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Prednapeta jekla - Povoskane in oplaščene niti za uporabo v gradbeništvu

Prestressing steels - Waxed and sheathed strands for construction applications

Spannstähle - Gewachste und gehüllte Litzen für Bauanwendungen

Aciers de précontrainte - Torons gainés cirés pour applications dans la construction

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ICS:

77.140.15 Jekla za armiranje betona Steels for reinforcement of concrete

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Prestressing steels - Waxed and sheathed strands for construction applications

Aciers de précontrainte - Torons gainés cirés pour applications dans la construction

Spannstähle - Gewachste und gehüllte Litzen für Bauanwendungen

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 459/SC 4.

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European foreword

This document (prEN 18035:2023) has been prepared by Technical Committee CEN/TC 459/SC 4 “Concrete reinforcing and prestressing steels”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN enquiry.

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1 Scope

This document specifies the requirements for uncoated high strength steel strands or zinc or zinc alloy coated high strength steel strands, encapsulated with wax and a sheath for construction applications.

The document applies only to products as supplied by the manufacturer.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 10020, *Definition and classification of grades of steel*

EN 10204, *Metallic products — Types of inspection documents*

EN 10244-1, *Steel wire and wire products — Non-ferrous metallic coatings on steel wire — Part 1: General requirements*

EN 10244-2, *Steel wire and wire products — Non-ferrous metallic coatings on steel wire — Part 2: Zinc or zinc alloy coatings*

EN ISO 175, *Plastics — Methods of test for the determination of the effects of immersion in liquid chemicals (ISO 175)*

EN ISO 527-1, *Plastics — Determination of tensile properties — Part 1: General principles (ISO 527-1)*

EN ISO 527-2, *Plastics — Determination of tensile properties — Part 2: Test conditions for moulding and extrusion plastics (ISO 527-2)*

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

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

EN ISO 10304-1, *Water quality — Determination of dissolved anions by liquid chromatography of ions — Part 1: Determination of bromide, chloride, fluoride, nitrate, nitrite, phosphate and sulfate (ISO 10304-1)*

EN ISO 10304-4, *Water quality — Determination of dissolved anions by liquid chromatography of ions — Part 4: Determination of chlorate, chloride and chlorite in water with low contamination (ISO 10304-4)*

EN ISO 15630-3, *Steel for the reinforcement and prestressing of concrete — Test methods — Part 3: Prestressing steel (ISO 15630-3)*

EN ISO 16120-1, *Non-alloy steel wire rod for conversion to wire — Part 1: General requirements (ISO 16120-1)*

EN ISO 16120-2, *Non-alloy steel wire rod for conversion to wire — Part 2: Specific requirements for general purpose wire rod (ISO 16120-2)*

EN ISO 16120-4, *Non-alloy steel wire rod for conversion to wire — Part 4: Specific requirements for wire rod for special applications (ISO 16120-4)*

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

ISO 2137, *Petroleum products and lubricants — Determination of cone penetration of lubricating greases and petrolatum*

ISO 2176, *Petroleum products — Lubricating grease — Determination of dropping point*

ISO 2207, *Petroleum waxes — Determination of congealing point*

ISO 6964, *Polyolefin pipes and fittings — Determination of carbon black content by calcination and pyrolysis — Test method*

ISO 11357-6, *Plastics — Differential scanning calorimetry (DSC) — Part 6: Determination of oxidation induction time (isothermal OIT) and oxidation induction temperature (dynamic OIT)*

ISO 18553, *Method for the assessment of the degree of pigment or carbon black dispersion in polyolefin pipes, fittings and compounds*

BS 2000-121, *Methods of test for petroleum and its products — Determination of oil separation from lubricating grease — Pressure filtration method*

DIN 51817, *Testing of lubricants — Determination of oil separation from greases under static conditions*

NF M 07-023, *Liquid fuels — Determination of chlorides in crude petroleum and petroleum products*

NF T 60-191, *Petroleum products and lubricating greases — Oil separation on storage of grease — Static conditions under pressure*

ASTM D942, *Standard Test Method for Oxidation Stability of Lubricating Greases by the Oxygen Pressure Vessel Method*

ASTM D1693, *Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics*

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp/>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1

uncoated strand

strand consisting of uncoated high strength steel wires

3.2

zinc or zinc alloy coated strand

strand consisting of zinc or zinc alloy hot-dip coated high strength steel wires

3.3

waxed and sheathed strand

uncoated or zinc or zinc alloy coated strand encapsulated with wax and a sheath

prEN 18035:2023 (E)**3.4****sheath**

continuous envelope surrounding the strand

3.5**batch of wax**

quantity of wax produced in one manufacturing operation

4 Symbols

The symbols used in this document and the corresponding designations are given in Table 1.

