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Steel rod, bars and wire for cold heading and cold extrusion

Part 5: Technical delivery conditions for stainless steels

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Steel rod, bars and wire for cold heading and cold extrusion - Part 5: Technical delivery conditions for stainless steels

Barres, fil machine et fils en acier pour transformation à froid et extrusion à froid - Partie 5: Conditions techniques de livraison des aciers inoxydables

Walzdraht, Stäbe und Draht aus Kaltstauch- und Kaltfließpressstählen - Teil 5: Technische Lieferbedingungen für nichtrostende Stähle

This European Standard was approved by CEN on 4 September 2017.

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European foreword

This document (EN 10263-5:2017) 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of an identical text or by endorsement, at the latest by May 2018, and conflicting national standards shall be withdrawn at the latest by May 2018.

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

This document supersedes EN 10263-5:2001.

This European Standard EN 10263, *Steel rod, bars and wire for cold heading and cold extrusion*, is subdivided as follows:

— *Part 1: General technical delivery conditions*;

— *Part 2: Technical delivery conditions for steels not intended for heat treatment after cold working*;

— *Part 3: Technical delivery conditions for case hardening steels*;

— *Part 4: Technical delivery conditions for steels for quenching and tempering*;

— *Part 5: Technical delivery conditions for stainless steels*.

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1 Scope

1.1 This European Standard is applicable to round rod, round bars and wire made of stainless steels intended for cold heading and cold extrusion having a diameter up to and including:

— 25 mm for ferritic and austenitic-ferritic steels;

— 50 mm for austenitic steels;

— 100 mm for martensitic steels.

1.2 EN 10263-1 is indispensable for the application of this part of EN 10263.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 10020, *Definition and classification of grades of steel*

EN 10088-1:2014, *Stainless steels — Part 1: List of stainless steels*

EN 10263-1:2017, *Steel rod, bars and wire for cold heading and cold extrusion — Part 1: General technical delivery conditions*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 10263-1 and the following apply.

3.1
stainless steels
steels with at least 10,5 % Cr and max. 1,2 % C (mass fraction)

4 Classification and designation

4.1 Classification

All steels covered by this part of EN 10263 are stainless steels according to EN 10020.

From a practical viewpoint these steels are also classified on the basis of their structure; see also EN 10088-1:2014, Annex C.

4.2 Designation

See EN 10263-1.

5 Production Process

See EN 10263-1.

6 Requirements

6.1 Delivery conditions

The delivery conditions in which the products covered by this part of EN 10263 are normally supplied, the product forms and the applicable requirements are given in Table 1 and Table 2.

6.2 Chemical composition

6.2.1 Cast analysis

The chemical composition shall be in accordance with the values specified in Table 3 for the cast analysis.

6.2.2 Product analysis

In cases where a product analysis is requested, the admissible deviations from the values specified for the cast analysis are indicated in Table 4.

6.3 Mechanical properties

The mechanical properties of the products, to be determined by the tensile test, shall be in accordance with the prescriptions given in Table 5, Table 6, Table 7 and Table 8.

6.4 Surface quality

6.4.1 Rod is normally supplied in the pickled condition. Mechanical descaling (sandblasting) can also be used, in which case a subsequent treatment in a pickling solution shall be carried out unless otherwise agreed. Particular processes such as peeling or shaving may also be applied, subject to specific agreement at the time of enquiry and order.

6.4.2 Minor surface imperfections which may occur under normal manufacturing conditions, such as scores originating from rolled-in scale, shall not be regarded as defects.

6.4.3 Any particular surface requirements may be agreed at the time of enquiry and order.

6.5 Supplementary or special requirements

6.5.1 Aptitude to cold forming

A test for the verification of the aptitude of products to cold forming may be carried out if agreed at the time of enquiry and order.

If for the verification of the aptitude to cold forming the upsetting test is applied, it shall be carried out as follows:

— a test piece with an initial length (height) equal to 1,5 x d, where d is the product diameter, is submitted to axial heading by means of a press until its length is reduced to 1/3 of the initial value.

The above test shall be carried out at ambient temperature and limited to the products with a maximum diameter of 15 mm.

