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Supersedes EN 10088-1:2005

English Version

Stainless steels - Part 1: List of stainless steels

Aciers inoxydables - Partie 1: Liste des aciers inoxydables

Nichtrostende Stähle - Teil 1: Verzeichnis der nichtrostenden Stähle

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Foreword

This document (EN 10088-1:2014) has been prepared by Technical Committee ECISS/TC 105 “Steels for heat treatment, alloy steels, free-cutting and stainless steels”, the secretariat of which is held by DIN.

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of an identical text or by endorsement, at the latest by April 2015 and conflicting national standards shall be withdrawn at the latest by April 2015.

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

This document supersedes EN 10088-1:2005.

This document mainly differs from the 2005 edition as follows:

a) addition of austenitic grades 1.4615 (also part 3), 1.4618 (2), 1.4376 (2), 1.4640 (2), 1.4646 (2, 3), 1.4020 (3), 1.4378 (3), addition of austenitic-ferritic (duplex) grades 1.4162 (2, 3), 1.4662 (2, 3), 1.4658 (3), 1.4482 (2, 3), 1.4062 (2, 3), 1.4669 (3), addition of ferritic grades 1.4621 (2), 1.4600 (2), 1.4607 (2), 1.4611 (2, 3), 1.4613 (2, 3), 1.4630 (2), 1.4634 (2),addition of martensitic grade 1.4150 (3), addition of precipitation hardening grade 1.4612 (3);

b) chemical composition was changed for following grades:austenitic grade 1.4371, 1.4597, austenitic-ferritic grade 1.4362.

Each of the tables for the chemical composition of steel grades now has a sub-section with grades designated as 'uncommon' (i.e. not produced in the past 10 years and which may be removed during the next revision).

EN 10088, under the general title *Stainless steels*, consists of the following parts:

— *Part 1: List of stainless steels* (including a table of European Standards, in which these stainless steels are further specified, see Annex B) [the present document];

— *Part 2: Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for general purposes*;

— *Part 3: Technical delivery conditions for semi-finished products, bars, rods, wire, sections and bright products of corrosion resisting steels for general purposes*;

— *Part 4: Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for construction purposes*;

— *Part 5: Technical delivery conditions for bars, rods, wire, sections and bright products of corrosion resisting steels for construction purposes*.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

The European Organization for Standardization (CEN) draws attention to the fact that it is claimed that compliance with this document may involve the use of patents applied to ten steel grades.

CEN takes no position concerning the evidence, validity and scope of these patent rights.

The holder of these patent rights has ensured CEN that they are willing to negotiate licences, under reasonable and non-discriminatory terms and conditions, with applicants throughout the world. In this respect, the statements of the holders of these patent rights are registered with CEN. Information may be obtained from:

Grade 1.4658
Sandvik AB
SE-81181 Sandviken, Sweden

Grade 1.4162, 14662
Outokumpu Stainless AB
SE-77480 Avesta, Sweden

Grade 1.4062, 1.4615, 1.4669
Ugitech
F-73403 Ugine Cedex, France

Grade 1.4062, 1.4669
Industeel
F-71200 Creusot, 56 Rue Clemenceau, France

Grade 1.4646, 1.4611, 1.4613
Acciai Speciali Terni
I-05100 Terni, Italy

1 Scope

This European Standard lists the chemical composition of stainless steels, which are subdivided in accordance with their main properties into corrosion resisting steels, heat resisting steels and creep resisting steels and specified in the European Standards given in Table 1.

Table 1 — Overview of material standards for stainless steels

Stainless steels		
Corrosion resisting steels	**Heat resisting steels**	**Creep resisting steels**
EN 10028–7		EN 10028–7
EN 10088–2		
EN 10088–3		
EN 10088–4		
EN 10088–5		
	EN 10095	
EN 10151		
EN 10216–5		EN 10216–5
EN 10217–7		
EN 10222–5		EN 10222–5
EN 10250–4		
EN 10263–5		
EN 10264–4	EN 10264–4	
EN 10269		EN 10269
EN 10270–3		
EN 10272		
EN 10296–2		
EN 10297–2		
		EN 10302
EN 10312		

Reference data on some physical properties are given in Tables E.1 to E.8.

NOTE 1 A matrix that shows which steels are included in which standard is given in Annex B.

NOTE 2 Valve steels are specified in EN 10090.

NOTE 3 Steel castings are specified in various European Standards (see Bibliography).

NOTE 4 Tool steels are specified in EN ISO 4957.

NOTE 5 Welding consumables are specified in various European Standards (see Bibliography).

2 Normative references

The following referenced 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 10079:2007, *Definition of steel products*

3 Terms and definitions

For the purposes of this document, the terms and definitions for the product forms given in EN 10079:2007 and the following apply.

3.1
stainless steels
steels with at least 10,5 % of chromium and maximum 1,2 % of carbon

[SOURCE: EN 10020:2000, 3.2.2]

Note 1 to entry: Stainless steels are further subdivided in accordance with their main property into corrosion resisting steels, heat resisting steels and creep resisting steels.

Note 2 to entry: One type of steel in Table 7 and five types of steel in Table 9 contain less chromium than the minimum defined for stainless steels, but are included in the heat-resisting and creep-resisting steels standards respectively, because they form a part of these two families of steels.

4 Chemical composition

The chemical composition of stainless steels is given:

— in Table 2 for austenitic corrosion resisting steels;

— in Table 3 for austenitic-ferritic corrosion resisting steels;

— in Table 4 for ferritic corrosion resisting steels;

— in Table 5 for martensitic and precipitation hardening corrosion resisting steels;

— in Table 6 for austenitic and austenitic-ferritic heat resisting steels;

— in Table 7 for ferritic heat resisting steels;

— in Table 8 for austenitic creep resisting steels;

— in Table 9 for martensitic creep resisting steels.

NOTE 1 The steel grades marked in Tables 2 to 9 as uncommon grades will be rechecked during the next revision and it will be decided whether to delete these steel grades or not.

NOTE 2 The chemical composition of nickel and cobalt alloys listed in EN 10095, EN 10269 and EN 10302 is given in Tables F.1 and F.2.

Table 2 — Chemical composition (cast analysis) of austenitic corrosion resisting steels

Steel designation		% by mass [a]										
Name	Number	C	Si	Mn	P	S	Cr	Mo	Ni	N	Cu [c]	Others
Austenitic steels												
X2CrNiN18–7	1.4318	0,030	1,00	2,00	0,045	0,015	16,5 to 18,5	-	6,0 to 8,0	0,10 to 0,20	-	-
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	-	-
X2CrNi18–9	1.4307	0,030	1,00	2,00	0,045	0,015 [b]	17,5 to 19,5	-	8,0 to 10,5	0,10	-	-
X9CrNi18–9	1.4325	0,03 to 0,15	1,00	2,00	0,045	0,030	17,0 to 19,0	-	8,0 to 10,0	-	-	-
X8CrNiS18–9 [e]	1.4305 [e]	0,10	1,00	2,00	0,045	0,15 to 0,35	17,0 to 19,0	-	8,0 to 10,0	0,10	1,00	-
X6CrNiCuS18–9-2 [e]	1.4570 [e]	0,08	1,00	2,00	0,045	0,15 to 0,35	17,0 to 19,0	0,60	8,0 to 10,0	0,10	1,40 to 1,80	-
X3CrNiCu18–9-4	1.4567	0,04	1,00	2,00	0,045	0,015 [b]	17,0 to 19,0	-	8,5 to 10,5	0,10	3,0 to 4,0	-
X5CrNiN19–9	1.4315	0,06	1,00	2,00	0,045	0,015	18,0 to 20,0	-	8,0 to 11,0	0,12 to 0,22	-	-
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	-
X5CrNiCu19–6-2	1.4640	0,030 to 0,08	0,50	1,50 to 4,0	0,045	0,015	18,0 to 19,0	-	5,5 to 6,9	0,03 to 0,11	1,30 to 2,00	-
X2CrNiN18–10	1.4311	0,030	1,00	2,00	0,045	0,015 [b]	17,5 to 19,5	-	8,5 to 11,5	0,12 to 0,22	-	-
X5CrNi18–10	1.4301	0,07	1,00	2,00	0,045	0,015 [b]	17,5 to 19,5	-	8,0 to 10,5	0,10	-	-
X6CrNiTi18–10	1.4541	0,08	1,00	2,00	0,045	0,015 [b]	17,0 to 19,0	-	9,0 to 12,0 [d]	-	-	Ti:5xC to 0,70
X6CrNiNb18–10	1.4550	0,08	1,00	2,00	0,045	0,015	17,0 to 19,0	-	9,0 to 12,0 [d]	-	-	Nb: 10xC to 1,00
X2CrNiCu19–10	1.4650	0,030	1,00	2,00	0,045	0,015	18,5 to 20,0	-	9,0 to 10,0	0,08	1,00	-
X2CrNi19–11	1.4306	0,030	1,00	2,00	0,045	0,015 [b]	18,0 to 20,0	-	10,0 to 12,0 [d]	0,10	-	-
X4CrNi18–12	1.4303	0,06	1,00	2,00	0,045	0,015 [b]	17,0 to 19,0	-	11,0 to 13,0	0,10	-	-
X1CrNiSi18–15–4	1.4361	0,015	3,7 to 4,5	2,00	0,025	0,010	16,5 to 18,5	0,20	14,0 to 16,0	0,10	-	-
X8CrMnCuN17–8-3	1.4597	0,10	2,00	6,5 to 9,0	0,040	0,030	15,0 to 18,0	1,00	3,00	0,10 to 0,30	2,00 to 3,5	-
X8CrMnNi19–6-3	1.4376	0,10	1,00	5,0 to 8,0	0,045	0,015	17,0 to 20,5		2,00 to 4,5	0,30	-	-
X3CrMnNiCu15–8-5–3[*)]	1.4615[*)]	0,030	1,00	7,0 to 9,0	0,040	0,010	14,0 to 16,0	0,80	4,5 to 6,0	0,02 to 0,06	2,0 to 4,0	-
X12CrMnNiN17–7-5	1.4372	0,15 [f]	1,00	5,5 to 7,5	0,045	0,015	16,0 to 18,0	-	3,5 to 5,5	0,05 to 0,25	-	-

Steel designation		% by mass [a]										
Name	Number	C	Si	Mn	P	S	Cr	Mo	Ni	N	Cu [c]	Others
X2CrMnNiN17–7-5	1.4371	0,030	1,00	6,0 to 8,0	0,045	0,015	16,0 to 17,5	-	3,5 to 5,5	0,15 to 0,25	1,00	-
X9CrMnNiCu17–8-5–2	1.4618	0,10	1,00	5,5 to 9,5	0,070	0,010	16,5 to 18,5	-	4,5 to 5,5	0,15	1,00 to 2,50	-
X12CrMnNiN18–9-5	1.4373	0,15	1,00	7,5 to 10,5	0,045	0,015	17,0 to 19,0	-	4,0 to 6,0	0,05 to 0,25	-	-
X11CrNiMnN19–8-6	1.4369	0,07 to 0,15	0,50 to 1,00	5,0 to 7,5	0,030	0,015	17,5 to 19,5	-	6,5 to 8,5	0,20 to 0,30	-	-
X13CrMnNiN18–13–2	1.4020	0,15	1,00	11,0 to 14.0	0,045	0,030	16,5 to 19,0	-	0,5 to 2,5	0,20 to 0,45	-	-
X6CrMnNiN18–13–3	1.4378	0,08	1,00	11,5 to 14,5	0,060	0,030	17,0 to 19,0	-	2,3 to 3,7	0,20 to 0,40	-	-
X6CrMnNiCuN18–12–4-2 [*)]	1.4646 [*)]	0,02 to 0,10	1,00	10,5 to 12,5	0,050	0,015	17,0 to 19,0	0,50	3,5 to 4,5	0,20 to 0,30	1,50 to 3,00	-
X1CrNi25–21	1.4335	0,020	0,25	2,00	0,025	0,010	24,0 to 26,0	0,20	20,0 to 22,0	0,10	-	-
Austenitic steels with Mo												
X2CrNiMoCuS17–10–2 [e]	1.4598 [e]	0,030	1,00	2,00	0,045	0,10 to 0,20	16,5 to 18,5	2,00 to 2,50	10,0 to 13,0	0,10	1,30 to 1,80	-
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	3,0 to 3,5	-
X2CrNiMoN17–11–2	1.4406	0,030	1,00	2,00	0,045	0,015 [b]	16,5 to 18,5	2,00 to 2,50	10,0 to 12,5 [d]	0,12 to 0,22	-	-
X2CrNiMo17–12–2	1.4404	0,030	1,00	2,00	0,045	0,015 [b]	16,5 to 18,5	2,00 to 2,50	10,0 to 13,0 [d]	0,10	-	-
X5CrNiMo17–12–2	1.4401	0,07	1,00	2,00	0,045	0,015 [b]	16,5 to 18,5	2,00 to 2,50	10,0 to 13,0	0,10	-	-
X6CrNiMoTi17–12–2	1.4571	0,08	1,00	2,00	0,045	0,015 [b]	16,5 to 18,5	2,00 to 2,50	10,5 to 13,5 [d]	-	-	Ti:5xC to 0,70
X6CrNiMoNb17–12–2	1.4580	0,08	1,00	2,00	0,045	0,015	16,5 to 18,5	2,00 to 2,50	10,5 to 13,5	-	-	Nb: 10xC to 1,00
X2CrNiMo17–12–3	1.4432	0,030	1,00	2,00	0,045	0,015 [b]	16,5 to 18,5	2,50 to 3,00	10,5 to 13,0	0,10	-	-
X3CrNiMo18–12–3	1.4449	0,035	1,00	2,00	0,045	0,015	17,0 to 18,2	2,25 to 2,75	11,5 to 12,5	0,08	1,00	-

Steel designation		% by mass [a]										
Name	Number	C	Si	Mn	P	S	Cr	Mo	Ni	N	Cu [c]	Others
X3CrNiMo17–13–3	1.4436	0,05	1,00	2,00	0,045	0,015 [b]	16,5 to 18,5	2,50 to 3,00	10,5 to 13,0 [d]	0,10	-	-
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 [d]	0,12 to 0,22	-	-
X2CrNiMoN18–12–4	1.4434	0,030	1,00	2,00	0,045	0,015	16,5 to 19,5	3,0 to 4,0	10,5 to 14,0 [d]	0,10 to 0,20	-	-
X2CrNiMo18–14–3	1.4435	0,030	1,00	2,00	0,045	0,015 [b]	17,0 to 19,0	2,50 to 3,00	12,5 to 15,0	0,10	-	-
X2CrNiMoN17–13–5	1.4439	0,030	1,00	2,00	0,045	0,015	16,5 to 18,5	4,0 to 5,0	12,5 to 14,5	0,12 to 0,22	-	-
X2CrNiMo18–15–4	1.4438	0,030	1,00	2,00	0,045	0,015 [b]	17,5 to 19,5	3,0 to 4,0	13,0 to 16,0 [d]	0,10	-	-
X1CrNiMoCuN20–18–7	1.4547	0,020	0,70	1,00	0,030	0,010	19,5 to 20,5	6,0 to 7,0	17,5 to 18,5	0,18 to 0,25	0,50 to 1,00	-
X1CrNiMoN25–22–2	1.4466	0,020	0,70	2,00	0,025	0,010	24,0 to 26,0	2,00 to 2,50	21,0 to 23,0	0,10 to 0,16	-	-
X1CrNiMoCuNW24–22–6	1.4659	0,020	0,70	2,00 to 4,0	0,030	0,010	23,0 to 25,0	5,5 to 6,5	21,0 to 23,0	0,35 to 0,50	1,00 to 2,00	W:1,50 to 2,50
X1CrNiMoCuN24–22–8	1.4652	0,020	0,50	2,00 to 4,0	0,030	0,005	23,0 to 25,0	7,0 to 8,0	21,0 to 23,0	0,45 to 0,55	0,30 to 0,60	-
X2CrNiMnMoN25–18–6-5	1.4565	0,030	1,00	5,0 to 7,0	0,030	0,015	24,0 to 26,0	4,0 to 5,0	16,0 to 19,0	0,30 to 0,60	-	Nb: 0,15
Austenitic steels with Ni as main alloying element												
X1NiCrMoCu25–20–5	1.4539	0,020	0,70	2,00	0,030	0,010	19,0 to 21,0	4,0 to 5,0	24,0 to 26,0	0,15	1,20 to 2,00	-
X1NiCrMoCuN25–20–7	1.4529	0,020	0,50	1,00	0,030	0,010	19,0 to 21,0	6,0 to 7,0	24,0 to 26,0	0,15 to 0,25	0,50 to 1,50	-
X2NiCrAlTi32–20	1.4558	0,030	0,70	1,00	0,020	0,015	20,0 to 23,0	-	32,0 to 35,0	-	-	Al:0,15 to 0,45 Ti:[8x(C+N)] to 0,60
X1NiCrMoCu31–27–4	1.4563	0,020	0,70	2,00	0,030	0,010	26,0 to 28,0	3,0 to 4,0	30,0 to 32,0	0,10	0,70 to 1,50	-

Steel designation		% by mass [a]										
Name	Number	C	Si	Mn	P	S	Cr	Mo	Ni	N	Cu [c]	Others
Uncommon austenitic steels												
X5CrNi17–7	1.4319	0,07	1,00	2,00	0,045	0,030	16,0 to 18,0	-	6,0 to 8,0	0,10	-	-
X8CrMnNiN18–9-5	1.4374	0,05 to 0,10	0,30 to 0,60	9,0 to 10,0	0,035	0,030	17,5 to 18,5	0,50	5,0 to 6,0	0,25 to 0,32	0,40	-
X1CrNiMoCuN25–25–5	1.4537	0,020	0,70	2,00	0,030	0,010	24,0 to 26,0	4,7 to 5,7	24,0 to 27,0	0,17 to 0,25	1,00 to 2,00	-

Elements not quoted in this table shall not be intentionally added to the steel without the agreement of the purchaser except for finishing the cast. All appropriate precautions are to 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 For bars, rods, wire, sections, bright products and the relevant semi-finished products, a maximum content of 0,030 % S applies. 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 and permitted. For weldability, a controlled sulfur content of 0,008 % to 0,030 % is recommended and permitted. For polishability, a controlled sulfur content of 0,015 % max. is recommended.

c For austenitic steel grades intended for cold heading and cold extruding, a Cu-content of max. 1,0 % is permitted.

d Where for special reasons, e. g. hot workability for the fabrication of seamless tubes where it is necessary to minimize the deltaferrite content, or with the aim of low magnetic permeability, the maximum Ni content may be increased by the following amounts:

- 0,50 % (m/m): 1.4571;
- 1,00 % (m/m): 1.4306, 1.4406, 1.4429, 1.4434, 1.4436, 1.4438, 1.4541, 1.4550;
- 1,50 % (m/m): 1.4404.

e Parts made of high sulfur free cutting austenitic steels may not comply with European Directive 94/27 regarding articles in contact with human skin.

f For pressure purposes a carbon limit of C ≤ 0,07 % is allowed.

*) Patented steel grade.

