SLOVENSKI STANDARD
SIST EN 10270-2:2012

01-januar-2012

Nadomešča:
SIST EN 10270-2:2002

Jeklena žica za vzmeti - 2. del: V olju kaljena in popuščena jeklena žica za vzmeti

Steel wire for mechanical springs - Part 2: Oil hardened and tempered spring steel wire

Stahldraht für Federn - Teil 2: Ölschlussvergüteter Federstahldraht

Fils en acier pour ressorts mécaniques - Partie 2: Fils en acier trempés à l'huile et revenus

Ta slovenski standard je istoveten z: EN 10270-2:2011

ICS:

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

SIST EN 10270-2:2012 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 10270-2

October 2011

ICS 77.140.25

Supersedes EN 10270-2:2001

English Version

Steel wire for mechanical springs - Part 2: Oil hardened and tempered spring steel wire

Fils en acier pour ressorts mécaniques - Partie 2: Fils en acier trempés à l'huile et revenus

Stahldraht für Federn - Teil 2: Ölschlussvergüteter Federstahldraht

This European Standard was approved by CEN on 10 September 2011.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of 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 United Kingdom.

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

Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents

Page

Foreword

This document (EN 10270-2:2011) 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 10270-2:2001.

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 oil hardened and tempered spring steel wire made from unalloyed or alloyed steels. They are primarily subject to torsional stresses such as in coil springs for compression and extension and in special cases also for applications where the spring wire is subject to bending stresses such as lever springs.

As a rule unalloyed steels are used for applications at room temperature whereas alloyed steels are generally used at a temperature above room temperature. Alloyed steels may also be chosen for above average tensile strengths.

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 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 10247, *Micrographic examination of the non-metallic inclusion content of steels using standard pictures*

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)*

ISO 7800, *Metallic materials — Wire — Simple torsion test*

3 Terms and definitions

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

3.1
oil hardened and tempered spring steel wire
wire that is heat treated in line in the following way: it is first transformed into austenite, quenched in oil or similar quenching medium, followed immediately by tempering by heating to the appropriate temperature

4 Classification

This standard deals with all types of hardened and tempered spring steel wire. The grade for normal applications made from unalloyed or alloyed steel has the abbreviation FD and is intended for static applications.

Spring steel wire for medium fatigue levels, such as required for some clutch springs from unalloyed or alloyed steel, has the abbreviation TD.

Spring steel wire from unalloyed steel or alloyed steel intended for use under severe dynamic duty such as for valve springs or other springs with similar requirements has the abbreviation VD.

The diameter ranges for the various wire grades are shown in Table 1.

Table 1 — Spring wire grades and diameter range

Tensile strength	Static	Medium fatigue	High fatique
Low tensile strength	FDC	TDC	VDC
Medium tensile strength	FDCrV	TDCrV	VDCrV
High tensile strength	FDSiCr	TDSiCr	VDSiCr
Very high tensile strength	FDSiCrV	TDSiCrV	VDSiCrV
Diameter range (mm)	0,50 to 17,00	0,50 to 10,00	0,50 to 10,00

Medium and high fatigue grades TD and VD are characterized by high steel cleanliness, specific chemical, mechanical and technological parameters and a well defined surface condition in relation to the allowable depth of surface defects and decarburization.

The static grade FD is characterized by its chemical, mechanical and technological characteristics as well as by a specified surface condition concerning surface defects and decarburization.

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 10270-2;

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

e) the nominal wire diameter selected from Tables 4 or 5 and for cut length the length and the length tolerance class (see Table 9);

f) the form of delivery and unit mass (see 6.1);

g) the type of inspection document;

h) any particular agreement.

EXAMPLE 5 t oil hardened and tempered spring steel wire according to this standard, grade VDC, nominal diameter 2,50 mm in coils of about 300 kg; inspection document 3.1 according to EN 10204:2004:

5 t spring steel wire EN 10270-2 – VDC-2,50 in coils of about 300 kg; EN 10204:2004 – 3.1

6 Requirements

6.1 Form of delivery

6.1.1 Oil hardened and tempered wire shall be supplied in coils, on spools or in cut lengths. The wire in coils or on spools shall form one continuous length. Wire in coil may also be supplied on carriers containing one or more coils.

For "VD" and "TD" grades no welds are permitted after the heat treatments preceding the final drawing operation; for "FD" grades no welds shall be made at finished size unless agreed otherwise between the parties.

6.1.2 The supplied wire units shall be tightly bound to ensure that wire spiral waps do not spring out unexpectedly. The starting end shall be marked and at the coil ends the wire shall be covered with a protective cap.

6.2 Surface finish

The wire shall be protected against corrosion and mechanical damage. Unless otherwise specified the wire shall be delivered in slightly oiled condition.

