

Stainless steels

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

The European Standard EN 10088-2:2005 has the status of a
British Standard

ICS 77.140.20; 77.140.50



British Standards

National foreword

This British Standard is the official English language version of EN 10088-2:2005. It supersedes BS EN 10088-2:1995 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee ISE/30, Stainless steels, which has the responsibility to:

aid enquirers to understand the text;

present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

monitor related international and European developments and promulgate them in the UK

BS EN 10088 is published in three parts. Two further parts of this series (prEN 10088-4 and prEN 10088-5) are currently in preparation and have been designed to meet the needs of the Construction Products Directive (CPD).

A list of organizations represented on this committee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled "International Standards Correspondence Index", or by using the "Search" facility of the *BSI Electronic Catalogue* or of British Standards Online.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 43 and a back cover.

The BSI copyright notice displayed in this document indicates when the document was last issued.

Amendments issued since publication

Amd. No	Date	Comments

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 June 2005

© BSI 30 June 2005

ISBN 0 580 46336 2

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 10088-2

June 2005

ICS 77.140.20; 77.140.50

Supersedes EN 10088-2:1995

English version

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

Aciers inoxydables - Partie 2: Conditions techniques de
livraison des tôles et bandes en acier de résistance à la
corrosion pour usage général

Nichtrostende Stähle - Teil 2: Technische
Lieferbedingungen für Blech und Band aus
korrosionsbeständigen Stählen für allgemeine Verwendung

This European Standard was approved by CEN on 4 May 2005

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions

CEN members are the national standards bodies of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

© 2005 CEN All rights of exploitation in any form and by any means reserved
worldwide for CEN national Members

Ref. No. EN 10088-2:2005: E

EN 10088-2:2005 (E)

Contents

	Page
Foreword	3
Scope	4
2 Normative references	4
3 Terms and definitions	5
4 Designation and ordering	5
4.1 Designation of steel grades	5
4.2 Designation to be used on ordering	5
5 Classification of grades	6
6 Requirements	7
6.1 Steelmaking process	7
6.2 Delivery condition	7
6.3 Chemical composition	7
6.4 Chemical corrosion properties	7
6.5 Mechanical properties	7
6.6 Surface quality	7
6.7 Internal soundness	8
6.8 Formability at room temperature	8
6.9 Dimensions and tolerances on dimensions and shape	8
6.10 Calculation of mass and tolerances on mass	8
7 Inspection and testing	8
7.1 General	8
7.2 Agreement on tests and inspection documents	8
7.3 Specific inspection and testing	9
7.4 Test methods	9
7.5 Retests	10
8 Marking	10
Annex A (informative) Guidelines for further treatment (including heat treatment) in fabrication	37
Annex B (informative) Applicable dimensional standards	42
Bibliography	43

Foreword

This document (EN 10088-2:2005) has been prepared by Technical Committee ECISS/TC 23 "Steels for heat treatment, alloy steels and free-cutting steels - Qualities and dimensions", 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 December 2005, and conflicting national standards shall be withdrawn at the latest by December 2005

This document supersedes EN 10088-2:1995

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 D),

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

The European Organisation for Standardisation (CEN) draws attention to the fact that it is claimed that compliance with this document may involve the use of patents concerning four steel grades

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

The holder of these patent rights has assured CEN that they are willing to negotiate licenses, 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

Grades 1.4362, 1.4410 and 1.4477

Sandvik AB
SE-811 81 SANDVIKEN
Sweden

Grade 1.4652

Outokumpu Stainless AB
SE-77480 AVESTA
Sweden

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

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom

EN 10088-2:2005 (E)**Scope**

1.1 This part of EN 10088 specifies the technical delivery conditions for hot or cold rolled sheet/plate and strip of standard grades and special grades of corrosion resisting stainless steels for general purposes

NOTE General purposes include the use of stainless steels in contact with foodstuffs

1.2 The general technical delivery conditions specified in EN 10021 apply in addition to the specifications of this European Standard, unless otherwise specified in this European Standard.

1.3 This European Standard does not apply to components manufactured by further processing of the product forms listed in 1.1 with quality characteristics altered as a result of such further processing

2 Normative references

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

EN 10002-1, *Metallic materials - Tensile testing - Part 1: Method of test at ambient temperature.*

EN 10002-5, *Metallic materials - Tensile testing - Part 5: Method of test at elevated temperature*

EN 10021, *General technical delivery requirements for steel and iron products*

EN 10027-1, *Designation systems for steels - Part 1: Steel names, principal symbols.*

EN 10027-2, *Designation systems for steels - Part 2: Numerical system*

EN 10045-1, *Metallic materials - Charpy impact test - Part 1: Test method.*

EN 10052, *Vocabulary of heat treatment terms for ferrous products.*

EN 10079, *Definition of steel products*

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

EN 10163-2, *Delivery requirements for surface condition of hot rolled steel plates, wide flats and sections - Part 2: Plate and wide flats*

EN 10168:2004, *Steel products – Inspection documents – List of information and description*

EN 10204:2004, *Metallic products - Types of inspection documents*

EN 10307, *Non-destructive testing - Ultrasonic testing of austenitic and austenitic-ferritic stainless steels flat products of thickness equal to or greater than 6 mm (reflection method)*

EN ISO 377, *Steel and steel products - Location and preparation of samples and test pieces for mechanical testing (ISO 377:1997)*

EN ISO 3651-2, *Determination of resistance to intergranular corrosion of stainless steels - Part 2: Ferritic, austenitic and ferritic-austenitic (duplex) stainless steels - Corrosion test in media containing sulfuric acid (ISO 3651-2:1998)*

EN ISO 6506-1, *Metallic materials - Brinell hardness test - Part 1 Test method (ISO 6506-1:1999)*

EN 10088-2:2005 (E)

EN ISO 6507-1, *Metallic materials - Vickers hardness test - Part 1: Test method (ISO 6507-1:1997)*

EN ISO 6508-1, *Metallic materials - Rockwell hardness test - Part 1: Test method (scales A, B, C, D, E, F, G, H, K, N, T) (ISO 6508-1:1999)*.

EN ISO 14284, *Steel and iron - Sampling and preparation of samples for the determination of chemical composition (ISO 14284:1996)*

3 Terms and definitions

For the purposes of this European Standard, the following terms and definitions apply

3.1**stainless steels**

definition in EN 10088-1 applies

3.2**corrosion resisting steels**

steels with at least 10,5 % Cr and max. 1,20 % C if their resistance to corrosion is of primary importance

3.3**product forms**

definitions in EN 10079 apply

3.4**types of heat-treatment**

definitions in EN 10052 apply

3.5**general purposes**

purposes other than the special purposes mentioned in the Bibliography

3.6**standard grades**

grades with a relatively good availability and a wider range of application

3.7**special grades**

grades for special use and/or with limited availability

4 Designation and ordering**4.1 Designation of steel grades**

The steel names and steel numbers (see Tables 1 to 4) were formed in accordance with EN 10027-1 and EN 10027-2 respectively

4.2 Designation to be used on ordering

The complete designation for ordering a product according to this document shall contain the following information

desired quantity,

product form (strip or sheet/plate),

EN 10088-2:2005 (E)

where an appropriate dimensional standard is available (see Annex B) the number of the standard, plus any choice of requirements;

if there is no dimensional standard, the nominal dimensions and tolerances required,

type of material (steel);

number of this document,

steel name or steel number,

if for the relevant steel in the table for the mechanical properties more than one treatment condition is covered, the symbol for the desired heat treatment or cold worked condition;

desired process route (see symbols in Table 6),

if a verification of internal soundness is required, flat products with thickness ≥ 6 mm shall be tested in accordance with EN 10307;

if an inspection document is required, its designation according to EN 10204

EXAMPLE 10 plates of a steel grade with the name X5CrNi18-10 and the number 1.4301 as specified in EN 10088-2 with nominal dimensions, thickness = 8 mm, width = 2000 mm, length = 5000 mm; tolerances on dimensions, shape and mass as specified in EN 10029 with thickness tolerance class A and flatness tolerance class N, in process route 1D (see Table 6), inspection document 3.1 as specified in EN 10204

10 plates EN 10029-8A x 2000 x 5000
Steel EN 10088-2 - X5CrNi18-10+1D
Inspection document 3.1

or

10 plates EN 10029-8A x 2000 x 5000
Steel EN 10088-2 - 1.4301+1D
Inspection document 3.1

5 Classification of grades

Steels covered in this document are classified according to their structure into

ferritic steels,

martensitic steels,

precipitation hardening steels,

austenitic steels,

austenitic-ferritic steels

See also Annex B to EN 10088-1

6 Requirements

6.1 Steelmaking process

Unless a special steelmaking process is agreed at the time of enquiry and order, the steelmaking process for steels conforming to this document shall be at the discretion of the manufacturer

6.2 Delivery condition

The products shall be supplied in the delivery condition agreed at the time of enquiry and order by reference to the process route given in Table 6 and, where different alternatives exist, to the treatment conditions given in Tables 7 to 11, 17 and 18 (see also Annex A)

6.3 Chemical composition

6.3.1 The chemical composition requirements given in Tables 1 to 4 apply with respect to the chemical composition according to the cast analysis

6.3.2 The product analysis may deviate from the limiting values for the cast analysis given in Tables 1 to 4 by the values listed in Table 5

6.4 Chemical corrosion properties

Referring to resistance to intergranular corrosion as defined in EN ISO 3651-2, for ferritic, austenitic and austenitic-ferritic steels the specification in Tables 7, 10 and 11 apply

NOTE 1 EN ISO 3651-2 is not applicable for testing martensitic and precipitation hardening steels

NOTE 2 The corrosion resistance of stainless steels is very dependant on the type of environment and can therefore not always be clearly ascertained through laboratory tests. It is therefore advisable to draw on the available experience of the use of the steels

6.5 Mechanical properties

6.5.1 The mechanical properties at room temperature as specified in Tables 7 to 11 apply for the relevant specified heat treatment condition. This does not apply to the process route 1U (hot rolled, not heat treated, not descaled)

If by agreement at the time of ordering the products are to be supplied in a non-heat-treated condition, the mechanical properties specified in Tables 7, 8, 9, 10 and 11 shall be obtained from reference test pieces which have received the appropriate heat treatment (simulated heat treatment)

For cold worked products, the tensile strength levels at ambient temperature as specified in Table 17 apply. The available tensile strength levels in the cold worked condition are indicated in Table 19

Alternatively, cold worked products can be ordered according to their 0,2 %-proof strength as given in Tables 18 and 20

NOTE Austenitic steels are insensitive to brittle fracture in the solution annealed condition. Because they do not have a pronounced transition temperature, which is characteristic of other steels, they are also useful for application at cryogenic temperatures

6.5.2 The values in Tables 12 to 16 apply for the 0,2 %- and 1 %-proof strength at elevated temperatures

6.6 Surface quality

Slight surface imperfections, inherent in the rolling process, are permitted

EN 10088-2:2005 (E)

When products are delivered in coil form, the degree and extent of such imperfections may be expected to be greater, due to the impracticability of removing short lengths of coil. For hot-rolled quarto-plates (symbol P in Tables 7 to 11), the requirements in EN 10163-2, class A2, apply unless otherwise agreed. For other products, where necessary, more precise requirements on surface quality may be agreed at the time of enquiry and order

6.7 Internal soundness

The products shall be free of internal defects which would exclude them from being used for their usual purpose. Ultrasonic testing of austenitic and austenitic-ferritic stainless steel flat products ≥ 6 mm may be agreed at the time of enquiry and order in accordance with EN 10307

6.8 Formability at room temperature

Cold formability may be verified by elongation in the tensile test

6.9 Dimensions and tolerances on dimensions and shape

The dimensions and the tolerances on dimensions and shape are to be agreed at the time of enquiry and order, as far as possible with reference to the dimensional standards listed in Annex B. EN 10029 shall normally only be applied for product form P (individually rolled plates, "quarto plates") and not for product form H (continuously rolled strip and plate), for which EN 10051 is to be applied. When applying EN 10029, thickness tolerance class B shall apply, unless specifically agreed otherwise at the time of enquiry and order

6.10 Calculation of mass and tolerances on mass

6.10.1 When calculating the nominal mass from the nominal dimensions the values given in EN 10088-1 shall be used as a basis for the density of the steel concerned

6.10.2 If the tolerances on mass are not specified in the dimensional standard listed in Annex B, they may be agreed at the time of enquiry and order

7 Inspection and testing

7.1 General

The appropriate process control, inspection and testing shall be carried out to ensure that the product complies with the requirements of the order

This includes the following

- suitable frequency of verification of the dimensions of the products,
- adequate intensity of visual examination of the surface quality of the products,
- appropriate frequency and type of test to ensure that the correct grade of steel is used

The nature and frequency of these verifications, examinations and tests is determined in the light of the degree of consistency that has been determined by the evidence of the quality system. In view of this, verifications by specific tests for these requirements are not necessary unless otherwise agreed

7.2 Agreement on tests and inspection documents

7.2.1 At the time of ordering the type of inspection document in accordance with EN 10204 may be agreed for each delivery

EN 10088-2:2005 (E)

7.2.2 If it is agreed to issue a test report 2.2 in accordance with EN 10204:2004 it shall indicate the following information

- a) information groups A, B and Z of EN 10168:2004,
- b) results of the cast analysis in accordance with the code numbers C71 to C92 in EN 10168:2004

7.2.3 If the issuing of an inspection certificate 3.1 or 3.2 according to EN 10204:2004 has been agreed, specific inspections according to 7.3 are to be carried out and the following information shall be given in the inspection document with the code numbers and details required by EN 10168:2004

- a) under 7.2.2 a),
- b) under 7.2.2 b),
- c) results of the mandatory tests marked in Table 21, second column, by "m";
- d) result of any optional test or inspections agreed at the time of enquiry and order.