Table 3 — Chemical composition (cast analysis) of austenitic-ferritic corrosion resisting steels

Steel designation		% by mass [a]										
Name	Number	C	Si	Mn	P	S	Cr	Mo	Ni	N	Cu	Others
X2CrNiN22-2*)	1.4062*)	0,030	1,00	2,00	0,040	0,010	21,5 to 24,0	0,45	1,00 to 2,90	0,16 to 0,28	-	-
X2CrCuNiN23–2-2*)	1.4669*)	0,045	1,00	1,00 to 3,00	0,040	0,030	21,5 to 24,0	0,50	1,00 to 3,00	0,12 to 0,20	1,60 to 3,00	-
Austenitic-ferritic steels with Mo												
X2CrNiMoSi18–5-3	1.4424	0,030	1,40 to 2,00	1,20 to 2,00	0,035	0,015	18,0 to 19,0	2,50 to 3,0	4,5 to 5,2	0,05 to 0,10	-	-
X2CrNiN23–4	1.4362	0,030	1,00	2,00	0,035	0,015	22,0 to 24,5	0,10 to 0,60	3,5 to 5,5	0,05 to 0,20	0,10 to 0,60	-
X2CrMnNiN21–5-1*)	1.4162*)	0,04	1,00	4,0 to 6,0	0,040	0,015	21,0 to 22,0	0,10 to 0,80	1,35 to 1,90	0,20 to 0,25	0,10 to 0,80	-
X2CrMnNiMoN21–5-3	1.4482	0,030	1,00	4,0 to 6,0	0,035	0,030	19,5 to 21,5	0,10 to 0,60	1,50 to 3,50	0,05 to 0,20	1,00	-
X2CrNiMoN22–5-3 [c]	1.4462 [c]	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	-	-
X2CrNiMnMoCuN24–4-3–2*)	1.4662*)	0,030	0,70	2,50 to 4,0	0,035	0,005	23,0 to 25,0	1,00 to 2,00	3,0 to 4,5	0,20 to 0,30	0,10 to 0,80	-
X2CrNiMoCuN25–6-3	1.4507	0,030	0,70	2,00	0,035	0,015	24,0 to 26,0	3,0 to 4,0	6,0 to 8,0	0,20 to 0,30	1,00 to 2,50	-
X3CrNiMoN27–5-2	1.4460	0,05	1,00	2,00	0,035	0,015 [b]	25,0 to 28,0	1,30 to 2,00	4,5 to 6,5	0,05 to 0,20	-	-
X2CrNiMoN25–7-4	1.4410	0,030	1,00	2,00	0,035	0,015	24,0 to 26,0	3,0 to 4,5	6,0 to 8,0	0,24 to 0,35	-	-
X2CrNiMoCuWN25–7-4	1.4501	0,030	1,00	1,00	0,035	0,015	24,0 to 26,0	3,0 to 4,0	6,0 to 8,0	0,20 to 0,30	0,50 to 1,00	W: 0,50 to 1,00
X2CrNiMoN29–7-2	1.4477	0,030	0,50	0,80 to 1,50	0,030	0,015	28,0 to 30,0	1,50 to 2,60	5,8 to 7,5	0,30 to 0,40	0,80	-
X2CrNiMoCoN28–8-5–1*)	1.4658*)	0,030	0,50	1,50	0,035	0,010	26,0 to 29,0	4,0 to 5,0	5,5 to 9,5	0,30 to 0,50	1,00	Co: 0,50 to 2,00
Uncommon austenitic-ferritic steels												
X2CrNiCuN23–4	1.4655	0,030	1,00	2,00	0,035	0,015	22,0 to 24,0	0,10 to 0,60	3,5 to 5,5	0,05 to 0,20	1,00 to 3,00	-

Elements not quoted in this table shall not be intentionally added to the steel without the agreement of the purchaser except for finishing the cast. All appropriate precautions are to 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 For bars, rods, wire, sections, bright products and the relevant semi-finished products, a maximum content of 0,030 % S applies. 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 and permitted. For weldability, a controlled sulfur content of 0,008 % to 0,030 % is recommended and permitted. For polishability, a controlled sulfur content of 0,015 % max. is recommended.

c By agreement, this grade can be delivered with a Pitting Resistance Equivalent Number (PRE = Cr + 3,3 Mo + 16 N, compare Table D.1) greater than 34.

*) Patented steel grade.

Table 4 — Chemical composition (cast analysis) of ferritic corrosion resisting steels

Steel designation		% by mass [a]											
Name	Number	C	Si	Mn	P	S	Cr	Mo	Ni	N	Nb	Ti	Others
X2CrNi12	1.4003	0,030	1,00	1,50	0,040	0,015 [b]	10,5 to 12,5	-	0,30 to 1,00	0,030	-	-	-
X2CrTi12	1.4512	0,030	1,00	1,00	0,040	0,015	10,5 to 12,5	-	-	-	-	[6 × (C+N)] to 0,65 [c]	-
X6CrNiTi12	1.4516	0,08	0,70	1,50	0,040	0,015	10,5 to 12,5	-	0,50 to 1,50	-	-	0,05 to 0,35	-
X6Cr13	1.4000	0,08	1,00	1,00	0,040	0,015 [b]	12,0 to 14,0	-	-	-	-	-	-
X6CrAl13	1.4002	0,08	1,00	1,00	0,040	0,015 [b]	12,0 to 14,0	-	-	-	-	-	Al: 0,10 to 0,30
X2CrMnNiTi12	1.4600	0,030	1,00	1,00 to 2,50	0,040	0,015	11,0 to 13,0	-	0,30 to 1,00	0,025	-	6 x C to 0,35	-
X2CrSiTi15	1.4630	0,030	0,20 to 1,50	1,00	0,050	0,050	13,0 to 16,0	0,50	0,50	-	0,50	[4 × (C+N) + 0,15] to 0,80 [c]	Al: 1,50 Cu: 0,50
X6Cr17	1.4016	0,08	1,00	1,00	0,040	0,015 [b]	16,0 to 18,0	-		-	-	-	-
X2CrTi17	1.4520	0,025	0,50	0,50	0,040	0,015	16,0 to 18,0	-	-	0,015	-	[4 × (C+N) + 0,15] to 0,80 [c]	-
X3CrTi17	1.4510	0,05	1,00	1,00	0,040	0,015 [b]	16,0 to 18,0	-	-	-	-	[4 × (C+N) + 0,15] to 0,80 [c]	-
X3CrNb17	1.4511	0,05	1,00	1,00	0,040	0,015 [b]	16,0 to 18,0	-	-	-	12 x C to 1,00	-	-
X6CrNi17–1	1.4017	0,08	1,00	1,00	0,040	0,015	16,0 to 18,0	-	1,20 to 1,60	-	-	-	-
X2CrTiNb18	1.4509	0,030	1,00	1,00	0,040	0,015	17,5 to 18,5	-		-	[3 x C + 0,30] to 1,00	0,10 to 0,60	-
X2CrAlSiNb18	1.4634	0,030	0,20 to 1,50	1,00	0,050	0,050	17,5 to 18,5	0,50	0,50	-	[3 x C + 0,30] to 1,00 [c]	-	Al: 0,20 to 1,50 Cu: 0,50

Steel designation		% by mass [a]											
Name	Number	C	Si	Mn	P	S	Cr	Mo	Ni	N	Nb	Ti	Others
X2CrNbTi20	1.4607	0,030	1,00	1,00	0,040	0,015	18,5 to 20,5	–		0,030	1,00	[4 × (C+N) + 0.15] to 0,80 [c]	-
X2CrTi21[*)]	1.4611[*)]	0,030	1,00	1,00	0,050	0,050	19,0 to 22,0	0,50	0,50	-	-	[4 × (C+N) + 0.20] to 1.00 [c]	Cu: 0,50, Al: 0,05
X2CrNbCu21	1.4621	0,030	1,00	1,00	0,040	0,015	20,0 to 21,5	-	-	0,030	0,20 to 1,00	-	Cu: 0,10 to 1,00
X2CrTi24[*)]	1.4613[*)]	0,030	1,00	1,00	0,050	0,050	22,0 to 25,0	0,50	0,50	-	-	[4 × (C+N) + 0.20] to 1.00 [c]	Cu: 0,50, Al:0,05
Ferritic steels with Mo													
X5CrNiMoTi15–2	1.4589	0,08	1,00	1,00	0,040	0,015	13,5 to 15,5	0,20 to 1,20	1,00 to 2,50	-	-	0,30 to 0,50	-
X6CrMoS17	1.4105	0,08	1,50	1,50	0,040	0,15 to 0,35	16,0 to 18,0	0,20 to 0,60	-	-	-	-	-
X6CrMo17–1	1.4113	0,08	1,00	1,00	0,040	0,015 [b]	16,0 to 18,0	0,90 to 1,40	-	-	-	-	-
X2CrMoTi17–1	1.4513	0,025	1,00	1,00	0,040	0,015	16,0 to 18,0	0,80 to 1,40	-	0,020	-	[4 × (C+N) + 0,15] to 0,80 [c]	-
X6CrMoNb17–1	1.4526	0,08	1,00	1,00	0,040	0,015	16,0 to 18,0	0,80 to 1,40	-	0,040	[7x(C+N)+0,10] to 1,00	-	-
X2CrMoTi18–2	1.4521	0,025	1,00	1,00	0,040	0,015	17,0 to 20,0	1,80 to 2,50	-	0,030	-	[4 × (C+N) + 0,15] to 0,80 [c]	-
X2CrMoTiS18–2	1.4523	0,030	1,00	0,50	0,040	0,15 to 0,35	17,5 to 19,0	2,00 to 2,50	-	-	-	[4 × (C+N) + 0,15] to 0,80 [c]	(C+N) ≤ 0,040
X2CrMoTi29–4	1.4592	0,025	1,00	1,00	0,030	0,010	28,0 to 30,0	3,50 to 4,50	-	0,045	-	[4 × (C+N) + 0,15] to 0,80 [c]	-

Steel designation		% by mass [a]											
Name	Number	C	Si	Mn	P	S	Cr	Mo	Ni	N	Nb	Ti	Others
Uncommon ferritic steels													
X1CrNb15	1.4595	0,020	1,00	1,00	0,025	0,015	14,0 to 16,0	-	-	0,020	0,20 to 0,60	-	-
X2CrNbZr17	1.4590	0,030	1,00	1,00	0,040	0,015	16,0 to 17,5	-		-	0,35 to 0,55	-	Zr ≥ 7x(C+N)+0,15

Elements not quoted in this table shall not be intentionally added to the steel without the agreement of the purchaser except for finishing the cast. All appropriate precautions are to 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 For bars, rods, wire, sections, bright products and the relevant semi-finished products, a maximum content of 0,030 % S applies. 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 and permitted. For weldability, a controlled sulfur content of 0,008 % to 0,030 % is recommended and permitted. For polishability, a controlled sulfur content of 0,015 % max. is recommended.

c The stabilization may be made by use of Ti and/or Nb and/or Zr. According to the atomic mass of these elements and the content of Carbon and Nitrogen, the equivalence shall be the following: Nb (% by mass) ≡ Zr (% by mass) ≡ 7/4 Ti (% by mass).

*) Patented steel grade

Table 5 — Chemical composition (cast analysis) of martensitic and precipitation hardening corrosion resisting steels

Steel designation		% by mass [a]									
Name	Number	C [c]	Si	Mn	P	S	Cr	Mo	Ni	Cu	Others
Martensitic steels											
X12Cr13	1.4006	0,08 to 0,15	1,00	1,50	0,040	0,015 [b]	11,5 to 13,5	-	0,75	-	-
X12CrS13	1.4005	0,06 to 0,15	1,00	1,50	0,040	0,15 to 0,35	12,0 to 14,0	0,60	-	-	-
X15Cr13	1.4024	0,12 to 0,17	1,00	1,00	0,040	0,015 [b]	12,0 to 14,0	-	-	-	-
X20Cr13	1.4021	0,16 to 0,25	1,00	1,50	0,040	0,015 [b]	12,0 to 14,0	-	-	-	-
X30Cr13	1.4028	0,26 to 0,35	1,00	1,50	0,040	0,015 [b]	12,0 to 14,0	-	-	-	-
X29CrS13	1.4029	0,25 to 0,32	1,00	1,50	0,040	0,15 to 0,25	12,0 to 13,5	0,60	-	-	-
X39Cr13	1.4031	0,36 to 0,42	1,00	1,00	0,040	0,015 [b]	12,5 to 14,5	-	-	-	-
X46Cr13	1.4034	0,43 to 0,50	1,00	1,00	0,040	0,015 [b]	12,5 to 14,5	-	-	-	-
X46CrS13	1.4035	0,43 to 0,50	1,00	2,00	0,040	0,15 to 0,35	12,5 to 14,0	-	-	-	-
X17CrNi16-2	1.4057	0,12 to 0,22	1,00	1,50	0,040	0,015 [b]	15,0 to 17,0	-	1,50 to 2,50	-	-
Martensitic steels with Mo											
X38CrMo14	1.4419	0,36 to 0,42	1,00	1,00	0,040	0,015	13,0 to 14,5	0,60 to 1,00	-	-	-
X55CrMo14	1.4110	0,48 to 0,60	1,00	1,00	0,040	0,015 [b]	13,0 to 15,0	0,50 to 0,80	-	-	V: 0,15
X3CrNiMo13–4	1.4313	0,05	0,70	1,50	0,040	0,015	12,0 to 14,0	0,30 to 0,70	3,5 to 4,5	-	N: ≥ 0,020
X1CrNiMoCu12–5-2	1.4422	0,020	0,50	2,00	0,040	0,003	11,0 to 13,0	1,30 to 1,80	4,0 to 5, 0	0,20 to 0,80	N: 0,020
X50CrMoV15	1.4116	0,45 to 0,55	1,00	1,00	0,040	0,015 [b]	14,0 to 15,0	0,50 to 0,80	-	-	V: 0,10 to 0,20 N: see [e]
X70CrMo15	1.4109	0,60 to 0,75	0,70	1,00	0,040	0,015 [b]	14,0 to 16,0	0,40 to 0,80	-	-	-
X2CrNiMoV13–5-2	1.4415	0,030	0,50	0,50	0,040	0,015	11,5 to 13,5	1,50 to 2,50	4,5 to 6,5	-	Ti: 0,010 V: 0,10 to 0,50
X1CrNiMoCu12–7-3	1.4423	0,020	0,50	2,00	0,040	0,003	11,0 to 13,0	2,30 to 2,80	6,0 to 7, 0	0,20 to 0,80	N: 0,020
X53CrSiMoVN16–2	1.4150	0,45 to 0,60	1,30 to 1,70	0,80	0,030	0,010	15,0 to 16,5	0,20 to 0,40	0,40	-	V: 0,20 to 0,40 N: 0,05 to 0,20

Steel designation		% by mass [a]									
Name	Number	C [c]	Si	Mn	P	S	Cr	Mo	Ni	Cu	Others
X4CrNiMo16–5-1	1.4418	0,06	0,70	1,50	0,040	0,015 [b]	15,0 to 17,0	0,80 to 1,50	4,0 to 6,0	-	N: ≥ 0,020
X14CrMoS17	1.4104	0,10 to 0,17	1,00	1,50	0,040	0,15 to 0,35	15,5 to 17,5	0,20 to 0,60	-	-	-
X39CrMo17–1	1.4122	0,33 to 0,45	1,00	1,50	0,040	0,015 [b]	15,5 to 17,5	0,80 to 1,30	1,00	-	-
X105CrMo17	1.4125	0,95 to 1,20	1,00	1,00	0,040	0,015 [b]	16,0 to 18,0	0,40 to 0,80	-	-	-
X40CrMoVN16–2	1.4123	0,35 to 0,50	1,00	1,00	0,040	0,015	14,0 to 16,0	1,00 to 2,50	0,50	-	V: 1,50 N: 0,10 to 0,30
X90CrMoV18	1.4112	0,85 to 0,95	1,00	1,00	0,040	0,015 [b]	17,0 to 19,0	0,90 to 1,30	-	-	V: 0,07 to 0,12
Precipitation hardening steels											
X5CrNiCuNb16–4	1.4542	0,07	0,70	1,50	0,040	0,015 [b]	15,0 to 17,0	0,60	3,0 to 5,0	3,0 to 5,0	Nb: 5xC to 0,45
X7CrNiAl17–7	1.4568	0,09	0,70	1,00	0,040	0,015	16,0 to 18,0	-	6,5 to 7,8 [d]	-	Al: 0,70 to 1,50
Precipitation hardening steels with Mo											
X5CrNiMoCuNb14–5	1.4594	0,07	0,70	1,00	0,040	0,015	13,0 to 15,0	1,20 to 2,00	5,0 to 6,0	1,20 to 2,00	Nb: 0,15 to 0,60
X1CrNiMoAlTi12–9-2	1.4530	0,015	0,10	0,10	0,010	0,005	11,5 to 12,5	1,85 to 2,15	8,5 to 9,5	-	Al: 0,60 to 0,80 Ti: 0,28 to 0,37 N: 0,010
X1CrNiMoAlTi12–10–2	1.4596	0,015	0,10	0,10	0,010	0,005	11,5 to 12,5	1,85 to 2,15	9,2 to 10,2	-	Al: 0,80 to 1,10 Ti: 0,28 to 0,40 N: 0,020
X1CrNiMoAlTi12–11–2	1.4612	0,015	0,10	0,10	0,010	0,005	11,0 to 12,5	1,75 to 2,25	10,2 to 11,3	-	Al: 1,35 to 1,75 Ti: 0,20 to 0,50 N: 0,010

Steel designation		% by mass [a]									
Name	Number	C [c]	Si	Mn	P	S	Cr	Mo	Ni	Cu	Others
X5NiCrTiMoVB25–15–2	1.4606	0,08	1,00	1,00 to 2,00	0,025	0,015	13,0 to 16,0	1,00 to 1,50	24,0 to 27,0	-	B: 0,001 0 to 0,010 Al: 0,35 Ti: 1,90 to 2,30 V: 0,10 to 0,50

Elements not quoted in this table shall not be intentionally added to the steel without the agreement of the purchaser except for finishing the cast. All appropriate precautions are to 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 For bars, rods, wire, sections, bright products and the relevant semi-finished products, a maximum content of 0,030 % S applies. 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 and permitted. For weldability, a controlled sulfur content of 0,008 % to 0,030 % is recommended and permitted. For polishability, a controlled sulfur content of 0,015 % max. is recommended.

c Tighter carbon ranges may be agreed at the time of enquiry and order.

d For better cold deformability, the upper limit may be increased to 8,3 %.

e For increased mechanical properties, nitrogen may be added up to 0,15 %.

Table 6 — Chemical composition (cast analysis) of austenitic and austenitic-ferritic heat-resisting steels

Steel designation		% by mass [a]								
Name	Number	C	Si	Mn	P	S	Cr	Ni	N	Others
X8CrNiTi18–10	1.4878	0,10	1,00	2,00	0,045	0,015	17,0 to 19,0	9,0 to 12,0	-	Ti: 5xC to 0,80
X6CrNiSiNCe19–10	1.4818	0,04 to 0,08	1,00 to 2,00	1,00	0,045	0,015	18,0 to 20,0	9,0 to 11,0	0,12 to 0,20	Ce: 0,03 to 0,08
X15CrNiSi20–12	1.4828	0,20	1,50 to 2,50	2,00	0,045	0,015	19,0 to 21,0	11,0 to 13,0	0,10	-
X9CrNiSiNCe21–11–2	1.4835	0,05 to 0,12	1,40 to 2,50	1,00	0,045	0,015	20,0 to 22,0	10,0 to 12,0	0,12 to 0,20	Ce: 0,03 to 0,08
X12CrNi23–13	1.4833	0,15	1,00	2,00	0,045	0,015	22,0 to 24,0	12,0 to 14,0	0,10	-
X25CrMnNiN25–9-7	1.4872	0,20 to 0,30	1,00	8,0 to 10,0	0,045	0,015	24,0 to 26,0	6,0 to 8,0	0,20 to 0,40	-
X8CrNi25–21	1.4845	0,10	1,50	2,00	0,045	0,015	24,0 to 26,0	19,0 to 22,0	0,10	-
X15CrNiSi25–21	1.4841	0,20	1,50 to 2,50	2,00	0,045	0,015	24,0 to 26,0	19,0 to 22,0	0,10	-
X10NiCrAlTi32–21	1.4876	0,12	1,00	2,00	0,030	0,015	19,0 to 23,0	30,0 to 34,0	-	Al: 0,15 to 0,60 Ti: 0,15 to 0,60
X6NiCrSiNCe35–25	1.4854	0,04 to 0,08	1,20 to 2,00	2,00	0,040	0,015	24,0 to 26,0	34,0 to 36,0	0,12 to 0,20	Ce: 0,03 to 0,08
X10NiCrSi35–19	1.4886	0,15	1,00 to 2,00	2,00	0,030	0,015	17,0 to 20,0	33,0 to 37,0	0,10	-

Steel designation		% by mass [a]								
Name	Number	C	Si	Mn	P	S	Cr	Ni	N	Others
Uncommon austenitic and austenitic-ferrtic heat-resisting steels										
X15CrNiSi25–4	1.4821	0,10 to 0,20	0,8 to 1,50	2,00	0,040	0,015	24,5 to 26,5	3,5 to 5,5	0,10	-
X12NiCrSi35–16	1.4864	0,15	1,00 to 2,00	2,00	0,045	0,015	15,0 to 17,0	33,0 to 37,0	0,10	-
X10NiCrSiNb35–22	1.4887	0,15	1,00 to 2,00	2,00	0,030	0,015	20,0 to 23,0	33,0 to 37,0	0,10	Nb: 1,00 to 1,50
X6NiCrNbCe32–27	1.4877	0,04 to 0,08	0,30	1,00	0,020	0,010	26,0 to 28,0	31,0 to 33,0	0,10	Al: 0,025 Ce: 0,05 to 0,10 Nb: 0,60 to 1,00
Elements not quoted in the table shall not be intentionally added to the steel without the agreement of the purchaser except for finishing the cast. All appropriate precautions are to be taken to avoid 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.										

