
**Non-alloy steel wire rod for
conversion to wire —**

Part 2:
**Specific requirements for general
purpose wire rod**

*Fil-machine en acier non allié destiné à la fabrication de fils —
Partie 2: Exigences spécifiques au fil-machine d'usage général*





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ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

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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).

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For an explanation on 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 the following URL: 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*.

This third edition cancels and replaces the second edition (ISO 16120-2:2011), which has been technically revised.

A list of all parts in the ISO 16120 series can be found on the ISO website.

Non-alloy steel wire rod for conversion to wire —

Part 2: Specific requirements for general purpose wire rod

1 Scope

This document is applicable to general purpose steel wire rod for drawing and/or cold rolling.

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 4948-2, *Steels — Classification — Part 2: Classification of unalloyed and alloy steels according to main quality classes and main property or application characteristics*

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

3 Terms and definitions

No terms and definitions are listed in this document.

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

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

4 Designation

In the designation C##D, “C” means non-alloy steel (see ISO/TS 4949); ## is the indicative average content of carbon; “D” signifies that it is for wire-drawing.

If steels are ordered according to chemical composition, ## indicates the values to be inserted by the purchaser according to the steel names designated in [Table 1](#), first column.

The designations of comparable steel grades in national or regional standards are provided in [Annex A](#).

Steels can also be ordered according to tensile strength. The mid-point of the required ultimate tensile strength (UTS) range shall be indicated as a suffix to the grade designation, e.g. C##D – 1020, where the required mid-point of the UTS is 1 020 MPa. “##” means “to be left blank” since the carbon content is at the discretion of the supplying mill, and the supplying mill indicates the exact number of ## based on the grade designation until shipment. See [Table 1](#) for the grade designation.

1) Under preparation. Stage at the time of publication: ISO/FDIS 16120-1:2016.

5 Requirements

5.1 General

For the general requirements, see ISO 16120-1.

5.2 Chemical composition

For the heat analysis, the values shown in [Table 1](#) shall apply. If a product analysis is required, the permissible deviations of the product analysis relative to the specified value of the heat analysis are given in [Table 2](#).

Table 1 — Chemical analysis (heat analysis)

Steel grade ^a	C ^b %	Si ^c %	Mn ^d %	Heat analysis						
				P %	S %	Cr %	Ni %	Mo %	Cu ^e %	Al ^f %
				max.	max.	max.	max.	max.	max.	max.
C4D	≤0,06	≤0,30	0,30 to 0,60	0,035	0,035	0,20	0,25	0,05	0,30	0,01
C7D	0,05 to 0,09	≤0,30	0,30 to 0,60	0,035	0,035	0,20	0,25	0,05	0,30	0,01
C9D	≤0,10	≤0,30	0,30 to 0,60	0,035	0,035	0,20	0,25	0,05	0,30	0,01
C10D	0,08 to 0,13	≤0,30	0,30 to 0,60	0,035	0,035	0,20	0,25	0,05	0,30	0,01
C12D	0,10 to 0,15	≤0,30	0,30 to 0,60	0,035	0,035	0,20	0,25	0,05	0,30	0,01
C15D	0,12 to 0,17	≤0,30	0,30 to 0,60	0,035	0,035	0,20	0,25	0,05	0,30	0,01
C18D	0,15 to 0,20	≤0,30	0,30 to 0,60	0,035	0,035	0,20	0,25	0,05	0,30	0,01
C20D	0,18 to 0,23	≤0,30	0,30 to 0,60	0,035	0,035	0,20	0,25	0,05	0,30	0,01
C26D	0,24 to 0,29	0,10 to 0,30	0,50 to 0,80	0,030	0,030	0,20	0,25	0,05	0,30	0,01
C32D	0,30 to 0,35	0,10 to 0,30	0,50 to 0,80	0,030	0,030	0,20	0,25	0,05	0,30	0,01
C38D	0,35 to 0,40	0,10 to 0,30	0,50 to 0,80	0,030	0,030	0,20	0,25	0,05	0,30	0,01
C42D	0,40 to 0,45	0,10 to 0,30	0,50 to 0,80	0,030	0,030	0,20	0,25	0,05	0,30	0,01
C48D	0,45 to 0,50	0,10 to 0,30	0,50 to 0,80	0,030	0,030	0,15	0,20	0,05	0,25	0,01
C50D	0,48 to 0,53	0,10 to 0,30	0,50 to 0,80	0,030	0,030	0,15	0,20	0,05	0,25	0,01
C52D	0,50 to 0,55	0,10 to 0,30	0,50 to 0,80	0,030	0,030	0,15	0,20	0,05	0,25	0,01
C56D	0,53 to 0,58	0,10 to 0,30	0,50 to 0,80	0,030	0,030	0,15	0,20	0,05	0,25	0,01
C58D	0,55 to 0,60	0,10 to 0,30	0,50 to 0,80	0,030	0,030	0,15	0,20	0,05	0,25	0,01