The criteria for the assessment of test results shall be agreed at the time of ordering bearing in mind the end use for which the products are intended.

6.5.2 Depth of surface discontinuities

The maximum admissible depth of surface discontinuities is indicated in Table 9. The depth of a discontinuity is considered as being the distance between the surface of the product and the bottom of the discontinuity, to be measured in a direction perpendicular to the surface along a radius. In case of dispute the determination of the depth of surface discontinuities shall be carried out by metallographic means with a magnification of X 100, on a straight cross section of the product in the delivery condition concerned.

Table 1 — Combination of usual heat-treatment conditions, product forms and applicable requirements

Heat-treatment condition at delivery	Symbol	Product form [a]			Steels			Applicable requirements		
		bar	rod	wire	ferritic	martensitic	austenitic and austenitic-ferritic			
Soft annealed	+A	X	X	X	X	X	–	Chemical composition as specified in Table 3	Mechanical properties as specified in Table 5 or 6 or 7 or 8	Supplementary or special requirements as specified in EN 10263-1:2017, Annex A[b]
Solution annealed	+AT	X	X	X	–	–	X			
Others	Other delivery conditions may be agreed at the time of enquiry and order.									

[a] X = applicable – = not applicable

[b] If agreed at the time of the enquiry and order.

Table 2 — Surface condition at delivery

Surface condition at delivery	Symbol	bar	rod	wire
Cold drawn	+C	–	x	x
Peeled	+PE	x	–	x
Skin passed	+LC	–	–	x

Table 3 — Steel grades and chemical composition — Cast analysis, % by mass [a]

Steel grade		C	Si	Mn	P	S	Cr	Mo	Ni	N	Cu	Others
Steel name	Steel number											
Austenitic steels												
X10CrNi18–8	1.4310	0,05 to 0,15	2,00	2,00	0,045	0,015	16,0 to 19,0	0,80	6,0 to 9,5	0,10	1,00	-
X2CrNi18–9	1.4307	0,030	1,00	2,00	0,045	0,030 [b]	17,5 to 19,5		8,0 to 10,5	0,10	1,00	-
X2CrNi19–11	1.4306	0,030	1,00	2,00	0,045	0,030 [b]	18,0 to 20,0		10,0 to 12,0	0,10	1,00	-
X5CrNi18–10	1.4301	0,07	1,00	2,00	0,045	0,030 [b]	17,5 to 19,5		8,0 to 10,5	0,10	1,00	-
X6CrNiTi18–10	1.4541	0,08	1,00	2,00	0,045	0,030 [b]	17,0 to 19,0		9,0 to 12,0	-	1,00	Ti = 5xC to 0,70
X4CrNi18–12	1.4303	0,06	1,00	2,00	0,045	0,030 [b]	17,0 to 19,0		11,0 to 13,0	0,10	–	-
X2CrNiMo 17–12–2	1.4404	0,030	1,00	2,00	0,045	0,030 [b]	16,5 to 18,5	2,00 to 2,50	10,0 to 13,0	0,10	1,00	-
X2CrNiMo17–12–3	1.4432	0,030	1,00	2,00	0,045	0,030 [b]	16,5 to 18,5	2,50 to 3,00	10,5 to 13,0	0,10	1,00	-
X5CrNiMo17–12–2	1.4401	0,07	1,00	2,00	0,045	0,030 [b]	16,5 to 18,5	2,00 to 2,50	10,0 to 13,0	0,10	1,00	-
X6CrNiMoTi17–12–2	1.4571	0,08	1,00	2,00	0,045	0,030 [b]	16,5 to 18,5	2,00 to 2,50	10,5 to 13,5	-	1,00	Ti = 5xC to 0,70
X2CrNiMoN17–13–3	1.4429	0,030	1,00	2,00	0,045	0,015	16,5 to 18,5	2,50 to 3,00	11,0 to 14,0	0,12 to 0,22	1,00	-
X3CrNiMo17–13–3	1.4436	0,05	1,00	2,00	0,045	0,030 [b]	16,5 to 18,5	2,50 to 3,00	10,5 to 13,0	0,10	–	-

[a] Maximum values unless indicated otherwise.

