INTERNATIONAL STANDARD

ISO 8458-1

Second edition
2002-08-01

Steel wire for mechanical springs —

Part 1: General requirements

Fils en acier pour ressorts mécaniques —

Partie 1: Exigences générales

Reference number
ISO 8458-1:2002(E)

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO 8458 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 8458-1 was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 17, *Steel wire rod and wire products*.

This second edition cancels and replaces the first edition (ISO 8458-1:1989) which has been technically revised.

ISO 8458 consists of the following parts, under the general title *Steel wire for mechanical springs*:

— *Part 1: General requirements*

— *Part 2: Patented cold-drawn non-alloy steel wire*

— *Part 3: Oil-hardened and tempered wire*

Steel wire for mechanical springs —

Part 1:
General requirements

1 Scope

This part of ISO 8458 specifies general requirements for steel spring wire of round cross-section, suitable for the manufacture of mechanical springs.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 8458. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 8458 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 377:1997, *Steel and steel products — Location and preparation of samples and test pieces for mechanical testing*

ISO 404:1992, *Steel and steel products — General technical delivery requirements*

ISO 3887:—[1)], *Steels — Determination of depth of decarburization*

ISO 4885:1996, *Ferrous products — Heat treatments — Vocabulary*

ISO 6892:1998, *Metallic materials — Tensile testing at ambient temperature*

ISO 7438:1985, *Metallic materials — Bend test*

ISO 7800:1984, *Metallic materials — Wire — Simple torsion test*

ISO 7802:1983, *Metallic materials — Wire — Wrapping test*

ISO 8458-2, *Steel wire for mechanical springs — Part 2: Patented cold-drawn non-alloy steel wire*

ISO 8458-3, *Steel wire for mechanical springs — Part 3: Oil-hardened and tempered wire*

ISO/TR 9769:1991 *Steel and iron — Review of available methods of analysis*

ISO 10474:1991 *Steel and steel products — Inspection documents*

ISO 14284:1996 *Steel and iron — Sampling and preparation of samples for the determination of chemical composition*

1) To be published. (Revision of ISO 3887:1976)

3 Terms and definitions

For the purposes of this part of ISO 8458, the following terms and definitions apply.

3.1
cast
geometrical shape (characterized by overall diameter and helical separation of ends) adopted by a single ring of wire when cut from the coil

3.2
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

[ISO 4885:1996]

3.3
oil-hardened and tempered wire
wire that has been heat treated in line firstly by being transformed into austenite, then quenched in oil or other suitable medium and finally tempered at an appropriate temperature

3.4
static duty
applications where springs are subjected to static stresses or infrequent dynamic loading, or a combination of both

NOTE This does not apply to situations of low-frequency high stress.

3.5
dynamic duty
applications where springs are subjected to frequent or predominantly dynamic loading and where a small coiling ratio or severe bending radius is required

3.6
ring
one turn of wire from a coil, i.e., one complete circle of wire

NOTE A ring of wire does not imply any specific length of wire or diameter of wire.

4 Information to be supplied by the purchaser

The purchasers shall clearly state the following information in their enquiries and orders:

a) the desired quantity;

b) the number of this International Standard including the number of the relevant part, i.e. ISO 8458-1, ISO 8458-2 or ISO 8458-3;

c) the wire grade, surface finish and coating where relevant;

d) the nominal wire diameter;

e) the form of delivery and unit mass;

f) the type of inspection document (see 6.12);

g) any particular agreement made;

EXAMPLE:

— 5 t spring wire ISO 8458-2-SM-2,5 phosphated

— inspection document ISO 10474-3.1.B

— on spools of about 500 kg.

5 Requirements

5.1 Dimensional tolerances

5.1.1 Diameter measurements shall be made at any cross section and shall not differ from the tolerances specified in Table 1 or Table 2, as appropriate.

For straightened and cut lengths, there is only one tolerance level derived from class B.

