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Carbon steel wire for bedding and seating springs

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 17, *Steel wire rod and wire products*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Carbon steel wire for bedding and seating springs

1 Scope

This document specifies requirements for carbon steel wire of round cross-section supplied in the cold-draw condition intended for the manufacture of springs for bedding and seating used in the automotive and furniture manufacturing industries.

This document is applicable to wire supplies in the uncoated condition, that is, without a metallic coating.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

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

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

ISO 7802, *Metallic materials — Wire — Wrapping test*

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

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

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
spring
mechanical device designed to store energy when deflected and to return the equivalent amount of energy when released

3.2
wap
one turn of steel wire from a coil, i.e. one complete circle of steel wire

Note 1 to entry: A wap of wire does not imply any specific length of wire or diameter of wire.

3.3
circular wire cast
external diameter of a free wire wap placed on a horizontal smooth surface

3.4
helix cast of wire
horizontal displacement of the two cut ends of a vertically hanging wire ring

Note 1 to entry: See *F* in Figure 1 a).

3.5
tip rise
horizontal displacement of the two cut ends of a wire ring placed on a horizontal surface

Note 1 to entry: See *S* in Figure 1 b).

3.6
pocket spring
cylindrical spring put into individual non-woven pockets in a spring mattress

3.7
bonnell
open coil spiral springs used to make mattresses

3.8
link spring
spring links bearing load springs

3.9
edging wire
steel wire used as a frame in mattresses and in seats

3.10
sinuous spring
'S' shaped springs running from the front to the back of a seat

4 Classification and marking

4.1 Classification

Spring wire are classified into five categories, depending on the type and application of the spring, see Table 1.

Table 1 — The classification of wire

Type	**Recommended diameter, d[a]** mm
Type I: Pocket spring	$1{,}4 \le d \le 3{,}0$
Type II: Bonnell	$1{,}2 \le d \le 2{,}8$
Type III: Link spring	$0{,}8 \le d \le 1{,}6$
Type IV: Edging wire	$3{,}5 \le d \le 6{,}0$
Type V: Sinuous springs	$2{,}2 \le d \le 4{,}5$
[a] Other diameter steel wire shall be supplied upon negotiation between the manufacturer and the purchaser.	

4.2 Marking

Example of marking:

Diameter 2,80 mm, Type II, the steel wire for Bonnell: φ2,80 mm— Type II-ISO XXXX -YYYY.

NOTE XXXX is the publication number of this document. YYYY is the version number of this document.

5 Information supplied by the purchaser

The purchaser shall include the following information in an enquiry or order:

a) A reference to this document (designation), i.e. ISO 23213:—;

b) Product classification;

c) Nominal diameter;

d) Tensile grade;

e) Quantity;

f) Anti-rust application (no oil, light oil, heavy oil);

g) Unit mass;

h) Other requirements.

6 Requirements

6.1 Diameter, appearance, coil weight

6.1.1 Diameter range

The range of nominal diameter of the steel wire is 0,80 mm to 6,00 mm, depending on spring application.

6.1.2 Diameter and tolerance

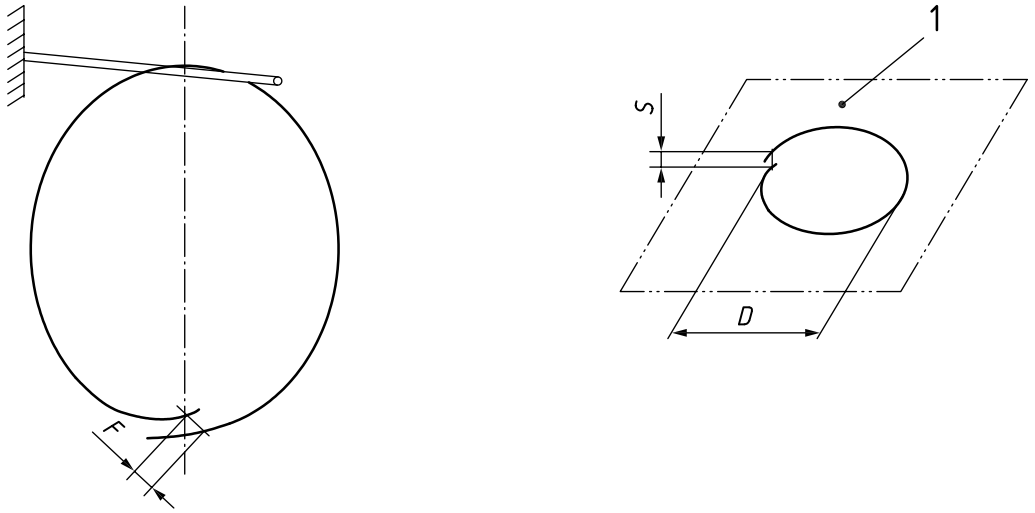
The wire diameter shall be measured with a micrometer at any cross section. Two measurement are made at 90 degrees to each other and the mean value is calculated. The difference between nominal diameter and mean diameter shall not exceed the tolerances specified in Table 2.

6.1.3 Ovality

The difference between the maximum and minimum diameter of the wire at the same cross section shall not be more than 50 % of the total permissible deviation specified in Table 2.