7.3 Specific inspection and testing**7.3.1 Extent of testing**

The tests to be carried out, either mandatorily (m) or by agreement (o) and the composition and size of the test units, and the number of sample products, samples and test pieces to be taken are given in Table 21

7.3.2 Selection and preparation of samples and test pieces

7.3.2.1 Sampling and sample preparation shall be in accordance with the requirements of EN ISO 14284 and EN ISO 377. In addition, the stipulations in 7.3.2.2 apply for the mechanical tests.

7.3.2.2 The test samples for the tensile test shall be taken in accordance with Figure 1 in such a way that they are located halfway between the centre and a longitudinal edge. If it has been agreed that impact tests shall be carried out, the test samples shall be taken from the same location

The samples shall be taken from products in the delivery condition. If agreed, the samples may be taken before flattening. For samples to be given a simulated heat treatment the conditions for annealing, hardening and tempering shall be agreed

7.3.2.3 Samples for the hardness test and for the resistance to intergranular corrosion test, where requested, shall be taken from the same locations as those for the mechanical tests. For direction of bending the test piece in the resistance to intergranular corrosion test, see Figure 2

7.4 Test methods

7.4.1 The chemical analysis shall be carried out using appropriate European Standards. The choice of a suitable physical or chemical analytical method for the analysis shall be at the discretion of the manufacturer. The manufacturer shall declare the test method used if required

NOTE The list of available European Standards on chemical analysis is given in CR 10261

7.4.2 The tensile test at room temperature shall be carried out in accordance with EN 10002-1 taking into account the additional or deviating conditions specified in Figure 1, footnote a

The tensile strength, elongation after fracture and the 0,2 % proof strength shall be determined. In addition for austenitic steels only, the 1 %-proof strength shall be determined

EN 10088-2:2005 (E)

7.4.3 If a tensile test at elevated temperature has been ordered, this shall be carried out in accordance with EN 10002-5. If the proof strength is to be verified, the 0,2 %-proof strength shall be determined, for ferritic, martensitic, precipitation hardening and austenitic-ferritic steels. In the case of austenitic steels, the 0,2 %- and the 1 %-proof strength shall be determined

7.4.4 If an impact test has been ordered, it shall be carried out in accordance with EN 10045-1 on test pieces with a V-notch. The average obtained from three test pieces is considered to be the test result (see also EN 10021)

7.4.5 The Brinell hardness test shall be carried out in accordance with EN ISO 6506-1, the Rockwell hardness test in accordance with EN ISO 6508-1, and the Vickers hardness test in accordance with EN ISO 6507-1

7.4.6 The resistance to intergranular corrosion shall be tested in accordance with EN ISO 3651-2

7.4.7 Dimensions and dimensional tolerances of the products shall be tested in accordance with the requirements of the relevant dimensional standards, where available

7.5 Retests

See EN 10021

8 Marking

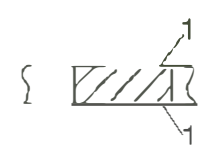
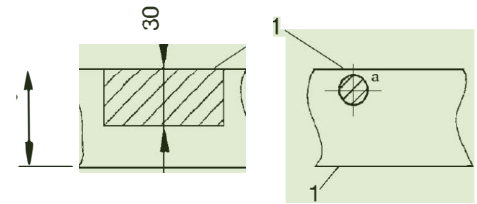

8.1 Unless otherwise agreed in the order, with the exception mentioned in 8.4, each product shall be marked with the information given in Table 22

8.2 Unless otherwise agreed the method of marking and the material of marking in accordance to 8.1 shall be at the option of the manufacturer

Its quality shall be such that it shall be durable for at least one year in unheated storage under cover
Corrosion resistance of the product shall not be impaired by the marking

8.3 One surface of the product shall be marked. This will normally be the prime surface of products, where only one surface is guaranteed to the required standard

8.4 As an alternative, for items that are wrapped, bundled or boxed, or where the surface is ground or polished, the marking may be applied to the packaging, or to a tag securely attached to it

Type of test piece	Product thickness mm	Direction of the longitudinal axis of the test piece in relation to the principal direction of rolling at a final rolling width of		Distance of the test piece from the rolled surface mm	
		< 300 mm	≥ 300 mm		
Tensile ^a	≤ 30			≤ 30	
	> 30	longitudinal	transverse		
Impact ^b	> 10	longitudinal	transverse	> 10	

In cases of doubt or dispute the gauge length shall be $L_0 = 5,65 \sqrt{S_0}$ for test pieces from products $t \geq 3$ mm. For products $t < 3$ mm thickness, non proportional test pieces with a gauge length of 80 mm and a width of 20 mm shall be used, but test pieces with a gauge length of 50 mm and a width of 12,5 mm may also be applied. For products with a thickness $3 \text{ mm} < t \leq 10 \text{ mm}$, flat proportional test pieces with two rolled surfaces and a maximum width of 30 mm shall be used. For products with a thickness $t > 10 \text{ mm}$, one of the following proportional test pieces shall be used

either a flat test piece with a maximum thickness of 30 mm; the thickness may be reduced to 10 mm by machining, but one rolled surface must be preserved

or a round test piece with a diameter of ≥ 5 mm the axis of which shall be located as close as possible to a plane in the outer sixth of the product thickness t .

Longitudinal axis of the notch shall always be perpendicular to the rolled surface of the product

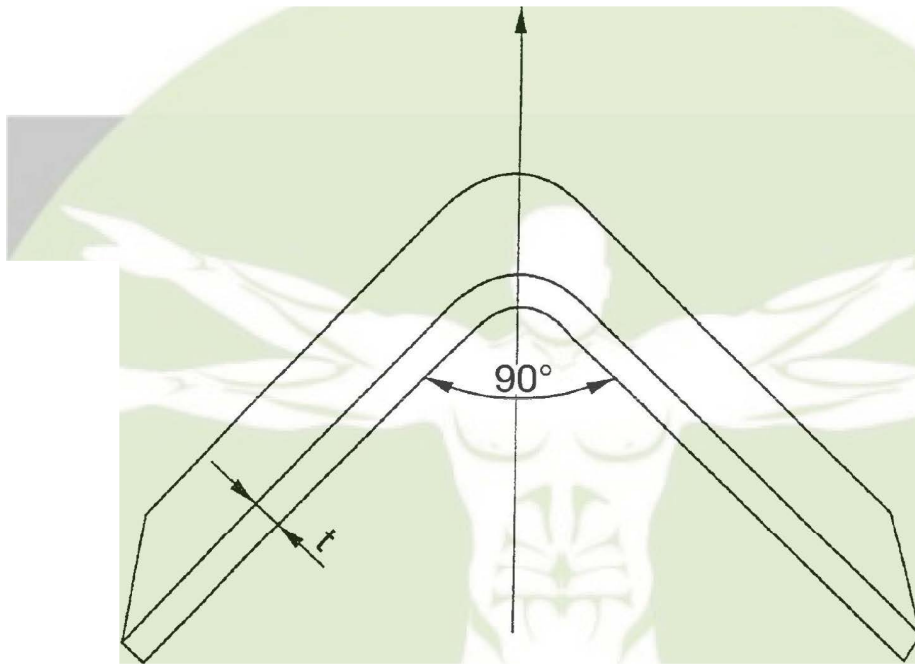
In the case of product thickness greater than 30 mm, the impact test piece may be taken at quarter of the product thickness

Key

1 Rolled surface

Figure 1 — Position of test pieces for flat products

EN 10088-2:2005 (E)



Key

Rolling direction

Figure 2 — Direction of bending the test piece in relation to the rolling direction in the resistance to intergranular corrosion test

EN 10088-2:2005 (E)

Table 1 — Chemical composition (cast analysis)^a of ferritic corrosion resisting steels

Steel designation		C	Si	Mn	P	S	N	Cr	Mo	Nb	Ni	Ti	Others
Name		max.	max.	max.	max.	max.	max.						
Standard grades													
X2CrNi12	1.4003	0,030	1,00	1,50	0,040	0,015	0,030	10,5 to 12,5			0,30 to 1,00		
X2CrTi12	1.4512	0,030	1,00	1,00	0,040	0,015		10,5 to 12,5				[6x (C+N)] to 0,65	
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
X6Cr17	1.4016	0,08	1,00	1,00	0,040	0,015 ^b		16,0 to 18,0					
X3CrTi17	1.4510	0,05	1,00	1,00	0,040	0,015 ^b		16,0 to 18,0				[4x(C+N) + 0,15] to 0,80 ^c	
X3CrNb17	1.4511	0,05	1,00	1,00	0,040	0,015		16,0 to 18,0		12 x C to 1,00			
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				
X2CrMoTi18-2	1.4521	0,025	1,00	1,00	0,040	0,015	0,030	17,0 to 20,0	1,80 to 2,50			[4x(C+N) + 0,15] to 0,80 ^c	
Special grades													
X2CrTi17	1.4520	0,025	0,50	0,50	0,040	0,015	0,015	16,0 to 18,0				0,30 to 0,60	
X1CrNb15	1.4595	0,020	1,00	1,00	0,025	0,015	0,020	14,0 to 16,0		0,20 to 0,60			
X2CrMo Ti17-1	1.4513	0,025	1,00	1,00	0,040	0,015	0,020	16,0 to 18,0	0,80 to 1,40			0,30 to 0,60	
X6CrNi17-1	1.4017	0,08	1,00	1,00	0,040	0,015		16,0 to 18,0			1,20 to 1,60		
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	
X6CrMo Nb17 1	1.4526	0,08	1,00	1,00	0,040	0,015	0,040	16,0 to 18,0	0,80 to 1,40		[7x(C+N)+0,10] to 1,00		
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
X2CrTiNb18	1.4509	0,030	1,00	1,00	0,040	0,015		17,5 to 18,5		[3xC+0,30] to 1,00		0,10 to 0,60	
X2CrMoTi29-4	1.4592	0,025	1,00	1,00	0,030	0,010	0,045	28,0 to 30,0	3,5 to 4,5			[4x(C+N) + 0,15] to 0,80 ^c	
<p>^a Elements not listed in this table shall not be intentionally added to the steel without the agreement of the purchaser except for finishing the cast. All 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</p> <p>^b Particular ranges of sulphur content may provide improvement of particular properties. For machinability a controlled sulphur content of 0,015 % to 0,030 % is recommended and permitted. For weldability, a controlled sulphur content of 0,008 % to 0,030 % is recommended and permitted For polishability, a controlled sulphur content of 0,015 % max. is recommended</p> <p>^c Stabilisation may be by use of titanium or niobium or zirconium According to the atomic mass of these elements and the content of carbon and nitrogen, the equivalence shall be the following Nb (% by mass) \equiv Zr (% by mass) \equiv $7/4$ Ti (% by mass)</p>													

