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Jeklena žica za vzmeti - 1. del: Patentirana hladno vlečena nelegirana jeklena žica za vzmeti

Steel wire for mechanical springs - Part 1: Patented cold drawn unalloyed spring steel wire

Stahldraht für Federn - Teil 1: Patentiert gezogener unlegierter Federstahldraht

Fils en acier pour ressorts mécaniques - Partie 1: Fils pour ressorts en acier non allié, patentés, tréfilés à froid

Ta slovenski standard je istoveten z: **EN 10270-1:2011**

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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EUROPEAN STANDARD

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Steel wire for mechanical springs - Part 1: Patented cold drawn unalloyed spring steel wire

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Foreword

This document (EN 10270-1:2011) 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of an identical text or by endorsement, at the latest by April 2012, and conflicting national standards shall be withdrawn at the latest by April 2012.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 10270-1:2001.

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*.

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.

1 Scope

1.1 This European Standard applies to patented cold drawn unalloyed steel wire of circular cross-section for the manufacture of mechanical springs for static duty and dynamic duty applications.

1.2 In addition to this European Standard, 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 10021, *General technical delivery conditions for steel products*

EN 10052, *Vocabulary of heat treatment terms for ferrous products*

EN 10204:2004, *Metallic products — Types of inspection documents*

EN 10218-1:2011, *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*

EN 10244-2:2009, *Steel wire and wire products — Non-ferrous metallic coatings on steel wire — Part 2: Zinc or zinc alloy coatings*

CEN/TR 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 (ISO 377:1997)*

EN ISO 3887, *Steels — Determination of depth of decarburization (ISO 3887:2003)*

EN ISO 6892-1, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature (ISO 6892-1:2009)*

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

EN ISO 16120-1, *Non-alloy steel rod for conversion to wire — Part 1: General requirements (ISO 16120-1:2011)*

EN ISO 16120-2, *Non-alloy steel wire rod for conversion to wire - Part 2: Specific requirements for general-purpose wire rod (ISO 16120-2:2011)*

EN ISO 16120-4, *Non-alloy steel wire rod for conversion to wire - Part 4: Specific requirements for wire rod for special applications (ISO 16120-4:2011)*

3 Terms and definitions

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

3.1
patented cold drawn wire
wire drawn to size by cold deformation of a starting material that has been subjected to a thermal treatment of patenting (see EN 10052), giving structure suitable for subsequent rolling or drawing

4 Classification

The grade of spring wire used depends on the stress level and the nature of the duty. Where springs are subjected to static stresses or infrequent dynamic loading a wire grade for static duty (S) shall be used. In the other cases with frequent or predominantly dynamic loading and where small coiling ratios or severe bending radius is required, a wire grade for dynamic duty (D) shall be used. Depending on the stress level, spring wire is manufactured in 3 tensile strength grades: Low, medium and high.

Table 1 gives an overview of the different grades.

Table 1 — Spring wire grades

Tensile strength [a]	Static	Dynamic
Low tensile strength	SL	—
Medium tensile strength	SM	DM
High tensile strength	SH	DH
[a] For specific applications another tensile strength may be agreed.		

5 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 term spring steel wire or straightened and cut lengths;

c) the number of this European standard: EN 10270-1;

d) the steel grade (see Tables 1 and 2);

e) the nominal wire diameter selected from Table 3 and for cut length the length and the length tolerance class (see Table 7);

f) the coating indicated by its abbreviation and surface finish (see 6.3);

g) the form of delivery and unit mass (see 6.2);

h) the type of inspection document;

i) any particular agreement.

EXAMPLE 5 t patented cold drawn tempered spring steel wire according to this standard, grade SM, nominal diameter 2,50 mm, phosphate coated on spools of about 300 kg; inspection document 3.1 according to EN 10204:2004:

5 t spring steel wire EN 10270-1 – SM-2,50 ph on spools of about 300 kg; EN 10204:2004 – 3.1.

6 Requirements

6.1 Material

6.1.1 General

Steel spring wire shall be made from steel corresponding to EN ISO 16120-1 with in addition:

— for SL, SM and SH EN ISO 16120-2

— for DM and DH EN ISO 16120-4

6.1.2 Chemical composition

The chemical composition according to the heat analysis shall comply with the limit values shown in Table 2. The permissible deviation of the product analysis from the heat analysis shall be in accordance with EN ISO 16120-2 and EN ISO 16120-4 respectively.

