Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

BRITISH STANDARD

BS EN
10088-3:2005

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

SAKY STEEL CO., LTD

The European Standard EN 10088-3:2005 has the status of a British Standard

ICS 77.140.50; 77.140.65; 77.140.20

NO COPYING WITHOUT BSI PERMISSION EXCEPT AS PERMITTED BY COPYRIGHT LAW

BSI
British Standards

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

National foreword

This British Standard is the official English language version of EN 10088-3:2005. It supersedes BS 1554:1990 and BS EN 10088-3:1995 which is withdrawn.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.

SAKY STEEL CO., LTD

Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 55 and a back cover.

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

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 46337 0

Amendments issued since publication

Amd. No.	Date	Comments

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 10088-3

June 2005

ICS 77.140.50; 77.140.65; 77.140.20

Supersedes EN 10088-3:1995

English version

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

Aciers inoxydables - Partie 3 : Conditions techniques de livraison pour les demi-produits, barres, fils machines, fils tréfilés, profils et produits transformés à froid en acier résistant à la corrosion pour usage général

Nichtrostende Stähle - Teil 3: Technische Lieferbedingungen für Halbzeug, Stäbe, Walzdraht, gezogenen Draht, Profile und Blankstahlerzeugnisse 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.

SAKY STEEL CO., LTD

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.

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

Contents

Page

Foreword 3

1 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 8
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 9
7.1 General 9
7.2 Agreement on tests and inspection documents 9
7.3 Specific inspection and testing 9
7.4 Test methods 10
7.5 Retests 10

8 Marking 11

Annex A (informative) Guidelines for further treatment (including heat treatment) in fabrication 46

Annex B (informative) Availability of corrosion resistant steel wire in the cold work-hardened condition 52

Annex C (informative) Applicable dimensional standards 54

Bibliography 55

SAKY STEEL CO., LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

Foreword

This document (EN 10088-3:2005) 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 10088-3:1995.

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 implement this European Standard: 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.

SAKY STEEL CO., LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

1 Scope

1.1 This part of EN 10088 specifies the technical delivery conditions for semi-finished products, hot or cold formed bars, rods, wire, sections and bright products 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 10163-3, *Delivery requirements for surface condition of hot rolled steel plates, wide flats and sections - Part 3: Sections.*

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

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

EN 10221, *Surface quality classes for hot-rolled bars and rods - Technical delivery conditions.*

EN 10306, *Iron and steel - Ultrasonic testing of H beams with parallel flanges and IPE beams.*

EN 10308, *Non destructive testing - Ultrasonic testing of steel bars.*

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

SAKY STEEL CO., LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

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 sulphuric acid (ISO 3651-2:1998).*

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

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

ISO 286-1, *ISO system of limits and fits – Part 1: Bases of tolerances, deviations and fits.*

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

SAKY STEEL CO., LTD

4 Designation and ordering

4.1 Designation of steel grades

The steel names and steel numbers (see Tables 2 to 5) 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:

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

— desired quantity;

— product form (e. g. round bars, square bars or rod);

— where an appropriate dimensional standard is available (see Table 7 and Annex C) 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 condition (see symbols in Table 7);

— if a verification of internal soundness is required, products shall be tested in accordance with EN 10306 or EN 10308;

— if an inspection document is required, its designation in accordance with EN 10204.

EXAMPLE 10 t round bars of a steel grade with the name X5CrNi18-10 and the number 1.4301 as specified in EN 10088-3 of 50 mm diameter, dimensional tolerances as specified in EN 10060, in condition 1D (see Table 7), inspection document 3.1 as specified in EN 10204:

10 t round bars EN 10060-50
Steel EN 10088-3-X5CrNi18-10+1D
Inspection document 3.1

or

10 t round bars EN 10060-50
Steel EN 10088-3-1.4301+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.

SAKY STEEL CO., LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

6 Requirements

6.1 Steelmaking process

Unless otherwise agreed at the time of enquiry and order, the steelmaking and manufacturing 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 conditions given in Table 7 and, where different alternatives exist, to the treatment conditions given in Tables 8 to 19 and 25 (see also Annex A).

6.3 Chemical composition

6.3.1 The chemical composition requirements given in Tables 2 to 5 apply in respect of 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 2 to 5 by the values listed in Table 6.

6.4 Chemical corrosion properties

Referring to resistance to intergranular corrosion as defined in EN ISO 3651-2, for ferritic, austenitic and austenitic-ferritic stainless steels the specifications in Tables 8, 11 and 12 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 dependent 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 8 to 12 apply for hot worked products of every condition, condition 1U and semi-finished products excluded, for cold processed products in condition 2D (excluding wire), and for each specified heat treatment condition.

For cold processed products of every specified condition, condition 2D and wire excluded, and each specified heat treatment condition, the mechanical properties at room temperature as specified in Tables 13 to 17 apply. For these products, the condition is the prime property with the mechanical properties secondary.

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 8 to 17 shall be obtained from reference test pieces which have received the appropriate heat treatment (simulated heat treatment).

For wire, the properties as specified in Tables 18 and 19 apply.

For bars which are intentionally cold work hardened in order to increase their tensile strength to a specified level, the mechanical properties at room temperature as specified in Table 25 apply. For these products, the mechanical properties are prime, with the condition a secondary property.

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.

SAKY STEEL CO., LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

6.5.2 The values in Tables 20 to 24 apply for the 0,2 %- and 1 %- proof strength at elevated temperatures.

6.6 Surface quality

The available surface finishes are given in Table 7. Slight surface imperfections, inherent to the rolling process, are permitted. Exact requirements concerning maximum depth of acceptable defects for bars, rods and sections in the relevant conditions are given in Table 1.

Table 1 — Maximum depth of acceptable defect for bars, rods and sections

Conditions	Product forms	Permissible defect depth[a]	Max. % of delivered weight in excess of permissible defect depth
1U, 1C, 1E, 1D	Sections	To be agreed upon at the time of enquiry and order on the basis of EN 10163-3.	
1U, 1C, 1E, 1D	Rounds and rod	To be agreed upon at the time of enquiry and order on the basis of EN 10221.	
1X[b], 2H[b], 2D[b]	Rounds	- max. 0,2 mm for $d \leq 20$ mm - max. 0,01 d for $20 < d \leq 75$ mm - max. 0,75 mm for $d > 75$ mm	1 %
	Hexagons	- max. 0,3 mm for $d \leq 15$ mm - max. 0,02 d for $15 < d \leq 63$ mm	2 %
	Other bars	- max. 0,3 mm for $d \leq 15$ mm - max. 0,02 d for $15 < d \leq 63$ mm	4 %
1G, 2B, 2G, 2P	Rounds	Technically defect free by manufacture.	0,2 %

[a] Defect depth is understood as being the distance, measured normally to the surface, between the bottom of the defect and that surface.

[b] At the time of enquiry and order it may be agreed that the product shall be delivered with a surface being technically defect free by manufacture. In this case, also the maximum % of delivered weight in excess of permissible defect depth shall be agreed.

For further information, e.g. roughness in conditions 2G and 2P, see Table 7.

6.7 Internal soundness

The products shall be free of internal defects which would exclude them from being used for their usual purpose. At the time of enquiry and order ultrasonic testing of H-beams with parallel flanges and IPE-beams may be agreed in accordance with EN 10306 and ultrasonic testing of steel bars may be agreed in accordance with EN 10308.

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 are to be agreed at the time of enquiry and order, as far as possible with reference to the dimensional standards listed in Table 7 and in Annex C.

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.

SAKY STEEL CO., LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

6.10.2 If the tolerances on mass are not specified in the dimensional standard listed in Table 7 or in Annex C, 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.

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 26, second column, by 'm';

d) results 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 26.

SKY STEEL CO., LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

7.3.2 Selection and preparation of samples

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 samples for the tensile test shall be taken in accordance with Figures 1 to 3. If it has been agreed that impact tests shall be carried out, the samples shall be taken from the same location.

The samples shall be taken from products in the delivery condition. If agreed, samples from bars may be taken before straightening. 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.

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, this generally being with proportional test pieces having a gauge length $L_0 = 5{,}65\sqrt{S_0}$. (S_0 = cross-section of the parallel length). In cases of doubt and in referee testing these test pieces shall be used.

For wire of nominal diameter < 4 mm, the tensile test is made directly on the product using a gauge length of 100 mm.

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.

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.

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.

SAKY STEEL CO., LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

8 Marking

8.1 Marking shall be durable.

8.2 Unless otherwise agreed, the requirements listed in Table 27 apply.

8.3 Unless otherwise agreed, the products shall be marked as follows:

— semi-finished products, bars and sections in thicknesses over 35 mm by inking, adhesive labels, electrolytic etching or stamping;

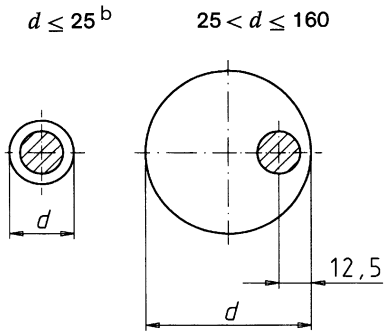
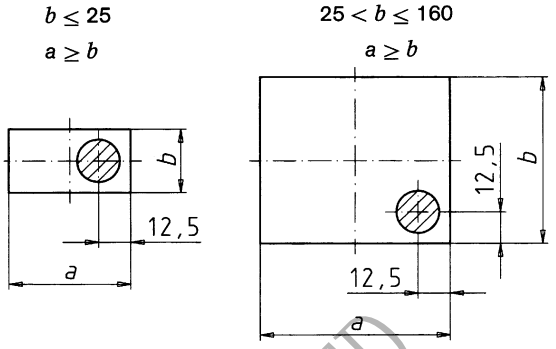
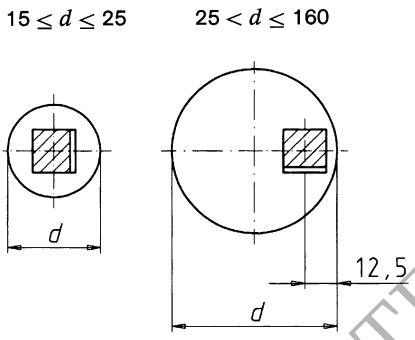
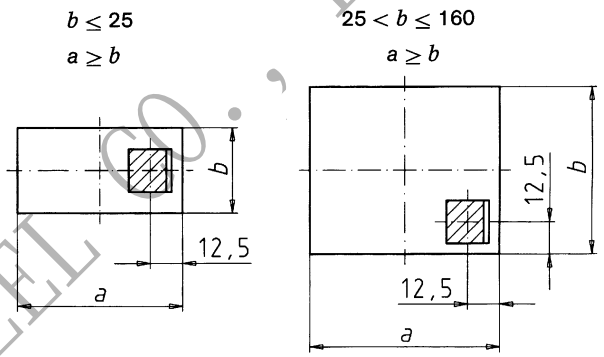
— bars and sections in thicknesses up to 35 mm by labels attached to the bundle or by means of the possibilities listed in the first hyphen;

— rods by means of a label attached to the coil.

NOTE If the marking is to be applied by inking or adhesive label, the inks or adhesives should be carefully selected to ensure that resistance to corrosion is not impaired.