EN 10088-2:2005 (E)

Table 2 — Chemical composition (cast analysis)^a of martensitic and precipitation hardening corrosion resisting steels

Steel designation		% by mass									
Name		C	Mn max	P max.	S max.	Cr	Cu	Mo	Nb	Ni	Others
Standard grades (martensitic steels) ^c											
X12Cr13	1.4006	0,08 to 0,15	1,00	1,50	0,040	0,015 ^b	11,5 to 13,5				≤ 0,75
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				
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				
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
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
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
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
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
Special grades (martensitic steels)											
X1CrNiMoCu12-5-2	1.4422	≤ 0,020	0,50	≤ 2,00	0,040	≤ 0,003	11,0 to 13,0	0,20 to 0,80	1,30 to 1,80		4,0 to 5,0 N: ≤ 0,020
X1CrNiMoCu12-7-3	1.4423	≤ 0,020	0,50	≤ 2,00	0,040	≤ 0,003	11,0 to 13,0	0,20 to 0,80	2,30 to 2,80		6,0 to 7,0 N: ≤ 0,020
Special grades (precipitation hardening steels)											
X5CrNiCuNb16-4	1.4542	≤ 0,07	0,70	1,50	0,040	0,015 ^b	15,0 to 17,0	3,0 to 5,0	≤ 0,60	5 x C to 0,45	3,0 to 5,0
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

^a 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 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

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

^c 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 %

EN 10088-2:2005 (E)

Table 3 — Chemical composition (cast analysis)^a of austenitic corrosion resisting steels

Steel designation Name		C	Si	Mn	P max	S	N	% by mass					Others
								Cr	Cu	Mo	Nb	Ni	
Standard grades													
X10CrNi18-8	1.4310	0,05 to 0,15	≤ 2,00	≤ 2,00	0,045	≤ 0,015	≤ 0,11	16,0 to 19,0		≤ 0,80		6,0 to 9,5	
X2CrNi18-7	1.4318	≤ 0,030	≤ 1,00	≤ 2,00	0,045	≤ 0,015	0,10 to 0,20	16,5 to 18,5				6,0 to 8,0	
X2CrNi18-9	1.4307	≤ 0,030	≤ 1,00	≤ 2,00	0,045	≤ 0,015 ^b	≤ 0,11	17,5 to 19,5				8,0 to 10,5	
X2CrNi19-11	1.4306	≤ 0,030	≤ 1,00	≤ 2,00	0,045	≤ 0,015 ^b	≤ 0,11	18,0 to 20,0				10,0 to 12,0	
X2CrNi18-10	1.4311	≤ 0,030	≤ 1,00	≤ 2,00	0,045	≤ 0,015 ^b	0,12 to 0,22	17,5 to 19,5				8,5 to 11,5	
X5CrNi18-10	1.4301	≤ 0,07	≤ 1,00	≤ 2,00	0,045	≤ 0,015 ^b	≤ 0,11	17,5 to 19,5				8,0 to 10,5	
X8CrNiS18-9	1.4305	≤ 0,10	≤ 1,00	≤ 2,00	0,045	0,15 to 0,35	≤ 0,11	17,0 to 19,0	≤ 1,00			8,0 to 10,0	
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 Ti: 5 x C to 0,70	
4CrNi18-12	1.4303	≤ 0,06	≤ 1,00	≤ 2,00	0,045	≤ 0,015 ^b	≤ 0,11	17,0 to 19,0				11,0 to 13,0	
2CrNiMo17-12-2	1.4404	< 0,030	< 1,00	< 2,00	0,045	≤ 0,015 ^b	≤ 0,11	16,5 to 18,5		2,00 to 2,50		10,0 to 13,0	
2CrNiMo17-11-2	1.4406	≤ 0,030	≤ 1,00	≤ 2,00	0,045	≤ 0,015 ^b	0,12 to 0,22	16,5 to 18,5		2,00 to 2,50		10,0 to 12,5	
CrNiMo17-12-2	1.4401	≤ 0,07	≤ 1,00	≤ 2,00	0,045	≤ 0,015 ^b	≤ 0,11	16,5 to 18,5		2,00 to 2,50		10,0 to 13,0	
CrNiMoTi17-12-2	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 Ti: 5 x C to 0,70	
CrNiMo17-12-3	1.4432	≤ 0,030	≤ 1,00	≤ 2,00	0,045	≤ 0,015 ^b	≤ 0,11	16,5 to 18,5		2,50 to 3,00		10,5 to 13,0	
CrNiMo18-14-3	1.4435	≤ 0,030	≤ 1,00	≤ 2,00	0,045	≤ 0,015 ^b	< 0,11	17,0 to 19,0		2,50 to 3,00		12,5 to 15,0	
2CrNiMo17-13-5	1.4439	≤ 0,030	≤ 1,00	≤ 2,00	0,045	≤ 0,015 ^b	0,12 to 0,22	16,5 to 18,5		4,0 to 5,0		12,5 to 14,5	
1NiCrMoCu25-20-5	1.4539	< 0,020	≤ 0,70	≤ 2,00	0,030	< 0,010	< 0,15	19,0 to 21,0	1,20 to 2,00	4,0 to 5,0		24,0 to 26,0	
Special grades													
5CrNi17-7	1.4319	< 0,07	< 1,00	< 2,00	0,045	< 0,030	≤ 0,11	16,0 to 18,0				6,0 to 8,0	
5CrNi19-9	1.4315	≤ 0,06	≤ 1,00	≤ 2,00	0,045	≤ 0,015	0,12 to 0,22	18,0 to 20,0				8,0 to 11,0	
1CrNi25-21	1.4335	< 0,020	< 0,25	< 2,00	0,025	< 0,010	< 0,11	24,0 to 26,0		< 0,20		20,0 to 22,0	
6CrNiNb18-10	1.4550	≤ 0,08	≤ 1,00	≤ 2,00	0,045	≤ 0,015		17,0 to 19,0			10 x C to 1,00	9,0 to 12,0	
1CrNiMoN25-22-2	1.4466	≤ 0,020	≤ 0,70	≤ 2,00	0,025	< 0,010	0,10 to 0,16	24,0 to 26,0		2,00 to 2,50		21,0 to 23,0	
6CrNiMoNb17-12-2	1.4580	≤ 0,08	≤ 1,00	≤ 2,00	0,045	≤ 0,015		16,5 to 18,5		2,00 to 2,50	10 x C to 1,00	10,5 to 13,5	
2CrNiMo17-13-3	1.4429	≤ 0,030	≤ 1,00	≤ 2,00	0,045	≤ 0,015	0,12 to 0,22	16,5 to 18,5		2,50 to 3,00		11,0 to 14,0	
X3CrNiMo17-13-3	1.4436	≤ 0,05	≤ 1,00	≤ 2,00	0,045	≤ 0,015 ^b	≤ 0,11	16,5 to 18,5		2,50 to 3,00		10,5 to 13,0	
X2CrNiMo18-12-4	1.4434	≤ 0,030	≤ 1,00	≤ 2,00	0,045	≤ 0,015	0,10 to 0,20	16,5 to 19,5		3,0 to 4,0		10,5 to 14,0	
X2CrNiMo18-15-4	1.4438	≤ 0,030	≤ 1,00	≤ 2,00	0,045	≤ 0,015 ^b	≤ 0,11	17,5 to 19,5		3,0 to 4,0		13,0 to 16,0	
X1CrNiMoCuN24-22-8 ^{*)}	1.4652 ^{*)}	≤ 0,020	≤ 0,50	2,00 to 4,0	0,030	≤ 0,005	0,45 to 0,55	23,0 to 25,0	0,30 to 0,60	7,0 to 8,0		21,0 to 23,0	
X1CrNiSi18-15-4	1.4361	≤ 0,015	3,7 to 4,5	≤ 2,00	0,025	≤ 0,010	≤ 0,11	16,5 to 18,5		≤ 0,20		14,0 to 16,0	
X11CrNiMnN19-8-6	1.4369	0,07 to 0,15	0,50 to 1,00	5,0 to 7,5	0,030	≤ 0,015	0,20 to 0,30	17,5 to 19,5				6,5 to 8,5	
X12CrMnNiN17-7-5	1.4372	≤ 0,15	≤ 1,00	5,5 to 7,5	0,045	≤ 0,015	0,05 to 0,25	16,0 to 18,0				3,5 to 5,5	
X2CrMnNiN17-7-5	1.4371	≤ 0,030	≤ 1,00	6,0 to 8,0	0,045	≤ 0,015	0,15 to 0,20	16,0 to 17,0				3,5 to 5,5	
X12CrMnNiN18-9-5	1.4373	≤ 0,15	≤ 1,00	7,5 to 10,5	0,045	≤ 0,015	0,05 to 0,25	17,0 to 19,0				4,0 to 6,0	
X8CrMnCuNB17-8-3	1.4597	≤ 0,10	≤ 2,00	6,5 to 8,5	0,040	≤ 0,030	0,15 to 0,30	16,0 to 18,0	2,00 to 3,5	≤ 1,00		≤ 2,00 B: 0,0005 to 0,0050	
X1NiCrMoCu31-27-4	1.4563	≤ 0,020	≤ 0,70	≤ 2,00	0,030	≤ 0,010	≤ 0,11	26,0 to 28,0	0,70 to 1,50	3,0 to 4,0		30,0 to 32,0	
X1CrNiMoCuN25-25-5	1.4537	≤ 0,020	≤ 0,70	≤ 2,00	0,030	≤ 0,010	0,17 to 0,25	24,0 to 26,0	1,00 to 2,00	4,7 to 5,7		24,0 to 27,0	

EN 10088-2:2005 (E)

Table 3 (continued)

Steel designation Name	Number	C	Si	Mn	P max	S	N	% by mass Cr	Cu	Mo	Nb	Ni	Others
X1CrNiMoCuN20-18-7	1.4547	≤ 0,020	≤ 0,70	≤ 1,00	0,030	≤ 0,010	0,18 to 0,25	19,5 to 20,5	0,50 to 1,00	3,0 to 7,0		17,5 to 18,5	
X1CrNiMoCuNW24-22-6	1.4659	≤ 0,020	≤ 0,70	2,00 to 4,0	0,030	≤ 0,010	0,35 to 0,50	23,0 to 25,0	1,00 to 2,00	5,5 to 6,5		21,0 to 23,0	W: 1,50 to 2,50
X1NiCrMoCuN25-20-7	1.4529	≤ 0,020	≤ 0,50	≤ 1,00	0,030	≤ 0,010	0,15 to 0,25	19,0 to 21,0	0,50 to 1,50	3,0 to 7,0		24,0 to 26,0	
X2CrNiMnMoN25-18-6-5	1.4565	≤ 0,030	≤ 1,00	5,0 to 7,0	0,030	≤ 0,015	0,30 to 0,60	24,0 to 26,0		4,0 to 5,0	≤ 0,15	16,0 to 19,0	

^a Elements not listed 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

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

Patented steel grade

EN 10088-2:2005 (E)

Table 4 — Chemical composition (cast analysis)^a of austenitic-ferritic corrosion resisting steels

