *Part 2: Zinc or zinc-alloy coating*

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Steel wire and wire products — Non-ferrous metallic coatings on steel wire —

Part 2: Zinc or zinc-alloy coating

1 Scope

This part of ISO 7989 specifies the requirements for the coating mass per unit area, for other properties and also for testing of zinc or zinc-alloy coatings on steel wire and steel wire products of circular or other section.

2 Normative references

The following referenced documents are indispensable for the application 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 1460:1992, *Metallic coatings — Hot dip galvanized coatings on ferrous materials — Gravimetric determination of the mass per unit area*

ISO 7802:2013, *Metallic materials — Wire — Wrapping test*

ISO 7989-1:2006, *Steel wire and wire products — Non-ferrous metallic coatings on steel wire — Part 1: General principles*

ISO 9224, *Corrosion of metals and alloys — Corrosivity of atmospheres — Guiding values for the corrosivity categories*

ISO 9227, *Corrosion tests in artificial atmospheres — Salt spray tests*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

wire with zinc or zinc-alloy coating

wire to which zinc or zinc-alloy coating has first been applied to protect it against corrosion.

Note 1 to entry: Steel wire and steel wire products of circular or other sections are produced in a continuously hot dip coated/galvanized or continuously electro galvanized process. The coating method may be hot dipping in a bath of molten zinc, or by means of an aqueous solution of suitable electrolyte. In the hot dipping process, wiping media may be used to modify the coating mass per unit area

3.2

zinc or zinc alloy coating

coating composed of zinc or zinc alloy, where the zinc alloy is zinc to which other elements have been deliberately added in order to obtain particular characteristics, and in which the quantity of zinc is at least 50%.

Note 1 to entry: The most common alloy elements are aluminium, tin and nickel, but other elements may also be considered.

3.3
coating mass per unit area

mass of zinc or zinc alloy per unit of surface area of bare wire.

Note 1 to entry: This is expressed in grams per square metre of surface.

3.4
Zinc-alu alloy coating

Is a Zn95Al5 or an advanced metallic coating

3.5
Advanced metallic coating

Is a metallic coating which reaches specific requirements. Examples of advanced metallic coatings are Zn90% + 10% aluminium and Zn95% + 5 % aluminium with 0,2 to 0,5 % magnesium.

4 Coating requirements

4.1 Requirements for the coating material

The zinc or zinc alloy used for the coating shall be specified at the time of the enquiry and order. For zinc alloys not mentioned in this part of ISO 7989, the alloy shall be specified at the enquiry and order.

NOTE For Zn-Al alloy coatings, reference is made to ASTM B997 or ASTM B750.

The ingot of the material used for the zinc coating shall be of minimum 99,9 % purity unless otherwise stated in the relevant product standard or other specification in the order. Coatings applied by electrolysis shall contain a minimum of 99 % zinc.

4.2 Requirements relating to coating on the wire

4.2.1 Coating mass per unit area

The minimum mass of zinc or zinc-aluminium alloy coatings, per unit of surface area of the wire, shall comply with the requirements of [table 1](#).

If no class of zinc coating or no coating mass per unit area is specified, the coating shall be called “regular coating”.

Zinc-coated wire produced as “regular coating” shall have the full surface covered with zinc, but there is no specified minimum weight of coating.

Coating mass different to [table 1](#) is possible in agreement between the manufacturer and the supplier.

Table 1 — Coating mass per unit area

Diameter <i>d</i> , mm	Classes					E ^{ab}	
	A g/m ²	AB g/m ²	B g/m ²	C g/m ²	D g/m ²		
0,15 ≤ <i>d</i> < 0,20	—	—	15	—	10	40	
0,20 ≤ <i>d</i> < 0,25	30	20	20	20	15		
0,25 ≤ <i>d</i> < 0,32	45	30	30	25	15		
0,32 ≤ <i>d</i> < 0,40	60	30	30	25	15		
0,40 ≤ <i>d</i> < 0,50	85	55	40	30	15		
0,50 ≤ <i>d</i> < 0,60	100	70	50	35	20		
0,60 ≤ <i>d</i> < 0,70	115	80	60	40	20		
0,70 ≤ <i>d</i> < 0,80	130	90	60	45	20		
0,80 ≤ <i>d</i> < 0,90	145	100	70	50	20		
0,90 ≤ <i>d</i> < 1,00	155	110	70	55	25		
1,00 ≤ <i>d</i> < 1,20	165	115	80	60	25		
1,20 ≤ <i>d</i> < 1,40	180	125	90	65	25		60
1,40 ≤ <i>d</i> < 1,65	195	135	100	70	30		
1,65 ≤ <i>d</i> < 1,85	205	145	100	75	30		
1,85 ≤ <i>d</i> < 2,15	215	155	115	80	40		
2,15 ≤ <i>d</i> < 2,50	230	170	125	85	45		
2,50 ≤ <i>d</i> < 2,80	245	185	125	95	45		
2,80 ≤ <i>d</i> < 3,20	255	195	135	100	50		
3,20 ≤ <i>d</i> < 3,80	265	210	135	105	60		
3,80 ≤ <i>d</i> < 4,40	275	220	135	110	60		
4,40 ≤ <i>d</i> < 5,20	280	220	150	110	70		
5,20 ≤ <i>d</i> < 8,20	290			110	80		
8,20 ≤ <i>d</i> ≤ 10,00	300			110	80		

