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BSI Standards Publication

Steel wire and wire products — Organic coatings on steel wire

Part 4: Polyester coated wire

National foreword

This British Standard is the UK implementation of EN 10245-4:2011. It supersedes BS EN 10245-4:2003 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee ISE/106, Wire Rod and Wire.

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

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Stahldraht und Drahterzeugnisse - Organische Beschichtungen auf Stahldraht - Teil 4: Polyester beschichteter Draht

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents

Foreword

This document (EN 10245-4:2011) has been prepared by Technical Committee ECISS/TC 106 “Wire rod and 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of an identical text or by endorsement, at the latest by April 2012, and conflicting national standards shall be withdrawn at the latest by April 2012.

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 10245-4:2003.

This standard is made up of the following parts:

— *Part 1: General Rules*;

— *Part 2: PVC finished wire*;

— *Part 3: PE coated wire*;

— *Part 4: Polyester coated wire*;

— *Part 5: Polyamide coated wire*.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

This European Standard for organic coatings for steel wire covers the requirements of a general nature and applies also to coatings for which no specific requirements have been established in the subsequent parts of this standard.

The subsequent parts of this standard deal more specifically with clearly defined coatings or groups of coatings. These coatings may have their own particular methods of application and their individual requirements which are specified in these parts of this standard, in other standards or in manufacturers data sheets.

Because the standard specifies requirements and tests not only for the coating but also for the coating material, it has proved not practical to put all the requirements in one clause and all the tests in another one. Following structure has been chosen in order to limit complexity and to facilitate the use.

In writing this series of standards consideration has been given to the nomenclature and transformation of organic coating materials as applied to steel wire products. These organic coating materials may, on application to wire and by their integration into the finished wire product, change their characteristics and properties.

This standard specifies characteristics and tests not only for the organic coating but also for the coating materials both before and after their application to steel wire and wire products. In addition it specifies the requirements for performance levels and testing methods on organic coating material which have become an integral and permanent part of the finished wire product. Therefore it has proven not to be practical to put all requirements in one clause and all the tests in another one.

To aid continuity and in order to limit complexity, the following structure has been chosen for this standard:

— **Clause 5** deals with the characteristics and testing methods of organic coating material as supplied by the manufacturer for the purposes of its application to the wire product.

  Tests described in this section are intended to be carried out by the organic coating material manufacturer or the applicator **before** the coating operation.

— **Clause 6** relates to the characteristics and testing methods for the "organic coating" when the organic coating material has been applied to and has become an integral part of the finished wire. Consequently tests are intended to be in the main carried out by the coating "applicators".

— **Clause 7** defines the performance requirements and testing methods on the "organic coating" of the finished wire product, and where this is not possible, tests will be carried out on "coated" panels Scope

1 Scope

Complementary to EN 10245-1, this European Standard specifies the characteristics and requirements for steel wire and wire products coated with polyester.

It covers both thermoplastic and thermosetting polyester.

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 10245-1, *Steel wire and wire products — Organic coatings on steel wire — Part 1: General rules*

EN ISO 527-3, *Plastics — Determination of tensile properties — Part 3: Test conditions for films and sheets (ISO 527-3:1995)*

EN ISO 868, *Plastics and ebonite — Determination of indentation hardness by means of a durometer (Shore hardness) (ISO 868:2003)*

EN ISO 1183-1, *Plastics — Methods for determining the density of non-cellular plastics — Part 1: Immersion method, liquid pyknometer method and titration method (ISO 1183-1:2004)*

EN ISO 1183-2, *Plastics — Methods for determining the density of non-cellular plastics — Part 2: Density gradient column method (ISO 1183-2:2004)*

EN ISO 1183-3, *Plastics — Methods for determining the density of non-cellular plastics — Part 3: Gas pyknometer method (ISO 1183-3:1999)*

EN ISO 2813, *Paints and varnishes — Determination of specular gloss of non-metallic paint films at 20°, 60° and 85° (ISO 2813:1994, including Technical Corrigendum 1:1997)*

EN ISO 2815, *Paints and varnishes — Buchholz indentation test (ISO 2815:2003)*

EN ISO 3231, *Paints and varnishes — Determination of resistance to humid atmospheres containing sulfur dioxide (ISO 3231:1993)*

EN ISO 3668, *Paints and varnishes — Visual comparison of the colour of paints (ISO 3668:1998)*

EN ISO 4892-1, *Plastics — Methods of exposure to laboratory light sources — Part 1: General guidance (ISO 4892-1:1999)*

EN ISO 4892-2, *Plastics — Methods of exposure to laboratory light sources — Part 2: Xenon-arc lamps (ISO 4892-2:2006)*

ISO 4582, *Plastics — Determination of changes in colour and variations in properties after exposure to daylight under glass, natural weathering or laboratory light sources*

ISO 7724-1, *Paints and varnishes — Colorimetry — Part 1: Principles*

ISO 7724-2, *Paints and varnishes — Colorimetry — Part 2: Colour measurement*

ISO 7724-3, *Paints and varnishes — Colorimetry — Part 3: Calculation of colour differences*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 10245-1 and the following apply.

