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Jeklena žica za vzmeti - 3. del: Nerjavna jeklena žica za vzmeti

Steel wire for mechanical springs - Part 3: Stainless spring steel wire

Stahldraht für Federn - Teil 3: Nichtrostender Federstahldraht

Fils en acier pour ressorts mécaniques - Partie 3: Fils en acier inoxydable

Ta slovenski standard je istoveten z: **prEN 10270-3**

ICS:

77.140.25	Vzmetna jekla	Spring steels
77.140.65	Jeklene žice, jeklene vrvi in verige	Steel wire, wire ropes and link chains

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Steel wire for mechanical springs - Part 3: Stainless spring steel wire

Fils en acier pour ressorts mécaniques - Partie 3: Fils en acier inoxydable

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COMITÉ EUROPÉEN DE NORMALISATION
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Contents

Page

Foreword

This document (prEN 10270-3:2008) has been prepared by Technical Committee ECISS/TC 30 “Steel wires”, the secretariat of which is held by AFNOR.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 10270-3:2001.

This European Standard for steel wire for mechanical springs is composed of the following parts:

— *Part 1: Patented cold drawn unalloyed spring steel wire*

— *Part 2: Oil hardened and tempered spring steel wire*

— *Part 3: Stainless spring steel wire*

1 Scope

1.1 This Part of EN 10270 applies to the grades of stainless steels listed in Table 1, which are usually used in the cold drawn condition in the form of wire of circular cross-section up to 10,00 mm in diameter, for the production of springs and spring parts that are exposed to corrosive effects and sometimes to slightly increased temperatures (see A.1).

1.2 In addition to the steels listed in Table 1 certain of the steel grades covered by EN 10088-3 e.g.1.4571, 1.4539, 1.4028 are also used for springs, although to much lesser extent. In these cases the mechanical properties (tensile strength, etc.) should be agreed between purchaser and supplier. Similarly, diameters between 10,00 mm and 15,00 mm may be ordered against this standard; in this case the parties should agree upon the required mechanical characteristics.

1.3 In addition to this part of EN 10270 the general technical delivery requirements of EN 10021 are applicable.

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 10002-1, *Metallic materials — Tensile test — Part 1: Method of test at ambient temperature.*

EN 10021, *General technical delivery requirements for steel products*.

EN 10027-1, *Designation systems for steel — Part 1: Steel names*.

EN 10027-2, *Designation systems for steel — Part 2: Numerical system*.

EN 10088-3, *Stainless steels — Part 3: Technical delivery conditions for semi-finished products, bars, rods, wire sections and bright products of corrosion resisting steels for general purposes*.

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

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

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

CR 10261, *Iron and steel — Review of available methods of chemical analysis*.

EN ISO 377, *Steel and steel products — Location and preparation of samples and test pieces for Mechanical testing*.

EN ISO 14284, *Steel and iron — Sampling and preparation of samples for the determination of chemical composition (ISO 14284:1996)*.

3 Designation

For products supplied according to this standard the designation shall state in the following order:

— the term spring wire or straightened and cut lengths;

— the number of this European standard: EN 10270-3;

— the steel grade, and where applicable the tensile strength level;

— the nominal wire diameter;

— the coating - if any.

EXAMPLE Standard designation of a stainless steel spring wire according to this standard - grade 1.4310 - normal strength level and nominal diameter 2,50 mm, nickel coated:

Spring wire EN 10270-3 - 1.4310 - NS - 2,50 Ni coated

4 Information to be supplied by the purchaser

The purchaser shall clearly state in his enquiry or order the product and following information:

a) the desired quantity;

b) the number of this European Standard: EN 10270-3;

c) the steel grade and for grade 1.4310 also the tensile strength level;

d) the nominal wire diameter;

e) the surface finish (see 5.3);

f) the form of delivery (see 5.2);

g) the type of inspection document (see 7.1) to be supplied;

h) any particular agreement made.

EXAMPLE 2 t stainless spring steel wire EN 10270-3 - 1.4310 - NS - 2,50 nickel coated in coils inspection document EN 10204 - 3.1.B

5 Requirements

5.1 Manufacturing process

Unless otherwise agreed in the order, the manufacturing process used in the making of the stainless steel wire is left to the discretion of the manufacturer. The starting condition (+AT: solution annealed) of the wire (rod) is specified in EN 10088-3.

5.2 Form of delivery

The wire shall be supplied in coils, on spools, on spoolless cores or carriers. Several coils may be assembled on a carrier. Unless otherwise specified the form of delivery shall be at the manufacturer's discretion. He shall however inform the purchaser about the form of delivery.