[b] Particular ranges of sulphur content may provide improvement of particular properties. For machinability a controlled sulphur content of 0,015 % to 0,030 % is recommended and permitted. For weldability, a controlled sulphur content of 0,008 % to 0,030 % is recommended and permitted. For polishability, a controlled sulphur content of 0,015 % max. is recommended.

[c] In order to improve the cold formability, a carbon content of max 0,04 % is recommended and may be agreed at the time of enquiry and order.

[d] By agreement, this grade can be delivered with a Pitting Resistance Equivalent Number (PRE = Cr + 3,3 Mo + 16 N, compare EN 10088-1:2014, Table D.1) greater than 34.

[e] A minimum content of 8 % of Ni is permitted, unless otherwise agreed at the time of enquiry and order.

Table 3 *(continued)*

Steel grade		C	Si	Mn	P	S	Cr	Mo	Ni	N	Cu	Others
Steel name	**Steel number**											
X3CrNiCu18-9-4	1.4567	0,04	1,00	2,00	0,045	0,030 [b]	17,0 to 19,0	–	8,5 to 10,5 [e]	0,10	3,00 to 4,0	-
X3CrNiCu19-9-2	1.4560	0,035	1,00	1,50 to 2,00	0,045	0,015	18,0 to 19,0	–	8,0 to 9,0	0,10	1,50 to 2,00	-
X3CrNiCuMo17-11-3-2	1.4578	0,04	1,00	2,00	0,045	0,015	16,5 to 17,5	2,00 to 2,50	10,0 to 11,0	0,10	3,00 to 3,5	-
Austenitic- ferritic steel												
X2CrNiMoN22-5-3 [d]	1.4462 [d]	0,030	1,00	2,00	0,035	0,015	21,0 to 23,0	2.50 to 3.5	4,5 to 6,5	0,10 to 0,22	-	-
Ferritic steels												
X6Cr17	1.4016	0,08 [c]	1,00	1,00	0,040	0,030 [b]	16,0 to 18,0	-	-	-	-	-
X6CrMo17-1	1.4113	0,08	1,00	1,00	0,040	0,030 [b]	16,0 to 18,0	0,90 to 1,40	-	-	-	-
Martensitic steel												
X12Cr13	1.4006	0,08 to 0,15	1,00	1,50	0,040	0,030 [b]	11,5 to 13,5		0,75	-	-	-

Elements not quoted in this table may not be intentionally added to the steel without the agreement of the purchaser except for finishing the heat. All appropriate precautions shall be taken to avoid the addition of such elements from scrap and other materials used in production which would impair mechanical properties and the suitability of the steel.

[a] Maximum values unless indicated otherwise.

[b] Particular ranges of sulphur content may provide improvement of particular properties. For machinability a controlled sulphur content of 0,015 % to 0,030 % is recommended and permitted. For weldability, a controlled sulphur content of 0,008 % to 0,030 % is recommended and permitted. For polishability, a controlled sulphur content of 0,015 % max. is recommended.

[c] In order to improve the cold formability, a carbon content of max 0,04 % is recommended and may be agreed at the time of enquiry and order.

[d] By agreement, this grade can be delivered with a Pitting Resistance Equivalent Number (PRE = Cr + 3,3 Mo + 16 N, compare EN 10088-1:2014, Table D.1) greater than 34.

[e] A minimum content of 8 % of Ni is permitted, unless otherwise agreed at the time of enquiry and order.

Table 4 — Permissible deviations between product analysis and the limiting values specified in Table 3 for the heat analysis

Elements	Limiting values of the cast (heat) analysis % by mass	Permissible deviation for the product analysis % by mass [a]
C	≤ 0,030	+ 0,005
	> 0,030 ≤ 0, 15	±0,01
Si	≤ 1,00	+ 0,05
	> 1,00 ≤ 2,00	+ 0,10
Mn	≤ 1,00	+ 0,03
	> 1,00 ≤ 2,00	±0,04
P	≤ 0,045	+ 0,005
S	≤ 0,015	+ 0,003
	> 0,015 ≤ 0,030	+ 0,005
N	≤ 0,22	± 0,01
Cr	≥ 11,5 < 15,0	±0,15
	≥ 15,0 ≤ 20,0	±0,20
	> 20,0 ≤ 23,0	±0,25
Cu	≤ 1,00	+ 0,07
	> 1,00 ≤ 4,0	±0,10
Mo	< 1,75	±0,05
	≥ 1,75 ≤ 3,5	±0,10
Ni	≤ 1,00	+ 0,03
	> 1,00 ≤ 5,0	±0,07
	> 5,0 ≤ 10,0	±0,10
	> 10,0 ≤ 14,0	±0,15
Ti	≤ 0,70	±0,05