Steel designation		% by mass										
Name	Number	C	Si	Mn	P	S	N	Cr	Cu	Mo	Ni	W
		max			max	max						
Standard grades												
X2CrNiN23-4 ^{*)}	1.4362 ^{*)}	0,030	≤ 1,00	≤ 2,00	0,035	0,015	0,05 to 0,20	22,0 to 24,0	0,10 to 0,60	0,10 to 0,60	3,5 to 5,5	
X2CrNiMoN22-5-3 ^b	1.4462 ^b	0,030	≤ 1,00	≤ 2,00	0,035	0,015	0,10 to 0,22	21,0 to 23,0		2,50 to 3,5	4,5 to 6,5	
Special grades												
X2CrNiCuN23-4	1.4655	0,030	≤ 1,00	≤ 2,00	0,035	0,015	0,05 to 0,20	22,0 to 24,0	1,00 to 3,00	0,10 to 0,60	3,5 to 5,5	
X2CrNiMoN29-7-2 ⁾	1.4477 ⁾	0,030	≤ 0,50	0,80 to 1,50	0,030	0,015	0,30 to 0,40	28,0 to 30,0	≤ 0,80	1,50 to 2,60	5,8 to 7,5	
X2CrNiMoCuN25-6-3	1.4507	0,030	≤ 0,70	≤ 2,00	0,035	0,015	0,20 to 0,30	24,0 to 26,0	1,00 to 2,50	3,0 to 4,0	6,0 to 8,0	
X2CrNiMoN25-7-4 ^{*)}	1.4410 ^{*)}	0,030	≤ 1,00	≤ 2,00	0,035	0,015	0,24 to 0,35	24,0 to 26,0		3,0 to 4,5	6,0 to 8,0	
X2CrNiMoCuWN25-7-4	1.4501	0,030	≤ 1,00	≤ 1,00	0,035	0,015	0,20 to 0,30	24,0 to 26,0	0,50 to 1,00	3,0 to 4,0	6,0 to 8,0	0,50 to 1,00
X2CrNiMoSi18-5-3	1.4424	0,030	1,40 to 2,00	1,20 to 2,00	0,035	0,015	0,05 to 0,10	18,0 to 19,0		2,50 to 3,0	4,5 to 5,2	

^a Elements not listed 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

^b By agreement, this grade can be delivered with a Pitting Resistance Equivalent Number (PRE = Cr + 3,3 Mo + 16 N, compare Table C.1 of EN 10088-1) greater than 34

^{*)} Patented steel grade

EN 10088-2:2005 (E)

Table 5 — Permissible product analysis tolerances on the limiting values given in Tables 1 to 4 for the cast analysis

Element	Specified limits, cast analysis		Permissible tolerance ^a
	% by mass		
Carbon		≤ 0,030	+ 0,005
	> 0,030	≤ 0,20	± 0,01
	> 0,20	≤ 0,50	± 0,02
	> 0,50	≤ 0,60	± 0,03
Silicon		≤ 1,00	+ 0,05
	> 1,00	≤ 4,5	± 0,10
Manganese		≤ 1,00	+ 0,03
	> 1,00	≤ 2,00	± 0,04
	> 2,00	≤ 10,5	± 0,10
Phosphorus		≤ 0,045	+0,005
Sulphur		≤ 0,015	+0,003
	> 0,015	≤ 0,030	±0,005
	> 0,15	≤ 0,35	± 0,02
Nitrogen		≤ 0,11	± 0,01
	≥ 0,11	≤ 0,50	± 0,02
Chromium		≤ 15,0	± 0,15
	≥ 10,5	≤ 20,0	± 0,20
	> 20,0	≤ 30,0	± 0,25
Copper		≤ 1,00	± 0,07
	> 1,00	≤ 5,0	± 0,10
Molybdenum		≤ 0,60	± 0,03
	> 0,60	≤ 1,75	± 0,05
	> 1,75	≤ 8,0	± 0,10
Niobium		≤ 1,00	± 0,05
Nickel		≤ 1,00	± 0,03
	> 1,00	≤ 5,0	± 0,07
	> 5,0	≤ 10,0	± 0,10
	> 10,0	≤ 20,0	± 0,15
	> 20,0	≤ 32,0	± 0,20
Aluminium		≤ 0,30	± 0,05
	≥ 0,10	≤ 1,50	± 0,10
Boron		≤ 0,0050	± 0,0005
Titanium		≤ 0,80	± 0,05
Tungsten		≤ 2,50	± 0,05
Vanadium		≤ 0,20	± 0,03

^a If several product analysis are carried out on one cast, and the contents of an individual element determined lies outside the permissible range of the chemical composition specified for the cast analysis, then it is only allowed to exceed the permissible maximum value or to fall short of the permissible minimum value, but not both at the same time

EN 10088-2:2005 (E)

Table 6 — Type of process route and surface finish of sheet, plate and strip^a

	Symbol ^b	Type of process route	Surface finish	Notes
Hot rolled	1U	Hot rolled, not heat treated, not descaled	Covered with rolling scale	Suitable for products which are to be further worked e.g. strip for rerolling
	1C	Hot rolled, heat treated, not descaled	Covered with rolling scale	Suitable for parts which will be descaled or machined in subsequent production or for certain heat-resisting applications
	1E	Hot rolled, heat treated, mechanically descaled	Free of scale	The type of mechanical descaling, e.g. coarse grinding or shot blasting, depends on the steel grade and the product, and is left to the manufacturer's discretion, unless otherwise agreed
	1D	Hot rolled, heat treated, pickled	Free of scale	Usually standard for most steel types to ensure good corrosion resistance; also common finish for further processing. It is permissible for grinding marks to be present. Not as smooth as 2D or 2B
Cold rolled	2H	Work hardened	Bright	Cold worked to obtain higher strength level
	2C	Cold rolled, heat treated, not descaled	Smooth with scale from heat treatment	Suitable for parts which will be descaled or machined in subsequent production or for certain heat-resisting applications
	2E	Cold rolled, heat treated, mechanically descaled	Rough and dull	Usually applied to steels with a scale which is very resistant to pickling solutions. May be followed by pickling
	2D	Cold rolled, heat treated, pickled	Smooth	Finish for good ductility, but not as smooth as 2B or 2R
	2B	Cold rolled, heat treated, pickled, skin passed	Smoother than 2D	Most common finish for most steel types to ensure good corrosion resistance, smoothness and flatness. Also common finish for further processing. Skin passing may be by tension levelling
	2R	Cold rolled, bright annealed ^c	Smooth, bright, reflective	Smoother and brighter than 2B. Also common finish for further processing
	2Q	Cold rolled, hardened and tempered, scale free	Free of scale	Either hardened and tempered in a protective atmosphere or descaled after heat treatment
Special finishes	1G or 2G	Ground ^d	See footnote e	Grade of grit or surface roughness can be specified. Unidirectional texture, not very reflective
	1J or 2J	Brushed ^d or dull polished ^d	Smoother than ground See footnote e	Grade of brush or polishing belt or surface roughness can be specified. Unidirectional texture, not very reflective
	1K or 2K	Satin polish ^d	See footnote e	Additional specific requirements to a "J" type finish, in order to achieve adequate corrosion resistance for marine and external architectural applications Transverse $R_a < 0,5 \mu\text{m}$ with clean cut surface finish
	1P or 2P	Bright polished ^d	See footnote e	Mechanical polishing. Process or surface roughness can be specified. Non-directional finish, reflective with high degree of image clarity
	2F	Cold rolled heat treated skin passed on roughened rolls	Uniform non-reflective matt surface	Heat treatment by bright annealing or by annealing and pickling
	1M	Patterned	Design to be agreed; 2 nd surface flat	Chequer plates used for floors
	2M			A fine texture finish mainly used for architectural applications
	2W	Corrugated	Design to be agreed	Used to increase strength and/or for cosmetic effect
	2L	Coloured ^d	Colour to be agreed	
	1S or 2S	Surface coated ^d		Coated with e.g. tin, aluminium

^a Not all process routes and surface finishes are available for all steels

^b First digit: 1 = hot rolled, 2 = cold rolled

^c May be skin passed

^d One surface only, unless specifically agreed at the time of enquiry and order

^e Within each finish description the surface characteristics can vary, and more specific requirements may need to be agreed between manufacturer and purchaser (e.g. grade of grit or surface roughness)

EN 10088-2:2005 (E)

Table 7 — Mechanical properties at room temperature of ferritic steels in the annealed condition (see Table A.1) and resistance to intergranular corrosion

Steel designation		Product form ^a	Thickness mm max	0,2 % proof strength		Tensile strength R_m MPa ¹	Elongation after fracture		Resistance to intergranular corrosion ^d	
Name	Number			$R_{p0,2}$ MPa ¹ min (long)	$R_{p0,2}$ MPa ¹ min (tr.)		$A_{80\text{ mm}}^b$ < 3 mm thick % min (long. + tr.)	A^c ≥ 3 mm thick % min (long. + tr.)	In the delivery condition	in the welded condition
Standard grades										
X2CrNi12	1.4003	C	8	280	320	450 to 650	20		no	no
		H	13,5				18			
		P	25°	250	280					
X2CrTi12	1.4512	C	8	210	220	380 to 560	25		no	no
		H	13,5							
X6CrNiTi12	1.4516	C	8	280	320	450 to 650	23		no	no
		H	13,5				20			
		P	25°	250	280					
X6Cr13	1.4000	C	8	240	250	400 to 600	19		no	no
		H	13,5	220	230					
		P	25°	220	230					
X6CrAl13	1.4002	C	8	230	250	400 to 600	17		no	no
		H	13,5	210	230					
		P	25°	210	230					
X6Cr17	1.4016	C	8	260	280	450 to 600	20		yes	no
		H	13,5	240	260		18			
		P	25°	240	260		20			
X3CrTi17	1.4510	C	8	230	240	420 to 600	23		yes	yes
		H	13,5							
X3CrNb17	1.4511	C	8	230	240	420 to 600	23		yes	yes
		H	13,5							
X6CrMo17-1	1.4113	C	8	260	280	450 to 630	18		yes	no
		H	13,5							
X2CrMoTi18 2	1.4521	C	8	300	320	420 to 640	20		yes	yes
		H	13,5	280	300		400 to 600			
		P	12	280	300		420 to 620			
Special grades										
X2CrTi17	1.4520	C	8	180	200	380 to 530	24		yes	yes
X1CrNb15	1.4595	C	8	210	220	380 to 560	25		yes	yes
X2CrMoTi17 1	1.4513	C	8	200	220	400 to 550	23		yes	yes
X6CrNi17 1	1.4017	C	8	330	350	500 to 750	12		yes	no
X5CrNiMoTi15-2	1.4589	C	8	400	420	550 to 750	16		yes	yes
		H	13,5	360	380		14		yes	yes
X6CrMoNb17-1	1.4526	C	8	280	300	480 to 560	25		yes	yes
X2CrNbZr17	1.4590	C	8	230	250	400 to 550	23		yes	yes
X2CrTiNb18	1.4509	C	8	230	250	430 to 630	18		yes	yes
X2CrMoTi29-4	1.4592	C	8	430	450	550 to 700	20		yes	yes

^a C = cold rolled strip; H = hot rolled strip; P = hot rolled plate

Values apply for test pieces with a gauge length of 80 mm and a width of 20 mm. Test pieces with a gauge length of 50 mm and width of 12,5 mm can also be used

^c Values apply for test pieces with a gauge length of $5,65 \sqrt{S_0}$

When tested according to EN ISO 3651-2

For thicknesses above 25 mm the mechanical properties can be agreed

1 MPa = 1 N/mm²

EN 10088-2:2005 (E)

Table 8 — Mechanical properties at room temperature of martensitic steels in the heat-treated condition (see Table A.2)

Steel designation		Product form ^a	Thick-ness mm max.	Heat-treat-ment-conditions ^b	Hardness ^c		0,2 %-proof strength $R_{p0.2}$ MPa ^f min	Tensile strength R_m MPa ^g	Elongation after fracture		Impact energy (ISO-V) KV > 10 mm thick J min	Hardness	
Name	Number				HV	max			$A_{80 \text{ mm}}^d$ < 3 mm thick % min (long. + tr.)	A^e ≥ 3 mm thick % min (long. + tr.)		HRC	HV
Standard grades													
X12Cr13	1.4006	C	8	+A	90	200		max. 600	20				
		H	13,5										
		P ^g	75	+QT550			400	550 to 750	15		by agreement		
				+QT650			450	650 to 850	12				
X15Cr13	1.4024	C	8	+A	90	200		max. 650	20				
		H	13,5	+A	90	200		max. 650	20				
		P	75	+A									
		P	75	+QT550			400	550 to 750	15		by agreement		
		P	75	+QT650			450	650 to 850	12				
X20Cr13	1.4021	C	3	+QT								44 to 50	440 to 530
		C	8	+A	95	225		max. 700	15				
		H	13,5										
		P ^g	75	+QT650			450	650 to 850	12		by agreement		
						+QT750		550	750 to 950	10			
X30Cr13	1.4028	C	3	+QT								45 to 51	450 to 550
		C	8	+A	97	235		max. 740	15				
		H	13,5										
		P ^g	75	+QT800			600	800 to 1000	10				
X39Cr13	1.4031	C	3	+QT								47 to 53	480 to 580
		C	8	+A	98	240		max. 760	12				
		H	13,5										
X46Cr13	1.4034	C	8	+A	99	245		max. 780	12				
		H	13,5										
X38CrMo14	1.4419	C	3	+QT								46 to 52	450 to 560
		C	4	+A	97	235		max. 760	15				
		H	6,5										
X55CrMo14	1.4110	C	8	+A	100	230		max. 850	12				
		H	13,5										
		P	75										
X50CrMoV15	1.4116	C	8	+A	100	230		max. 850	12				
		H	13,5										
X39CrMo17-1	1.4122	C	3	+QT								47 to 53	480 to 580
		C	8	+A	100	230		max. 900	12				
X3CrNiMo13 4	1.4313	H	13,5										
		P ^g	75	+QT780			630	780 to 980	15		70		
				+QT900		800	900 to 1100	11					
X4CrNiMo16-5-1	1.4418	P ^g	75	+QT840			660	840 to 1100	14		55		