SAKY STEEL CO., LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

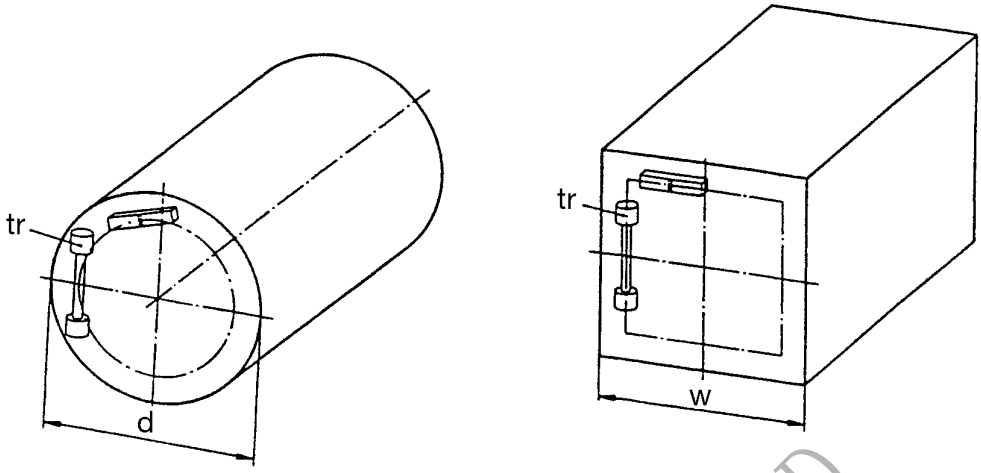
Type of test	Round cross-section products	Rectangular cross-section products
Tensile		
Impact [a]		

[a] For products of a round cross-section, the axis of the notch is parallel to a diameter; for products with a rectangular cross-section, the axis of the notch is perpendicular to the greatest rolled surface.

[b] Samples of product may alternatively be tested unmachined, in accordance with EN ISO 377.

Figure 1 — Position of test pieces for steel bars and rods ≤ 160 mm diameter or thickness (longitudinal test pieces)

SAKY STEEL CO., LTD



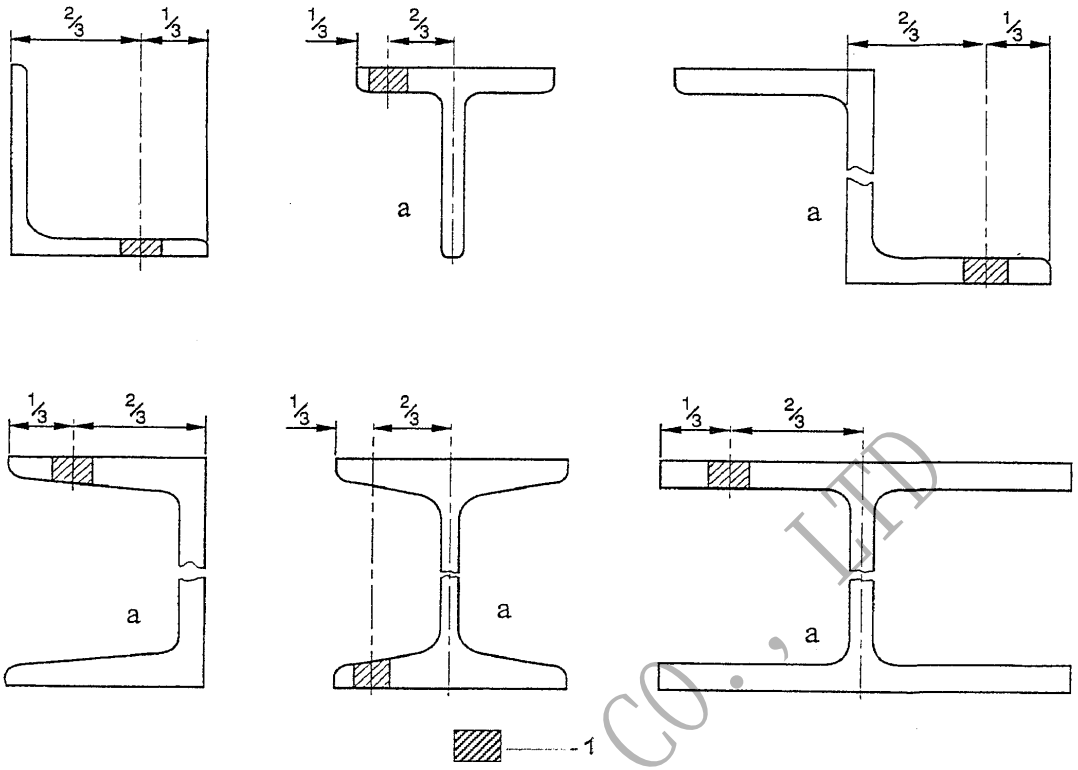
Key
tr transverse

NOTE The axis of the notch on the impact test pieces should be radial in the case of round steel bars, and perpendicular to the nearest rolled surface for rectangular bars.

Figure 2 — Position of test pieces for steel bars > 160 mm diameter or thickness (transverse test pieces)

SAKY STEEL CO., LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI



KEY

1 Location of sample

[a] By agreement, the sample can be taken from the web, at a quarter of the total height.

NOTE The axis of the notch on the impact test pieces should be perpendicular to the outside surface of the section.

Figure 3 — Position of test pieces for beams, channels, angles, T sections and Z sections

SAKY STEEL CO., LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

Table 2 — Chemical composition (cast analysis)[a] of ferritic corrosion resisting steels

Steel designation		% by mass										
Name	Number	C max.	Si max.	Mn max.	P max.	S	N max.	Cr	Mo	Ni	Ti	Others
Standard grades												
X2CrNi12	1.4003	0,030	1,00	1,50	0,040	≤ 0,030[b]	0,030	10,5 to 12,5	-	0,30 to 1,00	-	-
X6Cr13	1.4000	0,08	1,00	1,00	0,040	≤ 0,030[b]	-	12,0 to 14,0	-	-	-	-
X6Cr17	1.4016	0,08	1,00	1,00	0,040	≤ 0,030[b]	-	16,0 to 18,0	-	-	-	-
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	≤ 0,030[b]	-	16,0 to 18,0	0,90 to 1,40	-	-	-
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	-
X3CrNb17	1.4511	0,05	1,00	1,00	0,040	≤ 0,030[b]	-	16,0 to 18,0	-	-	-	Nb: 12xC to 1,00
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	-	0,30 to 0,80	(C + N) ≤ 0,040
X6CrMoNb17-1	1.4526	0,08	1,00	1,00	0,040	≤ 0,015	0,040	16,0 to 18,0	0,80 to 1,40	-	-	Nb:[7x(C+N)+ 0,10] to 1,00
X2CrTiNb18	1.4509	0,030	1,00	1,00	0,040	≤ 0,015	-	17,5 to 18,5	-	-	0,10 to 0,60	Nb:[(3xC)+0,30] to 1,00

[a] Elements not quoted in this table may 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.

SAKY STEEL CO., LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

Table 3 — Chemical composition (cast analysis)[a] of martensitic and precipitation hardening corrosion resisting steels

Steel designation		% by mass										
Name	Number	C	Si max.	Mn	P max.	S	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	≤ 0,030[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	≤ 0,030[b]	12,0 to 14,0	-	-	-	-	-
X20Cr13	1.4021	0,16 to 0,25	1,00	≤ 1,50	0,040	≤ 0,030[b]	12,0 to 14,0	-	-	-	-	-
X30Cr13	1.4028	0,26 to 0,35	1,00	≤ 1,50	0,040	≤ 0,030[b]	12,0 to 14,0	-	-	-	-	-
X39Cr13	1.4031	0,36 to 0,42	1,00	≤ 1,00	0,040	≤ 0,030[b]	12,5 to 14,5	-	-	-	-	-
X46Cr13	1.4034	0,43 to 0,50	1,00	≤ 1,00	0,040	≤ 0,030[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	-	-	-
X50CrMoV15	1.4116	0,45 to 0,55	1,00	≤ 1,00	0,040	≤ 0,030[b]	14,0 to 15,0	-	0,50 to 0,80	-	-	V: 0,10 to 0,20
X55CrMo14	1.4110	0,48 to 0,60	1,00	≤ 1,00	0,040	≤ 0,030[b]	13,0 to 15,0		0,50 to 0,80			V: ≤ 0,15
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	≤ 0,030[b]	15,5 to 17,5	-	0,80 to 1,30	-	≤ 1,00	-
X17CrNi16-2	1.4057	0,12 to 0,22	1,00	≤ 1,50	0,040	≤ 0,030[b]	15,0 to 17,0	-	-	-	1,50 to 2,50	-
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	≤ 0,030[b]	15,0 to 17,0	-	0,80 to 1,50	-	4,0 to 6,0	N: ≥ 0,020
Standard grades (Precipitation hardening steels)												
X5CrNiCuNb16-4	1.4542	≤ 0,07	0,70	≤ 1,50	0,040	≤ 0,030[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
X5CrNiMoCuNb14-5	1.4594	≤ 0,07	0,70	≤ 1,00	0,040	≤ 0,015	13,0 to 15,0	1,20 to 2,00	1,20 to 2,00	0,15 to 0,60	5,0 to 6,0	-
Special grades (Martensitic steels)[c]												
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	-	-	-
X46CrS13	1.4035	0,43 to 0,50	1,00	≤ 2,00	0,040	0,15 to 0,35	12,5 to 14,0	-	-	-	-	-
X70CrMo15	1.4109	0,60 to 0,75	0,70	≤ 1,00	0,040	≤ 0,030[b]	14,0 to 16,0	-	0,40 to 0,80	-	-	-

SAKY STEEL CO., LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

Table 3 (*continued*)

Steel designation		% by mass										
Name	Number	C	Si max.	Mn	P max.	S	Cr	Cu	Mo	Nb	Ni	Others
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
X105CrMo17	1.4125	0,95 to 1,20	1,00	≤ 1,00	0,040	≤ 0,030[b]	16,0 to 18,0	-	0,40 to 0,80	-	-	-
X90CrMoV18	1.4112	0,85 to 0,95	1,00	≤ 1,00	0,040	≤ 0,030[b]	17,0 to 19,0	-	0,90 to 1,30	-	-	V: 0,07 to 0,12
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
Special grades (Precipitation hardening steels)												
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
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: 0,0010 to 0,010 Al: ≤ 0,35 Ti: 1,90 to 2,30 V: 0,10 to 0,50

[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 %.

