



BSI Standards Publication

Steel wire for mechanical springs

Part 1: Patented cold drawn unalloyed spring steel wire

National foreword

This British Standard is the UK implementation of EN 10270-1:2011+A1:2017. It supersedes BS EN 10270-1:2011, which is withdrawn.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to CEN text carry the number of the CEN amendment. For example, text altered by CEN amendment A1 is indicated by A1 A1.

The UK participation in its preparation was entrusted to Technical Committee ISE/106, Wire Rod and Wire.

A list of organizations represented on this committee can be obtained on request to its secretary.

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English Version

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

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

Stahldraht für Federn - Teil 1: Patentiert gezogener
unlegierter Federstahldraht

This European Standard was approved by CEN on 10 September 2011 and includes Amendment 1 approved by CEN on 24 March 2017.

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European foreword

This document (EN 10270-1:2011+A1:2017) 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of an identical text or by endorsement, at the latest by November 2017, and conflicting national standards shall be withdrawn at the latest by November 2017.

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 includes Amendment 1 approved by CEN on 24 March 2017.

This document supersedes A1 EN 10270-1:2011 A1.

The start and finish of text introduced or altered by amendment is indicated in the text by tags A1 A1.

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, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey 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 — European standards for the determination of chemical composition*

EN ISO 377, *Steel and steel products — Location and preparation of samples and test pieces for mechanical testing (ISO 377)*

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

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

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

EN ISO 16120-1, *Non-alloy steel 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)*

3 Terms and definitions

For the purposes of this document, the following **A1** term and definition applies **A1**.

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: **A1** low **A1**, 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:

- the desired quantity;
- the term spring steel wire or straightened and cut lengths;
- the number of this European standard: EN 10270-1;
- the steel grade (see Tables 1 and 2);
- the nominal wire diameter selected from Table 3 and for cut length the length and the length tolerance class (see Table 7);
- the coating indicated by its abbreviation and surface finish (see 6.3);
- the form of delivery and unit mass (see 6.2);
- the type of inspection document **A1** (see 7.1) **A1**;
- 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 grades according to:

- for SL, SM and SH EN ISO 16120-2;
- for DM and DH EN ISO 16120-4.

For general requirements EN ISO 16120-1 applies. Ⓐ

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	P	S	Cu
SL, SM, SH	0,35 to 1,00	0,10 to 0,30	0,40 to 1,20	0,035 max.	0,035 max.	0,20 max.
DM, DH	0,45 to 1,00	0,10 to 0,30	0,40 to 1,20	0,020 max.	0,025 max.	0,12 max.

^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 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. $\overline{A_1}$ Reduction of area shall be measured only for wire diameter $0,80 \text{ mm} < d$. $\overline{A_1}$

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 <i>d</i>					Tensile strength R_m ^{b c d}						
Nominal size mm	Permissible deviations mm	SL MPa	SM MPa	DM MPa	SH MPa	DH ^e MPa	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 kg/1 000 m
<i>d</i> = 0,05	± 0,003										
0,05 < <i>d</i> ≤ 0,06											
0,06 < <i>d</i> ≤ 0,07											
0,07 < <i>d</i> ≤ 0,08											
0,08 < <i>d</i> ≤ 0,09											
0,09 < <i>d</i> ≤ 0,10	± 0,004										
0,10 < <i>d</i> ≤ 0,11											
0,11 < <i>d</i> ≤ 0,12											
0,12 < <i>d</i> ≤ 0,14											
0,14 < <i>d</i> ≤ 0,16											
0,16 < <i>d</i> ≤ 0,18								coiling test as specified in	σ_f	σ_f	0,200
											0,015 4
											0,022 2
											0,030 2
											0,039 5
											0,049 9
											0,061 7
											0,074 6
											0,088 8
											0,121
											0,158
											0,200