NOTE Elements not included in [Table 1](#) may not be added intentionally to the steel without the agreement of the purchaser, except those intended for finishing the heat. By agreement at the time of ordering, the grades can contain additions (commonly termed microalloying additions) of Cr and V. The content of Cr is up to 0,30 % and the content of V is 0,05 % to 0,10 %.

^a Non-alloy quality steel for general purposes shall comply with unalloyed quality steel in ISO 4948-2.

^b For steel grades C26D to C92D, the carbon range may be enlarged by lowering the minimum by 0,01 % and by increasing the maximum by 0,01%, by agreement between the supplier and purchaser.

^c For wire rod intended for galvanization, the required lower limit of silicon content should be specified at the time of ordering. By agreement at the time of ordering, the maximum silicon level for grades C4D to C20D may be further restricted.

^d For grades from C15D to C92D, a different range from the one indicated in [Table 1](#), but of the same amplitude, can be agreed at the time of ordering, with a maximum not exceeding 1,20 % and a minimum not lower than 0,30 %.

^e A maximum copper content of 0,20 % may be agreed at the time of ordering. For steel grades C48D to C92D, Cu + Sn shall be ≤0,25 %.

^f By agreement at the time of ordering, the value for aluminium can be fixed at 0,01 % to 0,06 %. In such cases, the value of silicon can be fixed at ≤0,10 % on request.

Table 1 (continued)

Steel grade ^a	Heat analysis									
	C ^b	Si ^c	Mn ^d	P	S	Cr	Ni	Mo	Cu ^e	Al ^f
	%	%	%	% max.	% max.	% max.	% max.	% max.	% max.	% max.
C60D	0,58 to 0,63	0,10 to 0,30	0,50 to 0,80	0,030	0,030	0,15	0,20	0,05	0,25	0,01
C62D	0,60 to 0,65	0,10 to 0,30	0,50 to 0,80	0,030	0,030	0,15	0,20	0,05	0,25	0,01
C66D	0,63 to 0,68	0,10 to 0,30	0,50 to 0,80	0,030	0,030	0,15	0,20	0,05	0,25	0,01
C68D	0,65 to 0,70	0,10 to 0,30	0,50 to 0,80	0,030	0,030	0,15	0,20	0,05	0,25	0,01
C70D	0,68 to 0,73	0,10 to 0,30	0,50 to 0,80	0,030	0,030	0,15	0,20	0,05	0,25	0,01
C72D	0,70 to 0,75	0,10 to 0,30	0,50 to 0,80	0,030	0,030	0,15	0,20	0,05	0,25	0,01
C76D	0,73 to 0,78	0,10 to 0,30	0,50 to 0,80	0,030	0,030	0,15	0,20	0,05	0,25	0,01
C78D	0,75 to 0,80	0,10 to 0,30	0,50 to 0,80	0,030	0,030	0,15	0,20	0,05	0,25	0,01
C80D	0,78 to 0,83	0,10 to 0,30	0,50 to 0,80	0,030	0,030	0,15	0,20	0,05	0,25	0,01
C82D	0,80 to 0,85	0,10 to 0,30	0,50 to 0,80	0,030	0,030	0,15	0,20	0,05	0,25	0,01
C86D	0,83 to 0,88	0,10 to 0,30	0,50 to 0,80	0,030	0,030	0,15	0,20	0,05	0,25	0,01
C88D	0,85 to 0,90	0,10 to 0,30	0,50 to 0,80	0,030	0,030	0,15	0,20	0,05	0,25	0,01
C92D	0,90 to 0,95	0,10 to 0,30	0,50 to 0,80	0,030	0,030	0,15	0,20	0,05	0,25	0,01

NOTE Elements not included in Table 1 may not be added intentionally to the steel without the agreement of the purchaser, except those intended for finishing the heat. By agreement at the time of ordering, the grades can contain additions (commonly termed microalloying additions) of Cr and V. The content of Cr is up to 0,30 % and the content of V is 0,05 % to 0,10 %.