6.1.4 Cast

The cast shall be as specified in Table 3.



a) Helix cast of wire **b) Tip rise**

Key

F helix cast of wire

D circular wire cast

S tip rise

1 Horizontal inspection surface area

Figure 1 — Diagram of wire cast

6.1.5 The minimum coil weight

The wire shall be delivered in packages of coils, spools, spoolless cores or carriers. The wire in each package shall consist of a single length of wire originating from only one heat.

The minimum coil weight shall be as specified in Table 4.

6.1.6 Welds

Welds made after cold drawing are not permitted.

Table 2 — Diameter and tolerance

Nominal diameter, *d* mm	**Diameter Tolerance** [a] mm
0,80 < *d* ≤ 1,50	+0,02 −0,02
1,50 < *d* ≤ 3,00	+0,02 −0,03
3,00 < *d* ≤ 6,00	+0,03 −0,03

[a] Other diameter tolerances can be negotiated between the manufacturer and the purchaser.

Table 3 — The circular wire cast, helix cast and tip rise

Nominal diameter, d mm	Circular wire cast, D mm	Helix cast, F mm	Tip rise, S mm
$0{,}80 < d \leq 1{,}00$	300 to 600	≤60	≤30
$1{,}00 \leq d \leq 1{,}60$	400 to 650		
$1{,}60 \leq d \leq 3{,}00$	550 to 900	≤100	≤80
$3{,}00 \leq d \leq 6{,}00$	600 to 1 200		

Table 4 — Minimum coil weight

Nominal diameter, d mm	Minimum coil weight kg
$0{,}80 < d \leq 1{,}20$	25
$1{,}20 < d \leq 1{,}80$	50
$1{,}80 < d \leq 3{,}00$	70
$3{,}00 < d \leq 6{,}00$	80

6.2 Steel grade and chemical composition

Steel spring wire shall be made from steel grades in accordance with ISO 16120-1 and ISO 16120-2 or with equivalent quality.

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

6.3 Mechanical properties

6.3.1 Tensile strength

The tensile test shall be carried out in accordance with ISO 6892-1. The tensile strength shall be calculated using the nominal wire diameter.

The tensile strength shall meet the requirements of

— Table 5 for wire used for Types I, II and III springs,

— Table 6 for wire used for Type IV springs, or

— Table 7 for wire used for Type V springs.

The range of tensile strength values within a batch of the same diameter shall not exceed 150 MPa.

Table 5 — The mechanical property of Type I II III steel wire

Nominal diameter, d mm	Tensile strength [a] MPa		Torsion value Min.
	Min.	Max.	
$0{,}8 \leq d < 1{,}0$	1 780	1 980	27
$1{,}0 \leq d < 1{,}2$	1 780	1 980	26
$1{,}2 \leq d < 1{,}4$	1 780	1 980	26
$1{,}4 \leq d < 1{,}6$	1 750	1 950	25
$1{,}6 \leq d < 1{,}8$	1 750	1 950	24

[a] Other tensile values can be negotiated between the manufacturer and the purchaser.

Table 5 *(continued)*

Nominal diameter, *d* mm	Tensile strength [a] MPa		Torsion value Min.
	Min.	Max.	
1,8 ≤ *d* < 2,0	1 730	1 930	22
2,0 ≤ *d* < 2,2	1 700	1 900	20
2,2 ≤ *d* < 2,4	1 700	1 900	18
2,4 ≤ *d* < 2,6	1 650	1 850	18
2,6 ≤ *d* < 2,8	1 620	1 820	18
2,8 ≤ *d* < 3,0	1 600	1 800	16

[a] Other tensile values can be negotiated between the manufacturer and the purchaser.

Table 6 — The tensile of Type IV (Edging wire) steel wire

Nominal diameter, *d* mm	Tensile strength range MPa			
	Grade A		Grade B	
	Min.	Max.	Min.	Max.
3,5 ≤ *d* < 4,5	1 350	1 550	1 600	1 800
4,5 ≤ *d* < 5,0	1 380	1 580	1 550	1 750
5,0 ≤ *d* < 5,5	1 350	1 550	1 600	1 800
5,5 ≤ *d* ≤ 6,0	1 100	1 300	1 300	1 500

Table 7 — The tensile of TypeV (sinuous springs) steel wire

Nominal diameter, *d* mm	Tensile strength range MPa	
	Min.	Max.
2,2 ≤ *d* < 2,3	1 600	1 800
2,3 ≤ *d* < 2,4	1 600	1 800
2,4 ≤ *d* < 2,5	1 590	1 790
2,5 ≤ *d* < 2,6	1 590	1 790
2,6 ≤ *d* < 2,7	1 570	1 770
2,7 ≤ *d* < 2,8	1 550	1 750
2,8 ≤ *d* < 2,9	1 530	1 730
2,9 ≤ *d* < 3,0	1 510	1 710
3,0 ≤ *d* < 3,1	1 490	1 690
3,1 ≤ *d* < 3,2	1 470	1 670
3,2 ≤ *d* < 3,5	1 450	1 650
3,5 ≤ *d* < 4,0	1 450	1 650
4,0 ≤ *d* ≤ 4,5	1 400	1 600

6.3.2 Wrapping test

The wrapping test shall be carried out on wire with a diameter less than 4,0 mm, in accordance with ISO 7802. The wire should not fracture when close wrapped three turns around a mandrel with a diameter equal to the wire diameter.