Table 7 — Chemical composition (cast analysis) of ferritic heat-resisting steels

Steel designation		% by mass [a]							
Name	Number	C	Si	Mn	P	S	Cr	Al	Others
X10CrAlSi7	1.4713	0,12	0,50 to 1,00	1,00	0,040	0,015	6,0 to 8,0	0,50 to 1,00	-
X10CrAlSi13	1.4724	0,12	0,70 to 1,40	1,00	0,040	0,015	12,0 to 14,0	0,70 to 1,20	-
X10CrAlSi18	1.4742	0,12	0,70 to 1,40	1,00	0,040	0,015	17,0 to 19,0	0,70 to 1,20	-
X10CrAlSi25	1.4762	0,12	0,70 to 1,40	1,00	0,040	0,015	23,0 to 26,0	1,20 to 1,70	-
X18CrN28	1.4749	0,15 to 0,20	1,00	1,00	0,040	0,015	26,0 to 29,0	-	N: 0,15 to 0,25
Uncommon ferritc heat-resisting steels									
X3CrAlTi18–2	1.4736	0,04	1,00	1,00	0,040	0,015	17,0 to 18,0	1,70 to 2,10	Ti: [4(C+N)+0,2] to 0,80
Elements not quoted in the table shall not be intentionally added to the steel without the agreement of the purchaser except for finishing the cast. All appropriate precautions are to be taken to avoid 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.									

Table 8 — Chemical composition (cast analysis) of austenitic creep-resisting steels

Steel designation		% by mass [a]														
Name	Number	C	Si	Mn	P	S	Cr	Mo	Ni	N	Al	Nb	Ti	V	W	Others
X6CrNi18–10	1.4948	0,04 to 0,08	1,00	2,00	0,035	0,015	17,0 to 19,0	-	8,0 to 11,0	0,10	-	-	-	-	-	-
X7CrNiNb18–10	1.4912	0,04 to 0,10	1,00	2,00	0,045	0,015	17,0 to 19,0	-	9,0 to 12,0	-	-	10xC to 1,20	-	-	-	-
X7CrNiTi18–10	1.4940	0,04 to 0,08	1,00	2,00	0,040	0,015	17,0 to 19,0	-	9,0 to 13,0	0,10	-	-	5x(C+N) to 0,80	-	-	-
X6CrNiTiB18–10	1.4941	0,04 to 0,08	1,00	2,00	0,035	0,015	17,0 to 19,0		9,0 to 12,0	-	-	-	5xC to 0,80	-	-	B: 0,001 5 to 0,005 0
X8CrNiNb16–13	1.4961	0,04 to 0,10	0,30 to 0,60	1,50	0,035	0,015	15,0 to 17,0	-	12,0 to 14,0	-	-	10xC to 1,20	-	-	-	-
X12CrNiWTiB16–13	1.4962	0,07 to 0,15	0,50	1,50	0,035	0,015	15,5 to 17,5	-	12,5 to 14,5	-	-	-	0,40 to 0,70	-	2,50 to 3,00	B: 0,001 5 to 0,006 0
X6CrNiWNbN16–16	1.4945	0,04 to 0,10	0,30 to 0,60	1,50	0,035	0,015	15,5 to 17,5	-	15,5 to 17,5	0,06 to 0,14	-	10xC to 1,20	-	-	2,50 to 3,5	-
X6CrNi23–13	1.4950	0,04 to 0,08	0,70	2,00	0,035	0,015	22,0 to 24,0	-	12,0 to 15,0	0,10	-	-	-	-	-	-
X6CrNi25–20	1.4951	0,04 to 0,08	0,70	2,00	0,035	0,015	24,0 to 26,0	-	19,0 to 22,0	0,10	-	-	-	-	-	-
X5NiCrAlTi31–20	1.4958	0,03 to 0,08	0,70	1,50	0,015	0,010	19,0 to 22,0	-	30,0 to 32,5	0,030	0,20 to 0,50	0,10	0,20 to 0,50	-	-	Co: 0,50 Cu: 0,50
X8NiCrAlTi32–21	1.4959	0,05 to 0,10	0,70	1,50	0,015	0,010	19,0 to 22,0	-	30,0 to 34,0	0,030	0,25 to 0,65	-	0,25 to 0,65	-	-	Co: 0,50 Cu: 0,50
Austenitic creep resisting steels with Mo																
X10CrNiMoMnNbVB15–10–1	1.4982	0,07 to 0,13	1,00	5,5 to 7,0	0,040	0,030	14,0 to 16,0	0,80 to 1,20	9,0 to 11,0	0,10	-	0,75 to 1,25	-	0,15 to 0,40	-	B:0,003 to 0,009

Steel designation		% by mass [a]														
Name	Number	C	Si	Mn	P	S	Cr	Mo	Ni	N	Al	Nb	Ti	V	W	Others
X8CrNiMoVNb16–13	1.4988	0,04 to 0,10	0,30 to 0,60	1,50	0,035	0,015	15,5 to 17,5	1,10 to 1,50	12,5 to 14,5	0,06 to 0,14	-	10xC to 1,20	-	0,60 to 0,85	-	-
X8CrNiMoNb16–16	1.4981	0,04 to 0,10	0,30 to 0,60	1,50	0,035	0,015	15,5 to 17,5	1,60 to 2,00	15,5 to 17,5	-	-	10xC to 1,20	-	-	-	-
X7CrNiMoBNb16–16	1.4986	0,04 to 0,10	0,30 to 0,60	1,50	0,045	0,030	15,5 to 17,5	1,60 to 2,00	15,5 to 17,5	-	-	Nb + Ta: 10xC to 1,20	-	-	-	B: 0,05 to 0,10
X6CrNiMoB17–12–2	1.4919	0,04 to 0,08	1,00	2,00	0,035	0,015	16,5 to 18,5	2,00 to 2,50	10,0 to 13,0	0,10	-	-	-	-	-	B: 0,001 5 to 0,005 0
X6CrNiMoTiB17–13	1.4983	0,04 to 0,08	0,75	2,00	0,035	0,015	16,0 to 18,0	2,00 to 2,50	12,0 to 14,0	-	-	-	5xC to 0,80	-	-	B: 0,0015 to 0,0060
X6CrNiMo17–13–2	1.4918	0,04 to 0,08	0,75	2,00	0,035	0,015	16,0 to 18,0	2,00 to 2,50	12,0 to 14,0	0,10	-	-	-	-	-	-
X3CrNiMoBN17–13–3	1.4910	0,04	0,75	2,00	0,035	0,015	16,0 to 18,0	2,00 to 3,00	12,0 to 14,0	0,10 to 0,18	-	-	-	-	-	B: 0,001 5 to 0,005 0
X12CrCoNi21–20	1.4971	0,08 to 0,16	1,00	2,00	0,035	0,015	20,0 to 22,5	2,50 to 3,5	19,0 to 21,0	0,10 to 0,20	-	0,75 to 1,25	-	-	2,00 to 3,00	Co: 18,5 to 21,0
X6NiCrTiMoVB25–15–2	1.4980	0,03 to 0,08	1,00	1,00 to 2,00	0,025	0,015	13,5 to 16,0	1,00 to 1,50	24,0 to 27,0	-	0,35	-	1,90 to 2,30	0,10 to 0,50	-	B: 0,003 0 to 0,010
Uncommon austenitic creep-resisting steels																
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Elements not quoted in this table shall not be intentionally added to the steel without the agreement of the purchaser except for finishing the cast. All appropriate precautions are to 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.																

Table 9 — Chemical composition (cast analysis) of martensitic creep-resisting steels

Steel designation		% by mass [a]													
Name	Number	C	Si	Mn	P	S	Cr	Mo	Ni	N	Al	Nb	V	W	Others
X10CrMoVNb9–1	1.4903	0,08 to 0,12	0,50	0,30 to 0,60	0,025	0,015	8,0 to 9,5	0,85 to 1,05	0,40	0,030 to 0,070	0,040	0,060 to 0,10	0,18 to 0,25	-	-
X11CrMoWVNb9–1-1	1.4905	0,09 to 0,13	0,10 to 0,50	0,30 to 0,60	0,020	0,010	8,5 to 9,5	0,90 to 1,10	0,10 to 0,40	0,050 to 0,090	0,040	0,060 to 0,10	0,18 to 0,25	0,90 to 1,10	B: 0,000 5 to 0,005 0
X19CrMoNbVN11–1	1.4913	0,17 to 0,23	0,50	0,40 to 0,90	0,025	0,015	10,0 to 11,5	0,50 to 0,80	0,20 to 0,60	0,050 to 0,10	0,020	0,25 to 0,55	0,10 to 0,30	-	B: 0,0015
X20CrMoV11–1	1.4922	0,17 to 0,23	0,40	0,30 to 1,00	0,025	0,015	10,0 to 12,5	0,80 to 1,20	0,30 to 0,80	-	-	-	0,20 to 0,35	-	-
X22CrMoV12–1	1.4923	0,18 to 0,24	0,50	0,40 to 0,90	0,025	0,015	11,0 to 12,5	0,80 to 1,20	0,30 to 0,80	-	-	-	0,25 to 0,35	-	-
X20CrMoWV12–1	1.4935	0,17 to 0,24	0,10 to 0,50	0,30 to 0,80	0,025	0,015	11,0 to 12,5	0,80 to 1,20	0,30 to 0,80	-	-	-	0,20 to 0,35	0,40 to 0,60	-
X12CrNiMoV12–3	1.4938	0,08 to 0,15	0,50	0,40 to 0,90	0,025	0,015	11,0 to 12,5	1,50 to 2,00	2,00 to 3,00	0,020 to 0,040	-	-	0,25 to 0,40	-	-
X8CrCoNiMo10–6	1.4911	0,05 to 0,12	0,10 to 0,80	0,30 to 1,30	0,025	0,015	9,8 to 11,2	0,50 to 1,00	0,20 to 1,20	0,035	-	0,20 to 0,50	0,10 to 0,40	≤ 0,70	B: 0,005 to 0,015 Co: 5,0 to 7,0
Uncommon martensitic creep-resisting steels															
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Elements not quoted in this table shall not be intentionally added to the steel without the agreement of the purchaser except for finishing the cast. All appropriate precautions are to 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.

Annex A
(informative)

Designation of ISO stainless steels and of comparable grades covered in various designation systems listed according to the European system

Table A.1 — Designation of ISO stainless steels and of comparable grades covered in various designation systems listed according to the European system

ISO number	ISO name	Line	Steel designations according to[a]							
			ASTM A959/ UNS[b]		EN 10088–1:2014 Number[c]		JIS[d]		GB/T20878/ ISC[e]	
				I/N/Wf		I/N/Wf		I/N/Wf		I/N/Wf
a) Austenitic steels										
4020–241–00-X	X13CrMnNiN18–13–2	AP33M	—	—	1.4020	I	—	—	—	—
4301–304–00-I	X5CrNi18–10	AP28E	S30400	W	1.4301	I	SUS304	W	S30408	W
4303–305–00-I	X6CrNi18–12	AP30I	S30500	W	1.4303	N	SUS305	W	S30510	W
4305–303–00-I	X10CrNiS18–9	AP27M	S30300	W	1.4305	W	SUS303	W	S30317	W
4306–304–03-I	X2CrNi19–11	AP30A	S30403	W	1.4306	N	SUS304L	W	S30403	N
4307–304–03-I	X2CrNi18–9	AP27B	S30403	W	1.4307	N	SUS304L	W	S30403	W
4310–301–00-I	X10CrNi18–8	AP26L	S30100	W	1.4310	N	—	—	S30110	W
4311–304–53-I	X2CrNiN18–9	AP27A	S30453	W	1.4311	N	SUS304LN	W	S30453	W
4315–304–51-I	X5CrNiN19–9	AP28F	S30451	N	1.4315	W	SUS304N1 SUS304N2	I N	S30458	W
4318–301–53-I	X2CrNiN18–7	AP25A	S30153	W	1.4318	N	SUS301L	W	S30153	W
4319–301–00-I	X5CrNi17–7	AP24H	S30100	W	1.4319	I	SUS301	W	S30110	W
4325–302–00-E	X9CrNi18–9	AP27N	S30200	W	1.4325	I	SUS302	W	S30210	W
4326–302–15-I	X12CrNiSi18–9-3	AP27P	S30215	W	(1.4326)	I	SUS302B	I	S30240	N
4335–310–02-I	X1CrNi25–21	AP46A	S31002	W	1.4335	I	—	—	—	—
4361–306–00-E	X1CrNiSi18–15–4	AP33A	—	—	1.4361	I	—	—	—	—
4369–202–91-I	X11CrNiMnN19–8-6	AP33L	—	—	1.4369	I	—	—	—	—
4371–201–53-I	X2CrMnNiN17–7-5	AP29B	S20153	N	1.4371	N	—	—	—	—
4372–201–00-I	X12CrMnNiN17–7-5	AP29O	S20100	N	1.4372	N	SUS201	W	S35350	N
4373–202–00-I	X12CrMnNiN18–9-5	AP32O	S20200	W	1.4373	N	SUS202	W	S35450	N
4376–201–00-E	X8CrMnNi19–6-3	AP28P	—	—	1.4376	I	—	—	—	—
4378–240–00-X	X6CrMnNiN18–13–3	AP34I	—	—	1.4378	I	—	—	—	—
4310–301–09-X	X12CrNi17–7	AP24N	S30100	I	(1.43XX)	I	SUS301	I	—	—
4541–321–00-I	X6CrNiTi18–10	AP28G	S32100	W	1.4541	I	SUS321	W	S32168	W
4550–347–00-I	X6CrNiNb18–10	AP28H	S34700	I	1.4550	N	SUS347	W	S34778	N

Steel designations according to[a]										
ISO number	**ISO name**	**Line**	ASTM A959/ **UNS**[b]		EN 10088–1:2014 **Number**[c]		**JIS**[d]		**GB/T20878/ ISC**[e]	
				I/N/Wf		I/N/Wf		I/N/Wf		I/N/Wf
4560–304–75-E	X3CrNiCu19–9-2	AP28D	—	—	1.4560	I	—	—	—	—
4567–304–30-I	X3CrNiCu18–9-4	AP27F	S30430	W	1.4567	N	SUSXM7	W	S30488	W
4567–304–76-I	X6CrNiCu17–8-2	AP25J	—	—	1.4567	W	SUS304J1	I	S30480	W
4567–304–98-X	X6CrNiCu18–9-2	AP27J	—	—	1.4567	W	SUS304J3	I	S30480	I
4570–303–31-I	X6CrNiCuS18–9-2	AP27I	S30331	I	1.4570	N	—	—	—	—
4597–204–76-I	X8CrMnCuN17–8-3	AP25L	—	—	1.4597	N	—	—	—	—
4615–201–75-E	X3CrMnNiCu15–8-5–3	AP28C	—	—	(1.4615)	I	—	—	—	—
4617–201–76-J	X6CrNiMnCu17–8-4–2	AP29I	—	—	(1.4617)	I	SUS304J2	I	—	—
4618–201–76-E	X9CrMnNiCu17–8-5–2	AP30L	—	—	(1.4618)	I	—	—	—	—
4625–303–23-X	X12CrNiSe18–9	AP27O	S30323	I	(1.4625)	I	SUS303Se	I	S30327	I
4640–304–76-E	X5CrNiCu19–6-2	AP28L	—	—	1.4640	I	—	—	—	—
4646–240–76-E	X6CrMnNiCuN18–12–4	AP34H	—	—	1.4646	I	—	—	—	—
4649–304–76-J	X6CrNiCu19–9-1	AP28I	—	—	(1.4649)	I	SUS304Cu	I	S30488	W
4650–304–75-E	X2CrNiCu19–10	AP29A	—	—	1.4650	I	SUS304L	W	S30403	W
4667–303–76-J	X12CrNiCuS18–9-3	AP27Q	—	—	(1.4667)	I	SUS303Cu	I	—	—
4818–304–15-E	X6CrNiSiNCe19–10	AP29J	S30415	W	1.4818	I	—	—	S30450	N
4824–308–09-J	X20CrNiN22–11	AP33Q	—	—	(1.4824)	I	SUH37	I	S30850	W
4828–305–09-I	X15CrNiSi20–12	AP32R	—	—	1.4828	N	—	—	—	—
4833–309–08-I	X18CrNi23–13	AP36R	S30908	W	1.4833	N	SUH309	W	S30908	W
4835–308–15-U	X7CrNiSiNCe21–11	AP32N	S30815	I	1.4835	N	—	—	—	—
4841–314–00-E	X15CrNiSi25–21	AP46R	S31400	N	1.4841	I	—	—	—	—
4845–310–08-E	X8CrNi25–21	AP46L	S31008	W	1.4845	I	SUS310S	W	S31008	N
4845–310–09-X	X23CrNi25–21	AP46O	S31008	W	1.4845	N	SUH310	I	S31020	I
4867–316–77-J	X40CrNiWSi15–14–3-2	AP29P	—	—	(1.4867)	I	SUH31	I	—	—
4884–305–00-X	X6CrNiSi18–13–4	AP31H	S30500	W	(1.4884)	I	SUSXM15J1	I	S38148	I
4890–202–09-X	X53CrMnNiN21–9-4	AP34V	—	—	(1.4890)	I	SUH35	I	S35650	I
4912–347–09-I	X7CrNiNb18–10	AP28K	S34709	W	1.4912	N	SUS347H	W	S34779	W
4940–321–09-I	X7CrNiTi18–10	AP28O	S32109	W	1.4940	N	SUS321H	W	S32169	N
4941–321–09-I	X6CrNiTiB18–10	AP28J	S32109	W	1.4941	W	—	—	S32169	W
4948–304–09-I	X7CrNi18–9	AP27L	S30409	W	1.4948	W	SUS304H	W	S30409	W
4950–309–08-E	X6CrNi23–13	AP36J	S30908	W	1.4950	I	SUS309S	W	S30908	W
4951–310–08-I	X6CrNi25–20	AP45L	S31008	W	1.4951	N	SUS310S	W	S31008	W
4961–347–77-E	X8CrNiNb16–13	AP29L	—	—	1.4961	I	—	—	—	—