SAW STEEL CO., LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

Table 4 — Chemical composition (cast analysis)[a] of austenitic corrosion resisting steels

Steel designation		% by mass											
Name	Number	C	Si	Mn	P max.	S	N	Cr	Cu	Mo	Nb	Ni	Others
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	-
X2CrNi18-9	1.4307	≤ 0,030	≤ 1,00	≤ 2,00	0,045	≤ 0,030[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	≤ 0,030[b]	≤ 0,11	18,0 to 20,0	-	-	-	10,0 to 12,0[c]	-
X2CrNiN18-10	1.4311	≤ 0,030	≤ 1,00	≤ 2,00	0,045	≤ 0,030[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	≤ 0,030[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	≤ 0,030[b]	-	17,0 to 19,0	-	-	-	9,0 to 12,0[c]	Ti: 5 x C to 0,70
X4CrNi18-12	1.4303	≤ 0,06	≤ 1,00	≤ 2,00	0,045	≤ 0,030[b]	≤ 0,11	17,0 to 19,0	-	-	-	11,0 to 13,0	-
X2CrNiMo17-12-2	1.4404	≤ 0,030	≤ 1,00	≤ 2,00	0,045	≤ 0,030[b]	≤ 0,11	16,5 to 18,5	-	2,00 to 2,50	-	10,0 to 13,0[c]	-
X2CrNiMoN17-11-2	1.4406	≤ 0,030	≤ 1,00	≤ 2,00	0,045	≤ 0,030[b]	0,12 to 0,22	16,5 to 18,5	-	2,00 to 2,50	-	10,0 to 12,5[c]	-
X5CrNiMo17-12-2	1.4401	≤ 0,07	≤ 1,00	≤ 2,00	0,045	≤ 0,030[b]	≤ 0,11	16,5 to 18,5	-	2,00 to 2,50	-	10,0 to 13,0	-
X6CrNiMoTi17-12-2	1.4571	≤ 0,08	≤ 1,00	≤ 2,00	0,045	≤ 0,030[b]	-	16,5 to 18,5	-	2,00 to 2,50	-	10,5 to 13,5[c]	Ti: 5 x C to 0,70
X2CrNiMo17-12-3	1.4432	≤ 0,030	≤ 1,00	≤ 2,00	0,045	≤ 0,030[b]	≤ 0,11	16,5 to 18,5	-	2,50 to 3,00	-	10,5 to 13,0	-
X2CrNiMoN17-13-3	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[c]	-
X3CrNiMo17-13-3	1.4436	≤ 0,05	≤ 1,00	≤ 2,00	0,045	≤ 0,030[b]	≤ 0,11	16,5 to 18,5	-	2,50 to 3,00	-	10,5 to 13,0[c]	-
X2CrNiMo18-14-3	1.4435	≤ 0,030	≤ 1,00	≤ 2,00	0,045	≤ 0,030[b]	≤ 0,11	17,0 to 19,0	-	2,50 to 3,00	-	12,5 to 15,0	-
X2CrNiMoN17-13-5	1.4439	≤ 0,030	≤ 1,00	≤ 2,00	0,045	≤ 0,015	0,12 to 0,22	16,5 to18,5	-	4,0 to 5,0	-	12,5 to 14,5	-
X6CrNiCuS18-9-2	1.4570	≤ 0,08	≤ 1,00	≤ 2,00	0,045	0,15 to 0,35	≤ 0,11	17,0 to 19,0	1,40 to 1,80	≤ 0,60	-	8,0 to 10,0	-
X3CrNiCu18-9-4	1.4567	≤ 0,04	≤ 1,00	≤ 2,00	0,045	≤ 0,030[b]	≤ 0,11	17,0 to 19,0	3,0 to 4,0	-	-	8,5 to 10,5	-
X1NiCrMoCu25-20-5	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													
X5CrNi17-7	1.4319	≤ 0,07	≤ 1,00	≤ 2,00	0,045	≤ 0,030	≤ 0,11	16,0 to 18,0	-	-	-	6,0 to 8,0	-
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	-
X5CrNiN19-9	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	-
X6CrNiNb18-10	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[c]	-
X1CrNiMoN25-22-2	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	-
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 x C to 1,00	10,5 to 13,5	-
X2CrNiMo18-15-4	1.4438	≤ 0,030	≤ 1,00	≤ 2,00	0,045	≤ 0,030[b]	≤ 0,11	17,5 to 19,5	-	3,0 to 4,0	-	13,0 to 16,0[c]	-
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	-
X8CrMnNiN18-9-5	1.4374	0,05 to 0,10	0,30 to 0,60	9,0 to 10,0	0,035	≤ 0,030	0,25 to 0,32	17,5 to 18,5	≤ 0,40	≤ 0,50	-	5,0 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

SAKY STEEL CO., LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

Table 4 (*continued*)

Steel designation		% by mass											
Name	Number	C	Si	Mn	P max.	S	N	Cr	Cu	Mo	Nb	Ni	Others
X3CrNiCu19-9-2	1.4560	≤ 0,035	≤ 1,00	1,50 to 2,00	0,045	≤ 0,015	≤ 0,11	18,0 to 19,0	1,50 to 2,00	-	-	8,0 to 9,0	-
X3CrNiCuMo17-11-3-2	1.4578	≤ 0,04	≤ 1,00	≤ 1,00	0,045	≤ 0,015	≤ 0,11	16,5 to 17,5	3,0 to 3,5	2,00 to 2,50	-	10,0 to 11,0	-
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	-
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	6,0 to 7,0	-	17,5 to 18,5	-
X2CrNiMoCuS17-10-2	1.4598	≤ 0,030	≤ 1,00	≤ 2,00	0,045	0,10 to 0,20	≤ 0,11	16,5 to 18,5	1,30 to 1,80	2,00 to 2,50	-	10,0 to 13,0	-
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	6,0 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.

[c] Where for special reasons, e.g. hot workability for the fabrication of seamless tubes where it is necessary to minimize the delta ferrite content, or with the aim of low magnetic permeability, the maximum Ni content may be increased by the following amounts:
0,50 % (by mass): 1.4571
1,00 % (by mass): 1.4306, 1.4406, 1.4429, 1.4436, 1.4438, 1.4541, 1.4550
1,50 % (by mass): 1.4404.

*) Patented steel grade.

SAKY STEEL CO., LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

Table 5 — Chemical composition (cast analysis)[a] of austenitic-ferritic corrosion resisting steels

Steel designation		% by mass										
Name	Number	C max.	Si	Mn	P max.	S max.	N	Cr	Cu	Mo	Ni	Others
Standard grades												
X3CrNiMoN27-5-2	1.4460	0,05	≤ 1,00	≤ 2,00	0,035	0,030[b]	0,05 to 0,20	25,0 to 28,0	-	1,30 to 2,00	4,5 to 6,5	-
X2CrNiMoN22-5-3[c]	1.4462[c]	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												
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	-
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	W: 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] 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] By agreement, this grade can be delivered with a Pitting Resistance Equivalent Number (PRE = Cr +3,3Mo + 16N, compare Table C.1 of EN 10088-1) greater than 34.

*) Patented steel grade.

SAKY STEEL CO., LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

Table 6 — Permissible product analysis tolerances on the limiting values given in Tables 2 to 5 for the cast analysis

Element	Specified limits, cast analysis % by mass		Permissible tolerance[a] % by mass
Carbon		≤ 0,030	+ 0,005
	> 0,030	≤ 0,20	± 0,01
	> 0,20	≤ 0,50	± 0,02
	> 0,50	≤ 1,05	± 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	≤ 10,0	± 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	≤ 0,60	± 0,02
Chromium	≥ 10,5	≤ 15,0	± 0,15
	> 15,0	≤ 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
	> 0,30	≤ 1,50	± 0,10
Boron		≤ 0,010	± 0,0005
Titanium		≤ 2,30	± 0,05
Tungsten		≤ 2,50	± 0,05
Vanadium		≤ 1,50	± 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.

SAKY STEEL CO., LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

Table 7 — Type of surface finish and process route of semi-finished products, rods and wires, bars and sections[a]

	Product forms				Tolerances on nominal dimensions [b]	Condition			Recommended use and observations
	Semi-finished products	Rods	Wires	Bars, sections		Symbol[c]	Surface finish	Type of process route	
Hot formed	x	x	-	x	EN 10017, EN 10058, EN 10059, EN 10060, EN 10061	1U	Covered with scale (spot ground if necessary). Not free of surface defects.	Hot formed, not heat treated, not descaled.	Suitable for products to be further hot formed.
	x	x	-	x		1C		Hot formed, heat treated[e], not descaled.	Suitable for products to be further processed (hot or cold).
	x	-	-	x	≥ IT 14[d]/ISO 286-1	1E	Largely free of scale (but some black spots may remain). Not free of surface defects.	Hot formed, heat treated[e] mechanically descaled[f]	
	-	x	-	x	EN 10017, EN 10058, EN 10059, EN 10060, EN 10061	1D	Free of scale (spot ground if necessary). Not free of surface defects.	Hot formed, heat treated[e] pickled, coated (optional).	Products used in their present condition or to be further processed (hot or cold).
	-	-	-	x	≥ IT 12[d]/ISO 286-1	1X	Free of scale (but some marks left from machining may remain). Not free of surface defects.	Hot formed, heat treated[e] rough machined[g]	
	-	x	-	x		1G	Appearance bright, but not uniform, Free of surface defects.	Hot formed, heat treated[e], descaled, rough machined[g] or shaved in the case of rod. Finishing by removal of material[h].	Suitable for severe applications (extrusion and/or cold or hot heading). Surface roughness can be specified.
Cold processed	-	-	x	x	Bars: IT 8 to 11[d] /EN 10278 Wire: T3 or T4 /EN 10218-2	2H	Smooth and matt or bright. Not necessarily polished. Not free of surface defects[i].	Finishes 1C, 1D or 1X, cold processed[j], coated (optional).	In products formed by cold drawing without subsequent heat treatment, the tensile strength is substantially increased, particularly in austenitic materials, depending on the degree of cold processing. The surface hardness may be higher than the centre hardness.
	-	-	x	x	Bars: IT 8 to 11[d] /EN 10278 Wire: T3 or T4 /EN 10218-2	2D	Smooth and matt or bright. Not free of surface defects[i].	Finish 2H, heat treated[e], pickled and skin-passed (optional), coated (optional).	This finish allows the restoration of the mechanical properties after cold processing. Products with good ductility (extrusion) and specific magnetic properties.
	-	-	-	x	Bars: IT 8 to 11[d] /EN 10278	2B	Smooth, uniform and bright. Free of surface defects.	Finishes 1C, 1D or 1X, cold processed[j], mechanically smoothed[k].	Products used in their present condition or intended for better finishing. In products formed by cold drawing without subsequent heat treatment, the tensile strength is substantially increased, particularly in austenitic materials, depending on the degree of cold processing. The surface hardness may be higher than the centre hardness.

SAKY STEEL CO., LTD

Table 7 (*continued*)

	Product forms				Tolerances on nominal dimensions [b]	Condition			Recommended use and observations
	Semi-finished products	Rods	Wires	Bars, sections		Symbol[c]	Surface finish	Type of process route	
	-	-	-	x	IT ≤ 9[d]/EN 10278	2G	Smooth, uniform and bright. Free of surface defects.	Finishes 2H, 2D or 2B, centreless ground, mechanically smoothed (optional)[l].	Finish for close tolerances. Unless otherwise agreed the surface roughness shall be Ra ≤ 1,2.
	-	-	-	x	IT < 11[d]/EN 10278	2P	Smoother and brighter than finish 2B or 2G. Free of surface defects.	Finishes 2H, 2D, 2B or 2G, specular polishing[l].	Products showing a well groomed surface appearance. Surface roughness shall be specified at the time of enquiry and order.

