

TECHNICAL SPECIFICATION

ISO/TS 15510

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Stainless steels — Chemical composition

Aciers inoxydables — Composition chimique

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

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.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of normative document:

- an ISO Publicly Available Specification (ISO/PAS) represents an agreement between technical experts in an ISO working group and is accepted for publication if it is approved by more than 50 % of the members of the parent committee casting a vote;
- an ISO Technical Specification (ISO/TS) represents an agreement between the members of a technical committee and is accepted for publication if it is approved by 2/3 of the members of the committee casting a vote.

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An ISO/PAS or ISO/TS is reviewed after three years in order to decide whether it will be confirmed for a further three years, revised to become an International Standard, or withdrawn. If the ISO/PAS or ISO/TS is confirmed, it is reviewed again after a further three years, at which time it must either be transformed into an International Standard or be withdrawn.

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.

ISO/TS 15510 was prepared by Technical Committee ISO/TC 17, *Steel*, Subcommittee SC 4, *Heat treatable and alloy steels*.

Introduction

In its meeting held on 6th June 2000, ISO/TC 17/SC 4 decided to issue the revised version of ISO/TR 15510:1997 as a Technical Specification. It was nevertheless also stated that future discussions on ISO/TS 15510 should lead to a full ISO Standard.

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Stainless steels — Chemical composition

1 Scope

This ISO Technical Specification lists the chemical compositions of stainless steels agreed by ISO/TC 17/SC 4 mainly on the basis of a composition of the specifications in existing ISO, ASTM, EN and JIS standards. They apply to all product forms including ingots and semi-finished material.

2 Normative references

The following referenced documents are indispensable for the application 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 6929:1987, *Steel products — Definitions and classification*

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3 Terms and definitions (standards.iteh.ai)

For the purposes of this document, the terms and definitions given in ISO 6929 as well as the following apply.

3.1

stainless steel

steel with at least 10,5 % mass fraction Cr and a maximum of 1,2 % mass fraction C

NOTE For the classification of stainless steels according to their structure, composition and application see Annex A.

4 Chemical composition

The chemical composition of stainless steels approved by ISO/TC 17/SC 4 is given in Table 1.

NOTE If, in special cases, e.g. an ISO committee charged with establishing or revising a standard for a specific product or application of stainless steels, sees the necessity of deviating from the specifications in Table 1 it should inform ISO/TC 17/SC 4 (Secretariat's address: DIN, Postfach 10 51 45, 40042 Düsseldorf, Germany) of the reasons for this and try, before such deviations are considered, to achieve consensus for a corresponding modification to Table 1.

5 Designation of comparable steels

In Table 2 are given the designations of stainless steels which are listed in other international, regional or national standards or designation systems and are comparable to the grades in Table 1.

NOTE To compare similar grades, it is necessary to check each element before making a substitution.

Table 1 — Internationally agreed specifications for the composition of stainless steels (applicable for cast analysis): (mass %)