ISO number	ISO name	Line	Steel designations according to[a]							
			ASTM A959/ UNS[b]		EN 10088–1:2014 Number[c]		JIS[d]		GB/T20878/ ISC[e]	
				I/N/Wf		I/N/Wf		I/N/Wf		I/N/Wf
b) Austenitic steels with Mo										
4401–316–00-I	X5CrNiMo17–12–2	AM31I	S31600	W	1.4401	N	SUS316	W	S31608	N
4404–316–03-I	X2CrNiMo17–12–2	AM31A	S31603	W	1.4404	N	SUS316L	W	S31603	N
4406–316–53-I	X2CrNiMoN17–11–2	AM30B	S31653	W	1.4406	N	SUS316LN	W	S31653	N
4429–316–53-I	X2CrNiMoN17–12–3	AM32B	S31653	W	1.4429	N	SUS316LN	W	S31653	N
4432–316–03-I	X2CrNiMo17–12–3	AM32A	S31603	W	1.4432	I	SUS316L	W	S31603	W
4434–317–53-I	X2CrNiMoN18–12–4	AM34B	S31753	W	1.4434	N	SUS317LN	W	S31753	W
4435–316–91-I	X2CrNiMo18–14–3	AM35A	—	—	1.4435	N	SUS316L	W	S31603	W
4436–316–00-I	X3CrNiMo17–12–3	AM32F	S31600	W	1.4436	I	SUS316	W	S31608	W
4438–317–03-I	X2CrNiMo19–14–4	AM37A	S31703	W	1.4438	W	SUS317L	W	S31703	W
4439–317–26-E	X2CrNiMoN17–13–5	AM35B	S31726	N	1.4439	I	—	—	S31723	W
4445–317–00-U	X6CrNiMo19–13–4	AM36I	S31700	I	(1.4445)	I	SUS317	W	S31708	N
4449–316–76-E	X3CrNiMo18–12–3	AM33F	—	—	1.4449	I	—	—	—	—
4466–310–50-E	X1CrNiMoN25–22–2	AM49A	S31050	W	1.4466	I	—	—	S31053	W
4476–317–92-X	X3CrNiMo18–16–5	AM39F	—	—	(1.4476)	I	SUS317J1	I	S31794	I
4483–317–26-I	X2CrNiMoN18–15–5	AM38A	S31726	W	(1.4483)	I	—	—	S31723	N
4494–316–74-J	X6CrNiMoS17–12–3	AM32K	—	—	(1.4494)	I	SUS316F	I	—	—
4495–316–51-J	X6CrNiMoN17–12–3	AM32H	S31651	N	(1.4495)	I	SUS316N	I	S31658	N
4496–309–51-J	X4CrNiMoN25–14–1	AM40F	—	—	(1.4496)	I	SUS317J2	I	—	—
4435–316–03-X	X2CrNiMo17–14–3	AM34C	—	—	(1.44xx)	I	SUS316L	I	—	—
4547–312–54-I	X1CrNiMoCuN20–18–7	AM45A	S31254	W	1.4547	N	SUS312L	W	S31252	N
4565–345–65-I	X2CrNiMnMoN25–18–6-5	AM54B	S34565	W	1.4565	I	—	—	S34553	N
4571–316–35-I	X6CrNiMoTi17–12–2	AM31F	S31635	W	1.4571	N	SUS316Ti	W	S31668	W
4578–316–76-E	X3CrNiCuMo17–11–3-2	AM30F	—	—	1.4578	I	—	—	—	—
4580–316–40-I	X6CrNiMoNb17–12–2	AM31G	S31640	W	1.4580	N	—	—	S31678	W
4647–316–75-X	X2CrNiMoCu18–14–2-2	AM34A	—	—	(1.4647)	I	SUS316J1L	I	S31683	I
4648–315–77-I	X6CrNiSiCuMo19–13–3-3–1	AM33I	—	—	(1.4648)	I	SUS315J2	W	—	—
4652–326–54-I	X1CrNiMoCuN24–22–8	AM54A	S32654	N	1.4652	I	—	—	S32652	N
4659–312–66-I	X1CrNiMoCuNW24–22–6	AM52B	S31266	W	1.4659	I	—	—	—	—
4660–315–77-I	X6CrNiCuSiMo19–10–3-2	AM30J	—	—	(1.4660)	I	SUS315J1	N	—	—
4665–316–76-J	X6CrNiMoCu18–12–2-2	AM32I	—	—	(1.4665)	I	SUS316J1	I	—	—
4879–317–77-J	X30CrNiMoPB20–11–2	AM33R	—	—	(1.4879)	I	SUH38	I	—	—
4910–316–77-E	X3CrNiMoBN17–13–3	AM33G	—	—	1.4910	I	—	—	—	—
4982–215–00-E	X10CrNiMoMnNbVB15–10–1	AM32P	S21500	N	1.4982	I	—	—	—	—

Steel designations according to[a]										
ISO number	ISO name	Line	ASTM A959/ UNS[b]		EN 10088–1:2014 Number[c]		JIS[d]		GB/T20878/ ISC[e]	
				I/N/W f		I/N/W f		I/N/W f		I/N/W f
c) Austenitic steels with Ni/Co as main alloying elements										
4389–384–00-I	X3NiCr18–16	AN34F	S38400	W	(1.4389)	I	SUS384	W	S38408	W
4478–083–67-U	X2NiCrMoN25–21–7	AN53A	N08367	I	(1.4478)	I	SUS836L	W	—	—
4479–089–36-U	X1NiCrMoMnN34–27–6-5	AN72A	N08936	I	(1.4479)	I	—	—	—	—
4529–089–26-I	X1NiCrMoCuN25–20–7	AN52A	N08926	W	1.4529	N	—	—	—	—
4537–310–92-E	X1CrNiMoCuN25–25–5	AN55A	—	—	1.4537	I	—	—	—	—
4539–089–04-I	X1NiCrMoCu25–20–5	AN50A	N08904	W	1.4539	N	SUS890L	W	S39042	N
4558–088–90-E	X2NiCrAlTi32–30	AN52B	—	—	1.4558	I	—	—	—	—
4563–080–28-I	X1NiCrMoCu31–27–4	AN62A	N08028	W	1.4563	I	—	—	—	—
4656–089–04-I	X1NiCrMoCu22–20–5-2	AN47A	N08904	N	(1.4656)	I	—	—	S39042	N
4657–080–20-U	X4NiCrCuMo35–20–4-3	AN58F	N08020	I	(1.4657)	I	—	—	—	—
4854–353–15-E	X6NiCrSiNCe35–25	AN60J	S35315	N	1.4854	I	—	—	—	—
4864–083–77-X	X13NiCr35–16	AN51O	—	—	1.4864	N	SUH 330	I	S33010	I
4876–088–00-I	X8NiCrAlTi32–21	AN53L	N08800	W	1.4876	N	NCF800	W	—	—
4958–088–77-E	X5NiCrAlTi31–20	AN51J	—	—	1.4958	I	—	—	—	—
4959–088–10-U	X7NiCrAlTi33–21	AN54L	N08810	I	1.4959	N	NCF800H	N	—	—
4959–088–11-U	X8NiCrAlTi33–21	AN54M	N08811	I	1.4959	W	—	—	—	—
4959–088–77-E	X8NiCrAlTi32–20	AN52L	—	—	1.4959	I	—	—	—	—
4971–314–79-I	X12CrNiCoMoWMnNNb21–20–20–3-3–2	AN64R	—	—	1.4971	N	SUH661	W	—	—
d) Austenitic-ferritic (duplex) steels										
4062–322–02-U	X2CrNiN22–2	DP24A	S32202	N	1.4062	I	—	—	—	—
4162–321–01-E	X2CrMnNiN21–5-1	DP27F	S32101	N	1.4162	I	—	—	—	—
4362–323–04-I	X2CrNiN23–4	DP27B	S32304	W	1.4362	I	—	—	S23043	W
4669–322–76-E	X2CrCuNiN23–2-2	DP25A	—	—	1.4669	I	—	—	—	—
e) Austenitic-ferritic (duplex) steels with Mo										
4410–327–50-E	X2CrNiMoN25–7-4	DM36A	S32750	W	1.4410	I	—	—	S25073	W
4424–315–00-I	X2CrNiMoSiMnN19–5-3–2-2	DM29B	S31500	N	1.4424	N				
4460–312–00-I	X3CrNiMoN27–5-2	DM34F	S31200	W	1.4460	I	—	—	S22553	W
4462–318–03-I	X2CrNiMoN22–5-3	DM30A	S32205	N	1.4462	I	SUS329J3L	W	S22053	N
4477–329–06-E	X2CrNiMoN29–7-2	DM38A	S32906	N	1.4477	I	—	—	—	—
4480–329–00-U	X6CrNiMo26–4-2	DM32F	S32900	I	(1.4480)	I	SUS329J1	W	—	—
4481–312–60-J	X2CrNiMoN25–7-3	DM35A	S31260	W	(1.4481)	I	SUS329J4L	I	S22583	W
4482–320–01-X	X2CrMnNiMoN21–5-3	DM29A	—	—	1.4482	I	—	—	—	—

Steel designations according to[a]										
ISO number	**ISO name**	**Line**	ASTM A959/ **UNS**[b]		EN 10088–1:2014 **Number**[c]		**JIS**[d]		**GB/T20878/ ISC**[e]	
				I/N/W f		I/N/W f		I/N/W f		I/N/W f
4485–332–07-U	X2CrNiMoN31–8-4	DM43A	S33207	I	(1.4485)	I	—	—	—	—
4501–327–60-I	X2CrNiMoCuWN25–7-4	DM36B	S32760	I	1.4501	N	—	—	S27603	N
4507–325–20-I	X2CrNiMoCuN25–6-3	DM34A	S32520	W	1.4507	I	—	—	S25554	—
4507–325–50-X	X3CrNiMoCuN26–6-3–2	DM35F	S32550	I	1.4507	W	—	—	S25554	I
4658–327–07-U	X2CrNiMoCoN28–8-5–1	DM42A	S32707	I	1.4658	I	—	—	—	—
4662–824–41-X	X2CrNiMnMoCuN24–4-3–2	DM33A	—	—	1.4662	I	—	—	—	—
f) Ferritic steels										
4000–410–08-I	X6Cr13	FP13G	S41008	W	1.4000	N	SUS410S	N	S41008	N
4002–405–00-I	X6CrAl13	FP13H	S40500	W	1.4002	N	SUS405	W	S11348	N
4003–410–77-I	X2CrNi12	FP12C	S41003	N	1.4003	N	—	—	S11213	N
4004–430–20-I	X7CrS17	FP17L	S43020	W	(1.4004)	I	SUS430F	W	S11717	W
4012–429–00-X	X10Cr15	FP15L	S42900	I	(1.4012)	I	SUS429	I	S11510	I
4016–430–00-I	X6Cr17	FP17I	S43000	W	1.4016	I	SUS430	W	S11710	W
4017–430–91-E	X6CrNi17–1	FP17H	—	—	1.4017	I	—	—	—	—
4030–410–90-X	X2Cr12	FP12A	—	—	(1.4030)	I	SUS410L	I	S11203	I
4509–439–40-X	X2CrTiNb18	FP18B	S43940	I	1.4509	N	SUS430LX	W	S11873	I
4510–430–35-I	X3CrTi17	FP17F	S43035	W	1.4510	N	SUS430LX	W	S11863	W
4510–430–36-J	X2CrNb17	FP17B	—	—	1.4510	N	SUS430LX	I	S11863	I
4511–430–71-I	X3CrNb17	FP17G	—	—	1.4511	N	SUS430LX	W	—	—
4512–409–10-I	X2CrTi12	FP12B	S40900	W	1.4512	N	SUH409L	W	S11163	—
4516–409–75-I	X6CrNiTi12	FP12F	S40975	W	1.4516	N	—	—	—	—
4520–430–70-I	X2CrTi17	FP17A	—	—	1.4520	N	SUS430LX	W	—	—
4595–429–71-I	X1CrNb15	FP15A	—	—	1.4595	N	—	—	—	—
4600–410–70-E	X2CrMnNiTi12	FP12D	—	—	1.4600	I	—	—	—	—
4607–445–00-E	X2CrNbTi20	FP20A	—	—	1.4607	I	—	—	—	—
4611–445–70-E	X2CrTi21	FP21A	—	—	1.4607	I	—	—	—	—
4613–446–70-E	X2CrTi24	FP24A	—	—	1.4607	I	—	—	—	—
4621–443–30-J	X2CrNbCu22	FP22A	—	—	(1.4621)	N	SUS443J1	I	—	—
4621–445–00-E	X2CrNbCu21	FP21B	S44500	W	(1.4621)	I	—	—	—	—
4664–430–75-J	X2CrCuTi18	FP18A	—	—	(1.4664)	I	SUS430J1L	I	—	—
4724–405–77-I	X10CrAlSi13	FP13L	—	—	1.4724	N	—	—	—	—
4742–430–77-I	X10CrAlSi18	FP18N	—	—	1.4742	N	—	—	—	—
4749–446–00-I	X15CrN26	FP26R	S44600	W	1.4749	W	SUH446	W	S12550	W
4762–445–72-I	X10CrAlSi25	FP25N	—	—	1.4762	N	—	—	—	—

Steel designations according to[a]										
ISO number	**ISO name**	**Line**	ASTM A959/ **UNS**[b]		EN 10088–1:2014 **Number**[c]		**JIS**[d]		**GB/T20878/ ISC**[e]	
				I/N/Wf		I/N/Wf		I/N/Wf		I/N/Wf
4764–442–72-J	X8CrAl19–3	FP19N	—	—	(1.4764)	I	SUH21	I	—	—
g) Ferritic steels with Mo										
4105–430–20-X	X6CrMoS17	FM17K	—	—	1.4105	I	—	—	—	—
4113–434–00-I	X6CrMo17–1	FM18I	S43400	W	1.4113	N	SUS434	W	S11790	W
4128–445–92-J	X2CrMo23–1	FM24B	—	—	(1.4128)	I	SUS445J1	I	—	—
4129–445–92-J	X2CrMo23–2	FM25A	—	—	(1.4129)	I	SUS445J2	I	—	—
4131–446–92-C	X1CrMo26–1	FM27A	S44627	W	(1.41319	I	SUSXM27	N	S12791	I
4135–447–92-C	X1CrMo30–2	FM32A	S44700	N	(1.41359	I	SUS447J1	N	S13091	I
4513–436–00-J	X2CrMoNbTi18–1	FM19A	S43600	W	(1.4513)	N	SUS436L	I	S11862	W
4521–444–00-I	X2CrMoTi18–2	FM20B	S44400	W	1.4521	N	SUS444	W	S11972	W
4523–182–35-I	X2CrMoTiS18–2	FM20C	S18235	W	1.4523	I	—	—	—	—
4526–436–00-I	X6CrMoNb17–1	FM18J	S43600	W	1.4526	N	—	—	S11770	W
4589–429–70-E	X5CrNiMoTi15–2	FM16H	—	—	1.4589	I	—	—	—	—
4609–436–77-J	X2CrMo19	FM19B	—	—	(1.4609)	I	SUS436J1L	I	—	—
4750–446–60-U	X2CrMoNi27–4-2	FM31A	S44660	I	(1.4750)	I	—	—	—	—
h) Martensitic steels										
4005–416–00-I	X12CrS13	MP13C	S41600	W	1.4005	N	SUS416	W	S41617	N
4006–410–00-I	X12Cr13	MP13B	S41000	W	1.4006	I	SUS410	W	S41010	W
4019–430–20-I	X14CrS17	MP17F	S43020	W	1.4019	I	—	—	S11717	W
4021–420–00-I	X20Cr13	MP13I	S42000	W	1.4021	I	SUS420J1	N	S42020	N
4023–440–04-I	X110Cr17	MP17W	S44004	W	(1.4023)	I	SUS440C	N	S44096	N
4024–410–09-E	X15Cr13	MP13F	—	—	1.4024	I	SUS410	W	—	—
4025–440–74-X	X110CrS17	MP17Z	—	—	(1.4025)	I	SUS440F	I	S44097	I
4028–420–00-I	X30Cr13	MP13M	S42000	W	1.4028	I	SUS420J2	W	S42030	N
4029–420–20-I	X33CrS13	MP13N	S42020	W	1.4029	N	SUS420F	N	S42037	N
4031–420–00-I	X39Cr13	MP13P	S42000	W	1.4031	I	—	—	S42040	W
4034–420–00-I	X46Cr13	MP13Q	S42000	W	1.4034	I	—	—	S42040	W
4035–420–74-E	X46CrS13	MP13R	—	—	1.4035	I	—	—	—	—
4038–420–00-I	X52Cr13	MP13U	S42000	W	(1.4038)	I	—	—	—	—
4039–420–09-I	X60Cr13	MP13V	—	—	(1.4039)	I	—	—	—	—
4040–440–02-X	X68Cr17	MP17U	S44002	W	(1.4040)	I	SUS440A	I	S44070	I
4041–440–03-X	X85Cr17	MP17V	S44003	W	(1.4041)	I	SUS440B	I	S44080	I
4057–431–00-X	X17CrNi16–2	MP16G	S43100	W	1.4057	I	SUS431	W	S43120	I
4058–429–99-J	X33Cr16	MP16O	—	—	(1.4058)	I	SUS429J1	I	—	—

Steel designations according to[a]										
ISO number	**ISO name**	**Line**	ASTM A959/ **UNS**[b]		EN 10088–1:2014 **Number**[c]		**JIS**[d]		**GB/T20878/ ISC**[e]	
				I/N/W f		I/N/W f		I/N/W f		I/N/W f
4642–416–72-J	X13CrPb13	MP13A	—	—	(1.4642)	I	SUS410F2	I	—	—
4643–420–72-J	X33CrPb13	MP13O	—	—	(1.4643)	I	SUS420F2	I	—	—
4766–440–77-X	X80CrSiNi20–2	MP20U	—	—	(1.4766)	I	SUH4	I	S48380	I
i) Martensitic steels with Mo										
4110–420–69-E	X55CrMo14	MM14U	—	—	1.4110	I	—	—	—	—
4116–420–77-E	X50CrMoV15	MM15U	—	—	1.4116	I	—	—	—	—
4119–410–92-C	X13CrMo13	MM13G	—	—	(1.4119)	I	SUS410J1	N	S45710	I
4122–434–09-I	X39CrMo17–1	MM18R	—	—	1.4122	I	—	—	—	—
4123–431–77-E	X40CrMoVN16–2	MM18T	—	—	1.4123	I	—	—	—	—
4313–415–00-I	X3CrNiMo13–4	MM14A	S41500	W	1.4313	N	SUSF6NM	W	S41595	W
4415–415–92-E	X2CrNiMoV13–5-2	MM15A	—	—	1.4415	I	—	—	—	—
4418–431–77-E	X4CrNiMo16–5-1	MM17A	—	—	1.4418	I	—	—	—	—
4419–420–97-E	X38CrMo14	MM14P	—	—	1.4419	I	—	—	S45830	W
4916–600–77-J	X18CrMnMoNbVN12	MM12G	—	—	(1.4916)	I	SUH 600	I	S46250	N
4923–422–77-E	X22CrMoV12–1	MM13H	—	—	1.4923	I	—	—	—	—
4929–422–00-I	X23CrMoWMnNiV12–1-1	MM13J	S42200	W	(1.4929)	I	SUH 616	N	S47220	N
j) Precipitation-hardening steels										
4542–174–00-I	X5CrNiCuNb16–4	PP20I	S17400	W	1.4542	N	SUS630	W	S51740	W
4568–177–00-I	X7CrNiAl17–7	PP24L	S17700	N	1.4568	N	SUS631	W	S51770	N
k) Precipitation-hardening steels with Mo										
4457–350–00-X	X9CrNiMoN17–5-3	PM25M	(S35000)	I	(1.4457)	W	—	—	S51750	I
4530–455–77-E	X1CrNiMoAlTi12–9-2	PM23A	—	—	1.4530	I	—	—	—	—
4532–157–00-I	X8CrNiMoAl15–7-2	PM24M	S15700	N	1.4532	N	—	—	S51570	
4534–138–00-X	X3CrNiMoAl13–8-3	PM24H	S13800	I	1.4534	N	—	—	S51380	
4594–155–92-E	X5CrNiMoCuNb14–5	PM21I	—	—	1.4594	I	—	—	—	—
4596–455–77-E	X1CrNiMoAlTi12–10–2	PM24A	—	—	1.4596	I	—	—	—	—
4644–662–20-U	X4NiCrMoTiMnSiB26–14–3-2	PM43J	(S66220)	I	(1.4644)	I	—	—	—	—

Steel designations according to[a]										
ISO number	**ISO name**	**Line**	ASTM A959/ **UNS**[b]		EN 10088–1:2014 **Number**[c]		**JIS**[d]		**GB/T20878/ ISC**[e]	
				I/N/W f		I/N/W f		I/N/W f		I/N/W f
k) Precipitation-hardening steels with Mo										
4645–469–10-U	X2CrNiMoCu AlTi12–9-4–3	PM25A	(S46910)	I	(1.4645)	I	—	—	—	—
4980–662–86-X	X6NiCrTiMoVB25–15–2	PM42J	(S66286)	I	1.4980	N	SUH660	I	S51525	W

NOTE The grades given in this table are comparable to those given in Table 1. However, to compare similar grades, it is necessary to check each element before making a substitution.

a See the sources in the Bibliography.

b US steel listed in ASTM A959 and in UNS; if the steel number is given in brackets then the steel has only a UNS number.

c European steel listed in EN 10088–1:2014 and in the “Stahl-Eisen-Liste”; if the steel number is given in brackets then the steel is only listed in the “Stahl-Eisen-Liste”.

d Japanese Industrial Standard.

e Chinese steel of ISC number listed in GB/T20878.

f I = identical steel to ISO steel grade; *N* = steel grade with closer match of composition, but not identical; W = wider match.