6.3 Chemical composition

The steel is characterized by the heat analysis which shall be in accordance with the values of Table 2. The permissible deviation of the product analysis from the limiting values of heat analysis shall be in accordance with Table 3.

6.4 Non metallic inclusions

The "VD" grades shall be checked for maximum size of inclusion according to EN 10247. The allowable level of inclusions shall be agreed between the parties at the enquiry and order.

6.5 Mechanical properties

For tensile strength R_m and reduction in area after fracture (Z) the wire grades shall satisfy the values listed in Tables 4 and 5. Reduction of area is measured only for size 1,00 mm and above (see Tables 4, 5 and 11).

The range of the tensile strength values within a coil/reel shall not exceed 50 MPa for the grades "VD", 60 MPa for the grades "TD" and 70 MPa for the grades "FD".

Table 2 — Chemical composition, % by mass

Grade	C	Si	Mn [a]	P max.	S max.	Cu max.	Cr	V
VDC	0,60 to 0,75	0,15 to 0,30	0,50 to 1,00	0,020	0,020	0,06	- [b]	-
VDCrV	0,62 to 0,72	0,15 to 0,30	0,50 to 0,90	0,025	0,020	0,06	0,40 to 0,60	0,15 to 0,25
VDSiCr	0,50 to 0,60	1,20 to 1,60	0,50 to 0,90	0,025	0,020	0,06	0,50 to 0,80	-
VDSiCrV	0,50 to 0,70	1,20 to 1,65	0,40 to 0,90	0,020	0,020	0,06	0,50 to 1,00	0,10 to 0,25 [C]
TDC	0,60 to 0,75	0,10 to 0,35	0,50 to 1,20	0,020	0,020	0,10	- [b]	-
TDCrV	0,62 to 0,72	0,15 to 0,30	0,50 to 0,90	0,025	0,020	0,10	0,40 to 0,60	0,15 to 0,25
TDSiCr	0,50 to 0,60	1,20 to 1,60	0,50 to 0,90	0,025	0,020	0,10	0,50 to 0,80	-
TDSiCrV	0,50 to 0,70	1,20 to 1,65	0,40 to 0,90	0,020	0,020	0,10	0,50 to 1,00	0,10 to 0,25 [C]
FDC	0,60 to 0,75	0,10 to 0,35	0,50 to 1,20	0,030	0,025	0,12	- [b]	-
FDCrV	0,62 to 0,72	0,15 to 0,30	0,50 to 0,90	0,030	0,025	0,12	0,40 to 0,60	0,15 to 0,25
FDSiCr	0,50 to 0,60	1,20 to 1,60	0,50 to 0,90	0,030	0,025	0,12	0,50 to 0,80	-
FDSiCrV	0,50 to 0,70	1,20 to 1,65	0,40 to 0,90	0,030	0,025	0,12	0,50 to 1,00	0,10 to 0,25

a Manganese may be ordered with restricted range, but with a minimum range of 0,20 %.

b For heavy wire diameter (above 8,5 mm) chromium may be added up to 0,30 % for proper through hardening.

c For medium and high fatigue grades the range of vanadium content can be limited to 0,05 % to 0,15 %

Table 3 — Permissible deviation of the product analysis from the limiting values for the heat analysis

Chemical element	Wire grade	Permissible deviation % by mass
C	All	± 0,03
Si	SiCr, SiCrV	± 0,05
	other grades	± 0,03
Mn	All	± 0,04
P	All	+ 0,005
S	All	+ 0,005
Cu	All	+ 0,02
Cr	All	± 0,05
V	All	± 0,02

Table 4 — Mechanical and technological properties and quality requirements for wire grades FDC, FDCrV, FDSiCr and FDSiCrV