Line	Steel designation	C		Si		Mn		P		S		N		Cr		Mo		Ni	Element	Others	
		min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.			min.	max.
a) Austenitic steels																					
1	X2CrNi18-9		0,030		1,00		2,00	0,045		0,030 ^a		0,11	17,5	19,5				8,0	10,0 ^b		
2	X2CrNi19-11		0,030		1,00		2,00	0,045		0,030 ^a		0,11	18,0	20,0				10,0	12,0 ^b		
3	X2CrNiN18-9		0,030		1,00		2,00	0,045		0,030 ^a	0,12	0,22	17,5	19,5				8,0	10,0		
4	X2CrNiN18-7		0,030		1,00		2,00	0,045		0,015	0,10	0,20	16,5	18,5				6,0	8,0		
5	X5CrNi17-7		0,07		1,00		2,00	0,045		0,030 ^a		0,11	16,0	18,0				6,0	8,0		
6	X5CrNi18-9		0,07		1,00		2,00	0,045		0,030 ^a		0,11	17,5	19,5				8,0	10,5		
7	X7CrNi18-9	0,04	0,08		1,00		2,00	0,045		0,030 ^a		0,11	18,0	20,0				8,0	10,5		
8	X6CrNi18-12		0,08		1,00		2,00	0,045		0,030 ^a		0,11	17,0	19,0				10,5	13,0		
9	X3NiCr18-16		0,04		1,00		2,00	0,045		0,030 ^a			15,0	17,0				17,0	19,0		
10	X5CrNiN18-8		0,07		1,00		2,50	0,045		0,030 ^a	0,10	0,16	18,0	20,0				8,0	11,0		
11	X10CrNi18-8	0,05	0,15		2,00		2,00	0,045		0,030 ^a		0,11	16,0	19,0		0,80		6,0	9,5		
12	X1CrNi25-21		0,02		0,25		2,00	0,025		0,010		0,11	24,0	26,0		0,20		20,0	22,0		
13	X12CrMnNi17-7-5		0,15		1,00	5,5	7,5	0,045		0,030 ^a	0,05	0,25	16,0	18,0				3,5	5,5		
14	X10CrNiS18-9		0,12		1,00		2,00	0,060	0,15			0,11	17,0	19,0				8,0	10,0	Cu	c
15	X3CrNiCu18-9-4		0,04		1,00		2,00	0,045		0,030 ^a		0,11	17,0	19,0				8,0	10,5	Cu	3,0
16	X6CrNiTi18-10		0,08		1,00		2,00	0,045		0,030 ^a			17,0	19,0				9,0	12,0 ^b	Ti	5 × C
17	X7CrNiTi18-10	0,04	0,08		1,00		2,00	0,045		0,030 ^a			17,0	19,0				9,0	12,0 ^b	Ti	5 × C
18	X6CrNiTiB18-10	0,04	0,08		1,00		2,00	0,035		0,015			17,0	19,0				9,0	12,0	Ti	5 × C
19	X6CrNiNb18-10		0,08		1,00		2,00	0,045		0,030 ^a			17,0	19,0				9,0	12,0 ^b	Nb	10 × C
20	X7CrNiNb18-10	0,04	0,08		1,00		2,00	0,045		0,030 ^a			17,0	19,0				9,0	12,0 ^b	Nb	10 × C
21	X2CrNiMo17-12-2		0,030		1,00		2,00	0,045		0,030 ^a		0,11	16,5	18,5	2,00	3,00		10,0	13,0 ^b		
22	X2CrNiMo17-12-3		0,030		1,00		2,00	0,045		0,030 ^a		0,11	16,5	18,5	2,50	3,00		10,5	13,0 ^b		
23	X2CrNiMo18-14-3		0,030		1,00		2,00	0,045		0,015		0,11	17,0	19,0	2,50	3,00		12,5	15,0		
24	X2CrNiMo19-14-4		0,030		1,00		2,00	0,045		0,030 ^a		0,11	17,5	20,0	3,0	4,0		12,0	16,0		
25	X2CrNiMoN17-11-2		0,030		1,00		2,00	0,045		0,030 ^a	0,12	0,22	16,5	18,5	2,00	3,00		10,0	12,5 ^b		

Table 1 (continued)