The delivery requirements are specified in 5.7.

Wire in straight lengths is normally supplied in bundles.

5.3 Surface finish

The wire may be coated or not. The specific coating and finish for stainless steel spring wire shall be agreed upon at the time of enquiry and order - e.g. uncoated, polished finish, nickel coated.

5.4 Chemical composition

5.4.1 The requirements for the chemical composition given in Table 1 apply to the heat analysis.

5.4.2 The permissible deviation of the product analysis from the values specified in Table 1 shall be in accordance with the provision in EN 10088-3. For a single heat the deviation of an element in the product analysis may be only below the minimum or only above the maximum value of the range specified for the heat analysis, but not both at the same time.

Table 1 — Chemical composition — Heat analysis[a] (% by mass)

Steel grade		C	Si max.	Mn max.	P max.	S max.	Cr	Mo	Ni	others
Name [b]	Number [b]									
X10CrNi18-8	1.4310	0,05 to 0,15	2,00	2,00	0,045	0,015	16,00-19,00	≤ 0,80	6,00-9,50	N:≤ 0,11
X5CrNiMo17-12-2	1.4401[c]	≤ 0,07	1,00	2,00	0,045	0,015	16,50-18,50	2,00-	10,00-13,00	N:≤ 0,11
X7CrNiAl17-7	1.4568	≤ 0,09	0,70	1,00	0,040	0,015	16,00-18,00	2,50[c]	6,50-7,80	Al: 0,70-1,50
X5CrNi18-10	1.4301	≤ 0,07	1,00	2,00	0,045	0,015	17,5-19,5	-	8,0-10,5	N:≤ 0,11

[a] Alternative compositions may be used by agreement.

[b] Names and numbers are derived in accordance with EN 10027 — Part 1 and Part 2 respectively.

[c] Steel 1.4436 may be used to provide increased corrosion resistance compared with 1.4401, with the specification of this part of EN 10270 applicable for steel 1.4401.

[d] For better cold formability the upper limit may be increased to 8,30 %.

Table 2 — Tensile strength in the drawn condition

	Tensile strength (MPa) [a b c d e f] for the following steel grades				
	1.4310		1.4401	1.4568	1.4301
Nominal diameter mm [g]	Normal tensile strength (NS)-min.	High tensile strength (HS)-min.	min.	min.	min.
$d \leq 0{,}20$	2 200	2 350	1 725	1 975	2 000
$0{,}20 < d \leq 0{,}30$	2 150	2 300	1 700	1 950	1 975
$0{,}30 < d \leq 0{,}40$	2 100	2 250	1 675	1 925	1 925
$0{,}40 < d \leq 0{,}50$	2 050	2 200	1 650	1 900	1 900
$0{,}50 < d \leq 0{,}65$	2 000	2 150	1 625	1 850	1 850
$0{,}65 < d \leq 0{,}80$	1 950	2 100	1 600	1 825	1 800
$0{,}80 < d \leq 1{,}00$	1 900	2 050	1 575	1 800	1 775
$1{,}00 < d \leq 1{,}25$	1 850	2 000	1 550	1 750	1 725
$1{,}25 < d \leq 1{,}50$	1 800	1 950	1 500	1 700	1 675
$1{,}50 < d \leq 1{,}75$	1 750	1 900	1 450	1 650	1 625
$1{,}75 < d \leq 2{,}00$	1 700	1 850	1 400	1 600	1 575
$2{,}00 < d \leq 2{,}50$	1 650	1 750	1 350	1 550	1 525
$2{,}50 < d \leq 3{,}00$	1 600	1 700	1 300	1 500	1 475
$3{,}00 < d \leq 3{,}50$	1 550	1 650	1 250	1 450	1 425
$3{,}50 < d \leq 4{,}25$	1 500	1 600	1 225	1 400	1 400
$4{,}25 < d \leq 5{,}00$	1 450	1 550	1 200	1 350	1 350
$5{,}00 < d \leq 6{,}00$	1 400	1 500	1 150	1 300	1 300
$6{,}00 < d \leq 7{,}00$	1 350	1 450	1 125	1 250	1 250
$7{,}00 < d \leq 8{,}50$	1 300	1 400	1 075	1 250	1 200
$8{,}50 < d \leq 10{,}00$	1 250	1 350	1 050	1 250	1 175

[a] Tensile strength calculated on actual diameter.

[b] The maximum tensile strength shall be the min. value plus 15 % of the minimum value. The range of tensile strength values within a production batch of the same heat shall be maximum 9 % of the minimum values in this table.