^a Non-alloy quality steel for general purposes shall comply with unalloyed quality steel in ISO 4948-2.

^b For steel grades C26D to C92D, the carbon range may be enlarged by lowering the minimum by 0,01 % and by increasing the maximum by 0,01%, by agreement between the supplier and purchaser.

^c For wire rod intended for galvanization, the required lower limit of silicon content should be specified at the time of ordering. By agreement at the time of ordering, the maximum silicon level for grades C4D to C20D may be further restricted.

^d For grades from C15D to C92D, a different range from the one indicated in Table 1, but of the same amplitude, can be agreed at the time of ordering, with a maximum not exceeding 1,20 % and a minimum not lower than 0,30 %.

^e A maximum copper content of 0,20 % may be agreed at the time of ordering. For steel grades C48D to C92D, Cu + Sn shall be $\leq 0,25$ %.

^f By agreement at the time of ordering, the value for aluminium can be fixed at 0,01 % to 0,06 %. In such cases, the value of silicon can be fixed at $\leq 0,10$ % on request.

Table 2 — Permissible deviation in the product analysis in relation to the specified heat analysis

Elements	Steel grade	Permissible deviation in product analysis %
C	C4D to C20D	$\pm 0,02$
	C26D to C82D	$\pm 0,03$
	C86D to C92D	$\pm 0,04$
Si	All grades	$\pm 0,04$
Mn	All grades	$\pm 0,06$
P and S	All grades	+0,005

NOTE If agreed at the time of ordering, the permissible deviation between product analysis and heat analysis for carbon can be in relation to the actual heat analysis instead of the specified range.

5.3 Internal soundness and surface quality

The wire rod shall have no internal and/or surface discontinuities, such as shrink holes, cracks, folds, incrustations, notches, scabs or rolling burrs, which may be detrimental to its correct use.

5.4 Depth of surface discontinuities

The wire rod shall not have any surface discontinuities with depths greater than those shown in [Table 3](#).

These limit values apply for the test chosen in accordance with ISO 16120-1:—, 9.4.3 and 9.5.3.

[Table 3](#) applies to round wire rod only; maximum discontinuity levels for other shapes may be agreed upon.

Table 3 — Limit values for the depth of surface discontinuities of round wire rod

Dimensions in millimetres

Nominal diameter d_N	Maximum permissible depth of surface discontinuities — radial depth ^a	Maximum permissible actual length of surface discontinuities ^{b,c}
$5 \leq d_N \leq 12$	0,20	0,25
$d_N > 12$	0,25	0,30

^a The depth of surface discontinuities is measured from the actual surface of the product in a radial direction.
^b The actual measured length of the discontinuities. See ISO 16120-1:—, Annex B for an explanation of terms.
^c The test for the maximum actual length of surface discontinuities may be skipped by agreement between the supplier and purchaser.

5.5 Core segregation

Unless otherwise agreed at the time of ordering, not more than 20 % of test pieces inspected from steel grade C60D, or those with a higher carbon content, shall be Class 4, and none shall be of Class 5 (see ISO 16120-1:—, Annex A). However, it is recommended that this evaluation be done as part of a quality system.

5.6 Tensile strength

For grades specified by chemical composition, and if requested by the purchaser at the time of ordering, the supplier shall provide guidance values of tensile strength.

For grades specified by tensile strength, the purchaser shall use the designations described in [Clause 4](#). The ultimate tensile strength of the wire rod shall fall within the limits of permissible variation given in [Tables 4](#) and [5](#) for the designated strength level.

The ranges given in [Table 4](#) are referred to as Option A.

For certain applications, the ranges given in [Table 5](#) (Option B) may be agreed at the time of enquiry and order.