[a] Not all surface finishes and process routes are available for all steels.
[b] For sections, the following standards are used, in practice, for tolerances on dimensions and shape: EN 10024, EN 10034, EN 10055, EN 10056-2 and EN 10279. See footnote to Annex C.
[c] First digit: 1 = Hot formed; 2 = Cold processed.
[d] Specific tolerance within this range shall be agreed upon at the time of enquiry and order.
[e] On ferritic, austenitic and austenitic-ferritic grades, the heat treatment may be omitted if the conditions for hot forming and subsequent cooling are such that the requirements for the mechanical properties of the product and the resistance to intergranular corrosion are obtained.
[f] Type of mechanical descaling (shot blasting, grinding, peeling) is left to the manufacturer's discretion unless otherwise agreed.
[g] Type of rough machining (grinding, peeling) is left to the manufacturer's discretion unless otherwise agreed.
[h] Type of finish is left to the manufacturer's discretion unless otherwise agreed.
[i] Unless otherwise agreed at the time of order.
[j] Type of cold processing (cold drawing, turning, grinding, abrading ...) is left to the manufacturer's discretion unless otherwise agreed.
[k] Type of mechanical polishing (burnishing, abrading) is left to the manufacturer's discretion unless otherwise agreed.
[l] Type of specular polishing (electro-polishing, felting, buffing ...) is left to the manufacturer's discretion unless otherwise agreed.

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

SAKY STEEL CO., LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

Table 8 — Mechanical properties at room temperature of annealed [a] (see Table A.1) ferritic steels and resistance to intergranular corrosion in conditions 1C, 1E, 1D, 1X, 1G and 2D

Steel designation		Thickness t or diameter[b] d	Hardness	0,2 %-proof strength	Tensile Strength	Elongation after fracture[d]	Resistance to intergranular corrosion[e]	
Name	Number	mm max.	HB[c] max.	$R_{p0,2}$[d] MPa[*)] min.	R_m[d] MPa[*)]	A % min. (long.)	in the delivery condition	in the welded condition
Standard grades								
X2CrNi12	1.4003	100	200	260	450 to 600	20	no	no
X6Cr13	1.4000	25	200	230	400 to 630	20	no	no
X6Cr17	1.4016	100	200	240	400 to 630	20	yes	no
X6CrMoS17	1.4105	100	200	250	430 to 630	20	no	no
X6CrMo17-1	1.4113	100	200	280	440 to 660	18	yes	no
Special grades								
X2CrTi17	1.4520	50	200	200	420 to 620	20	yes	yes
X3CrNb17	1.4511	50	200	200	420 to 620	20	yes	yes
X2CrMoTiS18-2	1.4523	100	200	280	430 to 600	15	yes	no
X6CrMoNb17-1	1.4526	50	200	300	480 to 680	15	yes	yes
X2CrTiNb18	1.4509	50	200	200	420 to 620	18	yes	yes

[a] Annealing 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.

[b] Width across flats for hexagons.

[c] Only for guidance.

[d] For rods, only the tensile strength values apply.

[e] When tested according to EN ISO 3651-2.

[*)] 1MPa = 1 N/mm²

SKY STEEL CO., LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

Table 9 — Mechanical properties at room temperature of heat-treated (see Table A.2) martensitic steels in conditions 1C, 1E, 1D, 1X, 1G and 2D

Steel designation		Thickness t or diameter[a] d	Heat-treatment condition[b]	Hardness	0,2 %-proof strength	Tensile strength	Elongation after fracture		Impact energy (ISO-V)	
Name	Number	mm		HB[c] max.	$R_{p0,2}$[d] MPa[*)] min.	R_m[d] MPa[*)]	A[d] % min. (long.)	(tr.)	KV J min. (long.)	(tr.)
Standard grades										
X12Cr13	1.4006	-	+A	220	-	max. 730	-	-	-	-
		≤ 160	+QT650	-	450	650 to 850	15	-	25	-
X12CrS13	1.4005	-	+A	220	-	max. 730	-	-	-	-
		≤ 160	+QT650	-	450	650 to 850	12	-	-	-
X15Cr13	1.4024	-	+ A	220	-	max. 730	-	-	-	-
		≤ 160	+QT650	-	450	650 - 850	15	-	-	-
X20Cr13	1.4021	-	+A	230	-	max. 760	-	-	-	-
		≤ 160	+QT700	-	500	700 to 850	13	-	25	-
			+QT800	-	600	800 to 950	12	-	20	-
X30Cr13	1.4028	-	+A	245	-	max. 800	-	-	-	-
		≤ 160	+QT850	-	650	850 to 1000	10	-	15	-
X39Cr13	1.4031	-	+A	245	-	max. 800	-	-	-	-
		≤ 160	+QT800	-	650	800 to 1000	10	-	12	-
X46Cr13	1.4034	-	+A	245	-	max. 800	-	-	-	-
		≤ 160	+QT800	-	650	850 to 1000	10	-	12	-
X38CrMo14	1.4419	-	+A	235	-	max. 760	-	-	-	-
X50CrMoV15	1.4116	-	+A	280	-	max. 900	-	-	-	-
X55CrMo14	1.4110	≤ 100	+A	280	-	max. 950	-	-	-	-
X14CrMoS17	1.4104	-	+A	220	-	max 730	-	-	-	-
		≤ 60	+QT650	-	500	650 to 850	12	-	-	-
		60 < t ≤ 160					10	-	-	-
X39CrMo17-1	1.4122	-	+A	280	-	max. 900	-	-	-	-
		≤ 60	+QT750	-	550	750 to 950	12	-	20	-
		60 < t ≤ 160							14	-
X17CrNi16-2	1.4057	-	+A	295	-	max. 950	-	-	-	-
		≤ 60	+QT800	-	600	800 to 950	14		25	
		60 < t ≤ 160					12	-	20	-
		≤ 60	+QT900	-	700	900 to 1050	12		20	
		60 < t ≤ 160					10	-	15	-
X3CrNiMo13-4	1.4313	-	+A	320	-	max. 1100	-	-	-	-
		≤ 160	+QT700	-	520	700 to 800	15	-	70	-
		160 < t ≤ 250					-	12	-	50
		≤ 160	+QT780	-	620	80 to 980	15	-	70	-
		160 < t ≤ 250					-	12	-	50
		≤ 160	+QT900	-	800	900 to 1100	12	-	50	-
		160 < t ≤ 250					-	10	-	40
X4CrNiMo16-5-1	1.4418	-	+A	320	-	max. 1100	-	-	-	-
		≤ 160	+QT760	-	550	760 to 960	16	-	90	-
		160 < t ≤ 250					-	14	-	70
		≤ 160	+QT900	-	700	900 to 1100	16	-	80	-
		160 < t ≤ 250					-	14	-	60
Special grades										
X29CrS13	1.4029	≤ 160	+A	245	-	max. 800	-	-	-	-
			+QT850	-	650	850 to 1000	9	-	-	-
X46CrS13	1.4035	≤ 63	+A	245	-	max 800	-	-	-	-
X70CrMo15	1.4109	≤ 100	+A	280	-	max. 900	-	-	-	-
X40CrMoVN16-2	1.4123	≤ 100	+A	280	-	-	-	-	-	-
X105CrMo17	1.4125	≤ 100	+A	285	-	-	-	-	-	-
X90CrMoV18	1.4112	≤ 100	+A	265	-	-	-	-	-	-
X2CrNiMoV13-5-2	1.4415	≤ 160	+QT750	-	650	750 to 900	18	-	100	-
			+QT850	-	750	850 to 1000	15	-	80	-

[a] Width across flats for hexagons.

[b] +A = annealed, +QT = quenched and tempered.

[c] Only for guidance.

[d] For rods, only the tensile strength values apply.

[*)] 1 MPa = 1 N/mm²

SAKI STEEL CO., LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

Table 10 — Mechanical properties at room temperature of heat-treated (see Table A.3) precipitation hardening steels in conditions 1C, 1E, 1D, 1X, 1G and 2D

Steel designation		Thickness *t* or diameter [a] *d*	Heat treatment condition[b]	Hard-ness[c]	0,2 %-proof strength	Tensile strength	Elongation after fracture	Impact energy (ISO-V)
Name	Number	mm		*HB*	$R_{p0,2}$ MPa*)	R_m MPa*)	*A* %	*KV* J
		max.		max.	min.		min. (long.)	min. (long.)
Standard grades								
X5CrNiCuNb16-4	1.4542	100	+AT	360	-	max. 1200	-	-
			+P800	-	520	800 to 950	18	75
			+P930	-	720	930 to 1100	16	40
			+P960	-	790	960 to 1160	12	-
			+P1070	-	1000	1070 to 1270	10	-
X7CrNiAl17-7	1.4568	30	+AT[d]	255	-	max. 850	-	-
X5CrNiMoCuNb14-5	1.4594	100	+AT	360	-	max.1200	-	-
			+P930	-	720	930 to 1100	15	40
			+P1000	-	860	1000 to 1200	10	-
			+P1070	-	1000	1070 to 1270	10	-
Special grades								
X1CrNiMoAlTi12-9-2	1.4530	150	+AT	363	-	max. 1200	-	-
			+P1200	-	1100	min. 1200	12	90
X1CrNiMoAlTi12-10-2	1.4596	150	+AT	363	-	max. 1200	-	-
			+P1400	-	1300	min. 1400	9	50
X5NiCrTiMoVB25-15-2	1.4606	50	+AT	212	250	max. 700	35	-
			+P880	-	550	880 to 1150	20	40

[a] Width across flats for hexagons

[b] +AT = solution annealed; +P = precipitation hardened.

[c] Only for guidance.

[d] For spring hard drawn condition see EN 10270-3.

