

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

Part 1: General principles

ICS 25.220.40; 77.140.65

National foreword

This British Standard is the UK implementation of EN 10244-1:2009. It supersedes BS EN 10244-1:2001 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee ISE/26, Steel wire.

A list of organizations represented on this committee can be obtained on request to its secretary.

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**Steel wire and wire products - Non-ferrous metallic coatings on
steel wire - Part 1: General principles**

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non ferreux sur fils d'acier - Partie 1 : Principes généraux

Stahldraht und Drahterzeugnisse - Überzüge aus
Nichteisenmetall auf Stahldraht - Teil 1: Allgemeine Regeln

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Foreword

This document (EN 10244-1:2009) has been prepared by Technical Committee ECISS/TC 30 "Steel wires", the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 2009, and conflicting national standards shall be withdrawn at the latest by October 2009.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 10244-1:2001.

This European Standard for non-ferrous metallic coating on steel wire is made up of the following parts:

- *Part 1: General principles*
- *Part 2: Zinc or zinc alloy coatings*
- *Part 3: Aluminium coatings*
- *Part 4: Tin coatings*
- *Part 5: Nickel coatings*
- *Part 6: Copper, bronze or brass coatings*

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1 Scope

This part of this European Standard specifies the requirements for the mass, other properties and testing of non-ferrous metal coatings on steel wire and steel wire products of circular or other cross-section.

This European Standard deals with requirements of general application and is of use for those coatings for which no particular requirements have been laid down in (EN 10244-2 to EN 10244-6). Deviations are possible, particularly if required for well-defined products. In such cases, appropriate requirements should be part of the relevant product standard.

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.

EN 10021, *General technical delivery conditions for steel products*

EN 10218-1, *Steel wire and wire products — General — Part 1: Test methods*

3 Terms and definitions

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

3.1

wire with non-ferrous metallic coating

wire to which a non-ferrous metallic coating has been applied.

NOTE Depending on the metal, the coating may be obtained by dipping in a bath of molten metal, by conversion using a bath of metallic salts in solution, by extrusion, by cladding, by electroplating using an electrolytic solution or by other methods.

4 Requirements relating to coating

4.1 Requirements for the specific type of metal and alloy

The type, quality and grade of coating metal or alloy shall be stated at the time of enquiry and order.

4.2 Coating mass

The coating mass shall be explicitly specified, preferably by reference to the appropriate product standard. If not the appropriate part of this European Standard shall apply.

The mass of the coating shall preferably be expressed as being the mass of coating per unit of surface area of bare wire (g/m^2). Other expressions may be accepted, such as the quantity of coating per unit of weight of coated wire or the thickness of coating. The latter is generally expressed as being the minimum required thickness.

NOTE The thickness of the coating may be converted into an equivalent mass per unit of bare wire surface or vice versa on the basis of the specific mass of the coating material (see Table 1).

A coating of 1 μm thickness corresponds to a total additional diameter of 2 μm for the overall diameter of the coated wire.

Table 1 — Coating mass g/m² equivalent to a thickness of 1 µm

Metal or alloy^a	Mass of coating (g/m²)
Al	2,69
Cu	8,96
Cu-Sn 91-09	8,56
Cu-Zn 63-37	8,47
Ni	8,85
Sn	7,28
Zn	7,14
Zn95/Al5	6,58

^a Percentage compositions expressed in % by weight (Cu-Zn 63-37 = Cu 63%, Zn 37%)

4.3 Appearance of coating

The coating shall be reasonably smooth, as evenly distributed as industrially practicable and not show discontinuities such as bare patches, dross contamination, etc.

4.4 Special finishes

If the purchaser requires a special finish e.g. wax-coating or additional requirements for the coating, these special details shall be agreed at the time of enquiry and order. The inspection methods shall be defined at the same time.

4.5 Adherence of coating

The adherence wrapping test shall be carried out in accordance with EN 10218-1 and the coating shall adhere to the steel below the coating. It shall not crack or split to such an extent that slivers of coating can be removed by simply rubbing with the fingers. The flaking or removal during testing of small particles resulting from mechanical polishing of the coating surface or by contact with the forming equipment shall not be considered to be a cause for rejection.

The wrapping test shall be carried out on wire with a nominal diameter of 7,5 mm or less. Unless otherwise specified, the relationship between the diameter of the coiling mandrel and the diameter of the wire shall be in accordance with 5.3.

In the case of a diameter greater than 7,5 mm, the wrapping test shall be replaced by a bending test in which the wire is bent to least 90 ° around the mandrel.

