SLOVENSKI STANDARD
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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: **prEN 10270-2**

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 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

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Foreword

This document (prEN 10270-2:2008) 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 10270-2:2001.

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*

1 Scope

1.1 This Part of EN 10270 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 compression and extension springs 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 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 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.*

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

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).*

EN ISO 3887, Steels — Determination of depth of decarburization.

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 and designation

4.1 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

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 - 17,00	0,50 - 10,00	0,50 - 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.

4.2 Designation

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

— the term: spring wire;

— the number of this European Standard: EN 10270-2;

— the abbreviation for the wire grade (see Table 1);

— the required nominal diameter selected from Table 4 or Table 5;

EXAMPLE Standard designation of an oil hardened and tempered steel spring wire according to this standard of wire grade VDC with a nominal diameter of 2,50 mm:

Spring wire EN 10270-2 - VDC - 2,50.

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 number of this European Standard: EN 10270-2;

c) wire grade (see 4.1);

d) the nominal wire diameter;

e) the form of delivery and unit mass;

f) the type of inspection document;

g) any particular agreement made.

EXAMPLE 5 t spring wire EN 10270-2 - VDC - 2,50

in coils of about 300 kg

inspection document EN 10204 - 3.1.B.

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 unforeseen. 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 ENV 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	0,60-0,75	0,15-0,30	0,50-1,00	0,020	0,020	0,06	[b]	
VDCrV	0,62-0,72	0,15-0,30	0,50-0,90	0,025	0,020	0,06	0,40-0,60	0,15-0,25
VDSiCr	0,50-0,60	1,20-1,60	0,50-0,90	0,025	0,020	0,06	0,50-0,80	
VDSiCrV	0,50-0,70	1,20-1,65	0,40-0,80	0,020	0,020	0,06	0,50-1,00	0,10-0,25
TDC	0,60-0,75	0,10-0,35	0,50-1,20	0,020	0,020	0,10	[b]	
TDCrV	0,62-0,72	0,15-0,30	0,50-0,90	0,025	0,020	0,10	0,40-0,60	0,15-0,25
TDSiCr	0,50-0,60	1,20-1,60	0,50-0,90	0,025	0,020	0,10	0,50-0,80	
TDSiCrV	0,50-0,70	1,20-1,65	0,40-0,80	0,020	0,020	0,10	0,50-1,00	0,10-0,25
FDC	0,60-0,75	0,10-0,35	0,50-1,20	0,030	0,025	0,12	[b]	
FDCrV	0,62-0,72	0,15-0,30	0,50-0,90	0,030	0,025	0,12	0,40-0,60	0,15-0,25
FDSiCr	0,50-0,60	1,20-1,60	0,50-0,90	0,030	0,025	0,12	0,50-0,80	
FDSiCrV	0,50-0,70	1,20-1,65	0,40-0,80	0,030	0,025	0,12	0,50-1,00	0,10-0,25

[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.

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 for wire grades				Minimum number of torsions for wire grades[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	1900 to 2100	2000 to 2200	2100 to 2300	–	–	–	–	–	–	–	–	–
0,50 < d ≤ 0,60		1900 to 2100	2000 to 2200	2100 to 2300									
0,60 < d ≤ 0,80		1900 to 2100	2000 to 2200	2100 to 2300						To be agreed upon	To be agreed upon	To be agreed upon	To be agreed upon
0,80 < d ≤ 1,00	± 0,015	1860 to 2060	1960 to 2160	2100 to 2300									
1,00 < d ≤ 1,30	± 0,020	1810 to 2010	1900 to 2100	2070 to 2260	2150 to 2290	45	45	45	45				
1,30 < d ≤ 1,40		1790 to 1970	1870 to 2070	2060 to 2250	2140 to 2280								
1,40 < d ≤ 1,60		1760 to 1940	1840 to 2030	2040 to 2220	2130 to 2270								
1,60 < d ≤ 2,00	± 0,025	1720 to 1890	1790 to 1970	2000 to 2180	2130 to 2270								
2,00 < d ≤ 2,50		1670 to 1820	1750 to 1900	1970 to 2140	2090 to 2230								
2,50 < d ≤ 2,70		1640 to 1790	1720 to 1870	1950 to 2120	2090 to 2230								
2,70 < d ≤ 3,00	± 0,030	1620 to 1770	1700 to 1850	1930 to 2100	2090 to 2230								
3,00 < d ≤ 3,20		1600 to 1750	1680 to 1830	1910 to 2080	2080 to 2220								
3,20 < d ≤ 3,50		1580 to 1730	1660 to 1810	1900 to 2060	2060 to 2200	42	42	42	42				
3,50 < d ≤ 4,00		1550 to 1700	1620 to 1770	1870 to 2030	2060 to 2200								

"*to be concluded*"

Table 4 (*concluded*)

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Nominal wire diameter	Permissibl edeviation s	Tensile strength R_m				Minimum reduction in area after fracture Z for wire grades				Minimum number of torsions for wire grades[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	1540 to 1690	1610 to 1760	1860 to 2020	2060 to 2200	40	40	40	40	To be agreed upon	To be agreed upon	To be agreed upon	To be agreed upon
$4{,}20 < d \leq 4{,}50$		1520 to 1670	1590 to 1740	1850 to 2000	2060 to 2200								
$4{,}50 < d \leq 4{,}70$		1510 to 1660	1580 to 1730	1840 to 1990	2060 to 2200								
$4{,}70 < d \leq 5{,}00$		1500 to 1650	1560 to 1710	1830 to 1980	2060 to 2200								
$5{,}00 < d \leq 5{,}60$		1470 to 1620	1540 to 1690	1800 to 1950	2030 to 2170	38	38	38	38				
$5{,}60 < d \leq 6{,}00$	± 0,040	1460 to 1610	1520 to 1670	1780 to 1930	2020 to 2160								
$6{,}00 < d \leq 6{,}50$		1440 to 1590	1510 to 1660	1760 to 1910	2010 to 2150	35	35	35	35				
$6{,}50 < d \leq 7{,}00$		1430 to 1580	1500 to 1650	1740 to 1890	2010 to 2150								
$7{,}00 < d \leq 8{,}00$	± 0,045	1400 to 1550	1480 to 1630	1710 to 1860	1960 to 2100								
$8{,}00 < d \leq 8{,}50$		1380 to 1530	1470 to 1620	1700 to 1850	1940 to 2080	32	32	32	32				
$8{,}50 < d \leq 10{,}00$	± 0,050	1360 to 1510	1450 to 1600	1660 to 1810	1920 to 2060								
$10{,}00 < d \leq 12{,}00$	± 0,070	1320 to 1470	1430 to 1580	1620 to 1770	1880 to 2020	30	30	30	30				
$12{,}00 < d \leq 14{,}00$	± 0,080	1280 to 1430	1420 to 1570	1580 to 1730	1840 to 1980								
$14{,}00 < d \leq 15{,}00$		1270 to 1420	1410 to 1560	1570 to 1720	1830 to 1970	–	–	–	–				
$15{,}00 < d \leq 17{,}00$	± 0,090	1250 to 1400	1400 to 1550	1550 to 1700	1810 to 1950								

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

b 1 MPa = 1 N/mm^2.