*) 1 MPa = 1 N/mm^2

SAKY STEEL CO., LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

Table 11 — Mechanical properties at room temperature of solution annealed [a] (see Table A.4) austenitic steels and resistance to intergranular corrosion in conditions 1C, 1E, 1D, 1X, 1G and 2D

Steel designation		Thickness t or diameter[b] d	Hardness[c, d]	0,2 %-proof strength	1 %-proof strength	Tensile strength[d, e]	Elongation after fracture[d, e]		Impact energy (ISO-V)		Resistance to intergranular corrosion[f]	
Name	Number	mm	*HB* max.	$R_{p0,2}$[e] MPa*) min.	$R_{p1,0}$[c,e] MPa*) min.	R_m MPa*)	*A* % min. (long.)	(tr.)	*KV* J min. (long.)	(tr.)	in the delivery condition	In the sensitized condition[g]
Standard grades												
X10CrNi18-8	1.4310	≤ 40	230	195	230	500 to 750	40	-	-	-	no	no
X2CrNi18-9	1.4307	≤ 160	215	175	210	500 to 700	45	-	100	-	yes	yes
		160 < t ≤ 250					-	35	-	60		
X2CrNi19-11	1.4306	≤ 160	215	180	215	460 to 680	45	-	100	-	yes	yes
		160 < t ≤ 250					-	35	-	60		
X2CrNiN18-10	1.4311	≤ 160	230	270	305	550 to 760	40	-	100	-	yes	yes
		160 < t ≤ 250					-	30	-	60		
X5CrNi18-10	1.4301	≤ 160	215	190	225	500 to 700	45	-	100	-	yes	no[h]
		160 < t ≤ 250					-	35	-	60		
X8CrNiS18-9	1.4305	≤ 160	230	190	225	500 to 750	35	-	-	-	no	no
X6CrNiTi18-10	1.4541	≤ 160	215	190	225	500 to 700	40	-	100	-	yes	yes
		160 < t ≤ 250					-	30	-	60		
X4CrNi18-12	1.4303	≤ 160	215	190	225	500 to 700	45	-	100	-	yes	no[h]
		160 < t ≤ 250					-	35	-	60		
X2CrNiMo17-12-2	1.4404	≤ 160	215	200	235	500 to 700	40	-	100	-	yes	yes
		160 < t ≤ 250					-	30	-	60		
X2CrNiMoN17-11-2	1.4406	≤ 160	250	280	315	580 to 800	40	-	100	-	yes	yes
		160 < t ≤ 250					-	30	-	60		
X5CrNiMo17-12-2	1.4401	≤ 160	215	200	235	500 to 700	40	-	100	-	yes	no[h]
		160 < t ≤ 250					-	30	-	60		
X6CrNiMoTi17-12-2	1.4571	≤ 160	215	200	235	500 to 700	40	-	100	-	yes	yes
		160 < t ≤ 250					-	30	-	60		
X2CrNiMo17-12-3	1.4432	≤ 160	215	200	235	500 to 700	40	-	100	-	yes	yes
		160 < t ≤ 250					-	30	-	60		
X2CrNiMoN17-13-3	1.4429	≤ 160	250	280	315	580 to 800	40	-	100	-	yes	yes
		160 < t ≤ 250					-	30	-	60		
X3CrNiMo17-13-3	1.4436	≤ 160	215	200	235	500 to 700	40	-	100	-	yes	no[h]
		160 < t ≤ 250					-	30	-	60		
X2CrNiMo18-14-3	1.4435	≤ 160	215	200	235	500 to 700	40	-	100	-	yes	yes
		160 < t ≤ 250					-	30	-	60		
X2CrNiMoN17-13-5	1.4439	≤ 160	250	280	315	580 to 800	35	-	100	-	yes	yes
		160 < t ≤ 250					-	30	-	60		
X6CrNiCuS18-9-2	1.4570	≤ 160	215	185	220	500 to 710	35	-	-	-	no	no
X3CrNiCu18-9-4	1.4567	≤ 160	215	175	210	450 to 650	45	-	-	-	yes	yes
X1NiCrMoCu25-20-5	1.4539	≤ 160	230	230	260	530 to 730	35	-	100	-	yes	yes
		160 < t ≤ 250					-	30	-	60		

SAKY STEEL CO., LTD

Table 11 (*continued*)

Steel designation		Thickness t or diameter[b] d	Hard-ness[c, d]	0,2 %-proof strength	1 %-proof strength	Tensile strength[d, e]	Elongation after fracture[d,e]		Impact energy (ISO-V)		Resistance to intergranular corrosion[f]	
Name	Number	mm	*HB* max.	$R_{p0,2}$[e] MPa*) min.	$R_{p1,0}$[c, e] MPa*) min.	R_m MPa*)	*A* % min.		*KV* J min.		in the delivery condition	in the sensitized condition[g]
							(long.)	(tr.)	(long.)	(tr.)		
Special grades												
X5CrNi17-7	1.4319	≤ 16	215	190	225	500 to 700	45	-	100	-	yes	no[h]
X9CrNi18-9	1.4325	≤ 40	215	190	225	550 to 750	40	-	-	-	yes	no
X5CrNiN19-9	1.4315	≤ 40	215	270	310	550 to 750	40	-	100	-	yes	no[h]
X6CrNiNb18-10	1.4550	≤ 160	230	205	240	510 to 740	40	-	100	-	yes	yes
		160 < t ≤ 250					-	30	-	60		
X1CrNiMoN25-22-2	1.4466	≤ 160	240	250	290	540 to 740	35	-	100	-	yes	yes
		160 < t ≤ 250	240	250	290	540 to 740	-	30	-	60	yes	yes
X6CrNiMoNb17-12-2	1.4580	≤ 160	230	215	250	510 to 740	35	-	100	-	yes	yes
		160 < t ≤ 250					-	30	-	60		
X2CrNiMo18-15-4	1.4438	≤ 160	215	200	235	500 to 700	40	-	100	-	yes	yes
		160 < t ≤ 250					-	30	-	60		
X1CrNiMoCuN24-22-8	1.4652	≤ 50	310	430	470	750 to 1000	40	-	100	-	yes	yes
X1CrNiSi18-5-4	1.4361	≤ 160	230	210	240	530 to 730	40	-	100	-	yes	yes
		160 < t ≤ 250					-	30	-	60		
X11CrNiMnN19-8-6	1.4369	≤ 15	300	340	370	750 to 950	35	35	100	60	yes	no
X12CrMnNiN17-7-5	1.4372	≤ 160	260	230	370	750 to 950	40	-	100	-	yes	no
		160 < t ≤ 250	260	230	370	750 to 950	-	35	-	60	yes	no
X8CrMnNiN18-9-5	1.4374	≤ 10	260	350	380	700 to 900	35	-	-	-	yes	no
X8CrMnCuNB17-8-3	1.4597	≤ 160	245	270	305	560 to 780	40	-	100		yes	no
X3CrNiCu19-9-2	1.4560	≤ 160	215	170	220	450 to 650	45	-	100	-	yes	yes
X3CrNiCuMo17-11-3-2	1.4578	≤ 160	215	175	-	450 to 650	45	-	-	-	yes	yes
X1NiCrMoCu31-27-4	1.4563	≤ 160	230	220	250	500 to 750	35	-	100	-	yes	yes
		160 < t ≤ 250					-	30	-	60		
X1CrNiMoCuN25-25-5	1.4537	≤ 160	250	300	340	600 to 800	35	-	100	-	yes	yes
		160 < t ≤ 250					-	30	-	60		
X1CrNiMoCuN20-18-7	1.4547	≤ 160	260	300	340	650 to 850	35	-	100	-	yes	yes
		160 < t ≤ 250					-	30	-	60		
X2CrNiMoCuS17-10-2	1.4598	≤ 160	215	200	235	500 to 700	40	-	100	-	yes	yes
X1CrNiMoCuNW24-22-6	1.4659	≤ 160	290	420	460	800 to 1000	50	-	90	-	yes	yes
X1NiCrMoCuN25-20-7	1.4529	≤ 160	250	300	340	650 to 850	40	-	100	-	yes	yes
		160 < t ≤ 250					-	35	-	60		
X2CrNiMnMoN25-18-6-5	1.4565	≤ 160	-	420	460	800 to 950	35	-	100	-	yes	yes

[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.

[b] Width across flats for hexagons.

[c] Only for guidance.

[d] The maximum HB-values may be raised by 100 HB or the tensile strength value may be raised by 200 MPa and the minimum elongation value may be lowered to 20 % for sections and bars of ≤ 35 mm thickness having a final cold deformation and for hot formed sections and bars of ≤ 8 mm thickness.

[e] For rods, only the tensile strength values apply.

[f] When tested according to EN ISO 3651-2.

[g] See NOTE 2 to 6.4.

[h] Sensitization treatment of 15 min at 700°C followed by cooling in air.

*) 1 MPa = 1 N/mm^2

SAKY STEEL CO., LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

Table 12 — Mechanical properties at room temperature of solution annealed [a] (see Table A.5) austenitic-ferritic steels and resistance to intergranular corrosion in conditions 1C, 1E, 1D, 1X, 1G and 2D

Steel designation		Thickness t or diameter[b] d	Hardness[c]	0,2 %-proof strength	Tensile strength	Elongation after fracture	Impact energy (ISO-V)	Resistance to intergranular corrosion[e]	
Name	Number	mm	HB max.	$R_{p0,2}$[d] MPa*) min.	R_m[d] MPa*)	A[d] % min. (long.)	KV J min. (long.)	in the delivery condition	in the sensitized condition[f]
Standard grades									
X3CrNiMoN27-5-2	1.4460	≤ 160	260	450	620 to 880	20	85	yes	yes
X2CrNiMoN22-5-3	1.4462	≤ 160	270	450	650 to 880	25	100	yes	yes
Special grades									
X2CrNiN23-4	1.4362	≤ 160	260	400	600 to 830	25	100	yes	yes
X2CrNiMoN29-7-2	1.4477	≤ 10	310	650	800 to 1050	25	100	yes	yes
		10 < t ≤ 160	310	550	750 to 1000	25	100	yes	yes
X2CrNiMoCuN25-6-3	1.4507	≤ 160	270	500	700 to 900	25	100	yes	yes
X2CrNiMoN25-7-4	1.4410	≤ 160	290	530	730 to 930	25	100	yes	yes
X2CrNiMoCuWN25-7-4	1.4501	≤ 160	290	530	730 to 930	25	100	yes	yes
X2CrNiMoSi18-5-3	1.4424	≤ 50	260	450	700 to 900	25	100	yes	yes
		50 < t ≤ 160	260	400	680 to 900	25	100	yes	yes

[a] Solution treatment may be omitted if the conditions for hot working and subsequent cooling are such that the requirement for the mechanical properties of the product and the resistance to intergranular corrosion as defined in EN ISO 3651-2 are obtained.

[b] Width across flats for hexagons.

[c] Only for guidance

[d] For rods, only the tensile strength values apply.

[e] When tested according to EN ISO 3651-2.

[f] See NOTE 2 to 6.4.

*) 1 MPa = 1N/mm^2

SAKY STEEL CO., LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

Table 13 — Mechanical properties for bright bars[a] at room temperature of annealed [b] (see Table A.1) ferritic steels in conditions 2H, 2B, 2G or 2P

Steel designation		Thickness t or diameter[c] d	0,2 %-proof strength	Tensile strength	Elongation after fracture
Name	Number	mm	$R_{p0,2}$ MPa*) min.	R_m MPa*)	A_5[d] % min.
Standard grades					
X6Cr17	1.4016	≤ 10[e]	320	500 to 750	8
		10 < t ≤ 16	300	480 to 750	8
		16 < t ≤ 40	240	400 to 700	15
		40 < t ≤ 63	240	400 to 700	15
		63 < t ≤100	240	400 to 630	20
X6CrMoS17	1.4105	≤ 10[e]	330	530 to 780	7
		10 < t ≤ 16	310	500 to 780	7
		16 < t ≤ 40	250	430 to 730	12
		40 < t ≤ 63	250	430 to 730	12
		63 < t ≤ 100	250	430 to 630	20
X6CrMo17-1	1.4113	≤ 10[e]	340	540 to 700	8
		10 < t ≤ 16	320	500 to 700	12
		16 < t ≤ 40	280	440 to 700	15
		40 < t ≤ 63	280	440 to 700	15
		63 < t ≤ 100	280	440 to 660	18
Special grades					
X2CrTi17	1.4520	≤ 10[e]	320	500 to 750	8
		10 < t ≤ 16	300	480 to 750	10
		16 < t ≤ 40	240	400 to 700	15
		40 < t ≤ 50	240	400 to 700	15
X3CrNb17	1.4511	≤ 10[e]	320	500 to 750	8
		10 < t ≤ 16	300	480 to 750	10
		16 < t ≤ 40	240	400 to 700	15
		40 < t ≤ 50	240	400 to 700	15
X6CrMoNb17-1	1.4526	≤ 10[e]	340	540 to 700	8
		10 < t ≤ 16	320	500 to 700	12
		16 < t ≤ 40	280	440 to 700	15
		40 < t ≤ 50	280	440 to 700	15
X2CrTiNb18	1.4509	≤ 10[e]	320	500 to 750	8
		10 < t ≤ 16	300	480 to 750	10
		16 < t ≤ 40	240	400 to 700	15
		40 < t ≤ 50	240	400 to 700	15

[a] Including cut lengths from wire.