Line	Steel designation	C		Si		Mn		P		S		N		Cr		Mo		Ni		Others		
		min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	Element	min.	max.
a) Austenitic steels																						
26	X2CrNiMoN17-12-3	0,030		1,00		2,00	0,045			0,030 ^a	0,12	0,22	16,5	18,5	2,50	3,00	10,5	13,0 ^b				
27	X2CrNiMoN18-12-4	0,030		1,00		2,00	0,045			0,030 ^a	0,10	0,20	16,5	19,5	3,00	4,00	10,5	14,0 ^b				
28	X2CrNiMoN18-15-5	0,030		1,00		2,00	0,045			0,030 ^a	0,12	0,22	17,0	20,0	4,0	5,0	13,0	17,0				
29	X1CrNiMoN25-22-2	0,020		0,70		2,00	0,025			0,010	0,10	0,16	24,0	26,0	2,00	2,50	21,0	23,0				
30	X5CrNiMo17-12-2	0,07		1,00		2,00	0,045			0,030 ^a		0,11	16,5	18,5	2,00	3,00	10,0	13,0				
31	X3CrNiMo17-12-3	0,05		1,00		2,00	0,045			0,030 ^a		0,11	16,5	18,5	2,50	3,00	10,5	13,0 ^b				
32	X6CrNiMoTi17-12-2	0,08		1,00		2,00	0,045			0,030 ^b		0,25	16,5	18,5	2,00	2,50	10,5	13,5 ^b	Ti	5 × C	0,70	
33	X6CrNiMoNb17-12-2	0,08		1,00		2,00	0,045			0,030 ^b		0,25	16,5	18,5	2,00	2,50	10,5	13,5	Nb	10 × C	1,00	
34	X1CrNiMoCuN20-18-7 ^d	0,020		0,70		1,00	0,035			0,015	0,18	0,25	19,5	20,5	6,0	7,0	17,5	18,5	Cu	0,50	1,00	
35	X1NiCrMoCu25-20-5	0,020		0,75		2,00	0,035			0,015	0,15	0,15	19,0	22,0	4,0	5,0	23,5	26,0	Cu	1,20	2,00	
36	X1NiCrMoCu31-27-4	0,020		0,70		2,00	0,030			0,010	0,11	0,21	26,0	28,0	3,0	4,0	30,0	32,0	Cu	0,70	1,50	
37	X1NiCrMoCuN25-20-7	0,020		0,75		2,00	0,035			0,015	0,15	0,25	19,0	21,0	6,0	7,0	24,0	26,0	Cu	0,50	1,50	
38	X1CrNiMoCuN24-22-8	0,020		0,50	2,0	4,0	0,030			0,005	0,45	0,55	23,0	25,0	7,0	8,0	21,0	23,0	Cu	0,30	0,60	
39	X8CrMnNiN18-9-5	0,05	0,10	0,30		9,0	0,035			0,030	0,25	0,32	17,5	18,5		0,50	5,0	6,0	Cu		0,40	
40	X8CrMnCuN17-8-3		0,10	2,00	6,5	8,5	0,040			0,030	0,15	0,30	16,0	18,0	1,00		2,00	2,00	Cu	2,00	3,50	
41	X1CrNiMoCuNW24-22-6	0,020		0,70	2,0	4,0	0,030			0,010	0,35	0,50	23,0	25,0	5,5	6,5	21,0	23,0	Cu	1,00	2,00	
42	X2CrNiMnMoN25-18-6-5	0,030		1,00		5,0	0,030			0,015	0,30	0,60	24,0	26,0	4,0	5,0	16,0	19,0	Nb		0,15	
43	X11CrNiMnN19-8-6	0,07	0,15	0,50		5,0	0,030			0,015	0,20	0,30	17,5	19,5			6,5	8,5				
44	X6CrNiCuS18-9-2	0,08		1,00		2,00	0,045	0,15				0,11	17,0	19,0		0,60	8,0	10,0	Cu	1,4	1,8	
45	X6CrNiCu17-8-2	0,08		1,70		3,00	0,045			0,030			15,0	18,0			6,0	9,0	Cu	1,0	3,0	
46	X12CrNiSi18-9-3	0,15	2,00	3,00		2,00	0,045			0,030			17,0	19,0			8,0	10,0				

Table 1 (continued)