5 Test conditions

5.1 Selection of samples

5.1.1 The number and the basis for the selection of test pieces shall be defined in the product specification. In the absence of such a definition, the manufacturer and purchaser shall agree between them on the degree of sampling.

5.1.2 When taking the samples, care shall be taken to avoid damaging the surface. Parts of the wire which are visibly damaged shall not be used.

5.1.3 A test piece of a suitable length for the specified tests shall be taken from one or both ends of each coil selected for sampling.

5.2 Determination of mass of coating

5.2.1 Gravimetric method

5.2.1.1 General

The mass of coating shall be determined using a gravimetric method. The metallic coating on a surface of known area is dissolved in a suitable solution to remove the coating completely without attacking the surface of the steel wire. If necessary a suitable inhibitor is added to the solution. The resulting mass loss is determined by weighing the test piece before and after the coating has dissolved.

5.2.1.2 Procedure

If necessary the test piece shall be degreased using an organic solvent which does not attack the coating and the test piece shall then be dried.

Before stripping, the test piece shall be weighed with high accuracy – i.e. better than 1 % of the assumed mass of the coating. The test piece shall be immersed fully in the stripping solution at ambient temperature and left until the coating dissolves completely. A sufficient quantity of solution shall be used to limit any changes in the composition of the stripping solution.

After stripping, the test piece shall be rinsed under running water and, if necessary, brushed to remove any loose substances which may be adhering to the surface; it shall then be plunged into alcohol or any other appropriate solvent, rapidly dried and once again weighed to the accuracy stipulated above.

The surface area of the exposed surface shall then be determined to an accuracy of 1 % by measuring the dimensions of the test piece.

5.2.1.3 Calculation of the coating mass

For the calculation of the coating mass the following symbols are employed:

- m_1 : The mass of the sample before chemical stripping expressed in grams;
- m_2 : The mass of the sample after chemical stripping expressed in grams;
- A : The coated surface of the sample in mm²;
- l : The length of the sample in mm;
- d : The diameter of the chemically stripped wire (in case of round wire) in mm;
- Δm : Weight loss of the sample by the chemical stripping;
- m_A : The mass of coating in g/m².

The mass of coating on the samples is:

$$\Delta m = m_1 - m_2 \quad (\text{in g})$$

The mass of coating per unit surface area = $\frac{\Delta m}{A}$ g/mm²

expressed in g/m² - this becomes: $m_A = \frac{\Delta m \times 10^6}{A} \text{ g/m}^2$ (1)

For round wire the surface area can be expressed as:

$$A = \pi \times d \times l \tag{2}$$

$$m_2 = \frac{\pi d^2}{4} \times l \times 7,85 \times 10^{-3}$$

$$= (\pi \times d \times l) d \times 1,962 \times 10^{-3} \tag{3}$$

Combining (2) and (3) results in:

$$m_2 = A \times d \times 1,962 \times 10^{-3} \text{ g} \tag{4}$$

or $A = \frac{m_2}{1,962 \times d \times 10^{-3}}$ (5)

Combining (1) and (5) results

$$m_A = \frac{\Delta m \times 10^6}{m_2 / 1,962 \times d \times 10^{-3}}$$

$$= \frac{\Delta m}{m_2} \times 10^3 \times d \times 1,962$$

$$= \frac{m_1 - m_2}{m_2} \times d \times 1,962 \quad \text{in g/m}^2 \tag{6}$$

5.2.2 Other methods

Depending on the type of coating, other methods may be used to obtain the mass of the coating more simply and more quickly. The use of these methods is authorized under the following conditions: proof of the validity of the method shall be supplied and in the event of any dispute, only the gravimetric method shall apply.

5.3 Adherence test

If the wire diameter is less than or equal to 7,5 mm, the adherence of the coating shall be tested by wrapping the wire for at least six tight turns around a cylindrical mandrel. Wires of diameter greater than 7,5 mm shall undergo a bending test at an angle of at least 90 ° around the mandrel. Unless otherwise specified in the subsequent parts of this standard or in the product standard the relationship between the diameter of the mandrel and the diameter of the wire shall be in accordance with Table 2.

Table 2 — Diameter of mandrel for wrapping test

Diameter of wire <i>d</i>	Diameter of mandrel
< 4 mm	4 <i>d</i>
≥ 4 mm	5 <i>d</i>

5.4 Retests

Testing and retesting shall be in accordance with EN 10021.

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