[b] Initial annealing treatment may be omitted if the conditions for previous hot working and subsequent cooling have been such that the requirements for the final mechanical properties of the product and the resistance to intergranular corrosion as defined in EN ISO 3651-2 are obtained.

[c] Width across flats for hexagons.

[d] Elongation A_5 is valid only for dimensions of 5 mm and above. For smaller diameters, the minimum elongation has to be agreed upon at the time of enquiry and order.

[e] In the range 1 mm ≤ d < 5 mm valid only for rounds. The mechanical properties of non round bars with thicknesses < 5 mm have to be agreed at the time of enquiry and order.

*) 1MPa = 1N/mm^2.

SAKY STEEL CO., LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

Table 14 — Mechanical properties for bright bars [a] at room temperature of heat-treated (see Table A.2) martensitic steels in conditions 2H, 2B, 2G or 2P

Steel designation		Thickness t or diameter[b] d	Annealed		Quenched + tempered						
Name	Number	mm	R_m MPa*) max.	HB [c] max.	Heat treatment condition	$R_{p0,2}$ MPa*) min.	R_m MPa*)	A_5[d] % min.		KV J min.	
								(long.)	(tr.)	(long.)	(tr.)
Standard grades											
X12Cr13	1.4006	≤ 10[e]	880	280	+QT650	550	700 to 1000	9	-	-	-
		10 < t ≤ 16	880	280		500	700 to 1000	9	-	-	-
		16 < t ≤ 40	800	250		450	650 to 930	10	-	25	-
		40 < t ≤ 63	760	230		450	650 to 880	10	-	25	-
		63 < t ≤ 160	730	220		450	650 to 850	15	-	25	-
X12CrS13	1.4005	≤ 10[e]	880	280	+QT650	550	700 to 1000	8	-	-	-
		10 < t ≤ 16	880	280		500	700 to 1000	8	-	-	-
		16 < t ≤ 40	800	250		450	650 to 930	10	-	-	-
		40 < t ≤ 63	760	230		450	650 to 880	10	-	-	-
		63 < t ≤ 160	730	220		450	650 to 850	12	-	-	-
X20Cr13	1.4021	≤ 10[e]	910	290	+QT700	600	750 to 1000	8	-	-	-
		10 < t ≤ 16	910	290		550	750 to 1000	8	-	-	-
		16 < t ≤ 40	850	260		500	700 to 950	10	-	25	-
		40 < t ≤ 63	800	250		500	700 to 900	12	-	25	-
		63 < t ≤ 160	760	230		500	700 to 850	13	-	25	-
X30Cr13	1.4028	≤ 10[e]	950	305	+QT850	700	900 to 1050	7	-	-	-
		10 < t ≤ 16	950	305		650	900 to 1150	7	-	-	-
		16 < t ≤ 40	900	280		650	850 to 1100	9	-	15	-
		40 < t ≤ 63	840	260		650	850 to 1050	9	-	15	-
		63 < t ≤ 160	800	245		650	850 to 1000	10	-	15	-
X39Cr13	1.4031	≤ 10[e]	950	305	+QT800	700	850 to 1100	7	-	-	-
		10 < t ≤ 16	950	305		700	850 to 1100	7	-	-	-
		16 < t ≤ 40	900	280		650	800 to 1050	8	-	12	-
		40 < t ≤ 63	840	260		650	800 to 1000	8	-	12	-
		63 < t ≤ 160	800	245		650	800 to 1000	10	-	12	-
X46Cr13	1.4034	≤ 10[e]	950	305	+QT850	700	900 to 1150	7	-	-	-
		10 < t ≤ 16	950	305		700	900 to 1150	7	-	-	-
		16 < t ≤ 40	900	280		650	850 to 1100	8	-	12	-
		40 < t ≤ 63	840	260		650	850 to 1000	8	-	12	-
		63 < t ≤ 160	800	245		650	850 to 1000	10	-	12	-
X14CrMoS17	1.4104	≤ 10[e]	880	280	+QT650	580	700 to 980	7	-	-	-
		10 < t ≤ 16	880	280		530	700 to 980	7	-	-	-
		16 < t ≤ 40	800	250		500	650 to 930	9	-	-	-
		40 < t ≤ 63	760	230		500	650 to 880	10	-	-	-
		63 < t ≤ 160	730	220		500	650 to 850	10	-	-	-
X39CrMo17-1	1.4122	≤ 10[e]	1000	340	+QT750	650	800 to 1050	8	-	-	-
		10 < t ≤ 16	1000	340		600	800 to 1050	8	-	-	-
		16 < t ≤ 40	980	310		550	800 to 1000	10	-	20	-
		40 < t ≤ 63	930	290		550	750 to 950	12	-	20	-
		63 < t ≤ 160	900	280		550	750 to 950	12	-	14	-
X17CrNi16-2	1.4057	≤ 10[e]	1050	330	+QT800	750	850 to 1100	7	-	-	-
		10 < t ≤ 16	1050	330		700	850 to 1100	7	-	-	-
		16 < t ≤ 40	1000	310		650	800 to 1050	9	-	25	-
		40 < t ≤ 63	950	295		650	800 to 1000	12	-	25	-
		63 < t ≤ 160	950	295		650	800 to 950	12	-	20	-

SAN STEEL CO., LTD

Table 14 - (*continued*)

Steel designation		Thickness t or diameter[b] d mm	Annealed		Quenched + tempered						
Name	Number		R_m MPa*) max.	HB [c] max.	Heat treatment Condition	$R_{p0,2}$ MPa*) min.	R_m MPa*)	A_5[d] % min.		KV J min.	
								(long.)	(tr.)	(long.)	(tr.)
Standard grades (continued)											
X4CrNiMo16-5-1	1.4418	≤ 10[e]	1150	380	+QT900	750	900 to 1150	10	-	-	-
		10 < t ≤ 16	1150	380		750	900 to 1150	10	-	-	-
		16 < t ≤ 40	1100	320		700	900 to 1100	12	-	80	-
		40 < t ≤ 63	1100	320		700	900 to 1100	16	-	80	-
		63 < t ≤ 160	1100	320		700	900 to 1100	16	-	80	-
		160 < t ≤ 250	1100	320		700	900 to 1100	-	14	-	60
Special grades											
X29CrS13	1.4029	≤ 10[e]	950	305	+QT850	750	900 to 1100	8	-	-	-
		10 < t ≤ 16	950	305		700	900 to 1100	8	-	-	-
		16 < t ≤ 40	900	280		650	850 to 1100	10	-	-	-
		40 < t ≤ 63	840	260		650	850 to 1050	10	-	-	-
		63 < t ≤ 160	800	245		650	850 to 1000	12	-	-	-
X46CrS13	1.4035	≤ 10[e]	880	280	-	-	-	-	-	-	-
		10 < t ≤ 16	880	280		-	-	-	-	-	-
		16 < t ≤ 40	800	250		-	-	-	-	-	-
		40 < t ≤ 63	760	230		-	-	-	-	-	-

[a] Including cut lengths from wire.

[b] Width across flats for hexagons.

[c] For information only.

[d] Elongation A_5 is valid only for dimensions of 5 mm and above. For smaller diameters, the minimum elongation has to be agreed upon at the time of enquiry and order.

[e] In the range 1 mm ≤ d < 5 mm valid only for rounds. The mechanical properties of non round bars with thicknesses < 5 mm have to be agreed at the time of enquiry and order.

*) 1MPa = 1N/mm^2.

SAKY STEEL CO., LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

Table 15 — Mechanical properties for bright bars [a] at room temperature of heat-treated (see Table A.3) precipitation hardening steels in conditions 2H, 2B, 2G or 2P

Steel designation		Thickness t or diameter [b] d	Annealed		Precipitation hardened				
Name	Number	mm	R_m MPa*) max.	HB [c] max.	Heat treatment condition	$R_{p0,2}$ MPa*) min.	R_m MPa*)	A_5 [d] % min. (long.)	KV J min. (long.)
Standard grade									
X5CrNiCuNb16-4	1.4542	≤ 10 [e]	1200	360	+P800	600	900 to 1100	10	-
		10 < t ≤ 16	1200	360		600	900 to 1100	10	-
		16 < t ≤ 40	1200	360		520	800 to 1050	12	75
		40 < t ≤ 63	1200	360		520	800 to 1000	18	75
		63 < t ≤ 160	1200	360		520	800 to 950	18	75
		≤ 100	-	-	+P930	720	930 to 1100	12	40
		≤ 100	-	-	+P960	790	960 to 1160	10	-
		≤ 100	-	-	+P1070	1000	1070 to 1270	10	-
Special grade									
X5NiCrTiMoVB25-15-2	1.4606	≤ 10 [e]	850	240	+P880	750	950 to 1200	15	30
		10 < t ≤ 16	800	230		750	950 to 1150	15	30
		16 < t ≤ 40	800	230		600	900 to 1150	18	40
		40 < t ≤ 50	700	212		550	880 to 1150	20	40

[a] Including cut lengths from wire.

[b] Width across flats for hexagons.

[c] For information only.

[d] Elongation A_5 is valid only for dimensions of 5 mm and above. For smaller diameters, the minimum elongation has to be agreed upon at the time of enquiry and order.

[e] In the range 1 mm ≤ d < 5 mm valid only for rounds. The mechanical properties of non round bars with thicknesses < 5 mm have to be agreed at the time of enquiry and order.

*) 1MPa = 1N/mm^2.