Line	Steel designation	C		Si		Mn		P		S		N		Cr		Mo		Ni		Element		Others		
		min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	
b) Austenitic-ferritic (duplex) steels																								
51	X2CrNiN23-4 ^d		0,030		1,00		2,00		0,035		0,015	0,05	0,20	22,0	24,0	0,10	0,60	3,5	5,5		Cu	0,10		0,60
52	X2CrNiMoN22-5-3 ^e		0,030		1,00		2,00		0,035		0,015	0,10	0,22	21,0	23,0	2,5	3,5	4,5	6,5					
53	X2CrNiMoCuN25-6-3		0,030		0,70		2,00		0,035		0,015	0,15	0,30	24,0	26,0	2,5	4,0	5,0	7,5		Cu	1,00		2,50
54	X2CrNiMoN25-7-4 ^d		0,030		1,00		2,00		0,035		0,015	0,24	0,35	24,0	26,0	3,0	4,5	6,0	8,0					
55	X3CrNiMoN27-5-2		0,050		1,00		2,00		0,035		0,015	0,05	0,20	25,0	28,0	1,30	2,00	4,5	6,5					
56	X2CrNiMoCuWN25-7-4		0,030		1,00		1,00		0,035		0,015	0,20	0,30	24,0	26,0	3,0	4,0	6,0	8,0		Cu	0,50		1,00
																					W	0,50		1,00
c) Ferritic steels																								
61	X2CrNi12		0,030		1,00		1,50		0,040		0,015	0,030	0,30	10,5	12,5			0,30	1,10					
62	X2CrTi12		0,030		1,00		1,00		0,040		0,030 ^a			10,5	12,5				0,50		Ti	6 × (C+N)		0,65
63	X6CrTi12		0,08		1,00		1,00		0,040		0,030			10,5	12,5				0,50		Ti	6 × (C+N)		0,65
64	X6CrNiTi12		0,08		1,00		1,00		0,040		0,015			10,5	12,5			0,50	1,50		Ti	0,05		0,35
65	X6Cr13		0,08		1,00		1,00		0,040		0,030 ^b			11,5	14,0				0,75					
66	X6CrAl13		0,08		1,00		1,00		0,040		0,030 ^a			11,5	14,0						Al	0,10		0,30
67	X6Cr17		0,08 ^b		1,00		1,00		0,040		0,030 ^b			16,0	18,0									
68	X7CrS17		0,09		1,50		1,50		0,040	0,15				16,0	18,0		0,60							
69	X6CrMo17-1		0,08		1,00		1,00		0,040		0,030 ^a			16,0	18,0	0,90	1,40							
70	X3CrTi17		0,05		1,00		1,00		0,040		0,030 ^a			16,0	19,0						Ti	4 × (C + N) + 0,20		0,75
71	X6CrMoNb17-1		0,08		1,00		1,00		0,040		0,015	0,040		16,0	18,0	0,80	1,40				Nb	5 × C		1,00
72	X2CrMoTi18-2		0,025		1,00		1,00		0,040		0,015	0,025		17,0	20,0	1,80	2,50				Ti+Nb	4 × (C + N) + 0,20		0,80
73	X3CrNb17		0,05		1,00		1,00		0,040		0,015			16,0	18,0						Nb	12 × C		1,00
74	X2CrMoTiS18-2		0,03		1,00		0,50		0,040	0,15				17,5	19,0	2,00	2,50				Ti	0,30		0,80
																					(C + N)			0,040

Table 1 (continued)