3.1
polyester
organic material which is the result of a polycondensation reaction of a polyhydroxy compound with di- or polycarbon acids

NOTE There are two main classes of polyester: the linear polyesters and the crosslinked polyesters. Linear polyesters generally are thermoplastic, whereas crosslinked polyester is thermosetting and is hard.

3.2
polyethyleneglycoltereftalate (PET)
one of the most commonly used linear polyesters

NOTE PET is only the abbreviation of polyethyleneglycoltereftalate. The designation of other types of polyester by PET is not correct and is to be avoided.

4 Methods of application of polyester coatings

The most commonly used method for polyester coating on wire is by extrusion and for coating of wire products is by powder coating. The coating may be applied directly on the surface of the wire or wire product or after applying a primer. Where appropriate other methods may be used.

5 Requirements and testing methods for polyester coating material

5.1 General

Unless otherwise specified the test methods for polyester coating material shall be in accordance with EN 10245-1.

5.2 Composition and method of application

The coating material shall be free of lead (Pb), cadmium (Cd) and benzoin. Other requirements for the composition shall be agreed between manufacturer and applicator and shall take account of this method of application. However, the polyester coating material shall fulfil the requirements of this standard. The processing of the polyester coating material shall be at the manufacturer's discretion.

The requirements for the polyester intended for extrusion are those for PET. For other coating material other requirements may be agreed between the parties.

5.3 Consistency

The manufacturer shall ensure that the organic coating material composition and its characteristics shall remain constant from batch to batch and unchanged from that as agreed at the time of inquiry and ordering.

The manufacturer shall immediately notify the applicator of any subsequent change in the type and quantity of the constituent parts of the composition once this has been agreed between the two parties.

At the request of the supplier or purchaser the presence of certain elements may be limited. In any case, the compound composition shall be cadmium-free.

5.4 Density

Unless otherwise agreed between the applicator and the coating material supplier the density of the coating material, when tested in accordance with EN ISO 1183- 1 to -3, shall be in accordance with Table 1.

Where the apparent density of the supplied powder is specified, requirements and test methods shall be agreed between the parties.

5.5 Hardness

When measured in accordance with EN ISO 868 the Shore hardness D shall be in accordance with Table 1. If so agreed between the parties the Bucholtz hardness, when measured in accordance with EN ISO 2815, shall be in accordance with Table 1.

5.6 Tensile strength

When tested in accordance with EN ISO 527-3 the minimum tensile strength shall be in accordance with Table 1.

5.7 Elongation

When tested in accordance with EN ISO 527-3 the elongation shall be in accordance with Table 1.

Table 1 — Requirements and tests for the coating material

Characteristics	Requirements for		Test method
	Thermoplastics materials	Thermosetting materials	
Density (kg/dm^3)	Neutral, uncoloured: 1,30 – 1,40 [a]	White: 1,50 – 1,70 $\pm$ 0,05 [a] Green: 1,45 – 1,65 $\pm$ 0,05	EN ISO 1183-1 to -3
Shore hardness D	Min. 76	not applicable	EN ISO 868
Bucholtz hardness	Not applicable	Min. 90	EN ISO 2815
Tensile strength MPa	Min. 55	not applicable	EN ISO 527-3
Elongation %	Min. 300	$>$ 50	EN ISO 527-3
[a] For other colours the density shall be by agreement.			

6 Requirements and test methods for polyester coating on wire and wire products

6.1 General

In addition to the general requirements of EN 10245-1, polyester coatings shall satisfy following requirements. The coating requirements are summarized in Table 2.

6.2 Appearance

Following examination by visual inspection with the naked eye, the surface of the polyester coating shall be smooth, shiny, free from irregularities and uniform in colour.

Small dents, not affecting subsequent use and resulting from contact with adjacent turns, shall not constitute a cause for rejection.

6.3 Colour

When tested in accordance with the parts of ISO 7724-1 to -3 for colour comparison the polyester coating shall be in accordance with Table 2. When colour difference is evaluated in accordance with EN ISO 3668 the polyester coating shall be in accordance with Table 2.

6.4 Gloss

When tested in accordance with EN ISO 2813 the gloss of the polyester coating shall be in accordance with Table 2.

6.5 Thickness

When tested in accordance with EN 10245-1 the thickness of the polyester coating shall be in accordance with Table 2.