SAKY STEEL CO., LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

Table 16 — Mechanical properties for bright bars [a] at room temperature of solution annealed [b] (see Table A.4) austenitic steels in conditions 2H, 2B, 2G or 2P

Steel designation		Thickness t	Solution annealed					
Name	Number	or diameter[c] d mm	$R_{p0,2}$ MPa*) min.	R_m MPa*)	A_5[d] % min.		KV J min.	
					(long.)	(tr.)	(long.)	(tr.)
Standard grades								
X2CrNi18-9	1.4307	≤ 10[e]	400	600 to 930	25	-	-	-
		10 < t ≤ 16	380	600 to 930	25	-	-	-
		16 < t ≤ 40	175	500 to 830	30	-	100	-
		40 < t ≤ 63	175	500 to 830	30	-	100	-
		63 < t ≤ 160	175	500 to 700	45	-	100	-
		160 < t ≤ 250	175	500 to 700	-	35	-	60
X2CrNi19-11	1.4306	≤ 10[e]	400	600 to 930	25	-	-	-
		10 < t ≤ 16	380	600 to 930	25	-	-	-
		16 < t ≤ 40	180	460 to 830	30	-	100	-
		40 < t ≤ 63	180	460 to 830	30	-	100	-
		63 < t ≤ 160	180	460 to 680	45	-	100	-
		160 < t ≤ 250	180	460 to 680	-	35	-	60
X5CrNi18-10	1.4301	≤ 10[e]	400	600 to 950	25	-	-	-
		10 < t ≤ 16	400	600 to 950	25	-	-	-
		16 < t ≤ 40	190	600 to 850	30	-	100	-
		40 < t ≤ 63	190	580 to 850	30	-	100	-
		63 < t ≤ 160	190	500 to 700	45	-	100	-
		160 < t ≤ 250	190	500 to 700	-	35	-	60
X8CrNiS18-9	1.4305	≤ 10[e]	400	600 to 950	15	-	-	-
		10 < t ≤ 16	400	600 to 950	15	-	-	-
		16 < t ≤ 40	190	500 to 850	20		100	-
		40 < t ≤ 63	190	500 to 850	20	-	100	-
		63 < t ≤ 160	190	500 to 750	35	-	100	-
X6CrNiTi18-10	1.4541	≤ 10[e]	400	600 to 950	25	-	-	-
		10 < t ≤ 16	380	580 to 950	25	-	-	-
		16 < t ≤ 40	190	500 to 850	30	-	100	-
		40 < t ≤ 63	190	500 to 850	30	-	100	-
		63 < t ≤ 160	190	500 to 700	40	-	100	-
X2CrNiMo17-12-2	1.4404	≤ 10[e]	400	600 to 930	25	-	-	-
		10 < t ≤ 16	380	580 to 930	25	-	-	-
		16 < t ≤ 40	200	500 to 830	30	-	100	-
		40 < t ≤ 63	200	500 to 830	30	-	100	-
		63 < t ≤ 160	200	500 to 700	40	-	100	-
		160 < t ≤ 250	200	500 to 700	-	30	-	60
X5CrNiMo17-12-2	1.4401	≤ 10[e]	400	600 to 950	25	-	-	-
		10 < t ≤ 16	380	580 to 950	25	-	-	-
		16 < t ≤ 40	200	500 to 850	30	-	100	-
		40 < t ≤ 63	200	500 to 850	30	-	100	-
		63 < t ≤ 160	200	500 to 700	40	-	100	-
		160 < t ≤ 250	200	500 to 700	-	30	-	60
X6CrNiMoTi17-12-2	1.4571	≤ 10[e]	400	600 to 950	25	-	-	-
		10 < t ≤ 16	380	580 to 950	25	-	-	-
		16 < t ≤ 40	200	500 to 850	30		100	-
		40 < t ≤ 63	200	500 to 850	30	-	100	-
		63 < t ≤ 160	200	500 to 700	40	-	100	-
		160 < t ≤ 250	200	500 to 700	-	30	-	60

SAKY STEEL CO., LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

Table 16 (*continued*)

Steel designation		Thickness t or diameter[c] d	Solution annealed					
Name	Number	mm	$R_{p0,2}$ MPa*) min.	R_m MPa*)	A_5[d] % min.		KV J min.	
					(long.)	(tr.)	(long.)	(tr.)
Standard grades (*continued*)								
X2CrNiMo17-12-3	1.4432	≤ 10[e]	400	600 to 930	25	-	-	-
		10 < t ≤ 16	380	600 to 880	25	-	-	-
		16 < t ≤ 40	200	500 to 850	30		100	-
		40 < t ≤ 63	200	500 to 850	30	-	100	-
		63 < t ≤ 160	200	500 to 700	40	-	100	-
		160 < t ≤ 250	200	500 to 700	-	30	-	60
X3CrNiMo17-13-3	1.4436	≤ 10[e]	400	600 to 950	25	-	-	-
		10 < t ≤ 16	400	600 to 950	25	-	-	-
		16 < t ≤ 40	200	500 to 850	30	-	100	-
		40 < t ≤ 63	190	500 to 850	30	-	100	-
		63 < t ≤ 160	200	500 to 700	40	-	100	-
		160 < t ≤ 250	200	500 to 700	-	30	-	60
X2CrNiMo18-14-3	1.4435	≤ 10[e]	400	600 to 950	25	-	-	-
		10 < t ≤ 16	400	600 to 950	25	-	-	-
		16 < t ≤ 40	235	500 to 850	30	-	100	-
		40 < t ≤ 63	235	500 to 850	30	-	100	-
		63 < t ≤ 160	235	500 to 700	40	-	100	-
		160 < t ≤ 250	235	500 to 700	-	30	-	60
X6CrNiCuS18-9-2	1.4570	≤ 10[e]	400	600 to 950	15	-	-	-
		10 < t ≤ 16	400	600 to 950	15	-	-	-
		16 < t ≤ 40	185	500 to 910	20	-	-	-
		40 < t ≤ 63	185	500 to 910	20	-	-	-
		63 < t ≤ 160	185	500 to 710	35	-	-	-
X3CrNiCu18-9-4	1.4567	≤ 10[e]	400	600 to 850	25	-	-	-
		10 < t ≤ 16	340	600 to 850	25	-	-	-
		16 < t ≤ 40	175	450 to 800	30		100	-
		40 < t ≤ 63	175	450 to 800	30	-	100	-
		63 < t ≤ 160	175	450 to 650	40	-	100	-
X1NiCrMoCu25-20-5	1.4539	≤ 10[e]	400	600 to 930	20	-	-	-
		10 < t ≤ 16	400	600 to 930	20	-	-	-
		16 < t ≤ 40	230	530 to 880	25		100	-
		40 < t ≤ 63	230	530 to 880	25	-	100	-
		63 < t ≤ 160	230	530 to 730	35	-	100	-
		160 < t ≤ 250	230	530 to 730	-	30	-	60
Special grades								
X3CrNiCu19-9-2	1.4560	≤ 10[e]	400	600 to 800	25	-	-	-
		10 < t ≤ 16	340	600 to 800	25	-	-	-
		16 < t ≤ 40	175	450 to 750	30	-	-	-
		40 < t ≤ 63	175	450 to 750	30	-	-	-
		63 < t ≤ 160	175	450 to 650	45	-	-	-

SAKY STEEL CO., LTD

Table 16 (*continued*)

Steel designation		Thickness t or diameter[c] d	Solution annealed					
Name	Number	mm	$R_{p0,2}$ MPa*) min.	R_m MPa*)	A_5[d] % min.		KV J min.	
					(long.)	(tr.)	(long.)	(tr.)
Special grades (*continued*)								
X3CrNiCuMo17-11-3-2	1.4578	≤ 10[e]	400	600 to 850	20	-	-	-
		10 < t ≤ 16	340	600 to 850	20	-	-	-
		16 < t ≤ 40	175	450 to 800	30	-	-	-
		40 < t ≤ 63	175	450 to 800	30	-	-	-
		63 < t ≤ 160	175	450 to 650	45	-	-	-
X2CrNiMoCuS17-10-2	1.4598	≤ 10[e]	400	600 to 930	15	-	-	-
		10 < t ≤ 16	400	600 to 900	20	-	-	-
		16 < t ≤ 40	200	500 to 850	25	-	-	-
		40 < t ≤ 63	200	500 to 800	30	-	-	-
		63 < t ≤ 160	200	500 to 700	40	-	-	-

[a] Including cut lengths from wire.

[b] Inital solution treatment may be omitted if the conditions for previous hot-working and subsequent cooling have been 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] Width across flats for hexagons.

[d] Elongation is valid only for dimensions of 5 mm and above. For smaller diameters, the minimum elongation has to be agreed upon at the time of enquiry and order.

[e] In the range 1 mm ≤ d < 5 mm valid only for rounds. The mechanical properties of non round bars with thicknesses < 5 mm have to be agreed at the time of enquiry and order.

*) 1MPa = 1N/mm^2.

SAKY STEEL CO., LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

Table 17 — Mechanical properties for bright bars [a] at room temperature of solution annealed [b] (see Table A.5) austenitic-ferritic steels in conditions 2H, 2B, 2G or 2P

Steel designation		Thickness t or diameter[c] d mm	Solution annealed			
Name	Number		$R_{p0,2}$ MPa*) min.	R_m MPa*)	A_5[d] % min. (long.)	KV J min. (long.)
Standard grades						
X3CrNiMoN27-5-2	1.4460	≤ 10[e]	610	770 to 1030	12	-
		10 < t ≤ 16	560	770 to 1030	12	-
		16 < t ≤ 40	460	620 to 950	15	85
		40 < t ≤ 63	460	620 to 950	15	85
		63 < t ≤ 160	460	620 to 880	20	85
X2CrNiMoN22-5-3	1.4462	≤ 10[e]	650	850 to 1150	12	-
		10 < t ≤ 16	650	850 to 1100	12	-
		16 < t ≤ 40	450	650 to 1000	15	100
		40 < t ≤ 63	450	650 to 1000	15	100
		63 < t ≤ 160	450	650 to 880	25	100
Special grade						
X2CrNiMoCuN25-6-3	1.4507	≤ 10[e]	- [f]	- [f]	- [f]	-
		10 < t ≤ 16	- [f]	- [f]	- [f]	-
		16 < t ≤ 40	500	700 to 900	25	100
		40 < t ≤ 63	500	700 to 900	25	100
		63 < t ≤ 160	500	700 to 900	25	100

[a] Including cut lengths from wire.

[b] Inital solution treatment may be omitted if the conditions for previous hot-working and subsequent cooling have been 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] Width across flats for hexagons.

[d] Elongation is valid only for dimensions of 5 mm and above. For smaller diameters, the minimum elongation has to be agreed upon at the time of enquiry and order.

[e] In the range 1 mm ≤ d < 5 mm valid only for rounds. The mechanical properties of non round bars with thicknesses < 5 mm have to be agreed at the time of enquiry and order.

[f] To be agreed upon at the time of enquiry and order.

*) 1MPa = 1N/mm^2.