Line	Steel designation	C		Si		Mn		P		S		N		Cr		Mo		Ni		Others	
		min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
d) Martensitic steels																					
81	X3CrNiMo13-4		0,05		0,70	0,50	1,00	0,040		0,015				12,0	14,0	0,30	1,00	3,5	4,5		
82	X12Cr13	0,08	0,15	1,00	1,00	1,50	0,040	0,030 ^a		0,030 ^a				11,5	13,5				0,75		
83	X12CrS13	0,08	0,15	1,00	1,00	1,50	0,040	0,15						12,0	14,0		0,60				
84	X20Cr13	0,16	0,25	1,00	1,00	1,50	0,040	0,030 ^a		0,030 ^a				12,0	14,0						
85	X30Cr13	0,26	0,35	1,00	1,00	1,50	0,040	0,030 ^a		0,030 ^a				12,0	14,0						
86	X39Cr13	0,36	0,42	1,00	1,00	1,00	0,040	0,030 ^a		0,030 ^a				12,5	14,5						
87	X46Cr13	0,43	0,50	1,00	1,00	1,00	0,040	0,030 ^a		0,030 ^a				12,5	14,5						
88	X52Cr13	0,48	0,55	1,00	1,00	1,00	0,040	0,030 ^a		0,030 ^a				12,5	14,5						
89	X60Cr13	0,56	0,65	1,00	1,00	1,00	0,040	0,030 ^a		0,030 ^a				12,5	14,5						
90	X14CrS17	0,10	0,17	1,00	1,00	1,50	0,040	0,15						16,0	18,0		0,60				
91	X17CrNi16-2	0,12	0,22	1,00	1,00	1,50	0,040			0,030				15,0	17,0			1,50	2,50		
92	X39CrMo17-1	0,33	0,45	1,00	1,00	1,50	0,040			0,015				15,5	17,5	0,80	1,30		1,00		
93	X105CrMo17	0,95	1,20	1,00	1,00	1,00	0,040			0,015				16,0	18,0	0,40	0,80				

Table 1 (continued)

Line	Steel designation	C		Si		Mn		P		S		N		Cr		Mo		Ni		Element		Others	
		min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
e) Precipitation hardening steels																							
101	X5CrNiCuNb16-4		0,07		0,70		1,50	0,040		0,030 ^a		15,0	17,0		0,60		3,0	5,0		Cu	3,0		5,0
102	X7CrNiAl17-7		0,09		0,70	1,00	0,040		0,015		16,0	18,0					6,5	7,8 ^h		Nb	5 × C	0,45	
103	X8CrNiMoAl15-7-2		0,10		0,70	1,20	0,040		0,015		14,0	16,0		2,00	3,00		6,5	7,8		Al	0,70	1,50	
a	Particular ranges of sulfur content may provide improvement of particular properties. For machinability, a controlled sulfur content of 0,015 % to 0,030 % is recommended. For weldability, a controlled sulfur content of 0,008 % to 0,020 % may be beneficial. For polishability, a controlled sulfur content of 0,015 % maximum is recommended.																						
b	Where, for special reasons (e.g. hot workability or low magnetic permeability), it is necessary to minimize the ferrite content, the maximum nickel content may be increased by the following amounts: by 0,50 % for steels in lines 1 and 32; by 1,00 % for steels in lines 2, 16, 17, 19, 20, 25, 26, 27 and 31; by 1,50 % for steels in lines 21 and 22.																						
c	Copper may be added up to 1,00 %. If added, it must be reported in the inspection document, provided such a document has been ordered.																						
d	Patented grade.																						
e	For special applications, the lower limits of N, Cr and Mo can be limited to 0,14 %, 22,0 % and 3,0 % respectively.																						
f	Where machinability is of special importance increased sulfur contents of up to 0,045 % are recommended and permitted.																						
g	For certain applications, e.g. weldability or high strength wire, a maximum of 0,12 % C may be agreed.																						
h	By special agreement, the steel when intended for cold deformation may also be ordered with 7,00 % to 8,30 % Ni.																						