[a] ± means that in one heat the deviation of the product analysis for a given element may occur over the upper value or under the lower value of the specified range in Table 3, but not both at the same time.

Table 5 — Mechanical properties for austenitic stainless steels in the specified delivery condition

Steel grade		Diameter		Delivery condition							
				+AT or +AT+PE		+AT+C		+AT+C+AT		+AT+C+AT+LC	
Steel name	Steel number	above	up to	R_m max	Z min	R_m max	Z min	R_m max	Z min	R_m max	Z min
		mm	mm	MPa	%	MPa	%	MPa	%	MPa	%
X10CrNi18-8	1.4310	2	5	–	–	-	-	720	65	760	60
		5	10	660	65	890	–	680	65	730	60
		10	25	660	65	850	–	660	65	-	-
		25	50	660	65	–	–	–	–	-	-
X2CrNi18-9	1.4307	2	5	–	–	-	-	680	68	730	63
		5	10	630	68	800	–	630	68	680	63
		10	25	630	68	760	–	630	68	-	-
		25	50	630	68	740	–	630	68	-	-

Steel grade		Diameter		Delivery condition							
				+AT or +AT+PE		+AT+C		+AT+C+AT		+AT+C+AT+LC	
Steel name	Steel number	above	up to	R_m max	Z min	R_m max	Z min	R_m max	Z min	R_m max	Z min
		mm	mm	MPa	%	MPa	%	MPa	%	MPa	%
X2CrNi19–11	1.4306	2	5	–	–	-	-	680	68	730	63
		5	10	630	68	780	–	630	68	680	63
		10	25	630	68	740	–	630	68	-	-
		25	50	630	68	–	–	–	–	-	-
X5CrNi18–10	1.4301	2	5	–	-	-	-	700	60	750	60
		5	10	650	65	820	–	650	65	700	60
		10	25	650	65	780	–	650	65	-	-
		25	50	650	65	–	–	–	–	-	-
X6CrNiTi18–10	1.4541	2	5	–	–	-	-	720	65	770	60
		5	10	680	65	850	–	680	65	730	60
		10	25	680	65	810	–	680	65	-	-
		25	50	680	65	–	–	–	–	-	-
X4CrNi18–12	1.4303	2	5	–	–	-	-	670	65	720	60
		5	10	650	65	800	–	650	65	700	60
		10	25	650	65	770	–	650	65	-	-
		25	50	650	65	–	–	–	–	-	-
X2CrNiMo17–12–2	1.4404	2	5	–	–	-	-	670	68	720	63
		5	10	650	68	780	–	650	68	700	63
		10	25	650	68	750	–	650	68	–	–
		25	50	650	68	–	–	–	–	-	-
X2CrNiMo17–12–3	1.4432	2	5	–	–	-	-	670	68	720	63
		5	10	650	68	780	–	650	68	700	63
		10	25	650	68	750	–	650	68	–	–
		25	50	650	68	–	–	–	–	-	-
X5CrNiMo17–12–2	1.4401	2	5	–	–	-	-	690	65	740	60
		5	10	660	65	830	–	670	65	720	60
		10	25	660	65	790	–	660	65	-	-
		25	50	660	65	–	–	–	–	-	-
X6CrNiMoTi17–12–2	1.4571	2	5	–	–	-	-	720	65	770	60
		5	10	680	65	850	–	680	65	730	60
		10	25	680	65	810	–	680	65	-	-
		25	50	680	65	–	–	–	–	-	-
X2CrNiMoN17–13–3	1.4429	2	5	–	–	-	-	820	60	870	55
		5	10	780	60	940	–	800	60	850	55
		10	25	780	60	910	–	780	60	-	-
		25	50	780	60	–		–	–	-	-
X3CrNiMo17–13–3	1.4436	2	5	–	–	-	-	690	65	740	60
		5	10	660	65	830	–	670	65	720	60
		10	25	660	65	790	–	660	65	-	-
		25	50	660	65	–	–	–	–	-	-