Table 4 — Permissible variation for ultimate tensile strength of the wire rod (MPa), Option A

Steel grade	Batch mean (in relation to the <i>specified</i> strength level)	Coil-to-coil and within coil variation (in relation to the <i>actual</i> batch mean)
C4D to C20D	±40	±40
C26D to C60D	±50	±50
C62D to C92D	±60	±60

Table 5 — Permissible variation for ultimate tensile strength of the wire rod (MPa), Option B

Steel grade	Batch mean (in relation to the <i>specified</i> strength level)	Coil-to-coil and within coil variation (in relation to the <i>actual</i> batch mean)
C4D to C20D	±70	±40
C26D to C60D	±90	±50
C62D to C92D	±110	±60

5.7 Scale characteristics

The scale characteristics may be agreed between the supplier and purchaser. These may be specified as quantity of scale and/or descalability.

5.8 Mechanical damage

The wire rod shall have no abrasive damage (the consequence of frictional contact between wire rod and wire rod, wire rod and concrete, or wire rod and steel) detrimental to its subsequent processing and end use. Standards of acceptability relating to permissible levels of damage may be agreed between the supplier and purchaser. Illustrative examples of mechanical damage are shown in ISO 16120-1:—, Annex C.

Annex A (informative)

Steel designations and designation of comparable steel grades

This document will be adopted by CEN without changes. The equivalent European steel numbers are therefore listed in column 2 of [Table A.1](#).

Table A.1 — Steel designations in accordance with this document and designation of comparable steel grades in national or regional standards

ISO 16120-2		JIS G 3505		GB/T 24242.2:2009	
Steel designation	European material no.	Steel designation	n/nr/ya	Steel designation	n/nr/ya
C4D	1.0300			C4D	y
C7D	1.0313	SWRM6	nr	C7D	y
C9D	1.0304	SWRM8	y	C9D	y
C10D	1.0310	SWRM10	y	C10D	y
C12D	1.0311	SWRM12	y	C12D	y
C15D	1.0413	SWRM15	y	C15D	y
C18D	1.0416	SWRM17	y	C18D	y
C20D	1.0414	SWRM20	y	C20D	y
		SWRM22	n		
C26D	1.0415	SWRH27	nr	C26D	y
C32D	1.0530	SWRH32	nr	C32D	y
C38D	1.0516	SWRH37	nr	C38D	y
C42D	1.0541	SWRH42A	nr	C42D	y
		SWRH42B			
C48D	1.0517	SWRH47A	nr	C48D	y
		SWRH47B			
C50D	1.0586		nr	C50D	y
C52D	1.0588	SWRH52A	nr	C52D	y
		SWRH52B			
C56D	1.0518		nr	C56D	y
C58D	1.0609	SWRH57A	nr	C58D	y
		SWRH57B			
C60D	1.0610		nr	C60D	y
C62D	1.0611	SWRH62A	nr	C62D	y
		SWRH62B			
C66D	1.0612		nr	C66D	y
C68D	1.0613	SWRH67A	nr	C68D	y
		SWRH67B			
C70D	1.0615		nr	C70D	y

^a Deviation of the chemical analysis (heat analysis) from that given in this document: n = no; nr = not relevant; y = relevant.

Table A.1 (continued)

ISO 16120-2		JIS G 3505		GB/T 24242.2:2009	
Steel designation	European material no.	Steel designation	n/nr/ya	Steel designation	n/nr/ya
C72D	1.0617	SWRH72A	nr	C72D	y
		SWRH72B			
C76D	1.0614		nr	C76D	y
C78D	1.0620	SWRH77A	nr	C78D	y
		SWRH77B			
C80D	1.0622			C80D	y
C82D	1.0626	SWRH82A	nr	C82D	y
		SWRH82B			
C86D	1.0616			C86D	y
C88D	1.0628			C88D	y
C92D	1.0618			C92D	y

^a Deviation of the chemical analysis (heat analysis) from that given in this document: n = no; nr = not relevant; y = relevant.

Bibliography

- [1] ISO/TS 4949, *Steel names based on letter symbols*
- [2] JIS G 3505, *Low carbon steel wire rods*
- [3] GB/T 24242.2:2009, *Non-alloy steel wire rod for conversion to wire — Part 2: Specific requirements for general-purpose wire rod*

