
Carbon steel wire for bedding and seating springs

Fil d'acier au carbone pour ressorts de literie et sièges

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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

vertical 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 wire	$1,4 \leq d \leq 3,0$
Type II: Bonnell wire	$1,2 \leq d \leq 2,8$
Type III: Link spring wire	$0,8 \leq d \leq 1,6$
Type IV: Edging wire	$3,5 \leq d \leq 6,0$
Type V: Sinuous spring wire	$2,2 \leq d \leq 4,5$
^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: $\varnothing 2,80$ mm— Type II-ISO 23213:2022.

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 23213:2022;
- 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

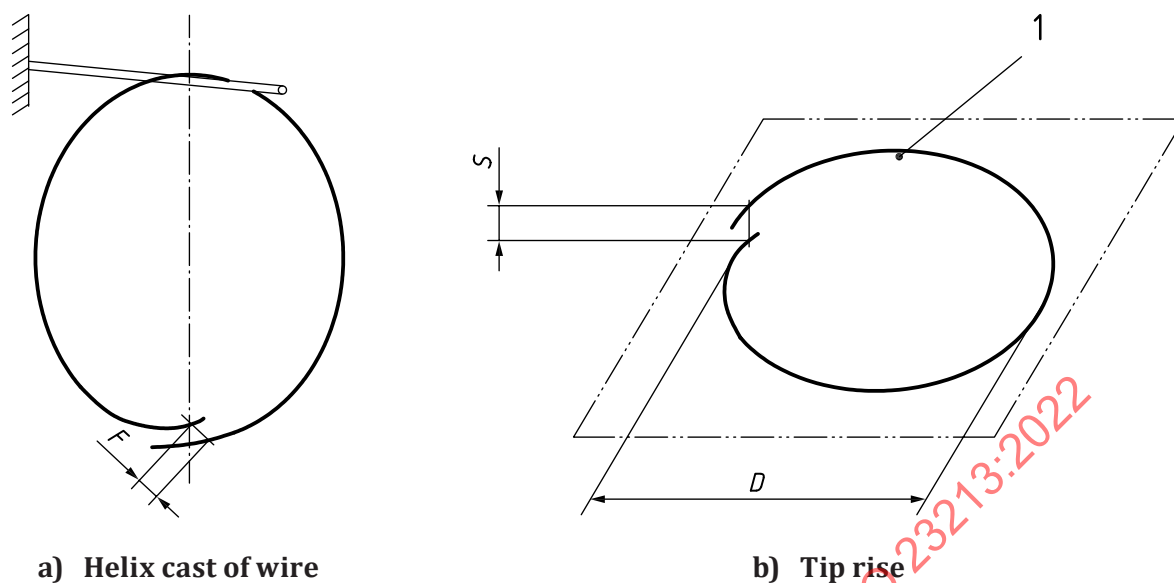
The wire diameter shall be measured with a micrometer at any cross section. Two measurement are made at 90 degrees to each other and the mean value is calculated. The difference between nominal diameter and mean diameter shall not exceed the tolerances specified in [Table 2](#).

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](#).

**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
$0,80 < d \leq 1,50$	+0,02 -0,02
$1,50 < d \leq 3,00$	+0,02 -0,03
$3,00 < d \leq 6,00$	+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, <i>d</i> mm	Circular wire cast, <i>D</i> mm	Helix cast, <i>F</i> mm	Tip rise, <i>S</i> 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, <i>d</i> 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 Types I, II and III wire,
- [Table 6](#) for Type IV wire, or
- [Table 7](#) for Type V wire.

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, <i>d</i> 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.	
$1,8 \leq d < 2,0$	1 730	1 930	22
$2,0 \leq d < 2,2$	1 700	1 900	20
$2,2 \leq d < 2,4$	1 700	1 900	18
$2,4 \leq d < 2,6$	1 650	1 850	18
$2,6 \leq d < 2,8$	1 620	1 820	18
$2,8 \leq d < 3,0$	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.
$3,5 \leq d < 4,5$	1 350	1 550	1 600	1 800
$4,5 \leq d < 5,0$	1 380	1 580	1 550	1 750
$5,0 \leq d < 5,5$	1 350	1 550	1 600	1 800
$5,5 \leq d \leq 6,0$	1 100	1 300	1 300	1 500

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

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

6.3.3 Torsion test

The torsion test shall be carried out in accordance with ISO 7800 for Type I, II and III wires and shall meet the requirements specified in [Table 5](#).

6.4 Surface quality

The surface of the wire shall be smooth and as free as possible from grooves, tears, rust and other surface defects, which have a noticeable adverse effect on the application of the wire.

6.5 Special requirements

Any special requirement shall be agreed between purchaser and supplier at the time of enquiry or order.

7 Inspection and testing

7.1 Requirements

The sampling and test requirements shall be in accordance with [Table 8](#).

Table 8 — Inspect item, sample quantities and inspect requirement

Inspect item	Sample quantities	Inspect method and requirement
Diameter	each coil	Micrometer with 0,01 mm accuracy
Surface quality	each coil	Visual inspection
Circular wire cast	each coil	Tape with 1 mm accuracy
Helix cast	each coil	Tape with 1 mm accuracy
Tip rise	each coil	Tape with 1 mm accuracy
Tensile strength	10 %, at least 3 coils	ISO 6892-1
Wrapping	10 %, at least 3 coils	ISO 7802
Torsion	10 %, at least 3 coils	ISO 7800

7.2 Inspection and acceptance

All inspection and testing shall be carried by the manufacturer except by special agreement between the manufacturer and purchaser.

7.3 Batching rule

Except by special agreement between the manufacturer and purchaser, the wire shall be inspected and tested by batch. A production batch is defined as a quantity of production of the same wire diameter originating from the same steel cast, which has been subjected to the same reduction in cross-section and with the same surface finish.

8 Retest

If any test result fails to meet the requirements of this document, then two further tests should be made from the same coil. If both tests are satisfactory, then the coil and batch are accepted. If either or both tests fail, the coil is rejected and each coil in the batch shall then be tested for acceptance.