Table 1 — Diameter tolerance for coiled wire

Dimensions in millimetres

Nominal diameter d	Tolerance (±)	
	Class A [a]	Class B [b]
$0,05 \leqslant d < 0,09$	0,003	—
$0,09 \leqslant d < 0,17$	0,004	—
$0,17 \leqslant d < 0,26$	0,005	—
$0,26 \leqslant d < 0,37$	0,006	0,010
$0,37 \leqslant d < 0,65$	0,008	0,012
$0,65 \leqslant d < 0,80$	0,010	0,015
$0,80 \leqslant d < 1,01$	0,015	0,020
$1,01 \leqslant d < 1,78$	0,020	0,025
$1,78 \leqslant d < 2,78$	0,025	0,030
$2,78 \leqslant d < 4,00$	0,030	0,030
$4,00 \leqslant d < 5,45$	0,035	0,035
$5,45 \leqslant d < 7,10$	0,040	0,040
$7,10 \leqslant d < 9,00$	0,045	0,045
$9,00 \leqslant d < 10,00$	0,050	0,050
$10,00 \leqslant d < 11,10$	0,070	0,070
$11,10 \leqslant d < 14,50$	0,080	0,080
$14,50 \leqslant d < 18,30$	0,090	0,090
$18,30 \leqslant d < 20,00$	0,100	0,100

[a] Class A tolerance is intended for wire grades of SH, DM, DH in ISO 8458-2 and TD, VD in ISO 8458-3.

[b] Class B tolerance is intended for wire grades of SL, SM in ISO 8458-2 and FD in ISO 8458-3.

Table 2 — Tolerance for straightened and cut lengths

Dimensions in millimetres

Nominal diameter, d	minus	plus
$0{,}26 \leqslant d < 0{,}37$	0,010	0,015
$0{,}37 \leqslant d < 0{,}50$	0,012	0,018
$0{,}50 \leqslant d < 0{,}65$	0,012	0,020
$0{,}65 \leqslant d < 0{,}70$	0,015	0,025
$0{,}70 \leqslant d < 0{,}80$	0,015	0,030
$0{,}80 \leqslant d < 1{,}01$	0,020	0,035
$1{,}01 \leqslant d < 1{,}35$	0,025	0,045
$1{,}35 \leqslant d < 1{,}78$	0,025	0,050
$1{,}78 \leqslant d < 2{,}60$	0,030	0,060
$2{,}60 \leqslant d < 2{,}78$	0,030	0,070
$2{,}78 \leqslant d < 3{,}01$	0,030	0,075
$3{,}01 \leqslant d < 3{,}35$	0,030	0,080
$3{,}35 \leqslant d < 4{,}01$	0,030	0,090
$4{,}01 \leqslant d < 4{,}35$	0,035	0,100
$4{,}35 \leqslant d < 5{,}00$	0,035	0,110
$5{,}00 \leqslant d < 5{,}45$	0,035	0,120
$5{,}45 \leqslant d < 6{,}01$	0,040	0,130
$6{,}01 \leqslant d < 7{,}10$	0,040	0,150
$7{,}10 \leqslant d < 7{,}65$	0,045	0,160
$7{,}65 \leqslant d < 9{,}00$	0,045	0,180
$9{,}00 \leqslant d < 10{,}00$	0,050	0,200
$10{,}00 \leqslant d < 11{,}10$	0,070	0,240
$11{,}10 \leqslant d < 12{,}00$	0,080	0,260
$12{,}00 \leqslant d < 4{,}50$	0,080	0,300
$14{,}50 \leqslant d < 17{,}35$	0,090	0,350
$17{,}35 \leqslant d < 18{,}40$	0,090	0,370
$18{,}40 \leqslant d < 20{,}00$	0,100	0,400

5.1.2 The out of roundness (ovality), that is 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 tolerance range for that diameter.

5.1.3 The requirement for the length tolerance for wire in cut lengths shall be as specified in Table 3.

Table 3 — Tolerance on the length of cut lengths

Dimensions in millimetres

Nominal length l	Tolerance	
	Class 1	Class 2
$0 < l \leqslant 300$	$^{+1,0}_{0}$	$^{+0,01l}_{0}$
$300 < l \leqslant 1\,000$	$^{+2,0}_{0}$	
$l > 1\,000$	$^{+0,002l}_{0}$	

5.2 Surface quality

The surface of the wire shall be smooth and as free as possible from grooves, tears, rust and any surface discontinuities that may have a noticeable adverse effect on the application of the wire.