Annex B
(informative)

Matrix to show which steels are included in which European Standard

Table B.1 — Matrix to show which steels are included in which standards (current at June 2004)

Steel designation		Steels listed in EN 10088-1 and specified in																	
Name	Number	EN 10028-7	EN 10088-2 (−4)	EN 10088-3 (−5)	EN 10095	EN 10151	EN 10216-5	EN 10217-7	EN 10222-5	EN 10250-4	EN 10263-5	EN 10264-4	EN 10269	EN 10270-3	EN 10272	EN 10296-2	EN 10297-2	EN 10302	EN 10312
austenitic corrosion resisting steels																			
X2CrNiN18–7	1.4318	x	x (x)													x			
X10CrNi18–8	1.4310		x	x		x					x	x		x					
X2CrNi18–9	1.4307	x	x (x)	x (x)			x	x	x	x	x		x		x	x	x		x
X9CrNi18–9	1.4325			x															
X8CrNiS18–9	1.4305		x	x (x)													x		
X6CrNiCuS18–9-2	1.4570			x															
X3CrNiCu18–9-4	1.4567			x (x)							x		x						
X5CrNi19–9	1.4315	x	X	x															
X3CrNiCu19–9-2	1.4560			x							x								
X5CrNiCu19–6-2	1.4640		X																
X2CrNiN18–10	1.4311	x	X (x)	x (x)			x	x	x	x					x	x	x		
X5CrNi18–10	1.4301	x	X (x)	x (x)	x	x	x	x	x	x	x	x	x		x	x	x		x
X6CrNiTi18–10	1.4541	x	X (x)	x (x)	x		x	x	x	x	x				x	x	x		x
X6CrNiNb18–10	1.4550	x	X	x (x)			x	x	x	x					x	x	x		
X2CrNiCu19–10	1.4650								x										
X2CrNi19–11	1.4306	x	x (x)	x (x)			x	x		x	x				x	x	x		x

Steel designation		Steels listed in EN 10088-1 and specified in																	
Name	Number	EN 10028-7	EN 10088-2 (−4)	EN 10088-3 (−5)	EN 10095	EN 10151	EN 10216-5	EN 10217-7	EN 10222-5	EN 10250-4	EN 10263-5	EN 10264-4	EN 10269	EN 10270-3	EN 10272	EN 10296-2	EN 10297-2	EN 10302	EN 10312
X4CrNi18–12	1.4303		X	x							x	x	x						
X1CrNiSi18–15–4	1.4361		x	x															
X8CrMnCuNB17–8-3	1.4597		x	x															
X8CrMnNi19–6-3	1.4376		x																
X3CrMnNiCu15–8-5–3	1.4615			x															
X12CrMnNiN17–7-5	1.4372		x (x)	x (x)		x													
X2CrMnNiN17–7-5	1.4371		x																
X9CrMnNiCu17–8-5–2	1.4618		x																
X12CrMnNiN18–9-5	1.4373		x																
X11CrNiMnN19–8-6	1.4369		x	x		x													
X13MnNiN18–13–2	1.4020			x															
X6CrMnNiN8–13–3	1.4378			x															
X6CrMnNiCuN18–12–4-2	1.4646		x	x															
X1CrNi25–21	1.4335	x	x (x)				x										x		
X2CrNiMoCuS17–10–2	1.4598			x															
X3CrNiCuMo17–11–3-2	1.4578			x (x)							x								
X2CrNiMoN17–11–2	1.4406	x	x (x)	x (x)					x	x					x				
X2CrNiMo17–12–2	1.4404	x	x (x)	x (x)			x	x	x	x	x		x		x	x	x		x
X5CrNiMo17–12–2	1.4401	x	x	x (x)		x	x	x	x	x	x	x	x	x	x	x	x		x
X6CrNiMoTi17–12–2	1.4571	x	x (x)	x (x)			x	x	x	x	x				x	x	x		x
X6CrNiMoNb17–12–2	1.4580	x	x	x			x								x		x		

Steel designation		Steels listed in EN 10088-1 and specified in																	
Name	Number	EN 10028-7	EN 10088-2 (−4)	EN 10088-3 (−5)	EN 10095	EN 10151	EN 10216-5	EN 10217-7	EN 10222-5	EN 10250-4	EN 10263-5	EN 10264-4	EN 10269	EN 10270-3	EN 10272	EN 10296-2	EN 10297-2	EN 10302	EN 10312
X2CrNiMo17–12–3	1.4432	x	x (x)	x (x)				x	x		x				x	x			x
X3CrNiMo18–12–3	1.4449								x										
X3CrNiMo17–13–3	1.4436	x	x (x)	x (x)			x	x	x	x	x				x	x	x		x
X2CrNiMoN17–13–3	1.4429	x	x (x)	x (x)			x	x	x	x	x		x		x	x	x		
X2CrNiMoN18–12–4	1.4434	x	x																
X2CrNiMo18–14–3	1.4435	x	x (x)	x (x)			x	x	x	x					x	x	x		x
X2CrNiMoN17–13–5	1.4439	x	x (x)	x (x)			x	x							x	x	x		x
X2CrNiMo18–15–4	1.4438	x	x (x)	x (x)				x											
X1CrNiMoCuN20–18–7	1.4547	x	x (x)	x (x)			x	x		x					x	x	x		x
X1CrNiMoN25–22–2	1.4466	x	x (x)	x (x)			x										x		
X1CrNiMoCuNW24–22–6	1.4659		x	x															
X1CrNiMoCuN24–22–8	1.4652		x	x															
X2CrNiMnMoN25–18–6-5	1.4565		x (x)	x (x)															
X1NiCrMoCu25–20–5	1.4539	x	x (x)	x (x)			x	x		x					x	x	x		x
X1NiCrMoCuN25–20–7	1.4529	x	x (x)	x (x)			x	x		x					x		x		x
X2NiCrAlTi32–20	1.4558						x										x		
X1NiCrMoCu31–27–4	1.4563	x	x (x)	x (x)			x	x		x					x		x		
uncommon austenitic corrosion resisting steels																			
X5CrNi17–7	1.4319		x	x															
X8CrMnNiN18–9-5	1.4374			x															

Steel designation		Steels listed in EN 10088-1 and specified in																	
Name	Number	EN 10028-7	EN 10088-2 (−4)	EN 10088-3 (−5)	EN 10095	EN 10151	EN 10216-5	EN 10217-7	EN 10222-5	EN 10250-4	EN 10263-5	EN 10264-4	EN 10269	EN 10270-3	EN 10272	EN 10296-2	EN 10297-2	EN 10302	EN 10312
X1CrNiMoCuN25–25–5	1.4537	x	x	x															
austenitic-ferritic corrosion resisting steels																			
X2CrNiN22-2	1.4062	x	x	x															
X2CrCuNiN23–2-2	1.4669			x															
X2CrNiMoSi18–5-3	1.4424		x (x)	x (x)			x										x		
X2CrNiN23–4	1.4362	x	x (x)	x (x)	x		x	x		x					x	x	x		x
X2CrMnNiN21–5-1	1.4162		x (x)	x (x)															
X2CrmnNiMoN21–5-3	1.4482		x	x															
X2CrNiMoN22–5-3	1.4462	x	x (x)	x (x)			x	x	x	x	x				x	x	x		x
X2CrNiMnMoCuN24–4-3–2	1.4662		x																
X2CrNiMoCuN25–6-3	1.4507	x	x	x			x			x					x		x		
X3CrNiMoN27–5-2	1.4460			x (x)						x							x		
X2CrNiMoN25–7-4	1.4410	x	x (x)	x (x)			x	x	x	x					x	x	x		
X2CrNiMoCuWN25–7-4	1.4501	x	x	x			x	x		x					x		x		
X2CrNiMoN29–7-2	1.4477		x (x)	x (x)													x		
X2CrNiMoCoN28–8-5–1	1.4658			x															
uncommon austenitic-ferritic corrosion resisting steels																			
X2CrNiCuN23–4	1.4655		x																

Steel designation		Steels listed in EN 10088-1 and specified in																	
Name	Number	EN 10028-7	EN 10088-2 (−4)	EN 10088-3 (−5)	EN 10095	EN 10151	EN 10216-5	EN 10217-7	EN 10222-5	EN 10250-4	EN 10263-5	EN 10264-4	EN 10269	EN 10270-3	EN 10272	EN 10296-2	EN 10297-2	EN 10302	EN 10312
ferritic corrosion resisting steels																			
X2CrNi12	1.4003	**X**	**X (x)**	**x (x)**											**x**	**x**			
X2CrTi12	1.4512		**X (x)**		**x**											**x**	**x**		
X6CrNiTi12	1.4516	**x**	**x**																
X6Cr13	1.4000		**x**	**x**	**x**														
X6CrAl13	1.4002		**x**							**x**							**x**		
X2CrMnNiTi12	1.4600		**x**																
X2CrSiTi15	1.4630		**x**																
X6Cr17	1.4016		**x (x)**	**x (x)**	**x**	**x**				**x**	**x**					**x**	**x**		
X2CrTi17	1.4520	**x**	**x**	**x**															
X3CrTi17	1.4510	**x**	**x (x)**		**x**											**x**	**x**		**x**
X3CrNb17	1.4511		**x**	**x**															**x**
X6CrNi17–1	1.4017		**x**																
X2CrTiNb18	1.4509	**x**	**x (x)**	**x**	**x**											**x**			
X2CrAlSiNb18	1.4634		**x**																
X2CrNiTi20	1.4607		**x**																
X2CrTi21	1.4611		**x**	**x**															
X2CrNbCu21	1.4621		**x**																
X2CrTi24	1.4613		**x**	**x**															
X5CrNiMoTi15–2	1.4589		**x**																
X6CrMoS17	1.4105			**x**															
X6CrMo17–1	1.4113		**x**	**x**							**x**								
X2CrMoTi17–1	1.4513		**x (x)**																
X6CrMoNb17–1	1.4526		**x (x)**	**x**												**x**			

Steel designation		Steels listed in EN 10088-1 and specified in																	
Name	Number	EN 10028-7	EN 10088-2 (−4)	EN 10088-3 (−5)	EN 10095	EN 10151	EN 10216-5	EN 10217-7	EN 10222-5	EN 10250-4	EN 10263-5	EN 10264-4	EN 10269	EN 10270-3	EN 10272	EN 10296-2	EN 10297-2	EN 10302	EN 10312
X2CrMoTi18–2	1.4521	x	x (x)													x			x
X2CrMoTiS18–2	1.4523			x (x)															
X2CrMoTi29–4	1.4592		x																
uncommon ferritic corrosion resisting steels																			
X1CrNb15	1.4595		x																
X2CrNbZr17	1.4590		x		x														
martensitic corrosion resisting steels																			
X12Cr13	1.4006		x (x)	x (x)	x					x	x				x		x		
X12CrS13	1.4005			x															
X15Cr13	1.4024		x	x															
X20Cr13	1.4021		x (x)	x (x)		x				x									
X30Cr13	1.4028		x	x		x				x									
X29CrS13	1.4029			x															
X39Cr13	1.4031		x	x		x													
X46Cr13	1.4034		x	x															
X46CrS13	1.4035			x															
X17CrNi16–2	1.4057			x (x)						x					x				
X38CrMo14	1.4419		x	x															
X55CrMo14	1.4110		x	x															
X3CrNiMo13–4	1.4313	x	x	x					x	x					x				
X1CrNiMoCu12–5-2	1.4422		x																
X50CrMoV15	1.4116		x	x															
X70CrMo15	1.4109			x															
X2CrNiMoV13–5-2	1.4415			x															

Steel designation		Steels listed in EN 10088-1 and specified in																	
Name	Number	EN 10028-7	EN 10088-2 (−4)	EN 10088-3 (−5)	EN 10095	EN 10151	EN 10216-5	EN 10217-7	EN 10222-5	EN 10250-4	EN 10263-5	EN 10264-4	EN 10269	EN 10270-3	EN 10272	EN 10296-2	EN 10297-2	EN 10302	EN 10312
X1CrNiMoCu12–7-3	1.4423		x																
X53CrSiMoVN16–2	1.4150			x															
X4CrNiMo16–5-1	1.4418	x	x (x)	x (x)						x					x				
X14CrMoS17	1.4104			x															
X39CrMo17–1	1.4122		x	x															
X105CrMo17	1.4125			x															
X40CrMoVN16–2	1.4123			x															
X90CrMoV18	1.4112			x															
precipitation hardening corrosion resisting steels																			
X5CrNiCuNb16–4	1.4542		x (x)	x (x)						x									
X7CrNiAl17–7	1.4568		x (x)	x (x)		x								x					
X5CrNiMoCuNb14–5	1.4594			x															
X1CrNiMoAlTi12–9-2	1.4530			x															
X1CrNiMoAlTi12–10–2	1.4596			x															
X1CrNiMoAlTi12–11–2	1.4612			x															
X5NiCrTiMoVB25–15–2	1.4606			x															
austenitic heat-resisting steels																			
X8CrNiTi18–10	1.4878				x												x		
X6CrNiSiNCe19–10	1.4818				x											x			
X15CrNiSi20–12	1.4828				x											x			
X9CrNiSiNCe21–11–2	1.4835				x											x	x		

Steel designation		Steels listed in EN 10088-1 and specified in																	
Name	Number	EN 10028-7	EN 10088-2 (−4)	EN 10088-3 (−5)	EN 10095	EN 10151	EN 10216-5	EN 10217-7	EN 10222-5	EN 10250-4	EN 10263-5	EN 10264-4	EN 10269	EN 10270-3	EN 10272	EN 10296-2	EN 10297-2	EN 10302	EN 10312
X12CrNi23–13	1.4833				x											x	x		
X25CrMnNiN25–9-7	1.4872				x														
X8CrNi25–21	1.4845				x											x	x		
X15CrNiSi25–21	1.4841				x							x							
X10NiCrAlTi32–21	1.4876				x												x		
X6NiCrSiNCe35–25	1.4854				x											x	x		
X10NiCrSi35–19	1.4886				x														
uncommon austenitic and austenitic-ferritic heat-resisting steels																			
X15CrNiSi25–4	1.4821				x														
X12NiCrSi35–16	1.4864				x														
X10NiCrSiNb35–22	1.4887				x														
X6NiCrNbCe32–27	1.4877				x														
ferritic heat-resisting steels																			
X10CrAlSi7	1.4713				x														
X10CrAlSi13	1.4724				x														
X10CrAlSi18	1.4742				x														
X10CrAlSi25	1.4762				x														
X18CrN28	1.4749				x												x		
Uncommon ferritic heat-resisting steels																			
X3CrAlTi18–2	1.4736				x														
austenitic creep-resisting steels																			
X6CrNi18–10	1.4948	x			x		x		x				x						
X7CrNiNb18–10	1.4912						x		x										
X7CrNiTi18–10	1.4940						x												

Steel designation		Steels listed in EN 10088-1 and specified in																
Name	Number	EN 10028-7	EN 10088-2 (−4)	EN 10088-3 (−5)	EN 10095	EN 10151	EN 10216-5	EN 10217-7	EN 10222-5	EN 10250-4	EN 10263-5	EN 10264-4	EN 10269	EN 10270-3	EN 10272	EN 10296-2	EN 10297-2	EN 10302	EN 10312
X6CrNiTiB18–10	1.4941	x			x		x		x				x					x	
X8CrNiNb16–13	1.4961	x					x											x	
X12CrNiWTiB16–13	1.4962																	x	
X6CrNiWNbN16–16	1.4945																	x	
X6CrNi23–13	1.4950	x			x														
X6CrNi25–20	1.4951	x			x														
X5NiCrAlTi31–20	1.4958	x					x											x	
X8NiCrAlTi32–21	1.4959	x					x											x	
X10CrNiMoMnNbVB 15–10–1	1.4982						x						x						
X8CrNiMoVNb16–13	1.4988						x											x	
X8CrNiMoNb16–16	1.4981						x											x	
X7CrNiMoBNb16–16	1.4986												x						
X6CrNiMoB17–12–2	1.4919												x					x	
X6CrNiMoTiB17–13	1.4983																	x	
X6CrNiMo17–13–2	1.4918						x												
X3CrNiMoBN17–13–3	1.4910	x					x		x				x					x	
X12CrCoNi21–20	1.4971																	x	
X6NiCrTiMoVB25–15–2	1.4980												x					x	
martensitic creep-resisting steels																			
X10CrMoVNb9–1	1.4903																	x	
X11CrMoWVNb9–1-1	1.4905																	x	
X19CrMoNbVN11–1	1.4913												x					x	

Steel designation		Steels listed in EN 10088-1 and specified in																	
Name	Number	EN 10028-7	EN 10088-2 (−4)	EN 10088-3 (−5)	EN 10095	EN 10151	EN 10216-5	EN 10217-7	EN 10222-5	EN 10250-4	EN 10263-5	EN 10264-4	EN 10269	EN 10270-3	EN 10272	EN 10296-2	EN 10297-2	EN 10302	EN 10312
X20CrMoV11–1	1.4922																	x	
X22CrMoV12–1	1.4923												x					x	
X20CrMoWV12–1	1.4935																	x	
X12CrNiMoV12–3	1.4938												x					x	
X8CrCoNiMo10–6	1.4911																	x	
*) Patented steel grade.																			

Annex C
(informative)

Classification of stainless steel grades

C.1 General

Stainless steels are classified according to 3 principles:

- use properties, to produce material standards;
- microstructure, to produce tables in the standards;
- significant alloying elements, to sort grades in the tables.

They may be further classified according to availability into standard grades and special grades. Special grades are intended for a particular use and with limited availability. Some alloy steels within the stainless steel definition are classified according to their use function as tool or valve steels.