EN 10088-2:2005 (E)

Table 8 (continued)

Steel designation Name	Product form ^a Number	Thick- ness mm max.	Heat treat- ment- condi- tion ^b	Hardness ^c		0,2 % proof strength $R_{p0.2}$ MPa ^f min	Tensile strength R_m MPa ^f	Elongation after fracture		Impact energy (ISO-V) KV J min	Hardness	
					max			$A_{80\text{ mm}}^d$ < 3 mm thick % min (long. + tr.)	A^e ≥ 3 mm thick % min (long. + tr.)		HRC	HV
Special grades												
X1CrNiMoCu12-5-2	1.4422	H	13,5	+A	100	300	550	750 to 950	15	100		
		P	75	+QT650			550	750 to 950	15	100		max. 300
X1CrNiMoCu12 7 3	1.4423	H	13,5	+A	100	300	550	750 to 950	15	100		
		P	75	+QT650			550	750 to 950	15	100		max. 300

^a C = cold rolled strip; H = hot rolled strip; P = hot rolled plate

^b +A = annealed, +QT = quenched and tempered

^c Brinell or Vickers or Rockwell hardness is normally determined for product forms C and H in heat treatment condition A. The tensile test shall be carried out in referee testing

^d Values apply for test pieces with a gauge length of 80 mm and a width of 20 mm; test pieces with a gauge length of 50 mm and a width of 12,5 mm may also be used

^e Values apply for test pieces with a gauge length of $5,65 \sqrt{S_0}$

^f Plates may also be delivered in the annealed condition; in such cases the mechanical properties are to be agreed at the time of enquiry and order

^g For thicknesses above 75 mm, the mechanical properties can be agreed

1 MPa = 1 N/mm²

EN 10088-2:2005 (E)

Table 9 — Mechanical properties at room temperature of precipitation hardening steels in the heat treated condition (see Table A.3)

Steel designation		Product form ^a	Thick-ness	Heat-treatment condition ^b	0,2 %-proof strength	Tensile strength	Elongation after fracture	
Name	Number						$R_{p0,2}$	R_m
			mm max		MPa ^j min	MPa ^j	< 3 mm thick %	≥ 3 mm thick %
Special grade								
X5CrNiCuNb16-4	1.4542	C	8	+AT ^e		≤ 1275	5	
				+P1300 ^f	1150	≥ 1300	3	
				+P900 ^f	700	≥ 900	6	
		P	50	+P1070 ^g	1000	1070 to 1270	8	10
				+P950 ^g	800	950 to 1150	10	12
				+P850 ^g	600	850 to 1050	12	14
		+SR630 ^h			≤ 1050			
X7CrNiAl17-7	1.4568	C	8	+AT ^{e,i}		≤ 1030	19	
				+P1450 ^f	1310	≥ 1450	2	

^a C = cold rolled strip; P = hot rolled plate

^b +AT = solution annealed; +P = precipitation hardened; +SR = strength relieved

^c Values apply for test pieces with a gauge length of 80 mm and a width of 20 mm; test pieces with a gauge length of 50 mm and a width of 12,5 mm can also be used

^d Values apply for test pieces with a gauge length of $5,65 \sqrt{S_0}$

^e Delivery condition

^f Condition of application; other precipitation hardening temperatures may be agreed

^g If ordered in the finally treated condition

^h Delivery condition for further processing; final treatment according to Table A.3

For spring-hard rolled condition see EN 10151

1 MPa = 1 N/mm²

EN 10088-2:2005 (E)

Table 10 — Mechanical properties at room temperature of austenitic steels in the solution annealed condition^a (see Table A.4) and resistance to intergranular corrosion

Steel designation Name	Product form ^b Number	Thick-ness mm max	0,2 %- proof strength	1 %- proof- strength	Tensile strength	Elongation after fracture		Impact energy (ISO V)		Resistance to intergranular corrosion ⁱ		
			$R_{p0,2}$	$R_{p1,0}$ ^c	R_m	A_{80} ^{d, f} < 3 mm thick %	$A^{d, g}$ ≥ 3 mm thick %	KV > 10 mm thick J min		in the delivery condition	in the sensitized condition ^l	
			MPa ^j min		MPa ^k	(tr.)	(tr.)	(long.)	(tr.)			
Standard grades												
X10CrNi18 8	1.4310	C	8	250	280	600 to 950	40	40			no	no
X2CrNi18 7	1.4318	C	8	350	380	650 to 850	35	40				
		H	13,5	330	370				90	60	yes	yes
		P ^l	75	330	370	630 to 830	45	45				
X2CrNi18-9	1.4307	C	8	220	250	520 to 700						
		H	13,5	200	240		45	45	100	60	yes	yes
		P ^l	75	200	240	500 to 700						
X2CrNi19-11	1.4306	C	8	220	250	520 to 700						
		H	13,5	200	240		45	45	100	60	yes	yes
		P ^l	75	200	240	500 to 700						
X2CrNi18 10	1.4311	C	8	290	320							
		H	13,5	270	310	550 to 750	40	40	100	60	yes	yes
		P ^l	75	270	310							
X5CrNi18-10	1.4301	C	8	230	260	540 to 750	45 ^k	45 ^k				
		H	13,5	210	250	520 to 720			100	60	yes	no ^l
		P ^l	75	210	250		45	45				
X8CrNiS18-9	1.4305	P ^l	75	190	230	500 to 700	35	35			no	no
X6CrNiTi18 10	1.4541	C	8	220	250	520 to 720						
		H	13,5	200	240		40	40	100	60	yes	yes
		P ^l	75	200	240	500 to 700						
X4CrNi18 12	1.4303	C	8	220	250	500 to 650	45	45			yes	no ^l
X2CrNiMo17-12-2	1.4404	C	8	240	270	530 to 680	40	40				
		H	13,5	220	260				100	60	yes	yes
		P ^l	75	220	260	520 to 670	45	45				
X2CrNiMoN17-11-2	1.4406	C	8	300	330							
		H	13,5	280	320	580 to 780	40	40	100	60	yes	yes
		P ^l	75	280	320							
X5CrNiMo17 12 2	1.4401	C	8	240	270	530 to 680	40	40				
		H	13,5	220	260				100	60	yes	no ^l
		P ^l	75	220	260	520 to 670	45	45				
X6CrNiMoTi17-12-2	1.4571	C	8	240	270	540 to 690						
		H	13,5	220	260		40	40	100	60	yes	yes
		P ^l	75	220	260	520 to 670						
X2CrNiMo17 12 3	1.4432	C	8	240	270	550 to 700	40	40				
		H	13,5	220	260				100	60	yes	yes
		P ^l	75	220	260	520 to 670	45	45				
X2CrNiMo18-14-3	1.4435	C	8	240	270	550 to 700	40	40				
		H	13,5	220	260				100	60	yes	yes
		P ^l	75	220	260	520 to 670	45	45				
X2CrNiMoN17 13 5	1.4439	C	8	290	320		35	35				
		H	13,5	270	310	580 to 780			100	60	yes	yes
		P ^l	75	270	310		40	40				
X1NiCrMoCu25-20-5	1.4539	C	8	240	270	530 to 730						
		H	13,5	220	260		35	35	100	60	yes	yes
		P ^l	75			520 to 720						

EN 10088-2:2005 (E)

Table 10 (continued)

Steel designation		Product form ^b	Thickness mm max	0.2 % proof-strength	1 % proof-strength	Tensile strength R_m MPa ¹⁾	Elongation after fracture		Impact energy (ISO-V)		Resistance to intergranular corrosion ^h	
Name	Number			$R_{p0.2}$	$R_{p1.0}$ ^c		A_{80} ^{d, f} < 3 mm thick % min (tr.)	A ^{d, g} ≥ 3 mm thick % min (tr.)	KV > 10 mm thick J min (long)		J min (tr.)	in the delivery condition
Special grades												
X5CrNi17-7	1.4319	C	3	230	260	550 to 750	45				yes	no ¹
		H	6	230	260	550 to 750	45	45				
X5CrNiN19-9	1.4315	C	8	290	320	500 to 750	40	40	100	60	yes	no
		H	13.5	270	310							
		P ¹⁾	15	270	310							
X1CrNi25 21	1.4335	P	75	200	240	470 to 670	40	40	100	60	yes	yes
X6CrNiNb18-10	1.4550	C	8	220	250	520 to 720	40	40	100	60	yes	yes
		H	13.5	200	240							
		P ¹⁾	75	200	240							
X1CrNiMoN25-22-2	1.4466	P ¹⁾	75	250	290	540 to 740	40	40	100	60	yes	yes
X6CrNiMoNb17-12-2	1.4580	P ¹⁾	75	220	260	520 to 720	40	40	100	60	yes	yes
X2CrNiMoN17-13 3	1.4429	C	8	300	330	580 to 780	35	35	100	60	yes	yes
		H	13.5	280	320							
		P ¹⁾	75	280	320							
X3CrNiMo17-13-3	1.4436	C	8	240	270	550 to 700	40	40	100	60	yes	no ¹
		H	13.5	220	260							
		P ¹⁾	75	220	260							
X2CrNiMoN18 12 4	1.4434	C	8	290	320	570 to 770	35	35	100	60	yes	yes
		H	13.5	270	310							
		P ¹⁾	75	270	310							
X2CrNiMo18-15-4	1.4438	C	8	240	270	550 to 700	35	35	100	60	yes	yes
		H	13.5	220	260							
		P ¹⁾	75	220	260							
X1CrNiMoCuN24-22-8	1.4652	C	8	430	470	750 to 1000	40	40	100	60	yes	yes
		H	13.5	430	470							
		P	15	430	470							
X1CrNiSi18 15-4	1.4361	P ¹⁾	75	220	260	530 to 730	40	40	100	60	yes	yes
X11CrNiMnN19 8-6	1.4369	C	4	340	370	750 to 950	35	35			yes	no
X12CrMnNiN17-7-5	1.4372	C	8	350	380	750 to 950	45	45	100	60	yes	no
		H	13.5	330	370							
		P ¹⁾	75	330	370							
X2CrMnNiN17-7-5	1.4371	C	8	300	330	650 to 850	45	45	100	60	yes	yes
		H	13.5	280	320							
		P ¹⁾	75	280	320							
X12CrMnNiN18-9-5	1.4373	C	8	340	370	680 to 880	45	45	100	60	yes	no
		H	13.5	320	360							
		P ¹⁾	75	320	360							
X8CrMnCuNB17-8-3	1.4597	C	8	300	330	580 to 780	40	40	100	60	yes	no
		H	13.5	300	330							
X1NiCrMoCu31 27 4	1.4563	P ¹⁾	75	220	260	500 to 700	40	40	100	60	yes	yes
X1CrNiMoCuN25-25-5	1.4537	P ¹⁾	75	290	330	600 to 800	40	40	100	60	yes	yes
X1CrNiMoCuN20 18 7	1.4547	C	8	320	350	650 to 850	35	35	100	60	yes	yes
		H	13.5	300	340							
		P ¹⁾	75	300	340							

EN 10088-2:2005 (E)

Table 10 (continued)