For round wire the thickness shall be the average of two measurements at right angles and at 3 cross sections of a sample, which shall not be more than 200 mm long.

For round wire with a diameter of 4 mm and above, for other shapes and for wire products, the thickness may be measured by the magnetic method in accordance with EN ISO 2178.

6.6 Elongation

This test is optional. When tested, the elongation of the PET coating shall be minimum 200 %.

6.7 Concentricity

When tested in accordance with EN 10245-1 the concentricity of the polyester coating shall be in accordance with Table 2.

6.8 Adherence

If so agreed between the parties, the adherence of polyester coating on round wire when tested in accordance with EN 10245-1 shall be in accordance with Table 2.

For other polyester coated wire, when an X-cut is made on the coating of thicker wire and wire products, up to the substrate, the loss of adherence shall be in accordance with Table 2.

Table 2 — Requirements and tests for polyester on wire and wire products

Characteristic	Requirements for		Test method
	Thermoplastics materials	Thermosetting materials	
Appearance	6.1.1 see EN 10245-1	6.1.1 see EN 10245-1	Visual inspection with the naked eye
Colour light colours dark colours	 $\Delta E \leq 1$ $\Delta E \leq 2$	 $\Delta E \leq 1$ $\Delta E \leq 2$	ISO 7724-1 to -3 For colour comparison EN ISO 3668
Gloss	0 - 50: tol.: ± 5 ≥ 50: tol.: ± 10	0 - 50: tol.: ± 5 ≥ 50: tol.: ± 10	EN ISO 2813
Thickness	Min.: 20 μm or according to product specification	Min.: 60 μm or according to product specification	EN 10245-1
Concentricity	Min.: 60 %	Min.: 60 % where applicable	EN 10245-1
Adherence round wire other and wire products	 Grade: 0 or 1 Max. 5 mm loss at the incision	 Grade: 0 or 1 Max. 5 mm loss at the incision	 EN 10245-1 6.8

7 Performance requirements and tests for the polyester coating on the finished wire and wire products

7.1 General

The performance requirements and test methods are summarized in Table 3.

Tests shall be carried out on samples of the finished wire or wire product. Where this is not possible or practical the parties may agree to perform the tests on coated panels.

7.2 Colour stability (accelerated weathering)

When tested in accordance with EN ISO 4892-1 and EN ISO 4892-2 and assessed for colour change in accordance with ISO 4582 after exposure to artificial light xenon arc source for a period of 2 500 hours, the colour difference and degradation shall be in accordance with Table 3.

The conditions during testing shall be to the following cycle: UV radiation black panel temperature 63°C for 4 hours followed by UV radiation at a relative humidity of 50 % for 4 hours.

The lamp shall be xenon arc lamp type A according to EN ISO 4892-2.

NOTE Other specific test parameters and requirements may be agreed between the parties in order to take specific product characteristics into consideration.

7.3 Kesternich test

If so agreed between the parties, when tested in accordance with EN ISO 3231 the results of the Kesternich test on polyester coating on finished wire shall be in accordance with Table 3.

7.4 Boiling water test

When tested in accordance with EN 10245-1 the adhesion of polyester coating on round finished wire shall be in accordance with Table 3.

For powder coated wire products, when tested in accordance with the X-cut test in 6.8, the loss of adhesion shall be in accordance with Table 3.

Samples shall be immersed in boiling demineralized or distilled water for two hours, followed by drying for 1 hour at ambient temperature (18 °C to 25 °C).

Table 3 — Performance requirements and tests

Characteristic	Requirement	Test method
Colour stability	ΔE: max. 5 (2500 h) Gloss: min. 50	EN ISO 4892-1 and EN ISO 4892-2
Kesternich test	No detachment of the coating	EN ISO 3231
Resistance to boiling water Round wire Wire products	 Grade: 1 No adhesion loss after 2 h	 EN 10245-1 X-cut test; 6.8

8 Retests

Procedures shall be in accordance with the relevant clauses of EN 10021.

9 Inspection and quality assurance

The inspection shall be in accordance with the procedures defined in EN 10021. Compliance with these requirements may be based on a certificate of compliance submitted by the manufacturer or the applicator, or on inspection documents according to EN 10204 or similar drawn up at the time of inspection by the applicator or wire product manufacturer or any other similar document based on the quality control system operated by the applicator or wire products manufacturers. In any case it is recommended that for purposes of traceability the batch number and inspection references be given.

Bibliography

[1] EN 10204, *Metallic products — Types of inspection documents*

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

[3] EN 10218-2, *Steel wire and wire products — General — Part 2: Wire dimensions and tolerances*

[4] EN ISO 2178, *Non-magnetic coatings on magnetic substrates — Measurement of coating thickness — Magnetic method (ISO 2178:1982)*

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