C.2 Classification by use properties

C.2.1 Corrosion resisting

A corrosion resisting steel is a steel with a good resistance to uniform or local attack from the environment. The protection is provided by a minimum content of 10,5 % Cr through a spontaneously formed chromium oxide film. The environment may be atmospheric at ambient temperature (indoor, rural, urban, industrial, marine) or a solution giving electrochemical conditions.

EN grades are given steel numbers (EN 10027-2) in the groups:

- 1.40xx for grades with < 2,5 % Ni, without Mo, without special additions;
- 1.41xx for grades with < 2,5 % Ni, with Mo, without special additions;
- 1.43xx for grades with ≥ 2,5 % Ni, without Mo, without special additions;
- 1.44xx for grades with ≥ 2,5 % Ni, with Mo, without special additions;
- 1.45xx and 1.46xx for grades with special additions, such as Ti, Nb or Cu.

C.2.2 Heat resisting

A heat resisting steel is a steel, mainly ferritic or austenitic, with a good resistance to oxidation and the effects of hot gases and combustion products at temperatures higher than 550 °C. In oxidizing atmospheres a protective oxide layer is formed by chromium, silicon and aluminium on the steel surface. This oxide also reduces the attack from sulfur. In a reducing atmosphere, where no oxide is formed, an increased nickel content will reduce carbon and nitrogen pickup, but increases the susceptibility to sulfur attack.

EN grades are given steel numbers in the groups:

- 1.47xx for grades with < 2,5 % Ni;
- 1.48xx for grades with ≥ 2,5 % Ni.

C.2.3 Creep resisting

A creep resisting steel is a steel, mainly martensitic and austenitic, with good resistance to deformation under mechanical long-time stressing at temperatures above 500 °C. Several austenitic grades are variants of grades in C.2.1 and C.2.2 with specified minimum carbon content.

EN grades are given steel numbers in the group 1.49xx.

C.3 Classification by microstructure

C.3.1 Ferritic

Ferrite (alpha-iron, α-Fe) has a body centred cubic (bcc) atomic packing. It is magnetic, and is brittle below a characteristic transition temperature. Delta-ferrite (δ) is a residual bcc structure from the solidification process and has similar characteristics.

Ferritic steels are annealed at temperatures 750 °C - 950 °C, to avoid the formation of austenite. Heat treatments at higher temperatures (typical example: heat affected zones in welds) may result in the formation of austenite, which transforms to martensite on cooling, and may also cause embrittlement due to grain coarsening. These effects are reduced by stabilization of the C and N contents with Ti, Nb or Zr.

As a rule, ferritic steels have a poor weldability due to their sensitivity to intergranular corrosion and embrittlement in the heat affected zone.

In the ASTM standards, the ferritic grades are classified in the 400 series.

C.3.2 Martensitic

Martensite is formed from austenite during heat treatment or by cold working. It has a high strength and is magnetic.

Above 900 °C to 1 000 °C these steels have an austenitic structure with high solubility for carbon. Upon cooling the austenite transforms to a supersaturated solution of carbon in a quadratic body centred α'-matrix, i.e. martensite, which is stable down to ambient temperature.

If the structure contains a high amount of ferrite the steels are called "*martensitic-ferritic"* or "*semi-ferritic"*. Steel grade examples are grades 1.4005 and 1.4006.

Traditional martensitic steels have high carbon contents in the range 0,08 % to 1 %. They are air hardening on cooling, but their mechanical strength may be increased by a quenching heat treatment. The type of cooling (in air, oil or water) is adapted for each grade. The ductility is improved by a tempering treatment before use. With carbon contents > 0,20 %, they are difficult to weld.

Martensitic steels are also made with a low carbon content (max. 0,06 %) and 3 % to 6 % Ni. These steels have a balanced composition that promotes stable austenite after hardening and tempering and are called "*martensitic-austenitic"* or "*nickel martensitic"*. These steels have a relatively good weldability. Examples are grades 1.4313 and 1.4418.

The low carbon type has been further developed to "*supermartensitic"* steels. Typical compositions are 11 % to 13 % Cr, 2 % to 6 % Ni, 0 to 3 % Mo and max. 0,030 % C and N. Their high strength is combined with good impact strength and good weldability. An example is 1.4415 (X2CrNiMoV13-5-2).

In the ASTM standards, the martensitic grades are classified in the 400 series.

C.3.3 Precipitation hardening

After solution annealing and quenching, the precipitation of intermetallic compounds, carbides, nitrides or copper phase from the martensitic structure gives an increased strength.

The specific heat treatment conditions shall be adjusted depending on the desired level of mechanical properties and the data provided by the manufacturers.

Examples are grades 1.4568, 1.4542 and 1.4594.

C.3.4 Austenitic

Austenite (gamma-iron, γ Fe) has a face centred cubic (fcc) atomic packing. It is not magnetic, and is ductile over a wide temperature range, from cryogenic to creep temperatures. It does not display brittle fracture. The tensile strength is high at low temperatures. By coldforming it may be workhardened to high strength levels.

Austenitic grades are solution annealed within the range 1 000 °C to 1 200 °C. Austenite does not harden from heat treatment. Austenite formers like Ni, C and N promote the austenitic structure, whereas ferrite formers like Cr, Mo and Si promote a ferritic structure. Conventional austenitic grades may contain traces of delta ferrite, for improved weldability. Alloying with interstitial elements, particularly N, will increase the strength.

The stability of the austenitic structure depends on the amount of alloying elements. Grades with alloy content on the low side may transform to martensite during plastic deformation and/or by cooling to low temperature. They are called "*metastable austenitic"*. Typical examples are grades 1.4310 and 1.4318.

Ferrite traces and high chromium and molybdenum contents may promote precipitation of sigma phase (σ) which is brittle. The critical temperature range for precipitation of this and other intermetallic phases is 600 °C to 900 °C.

Stable austenitic grades without any ferrite are called "*fully austenitic*" and may require special care in hot forming and welding. Typical examples are grades 1.4466 and 1.4539.

Grades with excellent corrosion resistance in aggressive environments due to high chromium, molybdenum and nitrogen contents may be called "*superaustenitic"*. Typical examples are grades 1.4547 and 1.4652

The metallic materials grouping system in CEN ISO/TR 15608 defines a separate austenitic steel group 8.2, with typical chromium contents over 19 %. This group contains all superaustenitic and most fully austenitic grades.

In the ASTM standards, the austenitic grades with manganese contents equal to or lower than 2 % are classified in the 300 series.

C.3.5 Austenitic-ferritic (Duplex)

These steels have a well-balanced two-phase structure, with ferrite content between 30 % and 50 %. Strength properties are higher than for austenitic steels hence high power is required for cold deformation. These steels have a good resistance to stress corrosion cracking.

Sigma phase, and other phases that may reduce toughness and corrosion resistance, can be formed rapidly in the range 600 °C to 900 °C, primarily from the ferrite. Hot forming is therefore be performed well above these temperatures and followed by rapid cooling. Welds should be cooled rapidly through this range.

The metallic materials grouping system in CEN ISO/TR 15608 defines a separate austenitic-ferritic steel group 10.2, with typical chromium contents over 24 %. This group will contain "*superduplex*" grades with high chromium, molybdenum and nitrogen contents. Typical examples are grades 1.4410, 1.4507 or 1.4501.

In the ASTM standards, the austenitic-ferritic grades are classified in the 300 series.

C.4 Classification by significant alloying elements

C.4.1 Chromium and Nickel

Chromium and Nickel are the main alloying elements in stainless steel, and give the basic sorting order in EN standards. "*Cr-steel"* is a traditional term for ferritic grades, whereas "*CrNi-steel"* may be used for austenitic grades.

C.4.2 Molybdenum

Molybdenum improves the corrosion resistance, especially against chloride induced pitting. It is detrimental in oxidizing acids, like nitric acid, and in oxidizing atmospheres at high temperature.

Austenitic grades with over 2 % Mo may be called "*CrNiMo-steel"*. They were earlier called "*acid resisting"*, due to their resistance in the acid sulphite pulping process.

C.4.3 Manganese

Manganese is added as a substitute for nickel as an austenite former and to increase the solubility of nitrogen. The metallic materials grouping system in CEN ISO/TR 15608 defines a separate austenitic steel group 8.3, with manganese contents 2 % to 9 %.

In the ASTM standards, the austenitic grades with manganese contents higher than 2 % are classified in the 200 series.

C.4.4 Low carbon

Chromium carbides may precipitate in the grain boundaries during slow cooling after heat treatment or welding, and cause intergranular attack in contact with corrosive environments. The critical temperature range is 600 °C to 800 °C. The modern method to avoid intergranular corrosion is to make steels with ≤ 0,030 % carbon, so called LC-steels (Low Carbon), in which case all of the carbon remains in solid solution and does not combine with chromium to form chromium-carbide precipitates. The traditional method is described in C.4.6.

C.4.5 Nitrogen

Nitrogen, being a strong austenite stabilizing element, is added as a substitute for nickel as an austenite former and to increase strength as well as the resistance to pitting corrosion.

C.4.6 Stabilization

Addition of titanium, niobium and/or zirconium prevents the precipitation of chromium carbides following heat treatment and/or welding processes. Stabilization was the preferred method up to the 1960s, when technological advances enabled low carbon grades to be made cheap and reliable. Stabilized grades display good strength properties up to about 600 °C.

C.4.7 Sulfur

Sulfur promotes chip breaking in machining operations and improves machinability considerably. Free cutting grades with 0,15 % to 0,35 % S are thus available with ferritic, martensitic and austenitic microstructure. The addition of sulfur is however detrimental to impact strength and corrosion resistance.

Annex D
(informative)

Empirical formulae for steel grade microstructure classification and pitting resistance ranking

The formulae given in Table D.1 are used for characterization of grades and classification into groups in cast condition (without PWHT). They may be updated and harmonized with other formulae in use. The traditional groups for Ferrite, Martensite and Austenite are complemented with transition groups marked in bold. The basis is the average chemical composition for the grade, i.e. (min+max/2). The steel groups are similar to the grouping of metallic materials in CEN ISO/TR 15608.

The FNA formula below is intended to be used for material in annealed condition. It's not intended to be used as an absolute Ferrite number determination method but can be used when minor chemical composition changes are of interest and how this might effect the microstructure. The formulae may also be used in steel manufacturing for statistical process control, and for optimization of properties within composition limits.

Table D.1 — Empirical formulae for steel grade microstructure classification

Microstructure characteristics	**Formulae and parameters**	**Range of application**	
FM Ferrite - Martensite-region in Schaeffler/de Long diagram	FM = (A - 1,2)/(F – 8) for *F* = min 8 where: *F* = 1,5Si + Cr + Mo + 2Ti + 0,5Nb A = 30C + 0,5Mn + 30N + Ni + 0,5Cu + 0,5Co	Fer	Ferritic when: FM = 0, 00 - 0,30
		Martensitic	**Ferritic-Martensitic** when: FM = 0,30 - 1,0
			Martensitic when: FM = 1,0 - 4
MS Ferrite - Martensite transform (1)	MS = 540 - 497C - 6,3Mn - 10,8Cr - 36,3Ni - 46,6Mo		Martensitic when: MS = 100 - 300
MNA Martensite Number based on Md30 (2)	MNA = 551 - 462(C+N) – 9,2Si – 8,1Mn – 13,7Cr – 29(Ni+Cu) - 18,5Mo - 68Nb		**Austenitic-Martensitic** when: MNA = 100 - 300
		Austenitic	**Metastable austenitic** when: MNA = 0 - 100 or MNK = (−2) - 0
MNK Martensite Number based on WRC-1992 diagram (4)	MNK = 25 – F – 0,90A for Mn = max 2,4 % MNK = 21 – 0,90F – A for Mn = 2,5 – 6,9 % MNK = 13 – 0,42F – 1,3A for Mn = min 7,0 % where: *F* = Cr + Mo + 2Ti + 0,7Nb A = 35C + 20N + Ni + 0,25Cu		
MS Austenite - Martensite transform (3)	MS = 502 – 810C - 13Mn - 1230N - 12Cr - 30Ni – 46Mo - 54Cu		Austenitic when: MS = (−1000) - (−10)

Microstructure characteristics	Formulae and parameters	Range of application	
SM Solidification Mode based on WRC-1992 diagram (4)	SM = F – 1,3A – 2,0 where: *F* = Cr + Mo + 2Ti + 0,7Nb A = 35C + 20N + Ni + 0,25Cu		Fully austenitic when: SM = (−30) - (−4)
FNA Ferrite Number based on complemented Schaeffler/de Long diagram (5)	FNA = 3,34F – 2,46A – 28,6 for FNA = max 5,9 FNA = 4,44F – 3,39A – 38,4 for FNA = 6,0 – 11,9 FNA = 4,06F – 3,23A – 32,2 for FNA = min 12 where: *F* = 1,5Si + Cr + Mo + 2Ti + 0,5Nb A = 30C + 0,5Mn + 30N + Ni + 0,5Cu + 0,5Co		Austenitic when: FNA = (−40) - 20
		Duplex	**Austenitic-Ferritic (Duplex)** when: FNA = 25 – 75 or SM = 8 - 15
IMP Intermetallic phases based on FNA equivalents and (3)	IMP = F - 0,23A - 20,2 for A = min 8,7 IMP = F + 1,25A - 32,8 for A = max 8,6	Sensitive to formation of IMP when: IMP = 4 - 10	
PRE Pitting Resistance Equivalent (6)	PRE = Cr + 3,3Mo + 16N most common formula for Supeaustenitic/duplex/ferritic PRE = Cr + 3,3Mo + 30N also for austenitic steels with Mo > 3%	Resistant when: PRE = 40 - 60	

(1) Walker, Gooch. 1986
(2) Angel 1954. Nohara 1977
(3) SINTEF Welding handbook. 1997
(4) Kotecki, Siewert. WRC 1992. Kotecki 2000
(5) ASME Sect III Div 1 NB-2433. 1992
(6) Herbsleb (30N) 1982. Truman (16N) 1987

Annex E
(informative)

Guidance data on some physical properties

Tables E.1 to E.8 give guidance data on some physical properties for stainless steels.

Table E.1 — Guidance data on some physical properties of austenitic corrosion resisting steels

Steel designation		Density	Modulus of elasticity at						Mean coefficient of thermal expansion between 20 °C and					Thermal conductivity at 20 °C $\frac{W}{m \cdot K}$	Specific thermal capacity at 20 °C $\frac{J}{kg \cdot K}$	Electrical resistivity at 20 °C $\frac{\Omega \cdot mm^2}{m}$	Magnetiz-able
			20 °C	100 °C	200 °C	300 °C	400 °C	500 °C	100 °C	200 °C	300 °C	400 °C	500 °C				
Name	Number	kg/dm^3	GPa						$10^{-6} \times K^{-1}$								
X2CrNiN18–7	1.4318	7,9	200	194	186	179	172	165	16,0	16,5	17,0	17,5	18,0	15	500	0,73	no [a]
X10CrNi18–8	1.4310	7,9	200	194	186	179	172	165	16,0	17,0	17,0	18,0	18,0	15	500	0,73	
X2CrNi18–9	1.4307	7,9	200	194	186	179	172	165	16,0	16,5	17,0	18,0	18,0	15	500	0,73	
X9CrNi18–9	1.4325	7,9	200	194	186	179	172	165	16,0	17,0	17,0	18,0	18,0	15	500	0,73	
X8CrNiS18–9	1.4305	7,9	200	194	186	179	172	165	16,0	16,5	17,0	17,5	18,0	15	500	0,73	
X6CrNiCuS18–9-2	1.4570	7,9	200	194	186	179	172	165	-	-	-	-	-	-	-	-	
X3CrNiCu18–9-4	1.4567	7,9	200	194	186	179	172	165	16,7	17,2	17,7	18,1	18,4	-	-	-	
X5CrNiN19–9	1.4315	7,9	200	194	186	179	172	165	16,0	16,5	17,0	17,5	18,0	15	500	0,73	
X3CrNiCu19–9-2	1.4560	7,9	200	194	186	179	172	165	-	-	-	-	-	-	-	-	
X5CrNiCu19–6-2	1.4640	7,9	200	194	186	179	172	165	16,0	16,5	17,0	17,5	18,0	15	500	0,73	

Steel designation		Density	Modulus of elasticity at						Mean coefficient of thermal expansion between 20 °C and					Thermal conductivity at 20 °C $\frac{W}{m \cdot K}$	Specific thermal capacity at 20 °C $\frac{J}{kg \cdot K}$	Electrical resistivity at 20 °C $\frac{\Omega \cdot mm^2}{m}$	Magnetizable
			20 °C	100 °C	200 °C	300 °C	400 °C	500 °C	100 °C	200 °C	300 °C	400 °C	500 °C				
Name	Number	kg/dm^3	GPa						$10^{-6} \times K^{-1}$								
X2CrNiN18–10	1.4311	7,9	200	194	186	179	172	165	16,0	16,5	17,0	17,5	18,0	15	500	0,73	no [a]
X5CrNi18–10	1.4301	7,9	200	194	186	179	172	165	16,0	16,5	17,0	17,5	18,0	15	500	0,73	
X6CrNiTi18–10	1.4541	7,9	200	194	186	179	172	165	16,0	16,5	17,0	17,5	18,0	15	500	0,73	
X6CrNiNb18–10	1.4550	7,9	200	194	186	179	172	165	16,0	16,5	17,0	17,5	18,0	15	500	0,73	
X2CrNiCu19–10	1.4650	7,9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
X2CrNi19–11	1.4306	7,9	200	194	186	179	172	165	16,0	16,5	17,0	17,5	18,0	15	500	0,73	
X4CrNi18–12	1.4303	7,9	200	194	186	179	172	165	16,0	16,5	17,0	17,5	18,0	15	500	0,73	
X1CrNiSi18–15–4	1.4361	7,7	200	194	186	179	172	165	16,5	-	-	-	-	14	-	-	
X8CrMnCuNB17–8-3	1.4597	7,8	200	194	186	179	172	165	16,0	16,5	17,0	17,5	18,0	15	500	0,73	
X8CrMnNi19–6-3	1.4376	7,9	200	194	186	179	172	165	16,0	16,5	17,0	17,5	18,0	15	500	0,73	
X3CrMnNiCu15–8-5–3	1.4615	7,8	190	186	179	172	165	158	16,3	17,5	18,0	18,3	19,0	13,1	500	0,73	
X12CrMnNiN17–7-5	1.4372	7,8	200	194	186	179	172	165	-	-	-	-	-	15	-	0,70	
X2CrMnNiN17–7-5	1.4371	7,8	200	194	186	179	172	165	17,0	17,5	18,0	18,5	-	15	500	0,70	
X9CrMnNiCu17–8-5–2	1.4618	7,9	200	194	186	179	172	165	16,0	16,5	17,0	17,5	18,0	15	500	0,73	
X12CrMnNiN18–9-5	1.4373	7,8	200	194	186	179	172	165	-	-	-	-	-	15	-	0,70	