Steel designation		Product form ^b	Thickness mm max	0.2 % proof strength	1 % proof strength	Tensile strength	Elongation after fracture		Impact energy (ISO V)		Resistance to intergranular corrosion ^h	
Name	Number			$R_{p0,2}$	$R_{p1,0}$ ^c	R_m	A_{80} ^{d, f} < 3 mm thick	A ^{d, g} ≥ 3 mm thick	KV > 10 mm thick		in the delivery condition	in the sensitized condition ^k
				MPa ^j min (tr.) ^{d, e}	MPa ^j	MPa ^j	% min (tr.)	% min (tr.)	J min (long.)	J min (tr.)		
Special grades												
X1CrNiMoCuNW24 22 6	1.4659	P ^j	75	420	460	800 to 1000		40	100	60	yes	yes
X1NiCrMoCuN25-20-7	1.4529	P ^j	75	300	340	650 to 850	40	40	100	60	yes	yes
X2CrNiMnMoN25-18-6-5	1.4565	C	6	420	460	800 to 950	30	30	120	90	yes	yes
		H	10									
		P	40									
<p>^a Solution treatment may be omitted if the conditions for hot working and subsequent cooling are such that the requirements for the mechanical properties of the product and the resistance to intergranular corrosion as defined in EN ISO 3651 – 2 are obtained</p> <p>^b C = cold rolled strip; H = hot rolled strip; P = hot rolled plate</p> <p>^c Only for guidance</p> <p>^d If, in the case of strip in rolling widths < 300 mm, longitudinal test pieces are taken, the minimum values are reduced as follows proof strength - minus 15 MPa, elongation for constant gauge length - minus 5 %; elongation for proportional gauge length - minus 2 %</p> <p>^e For continuously hot rolled products, 20 MPa higher minimum values of $R_{p0,2}$ and 10 MPa higher minimum values of $R_{p1,0}$ may be agreed at the time of enquiry and order</p> <p>^f Values apply for test pieces with a gauge length of 80 mm and a width of 20 mm; test pieces with a gauge length of 50 mm and a width of 12.5 mm can also be used</p> <p>^g Values apply for test pieces with a gauge length of $5,65 \sqrt{S_0}$</p> <p>^h When tested according to EN ISO 3651-2 See NOTE 2 to 6.4 For thicknesses above 75 mm, the mechanical properties can be agreed</p> <p>^k For stretcher levelled material, the minimum value is 5 % lower. Sensitization treatment of 15 min at 700 °C followed by cooling in air</p> <p>^j 1 MPa = 1N/mm²</p>												

Table 11 — Mechanical properties at room temperature of austenitic-ferritic steels in the solution annealed condition (see Table A.5) and resistance to intergranular corrosion

Steel designation		Product form ^a	Thickness	0,2 %-proof strength $R_{p0,2}$	Tensile strength R_m	Elongation after fracture		Impact energy (ISO V)		Resistance to intergranular corrosion ^f	
Name	Number					mm max	MPa ^g min (tr.) ^{b,c}	MPa ^g	A_{80} < 3 mm thick ^d % min (long.+tr.)	A ≥ 3 mm thick ^e % min (long.+tr.)	KV > 10 mm thick J (long.)
Standard grades											
X2CrNiN23-4	1.4362	C	8	450	650 to 850	20	20			yes	yes
		H	13,5	400				100	60		
		P ^h	75	400	630 to 800	25	25				
X2CrNiMoN22-5-3	1.4462	C	8	500	700 to 950	20	20			yes	yes
		H	13,5	460				100	60		
		P ^h	75	460	640 to 840	25	25				
Special grades											
X2CrNiCuN23 4	1.4655	C	8	420	600 to 850	20	20			yes	yes
		H	13,5	400				100	60		
		P ^h	75	400	630 to 800	25	25				
X2CrNiMoN29-7-2	1.4477	C	8	650	800 to 1050	20	20			yes	yes
		H	13,5	550	750 to 1000	20	20	100	60		
		P ^h	75	550							
X2CrNiMoCuN25-6-3	1.4507	C	8	550	750 to 1000	20	20			yes	yes
		H	13,5	530				100	60		
		P ^h	75	530	730 to 930	25	25				
X2CrNiMoN25-7-4	1.4410	C	8	550	750 to 1000	20	20			yes	yes
		H	13,5	530				100	60		
		P ^h	75	530	730 to 930	20	20				
X2CrNiMoCuWN25-7-4	1.4501	P ^h	75	530	730 to 930	25	25	100	60	yes	yes
X2CrNiMoSi18-5-3	1.4424	C	8	450	700 to 900	25	25	100	60	yes	yes
		H	13,5								
		P ^h	75	400	680 to 900						

^a C = cold rolled strip; H = hot rolled strip; P = hot rolled plate

^b If, in the case of strip in rolling widths < 300 mm, longitudinal test pieces are taken, the minimum proof strength values are reduced by 15 MPa

^c For continuously hot rolled products, 20 MPa higher minimum values of $R_{p0,2}$ may be agreed at the time of enquiry and order.

^d Values apply for test pieces with a gauge length of 80 mm and a width of 20 mm; test pieces with a gauge length of 50 mm and a width of 12,5 mm can also be used

^e Values apply for test pieces with a gauge length of $5,65 \sqrt{S_0}$.

^f When tested according to EN ISO 3651-2

^g See NOTE 2 to 6.4

^h For thicknesses above 75 mm, the mechanical properties can be agreed
1 MPa = 1 N/mm²

EN 10088-2:2005 (E)

Table 12 — Minimum values for the 0,2 % proof strength of ferritic steels at elevated temperatures

Steel designation		Heat treatment condition ^a	Minimum 0,2 % proof strength, MPa ¹⁾						
Name	Number		at a temperature (in °C) of						
			100	150	200	250	300	350	400
Standard grades									
X2CrNi12	1.4003	+A	240	235	230	220	215		
X2CrTi12	1.4512	+A	200	195	190	185	180	160	
X6CrNiTi12	1.4516	+A	300	270	250	245	225	215	
X6Cr13	1.4000	+A	220	215	210	205	200	195	190
X6CrAl13	1.4002	+A	220	215	210	205	200	195	190
X6Cr17	1.4016	+A	220	215	210	205	200	195	190
X3CrTi17	1.4510	+A	195	190	185	175	165	155	
X3CrNb17	1.4511	+A	230	220	205	190	180	165	
X6CrMo17-1	1.4113	+A	250	240	230	220	210	205	200
X2CrMoTi18-2	1.4521	+A	250	240	230	220	210	205	200
Special grades									
X2CrTi17	1.4520	+A	195	190	170	160	155		
X1CrNb15	1.4595	+A	200	195	190	185	180	160	
X6CrMoNb17-1	1.4526	+A	270	265	250	235	215	205	
X2CrNbZr17	1.4590	+A	230	220	210	205	200	180	
X2CrTiNb18	1.4509	+A	230	220	210	205	200	180	
X2CrMoTi29-4	1.4592	+A	395	370	350	335	325	310	

^a +A = annealed1 MPa = 1 N/mm²

EN 10088-2:2005 (E)

Table 13 — Minimum values for the 0,2 % proof strength of martensitic steels at elevated temperatures

Steel designation		Heat treatment condition ^a	Minimum 0,2 %-proof strength, MPa ¹						
Name	Number		at a temperature (in °C) of						
			200	250	300	350	400		
Standard grades									
X12Cr13	1.4006	+QT650	420	410	400	385	365	335	305
X15Cr13	1.4024	+QT650	420	410	400	385	365	335	305
X20Cr13	1.4021	+QT650	420	410	400	385	365	335	305
X3CrNiMo13-4	1.4313	+QT780	590	575	560	545	530	515	
		+QT900	720	690	665	640	620		
X4CrNiMo16-5-1	1.4418	+QT840	660	640	620	600	580		

^a +QT = quenched and tempered

1 MPa = 1 N/mm²

Table 14 — Minimum values for the 0,2 % proof strength of precipitation hardening steels at elevated temperatures

Steel designation		Heat treatment condition	Minimum 0,2 %-proof strength, MPa ¹				
Name	Number		at a temperature (in °C) of				
			100	150	200	250	300
Special grade							
X5CrNiCuNb16-4	1.4542	+P1070	880	830	800	770	750
		+P950	730	710	690	670	650
		+P850	680	660	640	620	600

+P = precipitation hardened

1 MPa = 1 N/mm²

EN 10088-2:2005 (E)

Table 15 — Minimum values for the 0,2 %-and 1 %-proof strength of austenitic steels at elevated temperatures

Steel designation Name	Number	Heat treatment condition ^a	Minimum 0,2 %-proof strength, MPa ¹										Minimum 1 %-proof strength, MPa ¹									
			at a temperature (in °C) of										at a temperature (in °C) of									
			100	150	200	250	300	350	400	450	500	550	100	150	200	250	300	350	400	450	500	550
Standard grades																						
X10CrNi18-8	1.4310	+AT	210	200	190	185	180	180					230	215	205	200	195	195				
X2CrNi18-7	1.4318	+AT	265	200	185	180	170	165					300	235	215	210	200	195				
X2CrNi18-9	1.4307	+AT	147	132	118	108	100	94	89	85	81	80	181	162	147	137	127	121	116	112	109	108
X2CrNi19 11	1.4306	+AT	147	132	118	108	100	94	89	85	81	80	181	162	147	137	127	121	116	112	109	108
X2CrNi18 10	1.4311	+AT	205	175	157	145	136	130	125	121	119	118	240	210	187	175	167	161	156	152	149	147
X5CrNi18-10	1.4301	+AT	157	142	127	118	110	104	98	95	92	90	191	172	157	145	135	129	125	122	120	120
X6CrNiTi18-10	1.4541	+AT	176	167	157	147	136	130	125	121	119	118	208	196	186	177	167	161	156	152	149	147
X4CrNi18-12	1.4303	+AT	155	142	127	118	110	104	98	95	92	90	188	172	157	145	135	129	125	122	120	120
X2CrNiMo17-12 2	1.4404	+AT	166	152	137	127	118	113	108	103	100	98	199	181	167	157	145	139	135	130	128	127
X2CrNiMoN17-11-2	1.4406	+AT	211	185	167	155	145	140	135	131	128	127	246	218	198	183	175	169	164	160	158	157
X5CrNiMo17 12 2	1.4401	+AT	177	162	147	137	127	120	115	112	110	108	211	191	177	167	156	150	144	141	139	137
X6CrNiMoTi17-12-2	1.4571	+AT	185	177	167	157	145	140	135	131	129	127	218	206	196	186	175	169	164	160	158	157
X2CrNiMo17-12-3	1.4432	+AT	166	152	137	127	118	113	108	103	100	98	199	181	167	157	145	139	135	130	128	127
X2CrNiMo18-14-3	1.4435	+AT	165	150	137	127	119	113	108	103	100	98	200	180	165	153	145	139	135	130	128	127
X2CrNiMoN17-13-5	1.4439	+AT	225	200	185	175	165	155	150				255	230	210	200	190	180	175			
X1NiCrMoCu25 20 5	1.4539	+AT	205	190	175	160	145	135	125	115	110	105	235	220	205	190	175	165	155	145	140	135
Special grades																						
X5CrNi17-7	1.4319	+AT	157	142	127	118	110	104	98	95	92	90	191	172	157	145	135	129	125	122	120	120
X5CrNi19-9	1.4315	+AT	205	175	157	145	136	130	125	121	119	118	240	210	187	175	167	161	156	152	149	147
X1CrNi25-21	1.4335	+AT	150	140	130	120	115	110	105				180	170	160	150	140	135	130			
X6CrNiNb18-10	1.4550	+AT	177	167	157	147	136	130	125	121	119	118	211	196	186	177	167	161	156	152	149	147
X1CrNiMoN25-22-2	1.4466	+AT	195	170	160	150	140	135					225	205	190	180	170	165				
X6CrNiMoNb17 12 2	1.4580	+AT	186	177	167	157	145	140	135	131	129	127	221	206	196	186	175	169	164	160	158	157
X2CrNiMoN17-13-3	1.4429	+AT	211	185	167	155	145	140	135	131	129	127	246	218	198	183	175	169	164	160	158	157
X3CrNiMo17-13-3	1.4436	+AT	177	162	147	137	127	120	115	112	110	108	211	191	177	167	156	150	144	141	139	137
X2CrNiMoN18-12-4	1.4434	+AT	211	185	167	155	145	140	135	131	129	127	218	198	183	175	169	164	160	158	157	
X2CrNiMo18-15-4	1.4438	+AT	172	157	147	137	127	120	115	112	110	108	206	188	177	167	156	148	144	140	138	136