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Nominal wire diameter	Permissible deviations	Tensile strength R_m				Minimum reduction in area after fracture Z				Minimum number of twists in the torsion test N_t [a]			
		FDC [b]	FDCrV [b]	FDSiCr [b]	FDSiCrV [b]	FDC	FDCrV	FDSiCr	FDSiCrV	FDC	FDCrV	FDSiCr	FDSiCrV
mm	mm	MPa	MPa	MPa	MPa	%	%	%	%				
d = 0,50	± 0,010	1 900 to 2 100	2 000 to 2 200	2 100 to 2 300	2 280 to 2 430	–	–	–	–	–	–	–	–
0,50 < d ≤ 0,60		1 900 to 2 100	2 000 to 2 200	2 100 to 2 300	2 280 to 2 430								
0,60 < d ≤ 0,80		1 900 to 2 100	2 000 to 2 200	2 100 to 2 300	2 280 to 2 430					To be agreed upon	To be agreed upon	To be agreed upon	To be agreed upon
0,80 < d ≤ 1,00	± 0,015	1 860 to 2 060	1 960 to 2 160	2 100 to 2 300	2 280 to 2 430								
1,00 < d ≤ 1,30		1 810 to 2 010	1 900 to 2 100	2 070 to 2 260	2 280 to 2 430	45	45	45	45				
1,30 < d ≤ 1,40	± 0,020	1 790 to 1 970	1 870 to 2 070	2 060 to 2 250	2 260 to 2 410								
1,40 < d ≤ 1,60		1 760 to 1 940	1 840 to 2 030	2 040 to 2 220	2 260 to 2 410								
1,60 < d ≤ 2,00	± 0,025	1 720 to 1 890	1 790 to 1 970	2 000 to 2 180	2 210 to 2 360								
2,00 < d ≤ 2,50		1 670 to 1 820	1 750 to 1 900	1 970 to 2 140	2 160 to 2 310								
2,50 < d ≤ 2,70		1 640 to 1 790	1 720 to 1 870	1 950 to 2 120	2 110 to 2 260								
2,70 < d ≤ 3,00	± 0,030	1 620 to 1 770	1 700 to 1 850	1 930 to 2 100	2 110 to 2 260								
3,00 < d ≤ 3,20		1 600 to 1 750	1 680 to 1 830	1 910 to 2 080	2 110 to 2 260								
3,20 < d ≤ 3,50		1 580 to 1 730	1 660 to 1 810	1 900 to 2 060	2 110 to 2 260	42	42	42	42				
3,50 < d ≤ 4,00		1 550 to 1 700	1 620 to 1 770	1 870 to 2 030	2 060 to 2 210								

"*to be continued*"

Table 4 (*concluded*)

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Nominal wire diameter	Permissible deviations	Tensile strength R_m				Minimum reduction in area after fracture Z				Minimum number of twists in the torsion test N_t[a]			
		FDC[b]	FDCrV[b]	FDSiCr[b]	FDSiCrV[b]	FDC	FDCrV	FDSiCr	FDSiCrV	FDC	FDCrV	FDSiCr	FDSiCrV
mm	mm	MPa	MPa	MPa	MPa	%	%	%	%				
$4{,}00 < d \leq 4{,}20$	± 0,035	1 540 to 1 690	1 610 to 1 760	1 860 to 2 020	2 060 to 2 210	40	40	40	40	To be agreed upon	To be agreed upon	To be agreed upon	To be agreed upon
$4{,}20 < d \leq 4{,}50$		1 520 to 1 670	1 590 to 1 740	1 850 to 2 000	2 060 to 2 210								
$4{,}50 < d \leq 4{,}70$		1 510 to 1 660	1 580 to 1 730	1 840 to 1 990	2 010 to 2 160								
$4{,}70 < d \leq 5{,}00$		1 500 to 1 650	1 560 to 1 710	1 830 to 1 980	2 010 to 2 160								
$5{,}00 < d \leq 5{,}60$		1 470 to 1 620	1 540 to 1 690	1 800 to 1 950	2 010 to 2 160	38	38	38	38				
$5{,}60 < d \leq 6{,}00$	± 0,040	1 460 to 1 610	1 520 to 1 670	1 780 to 1 930	1 960 to 2 110								
$6{,}00 < d \leq 6{,}50$		1 440 to 1 590	1 510 to 1 660	1 760 to 1 910	1 960 to 2 110	35	35	35	35				
$6{,}50 < d \leq 7{,}00$		1 430 to 1 580	1 500 to 1 650	1 740 to 1 890	1 960 to 2 110								
$7{,}00 < d \leq 8{,}00$	± 0,045	1 400 to 1 550	1 480 to 1 630	1 710 to 1 860	1 910 to 2 050								
$8{,}00 < d \leq 8{,}50$		1 380 to 1 530	1 470 to 1 620	1 700 to 1 850	1 890 to 2 030	32	32	32	32				
$8{,}50 < d \leq 10{,}00$	± 0,050	1 360 to 1 510	1 450 to 1 600	1 660 to 1 810	1 870 to 2 010								
$10{,}00 < d \leq 12{,}00$	± 0,070	1 320 to 1 470	1 430 to 1 580	1 620 to 1 770	1 830 to 1 970	30	30	30	30				
$12{,}00 < d \leq 14{,}00$	± 0,080	1 280 to 1 430	1 420 to 1 570	1 580 to 1 730	1 790 to 1 930								
$14{,}00 < d \leq 15{,}00$		1 270 to 1 420	1 410 to 1 560	1 570 to 1 720	1 780 to 1 920	–	–	–	–				
$15{,}00 < d \leq 17{,}00$	± 0,090	1 250 to 1 400	1 400 to 1 550	1 550 to 1 700	1 760 to 1 900								

a Requirements for twists are for $d \geq 0{,}70$ mm.

b 1 MPa = 1 N/mm^2.