Steel designation		Density	Modulus of elasticity at						Mean coefficient of thermal expansion between 20 °C and					Thermal conductivity at 20 °C $\frac{W}{m \cdot K}$	Specific thermal capacity at 20 °C $\frac{J}{kg \cdot K}$	Electrical resistivity at 20 °C $\frac{\Omega \cdot mm^2}{m}$	Magnetizable
			20 °C	100 °C	200 °C	300 °C	400 °C	500 °C	100 °C	200 °C	300 °C	400 °C	500 °C				
Name	Number	kg/dm^3	GPa						$10^{-6} \times K^{-1}$								
X11CrNiMnN19–8-6	1.4369	7,9	190	186	179	172	165	158	16,5	17,0	18,0	18,5	19,0	15	500	0,70	no [a]
X13MnNiN18–13–2	1.4020	7,8	200	192	184	175	168	160	16,2	16,8	17,6	18,2	19,3	15	500	0,8	
X6CrMnNiN8–13–3	1.4378	7,8	200	192	184	175	168	160	16,2	16,2	16,8	17,6	18,2	19,3	500	0,8	
X6CrMnNiCuN18–12–4-2	1.4646	7,7	215	175	145	130	115	110	16	16,5	17,0	17,5	18,0	17,2	463	0,73	
X1CrNi25–21	1.4335	7,9	195	190	182	174	166	158	15,8	16,1	16,5	16,9	17,3	14	450	0,85	
X2CrNiMoCuS17–10–2	1.4598	8,0	200	194	186	179	172	165	16,5	17,3	17,7	18,1	18,4	14,5	500	0,75	
X3CrNiCuMo17–11–3-2	1.4578	8,0	200	194	186	179	172	165	-	-	-	-	-	-	-	-	
X2CrNiMoN17–11–2	1.4406	8,0	200	194	186	179	172	165	16,0	16,5	17,0	17,5	18,0	15	500	0,75	
X2CrNiMo17–12–2	1.4404	8,0	200	194	186	179	172	165	16,0	16,5	17,0	17,5	18,0	15	500	0,75	
X5CrNiMo17–12–2	1.4401	8,0	200	194	186	179	172	165	16,0	16,5	17,0	17,5	18,0	15	500	0,75	
X6CrNiMoTi17–12–2	1.4571	8,0	200	194	186	179	172	165	16,5	17,5	18,0	18,5	19,0	15	500	0,75	
X6CrNiMoNb17–12–2	1.4580	8,0	200	194	186	179	172	165	16,5	17,5	18,0	18,5	19,0	15	500	0,75	
X2CrNiMo17–12–3	1.4432	8,0	200	194	186	179	172	165	16,0	16,5	17,0	17,5	18,0	15	500	0,75	
X2CrNiMo18–12–3	1.4449	8,0	200	194	186	179	172	165	16,0	16,5	17,0	17,5	18,0	15	500	0,75	

Steel designation		Density	Modulus of elasticity at						Mean coefficient of thermal expansion between 20 °C and					Thermal conductivity at 20 °C $\frac{W}{m \cdot K}$	Specific thermal capacity at 20 °C $\frac{J}{kg \cdot K}$	Electrical resistivity at 20 °C $\frac{\Omega \cdot mm^2}{m}$	Magnetizable
			20 °C	100 °C	200 °C	300 °C	400 °C	500 °C	100 °C	200 °C	300 °C	400 °C	500 °C				
Name	Number	kg/dm^3	GPa						$10^{-6} \times K^{-1}$								
X3CrNiMo17–13–3	1.4436	8,0	200	194	186	179	172	165	16,0	16,5	17,0	17,5	18,0	15	500	0,75	no [a]
X2CrNiMoN17–13–3	1.4429	8,0	200	194	186	179	172	165	16,0	16,5	17,0	17,5	18,0	15	500	0,75	
X2CrNiMoN18–12–4	1.4434	8,0	200	194	186	179	172	165	16,0	16,5	17,0	17,5	18,0	15	500	0,75	
X2CrNiMo18–14–3	1.4435	8,0	200	194	186	179	172	165	16,0	16,5	17,0	17,5	18,0	15	500	0,75	
X2CrNiMoN17–13–5	1.4439	8,0	200	194	186	179	172	165	16,0	16,5	17,0	17,5	18,0	14	500	0,85	
X2CrNiMo18–15–4	1.4438	8,0	200	194	186	179	172	165	16,0	16,5	17,0	17,5	18,0	14	500	0,85	
X1CrNiMoCuN20–18–7	1.4547	8,0	195	190	182	174	166	158	16,5	17	17,5	18	18	14	500	0,85	
X1CrNiMoN25–22–2	1.4466	8,0	195	190	182	174	166	158	15,7	-	17,0	-	-	14	500	0,80	
X1CrNiMoCuNW24–22–6	1.4659	8,2	190	185	179	174	166	158	15,0	15,5	16,0	16,3	16,5	12	450	1,00	
X1CrNiMoCuN24–22–8	1.4652	8,0	190	184	177	170	164	158	15,0	15,4	15,8	16,2	16,4	8,6	500	0,78	
X2CrNiMnMoN25–18–6-5	1.4565	8,0	190	186	177	170	165	158	14,5	15,5	16,3	16,8	17,2	12	450	0,92	
X1NiCrMoCu25–20–5	1.4539	8,0	195	190	182	174	166	158	15,8	16,1	16,5	16,9	17,3	12	450	1,00	
X1NiCrMoCuN25–20–7	1.4529	8,1	195	190	182	174	166	158	15,8	16,1	16,5	16,9	17,3	12	450	1,00	

Steel designation		Density	Modulus of elasticity at						Mean coefficient of thermal expansion between 20 °C and					Thermal conductivity at 20 °C $\frac{W}{m \cdot K}$	Specific thermal capacity at 20 °C $\frac{J}{kg \cdot K}$	Electrical resistivity at 20 °C $\frac{\Omega \cdot mm^2}{m}$	Magnetizable
			20 °C	100 °C	200 °C	300 °C	400 °C	500 °C	100 °C	200 °C	300 °C	400 °C	500 °C				
Name	Number	kg/dm^3	GPa						$10^{-6} \times K^{-1}$								
X2NiCrAlTi32–20	1.4558	8,0	200	195	188	182	175	168	16	16	16	16,5	16,5	12	475	0,99	no [a]
X1NiCrMoCu31–27–4	1.4563	8,0	195	190	182	174	166	158	15,8	16,1	16,5	16,9	17,3	12	450	1,00	
Uncommon austenitic corrosion resisting steels																	
X5CrNi17–7	1.4319	7,9	200	194	186	179	172	165	16,0	16,5	17,0	17,5	18,0	15	500	0.73	no [a]
X8CrMnNiN18–9-5	1.4374	7,8	199	192	185	170	165	158	16,7	17,3	18,2	18,4	18,6	12	500	0,73	
X1CrNiMoCuN25–25–5	1.4537	8,1	195	190	182	174	166	158	15,0	-	16,5	-	-	14	500	0,85	

a Small amounts of ferrite and/or martensite caused by cold deformation will increase the magnetizability.

Table E.2 — Guidance data on some physical properties of austenitic-ferritic corrosion resisting steels

Steel designation		Density	Modulus of elasticity at				Mean coefficient of thermal expansion between 20 °C and			Thermal conductivity at 20 °C $\frac{W}{m \cdot K}$	Specific thermal capacity at 20 °C $\frac{J}{kg \cdot K}$	Electrical resistivity at 20 °C $\frac{\Omega \cdot mm^2}{m}$	Magnetizable
			20 °C	100 °C	200 °C	300 °C	100 °C	200 °C	300 °C				
Name	Number	kg/dm^3	GPa				10^{-6} x K^{-1}						
X2CrNiN22-2	1.4062	7,8	200	194	186	180	13,0	13,5	14,0	15	480	0,68	yes
X2CrCuNiN23–2-2	1.4669	7,8	200	194	186	180	13,0	13,5	14,0	15	500	0,8	
X2CrNiMoSi18–5-3	1.4424	7,8	200	194	186	180	13,0	13,5	14,0	13	475	0,8	
X2CrNiN23–4	1.4362	7,8	200	194	186	180	13,0	13,5	14,0	15	500	0,8	
X2CrMnNiN21–5-1	1.4162	7,7	205	200	190	180	13,0	14,0	14,5	15	500	0,75	
X2CrMnNiMoN21–5-3	1.4482	7,8	200	194	186	180	13,0	13,5	15,0	13	500	0,8	
X2CrNiMoN22–5-3	1.4462	7,8	200	194	186	180	13,0	13,5	14,0	15	500	0,8	
X2CrNiMnMoCuN24–4-3–2	1.4662	7,7	205	200	190	180	13,0	13,5	14,0	15	500	0,8	
X2CrNiMoCuN25–6-3	1.4507	7,8	200	194	186	180	13,0	13,5	14,0	15	500	0,8	
X3CrNiMoN27–5-2	1.4460	7,8	200	194	186	180	13,0	13,5	14,0	15	500	0,8	
X2CrNiMoN25–7-4	1.4410	7,8	200	194	186	180	13,0	13,5	14,0	15	500	0,8	
X2CrNiMoCuWN25–7-4	1.4501	7,8	200	194	186	180	13,0	13,5	14,0	15	500	0,8	
X2CrNiMoN29–7-2	1.4477	7,7	200	194	186	180	11,5	12,0	12,5	13	470	0,8	
X2CrNiMoCoN28–8-5–1	1.4658	7,8	197	189	178	168	12,5	-	13,5	12	470	0,8	
Uncommon austenitic-ferritic corrosion resisting steels													
X2CrNiCuN23–4	1.4655	7,8	200	194	186	180	13,0	13,5	14,0	15	500	0,8	yes

Table E.3 — Guidance data on some physical properties of ferritic corrosion resisting steels

Steel designation		Density	Modulus of elasticity at						Mean coefficient of thermal expansion between 20 °C and					Thermal conductivity at 20 °C $\frac{W}{m \cdot K}$	Specific thermal capacity at 20 °C $\frac{J}{kg \cdot K}$	Electrical resistivity at 20 °C $\frac{\Omega \cdot mm^2}{m}$	Magnetizable
			20 °C	100 °C	200 °C	300 °C	400 °C	500 °C	100 °C	200 °C	300 °C	400 °C	500 °C				
Name	Number	kg/dm^3	GPa						$10^{-6} \times K^{-1}$								
X2CrNi12	1.4003								10,4	10,8	11,2	11,6	11,9	25	430	0,60	
X2CrTi12	1.4512								10,5	11,0	11,5	12,0	12,0	25	460	0,60	
X6CrNiTi12	1.4516								10,5	-	11,5	-	-	30	460	0,60	
X6Cr13	1.4000								10,5	11,0	11,5	12,0	12,0	30	460	0,60	
X6CrAl13	1.4002								10,5	11,0	11,5	12,0	12,0	30	460	0,60	yes
X2CrMnNiTi12	1.4600								10,5	-	-	-	-	25	460	0,60	
X2CrSiTi15	1.4630								10,3	10,5	11,1	11,5	11,7	22	460	0,70	
X6Cr17	1.4016								10,0	10,0	10,5	10,5	11,0	25	460	0,60	
X2CrTi17	1.4520	7,7	220	215	210	205	195	-	10,4	10,8	11,2	11,6	11,9	20	430	0,70	
X3CrTi17	1.4510								10,0	10,0	10,5	10,5	11,0	25	460	0,60	
X3CrNb17	1.4511								10,0	10,0	10,5	10,5	11,0	25	460	0,60	
X6CrNi17-1	1.4017								10,2	-	10,8	-	-	30	460	0,70	
X2CrTiNb18	1.4509								10,0	10,0	10,5	10,5	-	25	460	0,60	
X2CrAlSiNb18	1.4634								10,2	10,5	11,0	11,5	11,7	20	500	0,90	
X2CrNiTi20	1.4607								10,3	10,6	10,9	11,1	-	18	390	0,65	
X2CrTi21	1.4611								10,5	10,8	11,1	11,3	11,6	22,5	445	0,62	
X2CrNbCu21	1.4621								10,0	10,2	10,5	10,5	11,0	21	460	0,60	
X2CrTi24	1.4613								10,5	10,8	11,1	11,3	11,6	22,5	445	0,62	

Steel designation		Density	Modulus of elasticity at						Mean coefficient of thermal expansion between 20 °C and					Thermal conductivity at 20 °C $\frac{W}{m \cdot K}$	Specific thermal capacity at 20 °C $\frac{J}{kg \cdot K}$	Electrical resistivity at 20 °C $\frac{\Omega \cdot mm^2}{m}$	Magnetizable
			20 °C	100 °C	200 °C	300 °C	400 °C	500 °C	100 °C	200 °C	300 °C	400 °C	500 °C				
Name	Number	kg/dm^3	GPa						$10^{-6} \times K^{-1}$								
X5CrNiMoTi15-2	1.4589	7,7	220	215	210	205	195	-	10,5	11,0	11,5	12,0	12,0	25	460	0,60	yes
X6CrMoS17	1.4105								10,0	10,5	10,5	10,5	11,0	25	460	0,70	
X6CrMo17-1	1.4113								10,0	10,5	10,5	10,5	11,0	25	460	0,70	
X2CrMoTi17-1	1.4513								10,0	10,5	10,5	10,5	11,0	25	460	0,70	
X6CrMoNb17-1	1.4526								11,7	-	12,1	-	-	30	440	0,70	
X2CrMoTi18-2	1.4521								10,4	10,8	11,2	11,6	11,9	23	430	0,80	
X2CrMoTiS18-2	1.4523								10,4	10,8	11,2	11,6	11,9	23	430	0,80	
X2CrMoTi29-4	1.4592								11,5	-	12	-	-	17	440	0,67	
Uncommon ferritic corrosion resisting steels																	
X1CrNb15	1.4595	7,7	220	215	210	205	195	-	10,4	10,8	11,2	11,6	11,9	30	460	0,60	yes
X2CrNbZr17	1.4590								11	-	11,5	-	-	26	460	0,60	

Table E.4 — Guidance data on some physical properties of martensitic and precipitation hardening corrosion resisting steels

Steel designation		Density	Modulus of elasticity at					Mean coefficient of thermal expansion between 20 °C and				Thermal conductivity at 20 °C $\frac{W}{m \cdot K}$	Specific thermal capacity at 20 °C $\frac{J}{kg \cdot K}$	Electrical resistivity at 20 °C $\frac{\Omega \cdot mm^2}{m}$	Magnetizable
			20 °C	100 °C	200 °C	300 °C	400 °C	100 °C	200 °C	300 °C	400 °C				
Name	Number	kg/dm^3	GPa					10^{-6} x K^{-1}							
Martensitic corrosion resisting steels															
X12Cr13	1.4006	7,7	215	212	205	200	190	10,5	11,0	11,5	12,0	30	460	0,60	
X12CrS13	1.4005	7,7	215	212	205	200	190	10,5	11,0	11,5	12,0	30	460	0,60	
X15Cr13	1.4024	7,7	216	213	207	200	192	10,5	11,0	11,5	12,0	30	460	0,60	
X20Cr13	1.4021	7,7	215	212	205	200	190	10,5	11,0	11,5	12,0	30	460	0,60	
X30Cr13	1.4028	7,7	215	212	205	200	190	10,5	11,0	11,5	12,0	30	460	0,65	
X29CrS13	1.4029	7,7	215	212	205	200	190	10,5	-	11,5	-	30	460	0,55	
X39Cr13	1.4031	7,7	215	212	205	200	190	10,5	11,0	11,5	12,0	30	460	0,55	
X46Cr13	1.4034	7,7	215	212	205	200	190	10,5	11,0	11,5	12,0	30	460	0,55	
X46CrS13	1.4035	7,7	215	212	205	200	190	10,5	11,0	11,5	12,0	30	460	0,55	yes
X17CrNi16–2	1.4057	7,7	215	212	205	200	190	10,0	10,5	10,5	10,5	25	460	0,70	
X38CrMo14	1.4419	7,7	215	212	205	200	190	10,5	11,0	11,5	12,0	30	460	0,62	
X55CrMo14	1.4110	7,7	215	212	205	200	190	10,5	11,0	11,5	12,0	30	460	0,62	
X3CrNiMo13–4	1.4313	7,7	200	195	185	175	170	10,5	10,9	11,3	11,6	25	430	0,60	
X1CrNiMoCu12–5-2	1.4422	7,7	200	195	185	175	170	10,4	10,8	11,2	11,6	16	450	0,75	
X50CrMoV15	1.4116	7,7	215	212	205	200	190	10,5	11,0	11,0	11,5	30	460	0,65	
X70CrMo15	1.4109	7,7	215	212	205	200	190	10,5	11,0	11,0	11,5	30	460	0,65	
X2CrNiMoV13–5-2	1.4415	7,8	200	195	185	175	170	10,9	-	11,1	-	16	500	0,71	

Steel designation		Density	Modulus of elasticity at					Mean coefficient of thermal expansion between 20 °C and				Thermal conductivity at 20 °C $\frac{W}{m \cdot K}$	Specific thermal capacity at 20 °C $\frac{J}{kg \cdot K}$	Electrical resistivity at 20 °C $\frac{\Omega \cdot mm^2}{m}$	Magnetizable
			20 °C	100 °C	200 °C	300 °C	400 °C	100 °C	200 °C	300 °C	400 °C				
Name	Number	kg/dm^3	GPa					10^{-6} x K^{-1}							
X1CrNiMoCu12–7-3	1.4423	7,7	200	195	185	175	170	10,4	10,8	11,2	11,6	16	450	0,75	yes
X53CrSiMoVN16–2	1.4150	7,7	220	215	207	200	192	10,0	10,7	11,1	11,4	18	460	-	
X4CrNiMo16–5-1	1.4418	7,7	200	195	185	175	170	10,3	10,8	11,2	11,6	15	430	0,80	
X14CrMoS17	1.4104	7,7	215	212	205	200	190	10,0	10,5	10,5	10,5	25	460	0,70	
X39CrMo17–1	1.4122	7,7	215	212	205	200	190	10,4	10,8	11,2	11,6	15	430	0,80	
X105CrMo17	1.4125	7,7	215	212	205	200	190	10,4	10,8	11,2	11,6	15	430	0,80	
X40CrMoVN16–2	1.4123	7,7	195	188	182	177	-	10,4	10,6	10,8	11,1	24	430	0,80	
X90CrMoV18	1.4112	7,7	215	212	205	200	190	10,4	10,8	11,2	11,6	15	430	0,80	
Precipitation hardening corrosion resisting steels															
X5CrNiCuNb16–4	1.4542	7,8	200	195	185	175	170	10,9	-	11,1	-	16	500	0,71	yes
X7CrNiAl17–7	1.4568	7,8	200	195	185	175	170	13,0	13,5	14,0	-	16	500	0,80	
X5CrNiMoCuNb14–5	1.4594	7,8	200	195	185	175	170	10,9	-	11,1	-	16	500	0,71	
X1CrNiMoAlTi12–9-2	1.4530	7,7	195	187	178	171	-	10,0	10,3	10,7	11,2	16	500	0,71	
X1CrNiMoAlTi12–10–2	1.4596	7,7	195	187	178	171	-	10,0	10,3	10,7	11,2	16	500	0,71	
X1CrNiMoAlTi12–11–2	1.4612	7,8	-	-	-	-	-	10,3	11,1	11,4	11,7	16	485	-	
X5NiCrTiMoVB25–15–2	1.4606	7,9	211	206	200	192	183	16,5	16,8	18,0	17,5	14	460	0,91	no

Table E.5 — Guidance data on some physical properties of austenitic and austenitic-ferritic heat-resisting steels

Steel designation		Density	Mean coefficient of thermal expansion between 20 °C and					Thermal conductivity at 20 °C $\frac{W}{m \cdot K}$	Specific thermal capacity at 20 °C $\frac{J}{kg \cdot K}$	Electrical resistivity at 20 °C $\frac{\Omega \cdot mm^2}{m}$	Magnetizable
			200 °C	400 °C	600 °C	800 °C	1 000 °C				
Name	Number	kg/dm^3	10^{-6} x K^{-1}								
austenitic heat-resisting steels											
X8CrNiTi18–10	1.4878	7,9	17,0	18,0	18,5	19,0	-	15	500	0,73	
X6CrNiSiNCe19–10	1.4818	7,8	16,5	18,0	18,5	19,0	20,0	15	500	0,85	
X15CrNiSi20–12	1.4828	7,9	16,5	17,5	18,0	18,5	19,5	15	500	0,85	
X9CrNiSiNCe21–11–2	1.4835	7,8	17,0	18,0	18,5	19,0	19,5	15	500	0,85	
X12CrNi23–13	1.4833	7,9	16,0	17,5	18,0	18,5	19,5	15	500	0,78	
X25CrMnNiN25–9-7	1.4872	7,8	16,5	18,0	18,5	19,0	19,5	14,5	500	0,75	no [a]
X8CrNi25–21	1.4845	7,9	15,5	17,0	17,5	18,5	19,0	15	500	0,85	
X15CrNiSi25–21	1.4841	7,9	15,5	17,0	17,5	18,0	19,0	15	500	0,90	
X10NiCrAlTi32–21	1.4876	8,0	15,0	16,0	17,0	17,5	18,5	12	550	1,0	
X6NiCrSiNCe35–25	1.4854	7,9	15,5	16,5	17,0	17,5	18,0	11	450	1,0	
X10NiCrSi35–19	1.4886	8,0	15,5	16,0	17,0	17,7	18,0	12	460	1,0	
uncommon austenitic and austenitic-ferritic heat-resisting steel											
X15CrNiSi25–4	1.4821	7,7	13,0	13,5	14,0	14,5	15,0	17	500	0,90	yes
X12NiCrSi35–16	1.4864	8,0	15,0	16,0	17,0	17,5	18,5	12,5	550	1,0	no
X10NiCrSiNb35–22	1.4887	8,0	15,5	16,0	17,0	17,7	18,0	12	460	1,0	
X6NiCrNbCe32–27	1.4877	8,0	15,5	16,5	16,5	17,7	18,4	12	450	0,96	

a Slightly magnetic when cold worked.