For details see ISO 8458-2 and ISO 8458-3.

6 Inspection and testing

6.1 General

When agreed at the time of inquiry or order, one of the inspection documents in accordance with ISO 10474 may be submitted (see 6.12). Where specific inspection and testing are required, the requirements given in 6.2 to 6.11 apply.

6.2 Selection and preparation of samples and test pieces

The general conditions given in ISO 377 and ISO 14284 for the selection and preparation of samples and test pieces shall apply.

Samples for all required tests shall be taken from the end of the coil or cut length, as appropriate.

All mechanical tests shall be carried out on full-section test pieces.

6.3 Chemical analysis

In cases of dispute, chemical analyses shall be carried out in accordance with appropriate International Standards (see ISO/TR 9769).

If no International Standards are available, the methods shall be agreed upon at the time of inquiry and order.

6.4 Tensile test

The tensile test for the determination of tensile strength and reduction in area shall be carried out in accordance with ISO 6892. The tensile strength shall be calculated using the actual wire diameter.

6.5 Wrapping test

The wrapping test shall be carried out in accordance with ISO 7802.

6.6 Coiling test

The coiling test shall be carried out in the following manner:

A test piece, approximately 500 mm in length, shall be closely wound, under slight but reasonably uniform tension on a mandrel, three to three and a half times the nominal diameter. The mandrel diameter shall however be at least 1 mm.

The closed coil shall be stretched so that after releasing the stress, it sets to approximately three times its original length.

The surface condition of the wire and the regularity of the spring pitch (and individual windings) shall be inspected with the test piece in this condition.

6.7 Torsion test

The torsion test shall be carried out in accordance with ISO 7800. The speed of testing shall not exceed one turn per second.

6.8 Bend test

The bend test shall be the single bend test carried out in accordance with ISO 7438.

6.9 Diameter measurement

The diameter shall be measured using a micrometer or any other appropriate device at the same cross-section on a straight piece of wire.

6.10 Surface quality test methods

6.10.1 Deep etch test

The deep-etch test shall be applied to wires of 2 mm nominal diameter and over. Test pieces from cold drawn wire shall be given a stress-relieving treatment prior to the deep etching test. The cold test pieces shall be immersed in a solution of 50 % (*V*/*V*) of concentrated hydrochloric acid and water at a minimum temperature of 75 °C. The etching shall be finalized after a reduction in diameter of about 1 %.

In cases of dispute, metallographic examination shall be used.

6.10.2 Eddy current test

Where in line eddy current testing is specified or agreed between the parties, the conditions for the test and the evaluation of results shall also be agreed.

6.10.3 Decarburization

The depth of decarburization shall be inspected metallographically. Evaluation shall be performed on the transverse section of test pieces etched with nital and under magnification of × 100 to × 200 in accordance with ISO 3887.

The depth of decarburization shall be the mean of 8 measurements at the ends of four diameters located at 45° to each other starting from the zone of maximum decarburization and avoiding starting from a zone with a surface discontinuity.

The maximum single value of decarburization shall be recorded in addition to the average value.

6.11 Retests

For retests, the requirements of ISO 404 shall apply.

6.12 Inspection documents

ISO 10474 is valid, inspection documents being:

a) certificate of compliance with the order or

b) test report or

c) inspection certificate or

d) inspection report.

7 Marking

7.1 The general conditions for identification and marking contained in ISO 404 shall apply.

7.2 Unless otherwise stated in the order, the information listed in Table 4 shall be shown on a tag securely attached to each coil or bundle of lengths:

Table 4 — Tag information about the spring wires

	SL, SM, SH, DM, DH	FD	TD, VD
Number of ISO Standard	+	+	+
Manufacturer	+	+	+
Nominal diameter	+	+	+
Spring wire grade	+	+	+
Surface finish	(+)	–	–
Heat number	(+)	(+)	+
Identification number	+	(+)	+
Coating	(+)	–	–

The symbols in the table mean:

\+ The information shall be mentioned on the labels;

(+) The information shall be mentioned on the labels if so requested.

– The information is not mentioned.

8 Complaints

The conditions for dealing with complaints laid down in ISO 404 shall apply.

ICS 77.140.25

Price based on 7 pages