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Table 2 — Designations of the steels given in Table 1 and of comparable grades covered in various international, regional or national standards or designation systems

Line	Table 1	ASTM A 959/JUNS ^b	EN 10088-1:1995		Steel designations according to ^a					ISO 6931-1:1994	ISO 6931-2:1989	ISO 9328-5:1991
			Name ^c	Number ^c	JIS ^d	CSN ^e	ISO 683-13: 1986	ISO 683-16: 1976	ISO 4954:1993			
a) Austenitic steels												
1	X2CrNi18-9	S30403	X2CrNi18-9	1.4307	SUS304L	—	—	X2CrNi18 10E	—	—	—	X2CrNi18-10
2	X2CrNi19-11	S30403	X2CrNi19-11	1.4306	SUS304L	17249	—	—	—	—	—	—
3	X2CrNiN18-9	S30453	X2CrNiN18-10	1.4311	SUS304LN	—	10N	—	—	—	—	X2CrNiN18-10
4	X2CrNiN18-7	S30153	X2CrNiN18-7	1.4318	SUS301L	—	—	—	—	—	—	—
5	X5CrNi17-7	S30100	(X3CrNiN17-8)	(1.4319)	SUS301	—	—	—	—	—	—	—
6	X5CrNi18-9	S30400	X5CrNi18-10	1.4301	SUS304	17240	11	X5CrNi18 9E	—	—	—	X5CrNi18-9
7	X7CrNi18-9	S30409	(X6CrNi18-10)	(1.4948)	SUS304H	—	—	—	X7CrNi18 9	—	—	X7CrNi18-9
8	X6CrNi18-12	S30500	X4CrNi18-12	1.4303	SUS305	—	13	X5CrNi18 12E	—	—	—	—
9	X3NiCr18-16	S38400	—	—	SUS384	—	—	X6NiCr18 16E	—	—	—	—
10	X5CrNiN18-8	S30451	(X5CrNiN19-9)	(1.4315)	SUS304N1	—	—	—	—	—	—	—
11	X10CrNi18-8	S30100	X10CrNi18-8	1.4310	—	—	14	—	—	X9CrNi18-8	X12CrNi17 7	—
12	X1CrNi25-21	S31002	X1CrNi25-21	1.4335	—	—	—	—	—	—	—	—
13	X12CrMnNi17-7-5	S20100	X12CrMnNi17-7-5	1.4372	SUS201	—	A-2	—	—	—	—	—
14	X10CrNiS18-9	S30300	X8CrNiS18-9	1.4305	SUS303	—	17	—	—	—	—	—
15	X3CrNiCu18-9-4	S30430	X3CrNiCu18-9-4	1.4567	SUSXM7	—	—	X3CrNiCu18 9 3E	—	—	—	—
16	X6CrNiTi18-10	S32100	X6CrNiTi18-10	1.4541	SUS321	17247	15	X6CrNiTi18 10E	—	—	—	X6CrNiTi18-10
17	X7CrNiTi18-10	S32109	X6CrNiTi18-10	1.4541	SUS321H	—	—	—	X7CrNiTi18 10	—	—	X7CrNiTi18-10
18	X6CrNiTiB18-10	—	(X6CrNiTiB18-10)	(1.4941)	—	—	—	—	—	—	—	—
19	X6CrNiNb18-10	S34700	X6CrNiNb18-10	1.4550	SUS347	—	16	—	X7CrNiNb18 10	—	—	X6CrNiNb18-10
20	X7CrNiNb18-10	S34709	(X7CrNiNb18-10)	(1.4912)	SUS347H	—	—	—	—	—	—	X7CrNiNb18-10
21	X2CrNiMo17-12-2	S31603	X2CrNiMo17-12-2	1.4404	SUS316L	17349	19	—	—	—	—	X2CrNiMo17-12
22	X2CrNiMo17-12-3	S31603	X2CrNiMo17-12-3	1.4432	SUS316L	17350	19a	X2CrNiMo17 13 3E	—	—	—	X2CrNiMo17-13
23	X2CrNiMo18-14-3	S31603	X2CrNiMo18-14-3	1.4435	—	—	—	—	—	—	—	—
24	X2CrNiMo19-14-4	S31703	X2CrNiMo18-15-4	1.4438	SUS317L	—	24	—	—	—	—	X3CrNiMo18-16-4