Table E.6 — Guidance data on some physical properties of ferritic heat-resisting steels

Steel designation		Density	Mean coefficient of thermal expansion between 20 °C and					Thermal conductivity at 20 °C $\frac{W}{m \cdot K}$	Specific thermal capacity at 20 °C $\frac{J}{kg \cdot K}$	Electrical resistivity at 20 °C $\frac{\Omega \cdot mm^2}{m}$	Magnetizable
			200 °C	400 °C	600 °C	800 °C	1 000 °C				
Name	Number	kg/dm^3	$10^{-6} \times K^{-1}$								
X10CrAlSi7	1.4713	7,7	11,5	12,0	12,5	13,0	-	23	450	0,70	yes
X10CrAlSi13	1.4724		10,5	11,5	12,0	12,5	-	21	500	0,75	
X10CrAlSi18	1.4742		10,5	11,5	12,0	12,5	13,5	19	500	0,93	
X10CrAlSi25	1.4762		10,5	11,5	12,0	12,0	13,5	17	500	1,1	
X18CrN28	1.4749		10,0	11,0	11,5	12,0	13,0	17	500	0,70	
Uncommon ferritic heat resisting steels											
X3CrAlTi18–2	1.4736	7,7	10,5	10,8	12,0	12,5	13,0	21	500	0,60	yes

Table E.7 — Guidance data on some physical properties of austenitic creep-resisting steels

Steel Designation		Density	Modulus of elasticity at											Mean coefficient of thermal expansion between 20 °C and										Thermal conductivity at 20 °C	Specific thermal capacity at 20 °C	Electrical resistivity at 20 °C
			20 °C	100 °C	200 °C	300 °C	400 °C	500 °C	600 °C	700 °C	800 °C	900 °C	1000 °C	100 °C	200 °C	300 °C	400 °C	500 °C	600° C	700 °C	800 °C	900 °C	1000 °C	$\frac{W}{m \cdot K}$	$\frac{J}{kg \cdot K}$	$\frac{\Omega \cdot mm^2}{m}$
Name	Number	kg/dm^3	GPa											10^{-6} x K^{-1}												
X6CrNi18–10	1.4948	7,9	200	190	185	175	170	160	155	145	140	135	125	16,3	16,9	17,3	17,8	18,2	18,5	18,7	-	-	-	17	450	0,71
X7CrNiNb18–10	1.4912	7,9	200	194	186	179	172	165	155	-	-	-	-	16,0	16,5	17,0	17,5	18,0	18,5	-	-	-	-	15	500	0,73
X7CrNiTi18–10	1.4940	7,9	200	194	186	179	172	165	155	-	-	-	-	16,0	16,5	17,0	17,5	18,0	18,5	-	-	-	-	15	500	0,73
X6CrNiTiB18–10	1.4941	7,9	200	190	185	175	170	160	155	145	140	135	125	16,3	16,9	17,3	17,8	18,2	18,5	18,7	-	-	-	17	450	0,71
X8CrNiNb16–13	1.4961	7,9	200	190	185	175	170	160	155	145	140	135	125	16,3	16,9	17,3	17,8	18,2	18,5	18,7	-	-	-	16	450	0,78
X12CrNiWTiB16–13	1.4962	8,0	196	191	182	175	167	159	151	-	-	-	-	15,6	16,8	17,5	18,0	18,3	18,6	-	-	-	-	14	500	0,74
X6CrNiWNbN16–16	1.4945	8,0	196	192	186	181	174	165	157	-	-	-	-	10,5	10,9	11,3	11,6	12,0	12,2	-	-	-	-	14	440	0,60
X6CrNi23–13	1.4950	7,9	200	190	185	175	170	160	155	145	140	135	125	-	16,0	16,8	17,5	17,8	18,0	18,3	18,5	19,0	19,5	15	500	0,78
X6CrNi25–20	1.4951	7,9	200	190	185	175	170	160	155	145	140	135	125	-	15,5	16,3	17,0	17,3	17,5	18,0	18,5	18,8	19,0	15	500	0,85
X5NiCrAlTi31–20	1.4958	8,0	200	190	185	175	170	160	155	145	140	135	125	15,4	16,0	16,5	16,8	17,2	17,5	17,9	18,3	18,6	19,0	12	460	0,99
X8NiCrAlTi32–21	1.4959	8,0	200	190	185	175	170	160	155	145	140	135	125	15,4	16,0	16,5	16,8	17,2	17,5	17,9	18,3	18,6	19,0	12	460	0,99
X10CrNiMoMnNbVB15–10–1	1.4982	8,0	207	201	193	184	175	165	158	-	-	-	-	15,7	16,8	17,7	18,3	18,6	19,0	-	-	-	-	12,5	480	0,74
X8CrNiMoVNb16–13	1.4988	8,0	198	192	183	175	167	159	150	-	-	-	-	16,3	16,9	17,3	17,8	18,2	18,5	-	-	-	-	15	450	0,79
X8CrNiMoNb16–16	1.4981	8,0	198	192	183	175	167	159	150	-	-	-	-	16,3	16,9	17,3	17,8	18,2	18,5	-	-	-	-	16	450	0,77
X7CrNiMoBNb16–16	1.4986	7,9	196	192	186	181	174	165	157	-	-	-	-	16,6	17,7	17,9	17,9	17,9	18,1	-	-	-	-	15	460	-
X6CrNiMoB17–12–2	1.4919	8,0	196	192	186	181	174	165	157	-	-	-	-	16,3	16,9	17,3	-	18,2	18,5	-	-	-	-	16	450	0,77
X6CrNiMoTiB17–13	1.4983	8,0	200	190	185	175	170	160	155	-	-	-	-	-	17,0	-	18,0	-	-	-	-	-	-	15	500	0,74

Steel Designation		Density	Modulus of elasticity at											Mean coefficient of thermal expansion between 20 °C and										Thermal conductivity at 20 °C $\frac{W}{m \cdot K}$	Specific thermal capacity at 20 °C $\frac{J}{kg \cdot K}$	Electrical resistivity at 20 °C $\frac{\Omega \cdot mm^2}{m}$
			20 °C	100 °C	200 °C	300 °C	400 °C	500 °C	600 °C	700 °C	800 °C	900 °C	1000 °C	100 °C	200 °C	300 °C	400 °C	500 °C	600° C	700 °C	800 °C	900 °C	1000 °C			
Name	Number	kg/dm^3	GPa											10^{-6} x K^{-1}												
X6CrNiMo17–13–2	1.4918	8,0	200	194	186	179	172	165	155	-	-	-	-	16,0	16,5	17,0	17,5	18,0	18,5	-	-	-	-	15	500	0,75
X3CrNiMoBN17–13–3	1.4910	8,0	200	190	185	175	170	160	155	145	140	135	125	16,3	16,9	17,3	17,8	18,2	18,5	18,7	-	-	-	16	450	0,77
X12CrCoNi21–20	1.4971	8,3	200	195	190	185	178	170	160	-	-	-	-	14,2	14,6	15,0	15,5	15,9	16,4	-	-	-	-	11,6	-	-
X6NiCrTiMoVB25–15–2	1.4980	8,0	196	192	186	180	172	167	157	-	-	-	-	17,0	17,5	18,7	18,0	18,2	18,5	-	-	-	-	-	-	-

Table E.8 — Guidance data on some physical properties of martensitic creep-resisting steels

Steel Designation		Density	Modulus of elasticity at							Mean coefficient of thermal expansion between 20 °C and						Thermal conductivity at 20 °C $\frac{W}{m \cdot K}$	Specific thermal capacity at 20 °C $\frac{J}{kg \cdot K}$	Electrical resistivity at 20 °C $\frac{\Omega \cdot mm^2}{m}$
			20 °C	100 °C	200 °C	300 °C	400 °C	500 °C	600 °C	100 °C	200 °C	300 °C	400 °C	500 °C	600°C			
Name	Number	kg/dm^3	GPa							$10^{-6} \times K^{-1}$								
X10CrMoVNb9–1	1.4903	7,7	218	213	206	198	190	180	167	10,9	11,3	11,7	12,0	12,3	12,6	26	-	0,50
X11CrMoWVNb9–1-1	1.4905	7,8	218	213	206	198	190	180	167	10,7	11,1	11,5	11,9	12,3	12,6	26	450	0,47
X19CrMoNbVN11–1	1.4913	7,7	216	209	200	190	179	167	127	10,5	11	11,5	12	12,3	12,5	24	460	-
X20CrMoV11–1	1.4922	7,7	216	209	200	190	179	167	127	10,5	10,9	11,3	11,6	12,0	12,2	24	460	0,60
X22CrMoV12–1	1.4923	7,7	216	209	200	190	179	167	127	10,5	11	11,5	12	12,3	12,5	24	460	-
X20CrMoWV12–1	1.4935	7,7	216	209	200	190	179	167	127	10,5	11	11,5	12	12,3	12,5	24	460	-
X12CrNiMoV12–3	1.4938	7,8	216	209	200	190	179	167	127	10,8	11	11,3	11,6	11,9	12,1	30	460	0,60
X8CrCoNiMo10–6	1.4911	7,8	215	-	211	206	196	186	-	10,6	11,2	11,4	11,6	11,8	12,0	20	460	0,65

Annex F
(informative)

Chemical composition of nickel and cobalt alloys listed in EN 10095, EN 10269 and EN 10302

The chemical composition of nickel and cobalt alloys listed in EN 10095, EN 10269 and EN 10302 are given in Tables F.1 and F.2.

Table F.1 — Chemical composition (cast analysis) of nickel alloys listed in EN 10095

Alloy designation		% by mass [a]															
Name	Number	C	Si	Mn	P	S	Cr	Mo	Ni	Fe	Co	Al	Cu	Ti	Nb+Ta	B	Ce
NiCr15Fe	2.4816	0,05 to 0,10	0,50	1,00	0,020	0,015	14,0 to 17,0	-	≥ 72,0	6,0 to 10,0	[b]	0,30	0,50	0,30	-	-	-
NiCr20Ti	2.4951	0,08 to 0,15	1,00	1,00	0,020	0,015	18,0 to 21,0	-	Remainder	5,0	5,0	0,30	0,50	0,20 to 0,60	-	-	-
NiCr22Mo9Nb	2.4856	0,03 to 0,10	0,50	0,50	0,020	0,015	20,0 to 23,0	8,0 to 10,0	≥ 58,0	5,0	1,00	0,40	0,50	0,40	3,15 to 4,15	-	-
NiCr23Fe	2.4851	0,03 to 0,10	0,50	1,00	0,020	0,015	21,0 to 25,0	-	58,0 to 63,0	18,0	[b]	1,00 to 1,70	0,50	0,50	-	0,006	-
NiCr28FeSiCe	2.4889	0,05 to 0,12	2,50 to 3,0	1,00	0,020	0,010	26,0 to 29,0	-	≥ 45,0	21,0 to 25,0	[b]	-	0,30	-	-	-	0,03 to 0,09

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

a Maximum values unless indicated otherwise.

b A maximum of 1,5 % Co is allowed and counted as nickel. Reporting of cobalt is not required.

Table F.2 — Chemical composition (cast analysis) of nickel and cobalt alloys listed in EN 10269 and/or EN 10302

Alloy designation		% by mass[a]														
Name	Number	C	Si	Mn	P	S	Cr	Mo	Ni	Fe	Co	Al	Cu	Nb + Ta	Ti	Others
nickel alloys																
NiCr26MoW	2.4608	0,03 to 0,08	0,70 to 1,50	2,00	0,030	0,015	24,0 to 26,0	2,5 to 4,0	44,0 to 47,0	Remainder	2,50 to 4,0	-	-	-	-	W: 2,50 to 4,0
NiCr20Co18Ti	2.4632	0,13	1,00	1,00	0,020	0,015	18,0 to 21,0	-	Remainder	1,50	15,0 to 21,0	1,00 to 2,00	0,20	-	2,00 to 3,0	B: 0,020 Zr: 0,15
NiCr25FeAlY	2.4633	0,15 to 0,25	0,50	0,50	0,020	0,010	24,0 to 26,0	-	Remainder	8,0 to 11,0	-	1,80 to 2,40	0,10	-	0,10 to 0,20	Y: 0,05 to 0,12 Zr: 0,01 to 0,10
NiCr29Fe	2.4642	0,05	0,50	0,50	0,020	0,015	27,0 to 31,0	-	Remainder	7,0 to 11,0	-	0,50	0,50	-	-	-
NiCo20Cr20MoTi	2.4650	0,04 to 0,08	0,40	0,60	0,020	0,007	19,0 to 21,0	5,6 to 6,1	Remainder	0,70	19,0 to 21,0	0,30 to 0,60	0,20	-	1,90 to 2,40	B: 0,005 Ti+Al: 2,40 to 2,80
NiCr20Co13Mo4Ti3Al	2.4654	0,02 to 0,10	0,15	1,00	0,015	0,015	18,0 to 21,0	3,5 to 5,0	Remainder	2,00	12,0 to 15,0	1,20 to 1,60	0,10	-	2,80 to 3,3	B: 0,003 to 0,010 Zr: 0,02 to 0,08
NiCr23Co12Mo	2.4663	0,05 to 0,10	0,20	0,20	0,010	0,010	20,0 to 23,0	8,5 to 10,0	Remainder	2,00	11,0 to 14,0	0,70 to 1,40	0,50	-	0,20 to 0,60	B: 0,006
NiCr22Fe18Mo	2.4665	0,05 to 0,15	1,00	1,00	0,020	0,015	20,5 to 23,0	8,0 to 10,0	Remainder	17,0 to 20,0	0,50 to 2,50	0,50	0,50	-	-	B: 0,010 W: 0,20 to 1,00
NiCr19Fe19Nb5Mo3	2.4668	0,02 to 0,08	0,35	0,35	0,015	0,015	17,0 to 21,0	2,80 to 3,3	50,0 to 55,0	Remainder	1,00	0,30 to 0,70	0,30	4,7 to 5,5	0,60 to 1,20	B: 0,002 to 0,006
NiCr15Fe7TiAl	2.4669[b]	0,08	0,50	1,00	0,020	0,015	14,0 to 17,0	-	≥ 70,0	5,0 to 9,0	1,00	0,40 to 1,00	0,50	0,70 to 1,20	2,25 to 2,75	-
NiCr25Co20TiMo	2.4878	0,03 to 0,07	0,50	0,50	0,010	0,007	23,0 to 25,0	1,00 to 2,00	Remainder	1,00	19,0 to 21,0	1,20 to 1,60	0,20	0,70 to 1,20	2,80 to 3,2	B: 0,010 to 0,015 Ta: 0,05 Zr: 0,03 to 0,07
NiCr20TiAl	2.4952[b]	0,04 to 0,10	1,00	1,00	0,020	0,015	18,0 to 21,0	-	> 65,0	1,50	1,00	1,00 to 1,80	0,20	-	1,80 to 2,70	B: 0,008

Alloy designation		% by mass[a]														
Name	Number	C	Si	Mn	P	S	Cr	Mo	Ni	Fe	Co	Al	Cu	Nb + Ta	Ti	Others
cobalt alloy																
CoCr20W15Ni	2.4964	0,05 to 0,15	0,40	2,00	0,020	0,015	19,0 to 21,0	-	9,0 to 11,0	3,00	Remainder	-	-	-	-	W: 14,0 to 16,0

Elements not quoted in this table may not be intentionally added to the alloy without the agreement of the purchaser except for finishing the cast. All appropriate precautions are to 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 alloy.

a Maximum values unless indicated otherwise.

b EN 10269 includes only grades NiCr15Fe7TiAl (2.4669) and NiCr20TiAl (2.4952) from this table.

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[4] EN 10088-2, *Stainless steels — Part 2: Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for general purposes*

[5] EN 10088-3, *Stainless steels — Part 3: Technical delivery conditions for semi-finished products, bars, rods, wire, sections and bright products of corrosion resisting steels for general purposes*

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[12] EN 10213-3, *Technical delivery conditions for steel castings for pressure purposes — Part 3: Steel grades for use at low temperatures*

[13] EN 10213-4, *Technical delivery conditions for steel castings for pressure purposes — Part 4: Austenitic and austenitic-ferritic steel grades*

[14] EN 10216-5, *Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 5: Stainless steel tubes*

[15] EN 10217-7, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 7: Stainless steel tubes*

[16] EN 10222-5, *Steel forgings for pressure purposes — Part 5: Martensitic, austenitic and austenitic-ferritic stainless steels*

[17] EN 10250-4, *Open die steel forgings for general engineering purposes — Part 4: Stainless steels*

[18] EN 10263-5, *Steel rod, bars and steel wire for cold heading and cold extrusion — Part 5: Technical delivery conditions for stainless steels*

[19] EN 10264-4, *Steel wire and wire products — Steel wire for ropes — Part 4: Stainless steel wire*

[20] EN 10269, *Steels and nickel alloys for fasteners with specified elevated and/or low temperature properties*

[21] EN 10270-3, *Steel wire for mechanical springs — Part 3: Stainless spring steel wire*

[22] EN 10272, *Stainless steel bars for pressure purposes*

[23] EN 10283, *Corrosion resistant steel castings*

[24] EN 10295, *Heat resistant steel castings*

[25] EN 10296-2, *Welded circular steel tubes for mechanical and general engineering purposes — Technical delivery conditions - Part 2: Stainless steel*

[26] EN 10297-2, *Seamless circular steel tubes for mechanical and general engineering purposes — Technical delivery conditions - Part 2: Stainless steel*

[27] EN 10302, *Creep resisting steels, nickel and cobalt alloys*

[28] EN 10312, *Welded stainless steel tubes for the conveyance of aqueous liquids including water for human consumption — Technical delivery conditions*

[29] EN 12072, *Welding consumables — Wire electrodes, wires and rods for arc welding of stainless and heat-resisting steels — Classification*

[30] EN 12073, *Welding consumables — Tubular cored electrodes for metal arc welding with or without a gas shield of stainless and heat-resisting steels — Classification*

[31] EN ISO 4957, *Tool steels (ISO 4957:1999)*

[32] EN 1993-1-4, *Eurocode 3 — Design of steel structures — Part 1-4: General rules — Supplementary rules for stainless steels*

[33] CEN ISO/TR 15608, *Welding — Guidelines for a metallic material grouping system (ISO/TR 15608)*

[34] ISO 15510, *Stainless steels — Chemical composition*

[35] ASTM A959, *Standard Guide for Specifying Harmonized Standard Grade Compositions for Wrought Stainless Steels*