Table 1 — Symbols and corresponding designations

Symbol	Unit	Designation
A_{gt}	%	Percentage total extension at maximum force
D	%	Average coefficient of reduction of the maximum force in the deflected tensile test
D_i	mm	Minimum diameter of the coil of waxed and sheathed strand
E	MPa	Modulus of elasticity of the strand
F_0	kN	Initial force in the isothermal stress relaxation test and the stress corrosion test
F_m	kN	Maximum force
$F_{m,a}$	kN	Mean maximum force of the two test pieces adjacent to the test piece submitted to the relaxation test, fatigue test or corrosion test
$F_{p0,1}$	kN	0,1% proof force
F_r	N	Force range in the axial force fatigue test
ΔF_{rt}	N	Force loss in the test piece at time t in the isothermal stress relaxation test
F_{up}	N	Upper force in the axial force fatigue test
L	mm	Length of the test piece
M	g	Nominal mass per meter of the strand
M_t	g	Total mass of the test piece
M_s	g	Mass of the sheath
M_w	g	Total mass of wires
M_{wl}	g/m	Mass of wax per unit length
N		Number of force cycles in the axial force fatigue test
S_n	mm ²	Nominal cross-sectional area of the strand
t_a	h	Minimum lifetime to fracture in the stress corrosion test
$t_{f,m}$	h	Median lifetime to fracture in the stress corrosion test
t_n	mm	Minimum thickness of the sheath
Δm	%	Deviation from the nominal mass per meter

5 Classification and designation

5.1 Classification

The steels of the constituent strands of waxed and sheathed strands covered by this document shall be classified as special steels according to EN 10020.

5.2 Designation

The designation of the products covered by this document comprises in the order:

- the description of the product (i.e. waxed and sheathed strand);
- the designation of the strand from which the waxed and sheathed strand is produced in square brackets;
- the symbol + W for wax;
- the thickness class;
- the colour of the sheath when other than black, when applicable.

EXAMPLE

Waxed and sheathed strand [Y1860S7+ZA-15,7-R1-F3-D2]+W-T_n2 white designates a waxed and sheathed strand with a thickness class T_n2, made from a strand coated with a zinc-aluminium alloy of nominal diameter 15,7 mm, strength class 1 860 MPa, relaxation class R1, fatigue class F3 and class D2 of deflected tensile properties, of white colour.

NOTE The strength class is only used for designation purposes (see EN 10027-1). The strength class corresponds to the tensile strength obtained by dividing the maximum force (F_m) by the nominal cross-sectional area (S_n).

6 Information to be obtained by the manufacturer

The following information shall be obtained at the time of enquiry and order:

- a) designation of the product in accordance with 5.2;
- b) the packaging and protection requirements;
- c) the requirements concerning information to accompany the delivery (e.g. date of manufacture, delivery note, type of inspection document, see EN 10204, copies of force/extension diagrams);
- d) special requirements for labelling.

7 Requirements

7.1 Manufacturing process

The manufacturing method of the waxed and sheathed strands shall be at the discretion of the manufacturer provided that:

- the base strands are manufactured from wire produced with wire rod conforming to EN ISO 16120-1 and EN ISO 16120-2 or EN ISO 16120-1 and EN ISO 16120-4. Strands with normal production

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lengths may contain welds made in the individual wires before cold working but shall not contain welds made during or after cold working;

- in the case of zinc or zinc alloy coated strands, the coating of the constituent wires of the strand shall be completed before stranding;
- the sheath is applied to the waxed strand by direct extrusion and all the requirements of this document are fulfilled.

7.2 Requirements for the constituent materials of the waxed and sheathed strands**7.2.1 Wax**

The wax shall meet the requirements given in Table 2.

Table 2 — Requirements for waxes

Specified property	Reference of the test method	Specified values
Aggressive elements: Cl ⁻ , S ²⁻ , NO ₃ ⁻ , SO ₄ ²⁻	NF M 07-023 for the extraction method Measurement methods EN ISO 10304-4 for Cl ⁻ ; EN ISO 10304-1 for NO ₃ ⁻ , SO ₄ ²⁻ . Common ion chromatography for S ²⁻	≤ 50 ppm ≤ 50 ppm ≤ 100 ppm
Congealing point	ISO 2207	≥ 65 °C
Drop melting point	ISO 2176	≥ 60 °C
Cone penetration (1/10 mm; at 25 °C)	ISO 2137	≤ 125
Bleeding at 40 °C	NF T 60-191 ^a DIN 51817 BS 2000-121 (without the 100 g mass)	≤ 1,0 %
Oxidation stability	ASTM D942	≤ 0,03 MPa (100 h at 100 °C)
Red rust protection with a wax layer of 125 µm ± 5 µm - Saline fog at 5 % NaCl	EN ISO 9227	Pass a test of 168 h ± 2 h at 35 °C ± 1 °C (no corrosion)
^a After 7 days, without the 100 g mass.		

7.2.2 Base material of the sheath

The base material used for black sheaths shall be a high-density polyethylene (HDPE) and use carbon black as a filler. It shall meet the requirements given in Tables 3 and 4.