^a the corrosion resistance in salt spray according ISO 9227 of this class E must be at least equivalent of these from a zinc coating according class B

^b only for zinc-aluminium coatings

4.2.2 Coating requirements to salt-spray test

The surface of the samples of the wires, when tested according ISO 9227, shall not show more than 5 % dark brown rust after the minimum hours defined below.

The minimum number of hours of salt spray resistance depends on type of coating, wire diameter and specified minimum coating explained in [table 1](#).

[Table 2](#) is applicable to wires with minimum 1,6 mm diameter and minimum 100 g/m² coating weight.

The minimum number of hours will be calculated by multiplying minimum coating in g/m² and the normalised coefficient (h/g/m²) reported in [table 2](#).

Table 2 — Coating requirements^b

Coating type	Normalised coefficient (h/g/m ²) ^a
Zinc	2
Standard zinc alu alloy coatings (Zn95Al5)	6
Advanced zinc alu alloy coatings	12

^a h/g/m² : Multiplied by coating weight = Hours Salt spray before 5% steel rust according to ISO 9227.
For example: Zinc Class A wire:
- dia 1,65 with 205 g/m² will stand 410 hours
- dia 10,00 with 300 g/m² will stand 600 hours

^b The salt spray test result (e.g. 1500h) is the average value of 6 wire samples of each minimum 20 cm length.

4.2.3 Appearance of coating

The coating applied to the wire shall be reasonably smooth and as evenly distributed as industrial technology allows and not show discontinuities such as bare patches, dross contamination, etc.

NOTE The zinc-aluminium alloy might show difference in colour and become darker with time. This does not affect the corrosion protection performance.

4.2.4 Dipping test

If agreed at the time of the enquiry and order, the dipping (immersion) test shall be carried out according to the procedure detailed in 5.3. However, it should be pointed out that there is no direct link between the number of dips and the coating mass per unit area and that the result is determined as much by the conditions of manufacture of the coating as by the uniformity of the coating.

Table 3 gives the minimum number of immersions for coatings of classes A and AB. The dipping test does not apply to classes B, C and D.

Table 3 — Minimum number of dips

Nominal diameter <i>d</i> mm	Class A		Class AB	
	Number of dips		Number of dips	
	of 1 min ^a	of 1/2 min ^b	of 1 min ^a	of 1/2 min ^b
0,40 ≤ <i>d</i> < 0,60	—	1	—	—
0,60 ≤ <i>d</i> < 0,90	1	—	—	1
0,90 ≤ <i>d</i> < 1,00	1	1	—	1
1,00 ≤ <i>d</i> < 1,40	1	1	1	—
1,40 ≤ <i>d</i> < 1,65	2	—	1	—
1,65 ≤ <i>d</i> < 1,85	2	—	1	—
1,85 ≤ <i>d</i> < 2,15	2	—	1	1
2,15 ≤ <i>d</i> < 2,80	2	1	1	1
2,80 ≤ <i>d</i> < 4,40	3	—	2	—
4,40 ≤ <i>d</i> < 5,20	3	1	2	—
5,20 ≤ <i>d</i> < 8,20	3	1	—	—
8,20 ≤ <i>d</i> ≤ 10,00	4	—	—	—

^a for Zinc-Alu alloy coatings one dip equals 45 seconds instead of 1 min
^b for Zinc-Alu alloy coatings one dip equals 22 seconds instead of 1/2 min

4.2.5 Special finishes

If drawing after galvanizing is required, it shall be stipulated at the time of enquiry and order or in the appropriate product standard. The same also applies for other special finishes such as wax coating, a polished surface or an exceptionally smooth surface.

4.2.6 Adherence of coating

4.2.6.1 Wrapping test

During the test carried out in accordance with ISO 7802, the coating shall adhere to the steel when subjected to the conditions of wrapping test for adherence. It shall not crack or split to such an extent that slivers of coating can be removed by simply rubbing with the bare fingers. The loosening or detachment during testing of small particles of zinc resulting from mechanical polishing of the surface of the zinc or zinc-alloy coating shall not be considered to be a cause for rejection.

The wrapping test shall be carried out according to ISO 7989-1:2006, 5.3.

4.2.6.2 Assessment of adherence

To assess the adherence of the coating as may be specified in the relevant product standard or for evaluating different conditions of manufacturing, the following procedure may be applied.

Compare the coiled wire to the reference chart (see [Figure 1](#)). Allocate a value of 1 to 5 to the quality of adherence of the coating in accordance with the reference chart in [Figure 1](#).

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