[c] After straightening, the tensile strength may be reduced by up to 10 %.

[d] When better formability is required, lower tensile strength values may be agreed upon.

[e] The wire is supplied in the cold drawn condition. The tensile strength in the finished spring may be substantially influenced by a heat treatment; particularly precipitation hardening of grade 1.4568 results in substantially higher tensile strength (see A.5.2 and Table A.3).

[f] 1 MPa = 1 N/mm^2.

[g] Larger diameters may be specified in which case the parties shall agree the tensile strength at the time of enquiry and order.

5.5 Mechanical properties

5.5.1 For the tensile strength in the as drawn condition the data of Table 2 shall apply.

NOTE 1 Grade 1.4310 can be delivered in normal tensile strength (NS) or high tensile strength (HS).

NOTE 2 For steel 1.4568 the characteristics of the springs are not only determined by the characteristics of the drawn wire but also by the heat-treatment of the spring (see A.2). Therefore the steel should be of such quality so that by the heat treatment after drawing the mechanical properties are met.

5.5.2 In addition to the requirements of Table 2 the maximum tensile strength range within one unit package (individual coil, spool or reel,...) shall satisfy Table 3.

For straightened and cut lengths the values of Table 3 apply for the individual bundles.

Table 3 — Tensile strength range within an individual unit package (coil/spool/bundle)

Wire diameter *d* (mm)	**Max. range** (MPa)
$d \leq 1{,}50$	100
$1{,}50 < d \leq 10{,}00$	70

5.6 Technological properties

5.6.1 Coiling test

For evaluation of uniformity of coiling and surface condition the coiling test may be applied to wire with a diameter of 0,50 mm to 1,50 mm. The spring coiled in accordance with 6.4.3 shall show a defect free surface condition without splits or fracture; the coil shall have uniform pitch of the turns and a fair dimensional regularity of its diameter.

NOTE Although the usefulness of the coiling test is not generally recognized, it has been retained since it offers the possibility of revealing internal stresses. If doubtful test results are obtained the wire concerned should not be rejected immediately but efforts should be made by the parties concerned to elucidate the cause.

5.6.2 Wrapping test

The wrapping test may be applied to wire with a diameter of 0,30 mm to 3,00 mm. The wire shall not show any sign of cracks or surface imperfections when closely wrapped eight turns around a mandrel of a diameter equal to the wire size (see also 6.4.4).

5.6.3 Bend test

Where requested, the bend test may be applied for wire with a diameter over 3,00 mm. The wire shall withstand the test without any sign of failure.

NOTE In some applications the material is severely deformed by bending. Such is the case for extension springs with tight hooks, springs with bends on legs, spring wire forms, etc. In such cases the bend test provides for a wire test very close to actual use.

5.7 Supply conditions of wire on coils/reels and spools

5.7.1 General

The wire of each coil shall consist of one single length of wire originating from only one heat. It shall be wound so that there are no kinks.

Where wire is delivered on spools, spoolless cores or carriers up to 10 % of those may consist of a maximum of two wire lengths. The joints shall be properly made, suitably marked and labelled.

5.7.2 Coil size

The internal diameter of unit packages (coil/reels or spools) shall reach at least the values given in Table 4, unless otherwise agreed.

Table 4 — Wire diameter and associated minimum coil internal diameter

Wire diameter (*d*) (mm)	**Minimum internal diameter** (mm)
$0{,}18 \leq d \leq 0{,}28$	100
$0{,}28 < d \leq 0{,}50$	150
$0{,}50 < d \leq 0{,}70$	180
$0{,}70 < d \leq 1{,}60$	250
$1{,}60 < d \leq 4{,}50$	400
$4{,}50 < d$	500

5.7.3 Circular wire cast

The wire shall be uniformly cast and take a circular cast. Unless otherwise specified the wap diameter of the wire supplied in coils/reels may expand when the binding wires are removed, but should usually not retract to less than the unit internal diameter, other than by agreement between supplier and purchaser. The expansion shall be approximately even within a single unit package and within all the units in a production batch.

5.7.4 Helix cast of wire

The wire shall be dead cast, free from helix cast. The requirement shall be considered fulfilled in the case of wire below 5,00 mm if the following condition is satisfied.

An individual wap taken from a unit package and freely hung on a hook may show an axial displacement 'f' at the ends of the wap (see Figure 1); the displacement f shall not exceed a value given by the following equation:

$$f \leq \frac{0{,}2D}{\sqrt[4]{d}}$$

where

f the axial displacement in mm;

D the diameter of the free wap in mm;

d the diameter of the wire in mm.