Steel grade		Diameter		Delivery condition							
				+AT or +AT+PE		+AT+C		+AT+C+AT		+AT+C+AT+LC	
Steel name	Steel number	above	up to	R_m max	Z min	R_m max	Z min	R_m max	Z min	R_m max	Z min
		mm	mm	MPa	%	MPa	%	MPa	%	MPa	%
X3CrNiCu18-9-4	1.4567	2	5	–	–	-	-	600	68	650	63
		5	10	590	68	740	–	590	68	640	63
		10	25	590	68	700	–	590	68	-	-
		25	50	590	68	–	–	–	–	-	-
X3CrNiCu19-9-2	1.4560	2	5	–	–	-	-	630	68	680	63
		5	10	610	68	790	–	610	68	660	63
		10	25	610	68	750	–	610	68	-	-
		25	50	610	68	–	–	–	–	-	-
X3CrNiCu-Mo17-11-3-2	1.4578	2	5	–	–	-	-	630	68	680	63
		5	10	610	68	760	–	610	68	660	63
		10	25	610	68	720	–	610	68	-	-
		25	50	610	68	–	–	–	–	-	-

Table 6 — Mechanical properties for austenitic-ferritic stainless steels in the specified delivery condition

Steel grade		Diameter		Delivery condition							
				+AT or +AT+PE		+AT+C		+AT+C+AT		+AT+C+AT+LC	
Steel name	Steel number	above	up to	R_m max	Z min	R_m max	Z min	R_m max	Z min	R_m max	Z min
		mm	mm	MPa	%	MPa	%	MPa	%	MPa	%
X2CrNiMoN22-5-3	1.4462	2	5	880	55	–	–	950	55	1010	50
		5	10	880	55	1020	–	900	55	970	50
		10	25	880	55	1000	–	880	55	–	–

Table 7 — Mechanical properties for ferritic stainless steels in the specified delivery condition

Steel grade		Diameter		Delivery condition							
				+A or +A+PE		+A+ LC		+A+C+A		+A+C+A+LC	
Steel name	Steel number	above	up to	R_m max	Z min	R_m max	Z min	R_m max	Z min	R_m max	Z min
		[mm]	[mm]	MPa	%	MPa	%	MPa	%	MPa	%
X6Cr17	1.4016	2	5	–	–	–	–	560	63	620	61
		5	10	560	63	660	60	560	63	600	61
		10	25	560	63	640	60	560	63	-	-
X6CrMo17-1	1.4113	2	5	–	–	-	-	600	60	660	58
		5	10	600	60	710	57	600	60	640	58
		10	25	600	60	690	57	600	60	-	-

Table 8 — Mechanical properties for martensitic stainless steels in the specified delivery condition

Steel grade		Diameter		Delivery condition							
				+A or +A+PE		+A+ LC		+A+C+A		+A+C+A+LC	
Steel name	Steel number	above	up to	R_m max	Z min	R_m max	Z min	R_m max	Z min	R_m max	Z min
		mm	mm	MPa	%	MPa	%	MPa	%	MPa	%
X12Cr13	1.4006	2	5	–	–	-	-	600	60	660	58
		5	10	600	60	720	57	600	60	640	58
		10	25	600	60	700	57	600	60	-	-
		25	100	600	60	–	–	-	–	-	-

Table 9 — Depth of surface discontinuities

Diameter in the delivery condition [a] mm	Maximum permissible depth of discontinuities [b] mm
≤ 10	0,10
> 10	1 % of the diameter

[a] For diameter less than 5 mm, the permissible depth of surface discontinuities shall be reduced in proportion of the reduction of the diameter during cold drawing.

[b] For ferritic, martensitic and austenitic-ferritic steels, higher values may be agreed at the time of enquiry and order.

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