Table 2 — Chemical composition, % by mass

Grade	C [a]	Si	Mn [b, c]	P max.	S max.	Cu max.
SL, SM, SH	0,35 to 1,00	0,10 to 0,30	0,40 to 1,20	0,035	0,035	0,20
DM, DH	0,45 to 1,00	0,10 to 0,30	0,40 to 1,20	0,020	0,025	0,12

[a] Such a wide range is stipulated to accommodate the whole range of sizes. For individual sizes the carbon range is substantially more restricted.

[b] The range of manganese content in the table is wide to cope with various processing situations and the broad size range. The actual figures per size shall be more restricted.

[c] For the manganese content, a different range from the one indicated in the table may be agreed at the time of ordering, with a maximum not exceeding 1,20 % and with a minimum range of 0,20 %.

The addition of micro-alloying elements may be agreed between the manufacturer and the purchaser.

NOTE Some diameter ranges require particular attention for residuals. Therefore no figures are mentioned for chromium, nickel, molybdenum, tin, etc., leaving room for special arrangements between Purchaser and Supplier, dependent on their mutual processing conditions. This is also the case for the aluminium content.

6.2 Form of delivery

The wire shall be delivered in unit packages of a coil (singles, carriers or formers), spools, spoolless cores or as straight lengths. Unless otherwise agreed at the time of ordering, the form of delivery will be coils; straight lengths shall be supplied in bundles.

6.3 Coating and surface finish

The spring wire may be supplied phosphate coated (ph) either dry drawn or wet drawn, copper coated (cu), zinc (Z) or zinc/aluminium (ZA) coated.

Other coatings, considered as special, can be agreed between the purchaser and the supplier (see Annex A).

If no specific surface finish is specified, the type of finish shall be at the manufacturer's discretion.

In addition the wire can be ordered with an oiled surface for all surface finishes.

6.4 Mechanical properties

For the tensile strength (R_m) and reduction in area after fracture (Z) the wire grades shall satisfy the values listed in Table 3. Reduction of area shall be measured only for wire diameter 0,80 mm and above.

The range of tensile strength values within a unit package shall not exceed the values of Table 4.

Table 3 — Mechanical properties [a] and quality requirements for wire grades SL, SM, DM, SH and DH

1	2	3	4	5	6	7	8	9	10	11	12
Wire diameter d		Tensile strength R_m [b c d] For wire grades					Minimum reduction in area after fracture Z for wire grades SL, SM, SH, DM and DH	Minimum number of twists in the torsion test N_t for wire grades SL, SM, SH, DM and DH [c]	Permissible depth of surface defects for wire grades DM, DH	Permissible decarburization depth for wire grades DM, DH	Mass [h] kg/ 1 000 m
Nominal size mm	Permissible deviations mm	SL MPa	SM MPa	DM MPa	SH MPa	DH [e] MPa	%		mm	mm	
d = 0,05	± 0,003					2 800 to 3 520		coiling test as specified in 7.4.3	- [f]	- [f]	0,015 4
0,05 < d ≤ 0,06						2 800 to 3 520					0,022 2
0,06< d ≤ 0,07						2 800 to 3 520					0,030 2
0,07< d ≤ 0,08						2 800 to 3 480					0,039 5
0,08< d ≤ 0,09						2 800 to 3 430					0,049 9
0,09 < d ≤ 0,10	± 0,004					2 800 to 3 380					0,061 7
0,10 < d ≤ 0,11						2 800 to 3 350					0,074 6
0,11 < d ≤ 0,12						2 800 to 3 320					0,088 8
0,12 < d ≤ 0,14						2 800 to 3 250					0,121
0,14 < d ≤ 0,16						2 800 to 3 200					0,158
0,16 < d ≤ 0,18	± 0,005					2 800 to 3 160					0,200
0,18 < d ≤ 0,20						2 800 to 3 110					0,247
0,20 < d ≤ 0,22						2 770 to 3 080					0,298
0,22 < d ≤ 0,25						2 720 to 3 010					0,385
0,25 < d ≤ 0,28	± 0,008					2 680 to 2 970					0,488
0,28 < d ≤ 0,30			2 370 to 2 650	2 370 to 2 650	2 660 to 2 940	2 660 to 2 940					0,555
0,30 < d ≤ 0,32			2 350 to 2 630	2 350 to 2 630	2 640 to 2 920	2 640 to 2 920					0,631
0,32 < d ≤ 0,34			2 330 to 2 600	2 330 to 2 600	2 610 to 2 890	2 610 to 2 890					0,713
0,34 < d ≤ 0,36			2 310 to 2 580	2 310 to 2 580	2 590 to 2 870	2 590 to 2 870					0,799
0,36 < d ≤ 0,38			2 290 to 2 560	2 290 to 2 560	2 570 to 2 850	2 570 to 2 850					0,890

to be continued