EN 10088-2:2005 (E)

Table 15 (continued)

X1CrNiMoCuN24-22-8	1.4652	+AT	350	320	315	310	300	295	295	285	280	275	390	370	355	345	335	330	330	320	310	305
X1CrNiSi18-15-4	1.4361	+AT	185	160	145	135	125	120	115				210	190	175	165	155	150				
X11CrNiMnN19-8-6	1.4369	+AT	295	260	230	220	205	185					325	295	265	250	230	205				
X12CrMnNiN17-7-5	1.4372	+AT	295	260	230	220	205	185					325	295	265	250	230	205				
X2CrMnNiN17-7-5	1.4371	+AT	275	235	190	180	165	145					305	265	220	205	180	165				
X12CrMnNiN18-9-5	1.4373	+AT	295	260	230	220	205	185					325	295	265	250	230	205				
X8CrMnCuNB17-8-3	1.4597	+AT	225	205	190	177	165	152	145	140	137	135	260	235	218	204	190	180	175	168	165	165
X1NiCrMoCu31-27-4	1.4563	+AT	190	175	160	155	150	145	135	125	120	115	220	205	190	185	180	175	165	155	150	145
X1CrNiMoCuN25-25-5	1.4537	+AT	240	220	200	190	180	175	170				270	250	230	220	210	205	200			
X1CrNiMoCuN20-18-7	1.4547	+AT	230	205	190	180	170	165	160	153	148		270	245	225	212	200	195	190	184	180	
X1CrNiMoCuNW24-22-6	1.4659	+AT	350	330	315	307	300	298	295	288	280	270	390	365	350	342	335	328	325	318	310	300
X1CrNiMoCuN25-20-7	1.4529	+AT	230	210	190	180	170	165	160				270	245	225	215	205	195	190			
X2CrNiMnMoN25-18-6-5	1.4565	+AT	350	310	270	255	240	225	210	210	210	200	400	355	310	290	270	255	240	240	240	230

^a +AT = solution annealed

) 1 MPa = 1 N/mm²

EN 10088-2:2005 (E)

Table 16 — Minimum values for the 0,2 %-proof strength of austenitic-ferritic steels at elevated temperatures

Steel designation Name	Number	Heat treatment condition ^a	Minimum 0,2 % proof strength, MPa ¹ , at a temperature (in °C) of			
			150	200	250	
Standard grades						
X2CrNiN23-4	1.4362	+AT	330	300	280	265
X2CrNiMoN22-5-3	1.4462	+AT	360	335	315	300
Special grades						
X2CrNiCuN23-4	1.4655	+AT	330	300	280	265
X2CrNiMoN29-7-2	1.4477	+AT	500	460	430	400
X2CrNiMoCuN25-6-3	1.4507	+AT	450	420	400	380
X2CrNiMoN25-7-4	1.4410	+AT	450	420	400	380
X2CrNiMoCuWN25-7-4	1.4501	+AT	450	420	400	380
X2CrNiMoSi18-5-3	1.4424	+AT (t ≤ 20)	370	350	330	325
		+AT (20 < t ≤ 75)	320	305	290	285

^a +AT = solution annealed
1 MPa = 1 N/mm²

Table 17 — Tensile strength levels in the cold worked condition (process route 2H)

Symbol	Tensile strength ^{a,b} MPa ¹
+C700	700 to 850
+C850	850 to 1000
+C1000	1000 to 1150
+C1150	1150 to 1300
+C1300	1300 to 1500

^a Intermediate tensile strength values may be agreed. Alternatively, the steels may be specified in terms of minimum 0,2 %-proof strength (see Tables 18 and 20) or hardness, but only one parameter can be specified in the order

^b Maximum product thickness for each tensile strength level decreases with the tensile strength. The maximum product thickness and remaining elongation are also dependent on the work hardening behaviour of the steel and the cold working conditions. Consequently, more exact information may be requested from the manufacturer

1 MPa = 1 N/mm²

EN 10088-2:2005 (E)

Table 18 — 0,2 %-proof strength levels in the cold worked condition (process route 2H)

Symbol	0,2 %-proof strength ^{a,b} MPa
+CP350	350 to 500
+CP500	500 to 700
+CP700	700 to 900
+CP900	900 to 1100
+CP1100	1100 to 1300
^a Intermediate proof strength values may be agreed	
^b Maximum product thickness for each proof strength level decreases with the proof strength	
^c) 1 MPa = 1 N/mm ²	

Table 19 — Available tensile strength levels of steel grades in the cold worked condition (process route 2H)

Steel designation		Available tensile strength level				
Name	Number	+C700	+C850	+C1000	+C1150	+C1300
Standard grades						
X6Cr17	1.4016	X	X			
X10CrNi18-8	1.4310	X	X	X	X	X ^a
X2CrNi18-7	1.4318		X	X		
X5CrNi18-10	1.4301	X	X	X	X	X
X6CrNiTi18-10	1.4541	X	X			
X5CrNiMo17-12-2	1.4401	X	X ^a			
X6CrNiMoTi17-12-2	1.4571	X	X			
Special grades						
X6CrNiNb18-10	1.4550	X	X			
X12CrMnNiN17-7-5	1.4372		X	X	X	X ^b
X2CrMnNiN17-7-5	1.4371	X	X			
X12CrMnNiN18-9-5	1.4373	X	X			
X11CrNiMnN19-8-6	1.4369		X	X		
X8CrMnCuNB17-8-3	1.4597	X	X	X		

For higher R_m -values see EN 10151

Higher values up to tensile strength level +C1500 may be agreed

EN 10088-2:2005 (E)

Table 20 — Available 0,2 %-proof strength levels of steel grades in the cold worked condition (process route 2H)

Steel designation		Available 0,2 %-proof strength level				
Name	Number	P350	+CP500	+CP700	+CP900	+CP1 0
Standard grades						
X6Cr17	1.4016	X	X			
X10CrNi18-8	1.4310		X	X	X	X ^a
X2CrNiN18-7	1.4318		X	X		
X5CrNi18-10	1.4301	X	X	X	X	X
X6CrNiTi18-10	1.4541	X	X			
X5CrNiMo17-12-2	1.4401	X	X ^a			
X6CrNiMoTi17-12-2	1.4571	X	X			
Special grades						
X6CrNiNb18-10	1.4550	X	X			
X12CrMnNiN17-7-5	1.4372		X	X	X	X ^b
X2CrMnNiN17-7-5	1.4371		X	X		
X12CrMnNiN18-9-5	1.4373		X	X		
X11CrNiMn19-8-6	1.4369		X	X	X	X
X8CrMnCuNB17-8-3	1.4597	X	X	X		

^a For higher $R_{p0,2}$ values see EN 10151

^b Higher values up to proof strength level +CP1300 may be agreed

EN 10088-2:2005 (E)

Table 21 — Tests to be carried out, test units and extent of testing in specific testing

Test	a	Test unit	Product form		Number of test pieces per test sample	
			Strip and sheet cut from strip (C, H) in rolling width < 600 mm ≥ 600 mm	Rolled plate (P)		
Chemical analysis	m	Cast	The cast analysis is given by the manufacturer. ^b			
Tensile test at room temperature	m ^c	Same cast, same nominal thickness ± 10 %, same final treatment condition (i.e. same heat treatment and/or same degree of cold deformation)	The extent of testing shall be agreed at the time of ordering	1 test sample from each coil	a) Plates processed under identical conditions may be collected into a batch with a maximum total weight of 30000 kg comprising no more than 40 plates. One test sample per batch shall be taken from heat treated plates up to 15 m in length. One test sample shall be taken from each end of the longest plate in the batch where heat treated plates are longer than 15 m b) If the plate cannot be tested in batches, one test sample shall be taken from one end from heat treated plates up to 15 m long and one test sample shall be taken from each end of heat treated plates longer than 15 m	1
Hardness test on martensitic steels ^d	m ^{e,f}		To be agreed at the time of ordering (see Table 8)			
Tensile test at elevated temperature	o		To be agreed at the time of ordering (see Tables 12 to 16)			
Impact test at room temperature	o ^g		To be agreed at the time of ordering (see Tables 8, 10 and 11)		3	
Resistance to intergranular corrosion	o ^h		To be agreed at the time of ordering if intergranular corrosion is a hazard (see Tables 7, 10 and 11)			

^a Tests marked with a "m" (mandatory) shall be carried out as specific tests in all cases. Those marked with an "o" (optional) shall be carried out as specific tests only if agreed at the time of enquiry and order

^b Product analysis may be agreed at the time of enquiry and order; the extent of testing shall be specified at the same time

^c Except for martensitic steels in heat treatment condition +A (see, however, footnote e)

^d Hardness test on annealed martensitic steels is to be performed on the product surface

^e Mandatory for heat treatment condition +A. However, in cases of dispute or at the manufacturer's discretion, the tensile test may be carried out.

^f Mandatory for product form C in heat treatment condition +QT

^g For austenitic steels, the impact test is normally not carried out (see NOTE in 6. 5.1)

^h Test for resistance to intergranular corrosion is normally not carried out

EN 10088-2:2005 (E)

Table 22 — Marking of the products

Marking of:	Products	
	with specific testing ^a	without specific testing ^a
Manufacturer's name, trade mark or logo	+	+
The number of this document	(+)	(+)
Steel number or name	+	+
Type of finish	(+)	(+)
Cast number	+	+
Identification number ^b	+	(+)
Direction of rolling ^c	(+)	(+)
Nominal thickness	(+)	(+)
Nominal dimensions other than thickness	(+)	(+)
Inspector's mark	(+)	
Customer's order No	(+)	(+)

^a Symbols in the table mean

= the marking shall be applied;

(+) = the marking shall be applied if so agreed, or at the manufacturer's discretion

= no marking necessary

^b If specific tests are to be carried out, the numbers or letters used for identification shall allow the product(s) to be related to the relevant inspection certificate

^c Direction of rolling is normally obvious from the shape of the product and the position of the marking. Marking may either be longitudinally applied by roller stamping or it may be near to one end of the piece and transverse to the rolling direction. A specific separate indication of the principal rolling direction will not normally be required, but may be requested by the customer

Annex A (informative)

Guidelines for further treatment (including heat treatment) in fabrication

- A.1** The guidelines given in Tables A.1 to A.5 are intended for hot forming and heat treatment
- A.2** Flame cutting may adversely affect edge areas; where necessary, they should be machined
- A.3** As the corrosion resistance of stainless steels is only ensured with a metallurgically clean surface, layers of scale and annealing colours produced during hot forming, heat treatment or welding should be removed as far as possible before use. Finished parts made of steels with approximately 13 % Cr also require the best surface condition (e.g. polished) in order to achieve maximum resistance to corrosion

Table A.1 — Guidelines on the temperatures for hot forming and heat treatment ^a of ferritic corrosion resisting steels

Steel designation Name		Hot forming		Heat treatment symbol	Annealing	
		Temperature °C	Type of co		Temperature ^b °C	Type of co
Standard grades						
X2CrNi12	1.4003	1100 to 800	air	+A	700 to 760	
X2CrTi12	1.4512				770 to 830	
X6CrNiTi12	1.4516				790 to 850	
X6Cr13	1.4000				750 to 810	
X6CrAl13	1.4002				750 to 810	
X6Cr17	1.4016				770 to 830	
X3CrTi17	1.4510				770 to 830	
X3CrNb17	1.4511				790 to 850	
X6CrMo17-1	1.4113				790 to 850	
X2CrMoTi18-2	1.4521				820 to 880	
Special grades						
X2CrTi17	1.4520	1100 to 800	air	+A	820 to 880	
X1CrNb15	1.4595				770 to 830	
X2CrMoTi17-1	1.4513				820 to 880	
X6CrNi17-1	1.4017				750 to 810	
X5CrNiMoTi15-2	1.4589				750 to 800	
X6CrMoNb17-1	1.4526				800 to 860	
X2CrNbZr17	1.4590				870 to 930	
X2CrTiNb18	1.4509				870 to 930	
X2CrMoTi29-4	1.4592				900 to 1000	
^a Temperature of annealing shall be agreed for simulated heat-treated test-pieces ^b If heat-treatment is carried out in a continuous furnace, the upper part of the range specified is usually preferred, or even exceeded						

EN 10088-2:2005 (E)

Table A.2 — Guidelines on the temperatures for hot forming and heat treatment ^a of martensitic corrosion resisting steels

Steel designation		Hot forming		Heat treatment symbol	Annealing		Quenching		Tempering Temperature °C	
Name	Number	Temperature °C	Type of cooling		Temperature ^b °C	Type of cooling	Temperature ^b °C	Type of cooling		
X12Cr13	1.4006	1100 to 800	air	+A	750 to 810					
				+QT550			950 to 1010	oil, air	700 to 780	
				+QT650					620 to 700	
+A	750 to 810									
+QT550					950 to 1050	oil, air	700 to 780			
+QT650							660 to 700			
X15Cr13	1.4024		1100 to 800	air	+A	750 to 810				
X20Cr13	1.4021				+QT			950 to 1050		200 to 350
					+QT650				oil, air	700 to 780
					+QT750			950 to 1010		620 to 700
X30Cr13	1.4028	+A			730 to 790					
		+QT					950 to 1050	oil, air	200 to 350	
		+QT800				950 to 1010		650 to 730		
X39Cr13	1.4031	1100 to 800		slow cooling	+A	730 to 790				
					+QT			1000 to 1100	oil, air	200 to 350
X46Cr13	1.4034				+A	730 to 790				
			+A		750 to 830					
X38CrMo14	1.4419		+QT				1000 to 1100	oil, air	200 to 350	
			X55CrMo14		1.4110	+A	750 to 830			
+QT						1000 to 1100	oil, air	200 to 350		
X50CrMoV15	1.4116		1150 to 900	air	+A	770 to 830				
X39CrMo17-1	1.4122				+A	770 to 830				
					+QT			1000 to 1100	oil, air	200 to 350
X1CrNiMoCu12-5-2	1.4422	+A			900 to 1000					
		+QT800					900 to 1050	oil, air	600 to 640	
X1CrNiMoCu12-7-3	1.4423	+A			900 to 1000					
		+QT800				900 to 1050	oil, air	600 to 640		
X3CrNiMo13-4	1.4313	+QT780						560 to 640		
		+QT900				950 to 1050	oil, air, water	510 to 590		
X4CrNiMo16-5-1	1.4418	+QT840				900 to 1000		570 to 650		

^a Temperatures of annealing, quenching and tempering shall be agreed for simulated heat-treated test pieces

^b If heat treatment is carried out in a continuous furnace, the upper part of the range specified is usually preferred, or even exceeded

EN 10088-2:2005 (E)

Table A.3 — Guidelines on the temperatures for hot forming and heat treatment ^a of precipitation hardening corrosion resisting steels

Steel designation		Hot forming		Heat treatment symbol	Stress relieving		Solution annealing		Precipitation hardening
Name	Number	Temperature °C	Type of cooling		Temperature °C	Type of cooling	Temperature ^b °C	Type of cooling	Temperature °C
Special grades									
X5CrNiCuNb16-4	1.4542	1150	Air	+AT		1025 to 1055	air		
				+P850				4 h (610 to 630)	
				+P900				1 h (590 to 610)	
				+P950	1025 to 1055	air	1 h (580 to 600)		
				+P1070			1 h (540 to 560)		
				+P1300			1 h (470 to 490)		
				+SR630	≥ 4 h (600 to 660) ^c				
X7CrNiAl17-7	1.4568			+AT		1030 to 1050	air		
				+P1450		10 min 945 to 965	d	1 h (500 to 520)	
^a Temperatures of solution annealing shall be agreed for simulated heat-treated test pieces ^b If heat treatment is carried out in a continuous furnace, the upper part of the range specified is usually preferred, or even exceeded ^c After martensitic transformation. Solution annealing at 1025°C to 1055°C will be necessary before precipitation hardening ^d Quick cooling to ≤ 20 °C; cooling within 1 h to -70 °C; holding time 8 h; reheating in air to +20 °C									

EN 10088-2:2005 (E)

Table A.4 — Guidelines on the temperatures for hot forming and heat treatment ^a of austenitic corrosion resisting steels

Steel designation Name	Hot forming		Heat treatment symbol	Solut on annealing			
	Temperature °C	Type of cooling		Temperature ^{b,c,d} °C	Type of cooling		
Standard grades							
X10CrNi18-8	1.4310	1150 to 850	air	+AT	1010 to 1090		
X2CrNiN18 7	1.4318				1020 to 1100		
X2CrNi18-9	1.4307				1000 to 1100		
X2CrNi19 11	1.4306				1000 to 1100		
X2CrNiN18-10	1.4311				1000 to 1100		
X5CrNi18 10	1.4301				1000 to 1100		
X8CrNiS18-9	1.4305				1000 to 1100	water, air ^e	
X6CrNiTi18 10	1.4541				1000 to 1100		
X4CrNi18 12	1.4303				1000 to 1100		
X2CrNiMo17 12 2	1.4404				1030 to 1110		
X2CrNiMoN17 11 2	1.4406				1030 to 1110		
X5CrNiMo17 12 2	1.4401				1030 to 1110		
X6CrNiMoTi17 12-2	1.4571				1030 to 1110		
X2CrNiMo17-12-3	1.4432				1030 to 1110		
X2CrNiMo18-14-3	1.4435				1030 to 1110		
X2CrNiMoN17-13-5	1.4439				1060 to 1140		
X1NiCrMoCu25-20-5	1.4539	1060 to 1140					
Special grades							
X5CrNiN17 7	1.4319	1150 to 850	air	+AT	1000 to 1100		
X5CrNiN19 9	1.4315				1000 to 1100		
X1CrNi25-21	1.4335				1030 to 1110		
X6CrNiNb18-10	1.4550				1020 to 1120		
X1CrNiMoN25-22-2	1.4466				1070 to 1150		
X6CrNiMoNb17-12-2	1.4580				1030 to 1110		
X2CrNiMoN17 13 3	1.4429				1030 to 1110		
X3CrNiMo17 13 3	1.4436				1030 to 1110		
X2CrNiMoN18 12 4	1.4434				1070 to 1150		
X2CrNiMo18-15-4	1.4438				1070 to 1150		
X1CrNiMoCuN24-22-8	1.4652				1200 to 1000	1150 to 1200	water, air ^e
X1CrNiSi18-15-4	1.4361				1100 to 1160		
X11CrNiMnN19-8-6	1.4369				1000 to 1100		
X12CrMnNiN17-7-5	1.4372				1000 to 1100		
X2CrMnNiN17 7 5	1.4371	1000 to 1100					
X12CrMnNiN18 9 5	1.4373	1150 to 850	1000 to 1100				
X8CrMnCuNB17-8-3	1.4597	1000 to 1100					
X1NiCrMoCu31-27-4	1.4563	1070 to 1150					
X1CrNiMoCuN25-25-5	1.4537	1120 to 1180					
X1CrNiMoCuN20 18 7	1.4547	1200 to 1000	1150 to 1200				
X1CrNiMoCuNW24-22-6	1.4659	1140 to 1200					
X1NiCrMoCuN25 20 7	1.4529	1150 to 850	1120 to 1180				
X2CrNiMnMoN25-18-6-5	1.4565	1200 to 950	1120 to 1170				
^a Temperatures of solution annealing shall be agreed for simulated heat-treated test pieces ^b Solution annealing may be omitted if the conditions for hot working and subsequent cooling are such that the requirements for the mechanical properties of the product and the resistance to intergranular corrosion as defined in EN ISO 3651-2 are obtained ^c If heat treatment is carried out in a continuous furnace, the upper part of the range specified is usually preferred, or even exceeded ^d Lower end of the range specified for solution annealing should be aimed at the heat treatment as part of further processing, because otherwise the mechanical properties might be affected. If the temperature of hot forming does not drop below the lower temperature for solution annealing, a temperature of 980°C is adequate as a lower limit for Mo-free steels, a temperature of 1000°C for steels with Mo contents up to 3 % and a temperature of 1020°C for steels with Mo contents exceeding 3 % ^e Cooling sufficiently rapidly in order to avoid the occurrence of intergranular corrosion as defined in EN ISO 3651-2							

EN 10088-2:2005 (E)

Table A.5 — Guidelines on the temperatures for hot forming and heat treatment ^a of austenitic-ferritic corrosion resisting steels

Steel designation		Hot forming		Heat treatment symbol	Solution annealing	
Name	Number	Temperature °C	Type of cooling		Temperature ^b °C	Type of cooling
Standard grades						
X2CrNiN23-4	1.4362	1150 to 950	air	+AT	950 to 1050	water, air ^c
X2CrNiMoN22-5-3	1.4462				1020 to 1100	
Special grades						
X2CrNiCuN23-4	1.4655	1150 to 1000	air	+AT	950 to 1050	water, air ^c
X2CrNiMoN29-7-2	1.4477				1040 to 1120	
X2CrNiMoCuN25-6-3	1.4507					
X2CrNiMoN25-7-4	1.4410					
X2CrNiMoCuWN25-7-4	1.4501					
X2CrNiMoSi18-5-3	1.4424	1000 to 1100				
^a Temperatures of solution annealing shall be agreed for simulated heat-treated test pieces ^b If heat treatment is carried out in a continuous furnace, the upper part of the range specified is usually preferred or even exceeded ^c Cooling sufficiently rapidly in order to avoid precipitation						

EN 10088-2:2005 (E)

Annex B
(informative)

Applicable dimensional standards

EN 10029, *Hot rolled steel plates 3 mm thick or above - Tolerances on dimensions, shape and mass*

EN 10048, *Hot rolled narrow steel strip - Tolerances on dimensions and shape*

EN 10051, *Continuously hot rolled uncoated plate, sheet and strip of non alloy and alloy steels – Tolerances on dimensions and shape (includes amendment A1:1997)*

EN 10258, *Cold-rolled stainless steel narrow strip and cut lengths - Tolerances on dimensions and shape*

EN 10259, *Cold-rolled stainless steel wide strip and plate/sheet - Tolerances on dimensions and shape*

Bibliography

- [1] EN 10028-7, *Flat products made of steels for pressure purposes – Part 7: Stainless steels*
- [2] EN 10095, *Heat resisting steels and nickel alloys*
- [3] EN 10151, *Stainless steel strip for springs – Technical delivery conditions*
- [4] EN 10163-1, *Delivery requirements for surface condition of hot rolled steel plates, wide flats and sections - Part 1: General requirements*
- [5] EN 10302, *Creep resisting steels, nickel and cobalt alloys*
- [6] CR 10261, *ECISS Information Circular 11 - Iron and steel – Review of available methods of chemical analysis*

BSI — British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover.
Tel: +44 (0)20 8996 9000. Fax: +44 (0)20 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards

Buying standards

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: +44 (0)20 8996 9001.
Fax: +44 (0)20 8996 7001. Email: orders@bsi-global.com. Standards are also available from the BSI website at <http://www.bsi-global.com>

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested

Information on standards

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact the Information Centre.
Tel: +44 (0)20 8996 7111. Fax: +44 (0)20 8996 7048. Email: info@bsi-global.com

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration.
Tel: +44 (0)20 8996 7002. Fax: +44 (0)20 8996 7001.
Email: membership@bsi-global.com.

Information regarding online access to British Standards via British Standards Online can be found at <http://www.bsi-global.com/bsonline>.

Further information about BSI is available on the BSI website at <http://www.bsi-global.com>.

Copyright

Copyright subsists in all BSI publications. BSI also holds the copyright, in the UK, of the publications of the international standardization bodies. Except as permitted under the Copyright, Designs and Patents Act 1988 no extract may be reproduced, stored in a retrieval system or transmitted in any form or by any means – electronic, photocopying, recording or otherwise – without prior written permission from BSI.

This does not preclude the free use, in the course of implementing the standard, of necessary details such as symbols, and size, type or grade designations. If these details are to be used for any other purpose than implementation then the prior written permission of BSI must be obtained

Details and advice can be obtained from the Copyright & Licensing Manager.
Tel: +44 (0)20 8996 7070. Fax: +44 (0)20 8996 7553.
Email: copyright@bsi-global.com.