SAKY STEEL CO. LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

Table 18 — Tensile strength of wire in diameters of 0,05 mm and above in 2H condition [a]

Steel designation [b, c]		Tensile strength levels	Range of tensile strength [d]
Name	Number		MPa*)
Ferritic steels			
X6Cr17, X6CrMoS17,	1.4016, 1.4105,	+C500	500 to 700
X6CrMo17-1, X3CrNb17	1.4113, 1.4511,	+C600	600 to 800
		+C700	700 to 900
		+C800	800 to 1000
		+C900	900 to 1100
Martensitic and precipitation hardening steels			
X12Cr13, X12CrS13,	1.4006, 1,4005,	+C500	500 to 700
X20Cr13, X30Cr13	1.4021, 1,4028,	+C600	600 to 800
X46Cr13, X14CrMoS17	1.4034, 1.4104,	+C700	700 to 900
X17CrNi16-2, X7CrNiAl17-7	1.4057, 1.4568	+C800	800 to 1000
X5NiCrTiMoVB25-12-2	1.4606	+C900	900 to 1100
		+C1000	1000 to 1250
		+C1100	1100 to 1350
		+C1200	1200 to 1450
		+C1400	1400 to 1700
		+C1600	1600 to 1900
		+C1800	1800 to 2100
Austenitic steels			
X10CrNi18-8, X2CrNi18-9,	1.4310, 1.4307,	+C500	500 to 700
X2CrNi19-11, X5CrNi18-10,	1.4306, 1.4301,	+C600	600 to 800
X8CrNiS18-9, X6CrNiTi18-10,	1.4305, 1.4541,	+C700	700 to 900
X4CrNi18-12, X2CrNiMo17-12-2,	1.4303, 1.4404,	+C800	800 to 1000
X5CrNiMo17-12-2, X6CrNiMoTi17-12-2,	1.4401, 1.4571,	+C900	900 to 1100
X2CrNiMo17-12-3, X3CrNiMo17-13-3,	1.4432, 1.4436	+C1000	1000 to 1250
X2CrNiMo18-14-3, X6CrNiCuS18-9-2,	1.4435, 1.4570,	+C1100	1100 to 1350
X3CrNiCu18-9-4, X1NiCrMoCu25-20-5,	1.4567, 1.4539,	+C1200	1200 to 1450
X1CrNiMoN25-22-2, X8CrMnNiN18-9-5,	1.4466, 1.4374,	+C1400	1400 to 1700
X8CrMnCuNB17-8-3, X1NiCrMoCu31-27-4,	1.4597, 1.4563,	+C1600	1600 to 1900
X1CrNiMoCuN20-18-7, X1NiCrMoCuN25-20-7,	1.4547, 1.4529,	+C1800	1800 to 2100
X1CrNi25-21, X2CrNiMoN18-12-4	1.4335, 1.4434		
Austenitic-ferritic steels			
X2CrNiMoN22-5-3	1.4462	+C800	800 to 1000
X2CrNiN23-4	1.4362	+C900	900 to 1100
X2CrNiMoN25-7-4	1.4410	+C1000	1000 to 1250
		+C1100	1100 to 1350
		+C1200	1200 to 1450
		+C1400	1400 to 1700
		+C1600	1600 to 1900
		+C1800	1800 to 2100

[a] For spring applications, see EN 10270-3. For cold heading, see EN 10263-5.

[b] Not all grades are available in all tensile strength levels or all diameters. Guidance data for nominal dimensions *d* depending on strength levels are given in Annex B.

[c] Elongation depends on nominal dimensions *d* and may be agreed upon at the time of enquiry and order.

[d] Intermediate values may be agreed.

*) 1 MPa = 1 N/mm²

SAKY STEEL CO., LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

Table 19 — Mechanical properties at room temperature of annealed wire in 2D condition [a,b]

Steel designation Name	Number	Nominal dimension *d* mm	Tensile strength MPa*) max.	Elongation % min.
Ferritc steels (+A) [c]				
X6Cr17	1.4016	0,05 < *d* ≤ 0,10	950	10
X6CrMoS17	1.4105	0,10 < *d* ≤ 0,20	900	10
X6CrMo17-1	1.4113	0,20 < *d* ≤ 0,50	850	15
X3CrNb17	1.4511	0,50 < *d* ≤ 1,00	850	15
		1,00 < *d* ≤ 3,00	800	15
		3,00 < *d* ≤ 5,00	750	15
		5,00 < *d* ≤ 16,00	700	20
Martensitic (+A) and precipitation hardening (+AT) steels [c]				
X12Cr13	1.4006	0,50 < *d* ≤ 1,00	1100	10
X12CrS13	1.4005	1,00 < *d* ≤ 3,00	1050	10
X20Cr13	1.4021	3,00 < *d* ≤ 5,00	1000	10
X30Cr13	1.4028	5,00 < *d* ≤ 16,00	950	15
X46Cr13	1.4034			
X14CrMoS17	1.4104			
X17CrNi16-2	1.4057			
X7CrNiAl17-7	1.4568			
X5NiCrTiMoVB25-12-2	1.4606			
Austenitic steels (+AT) [c]				
X10CrNi18-8, X2CrNi18-9,	1.4310, 1.4307,	0,05 < *d* ≤ 0,10	1100	20
X2CrNi19-11, X5CrNi18-10,	1.4306, 1.4301,	0,10 < *d* ≤ 0,20	1050	20
X8CrNiS18-9, X6CrNiTi18-10,	1.4305, 1.4541,	0,20 < *d* ≤ 0,50	1000	30
X4CrNi18-12, X2CrNiMo17-12-2,	1.4303, 1.4404,	0,50 < *d* ≤ 1,00	950	30
X5CrNiMo17-12-2, X6CrNiMoTi17-12-2,	1.4401, 1.4571,	1,00 < *d* ≤ 3,00	900	30
X2CrNiMo17-12-3, X3CrNiMo17-13-3,	1.4432, 1.4436	3,00 < *d* ≤ 5,00	850	35
X2CrNiMo18-14-3, X6CrNiCuS18-9-2,	1.4435, 1.4570,	5,00 < *d* ≤ 16,00	800	35
X3CrNiCu18-9-4, X1NiCrMoCu25-20-5,	1.4567, 1.4539,			
X1CrNiMoN25-22-2, X8CrMnNiN18-9-5,	1.4466, 1.4374,			
X8CrMnCuNB17-8-3, X1NiCrMoCu31-27-4,	1.4597, 1.4563,			
X1CrNiMoCuN20-18-7, X1NiCrMoCuN25-20-7,	1.4547, 1.4529,			
X1CrNi25-21, X2CrNiMoN18-12-4	1.4335, 1.4434			
Austenitic-ferritic steels (+AT) [c]				
X2CrNiMoN22-5-3	1.4462	0,50 < *d* ≤ 1,00	1050	20
X2CrNiN23-4	1.4362	1,00 < *d* ≤ 3,00	1000	20
X2CrNiMoN25-7-4	1.4410	3,00 < *d* ≤ 5,00	950	25
		5,00 < *d* ≤ 16,00	900	25

a If skin passed (i. e. less than 5 % reduction in cross section), the maximum tensile strength might be increased by up to 50 MPa.

b For cold heading, see EN 10263-5.

c +A = annealed, +AT = solution annealed.

*) 1 MPa = 1 N/mm²

SAKY STEEL CO., LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

Table 20 — 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*) at a temperature (in °C) of						
Name	Number		100	150	200	250	300	350	400
Standard grades									
X2CrNi12	1.4003	+A	240	230	220	215	210	-	-
X6Cr13	1.4000	+A	220	215	210	205	200	195	190
X6Cr17	1.4016	+A	220	215	210	205	200	195	190
X6CrMoS17	1.4105	+A	230	220	215	210	205	200	195
X6CrMo17-1	1.4113	+A	250	240	230	220	210	205	200
Special grades									
X2CrTi17	1.4520	+A	190	180	170	160	155	-	-
X3CrNb17	1.4511	+A	190	180	170	160	155	-	-
X2CrMoTiS18-2	1.4523	+A	250	240	230	220	210	205	200
X6CrMoNb17-1	1.4526	+A	270	265	250	235	215	205	-
X2CrTiNb18	1.4509	+A	190	180	170	160	155	-	-

[a] +A = annealed

*) 1 MPa = 1 N/mm²

SAKY STEEL CO., LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

Table 21 — 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*) at a temperature (in °C) of						
Name	Number		100	150	200	250	300	350	400
Standard grades									
X12Cr13	1.4006	+QT650	420	410	400	385	365	355	305
X15Cr13	1.4024	+QT650	420	410	400	385	365	-	300
X20Cr13	1.4021	+QT700	460	445	430	415	395	365	330
		+ QT800	515	495	475	460	440	405	355
X39CrMo17-1	1.4122	+ QT750	540	535	530	520	510	490	470
X17CrNi16-2	1.4057	+ QT800	515	495	475	460	440	405	355
		+ QT900	565	525	505	490	470	430	375
X3CrNiMo13-4	1.4313	+ QT650	500	490	480	470	460	450	-
		+QT780	590	575	560	545	530	515	-
		+QT900	720	690	665	640	620	-	-
X4CrNiMo16-5-1	1.4418	+QT760	520	510	500	490	480	-	-
		+QT900	660	640	620	600	580	-	-
Special grade									
X2CrNiMoV13-5-2	1.4415	+QT750	620	605	595	585	580	570	560
		+QT850	710	695	680	670	660	645	635

[a] +QT = quenched and tempered

*) 1 MPa = 1 N/mm²

Table 22 — Minimum values for the 0,2 %- proof strength of precipitation hardening steels at elevated temperatures

Steel designation		Heat treatment condition[a]	Minimum 0,2 %- proof strength (MPa*) at a temperature (in °C) of				
Name	Number		100	150	200	250	300
Standard grades							
X5CrNiCuNb16-4	1.4542	+P800	500	490	480	470	460
		+P930	680	660	640	620	600
		+P960	730	710	690	670	650
		+P1070	880	830	800	770	750
X5CrNiMoCuNb14-5	1.4594	+P930	680	660	640	620	600
		+P1000	785	755	730	710	690
Special grade							
X5NiCrTiMoVB25-15-2	1.4606	+P880	540	530	520	510	500

[a] +P = precipitation hardened.

*) 1 MPa = 1 N/mm²

SAKY STEEL CO., LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

Table 23 — Minimum values for the 0,2 %- and 1 %-proof strength of austenitic steels at elevated temperatures

Steel designation		Heat treatment condition [a]	Minimum 0,2 %- proof strength (MPa*)										Minimum 1 % proof strength (MPa*)									
Name	Number		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	-	-	-	-
X2CrNi18-9	1.4307	+AT	145	130	118	108	100	94	89	85	81	80	180	160	145	135	127	121	116	112	109	108
X2CrNi19-11	1.4306	+AT	145	130	118	108	100	94	89	85	81	80	180	160	145	135	127	121	116	112	109	108
X2CrNiN18-10	1.4311	+AT	205	175	157	145	136	130	125	121	119	118	240	210	187	175	167	160	156	152	149	147
X5CrNi18-10	1.4301	+AT	155	140	127	118	110	104	98	95	92	90	190	170	155	145	135	129	125	122	120	120
X6CrNiTi18-10	1.4541	+AT	175	165	155	145	136	130	125	121	119	118	205	195	185	175	167	161	156	152	149	147
X4CrNi18-12	1.4303	+AT	155	140	127	118	110	104	98	95	92	90	190	170	155	145	135	129	125	122	120	120
X2CrNiMo17-12-2	1.4404	+AT	165	150	137	127	119	113	108	103	100	98	200	180	165	153	145	139	135	130	128	127
X2CrNiMoN17-11-2	1.4406	+AT	215	195	175	165	155	150	145	140	138	136	245	225	205	195	185	180	175	170	168	166
X5CrNiMo17-12-2	1.4401	+AT	175	158	145	135	127	120	115	112	110	108	210	190	175	165	155	150	145	141	139	137
X6CrNiMoTi17-12-2	1.4571	+AT	185	175	165	155	145	140	135	131	129	127	215	205	192	183	175	169	164	160	158	157
X2CrNiMo17-12-3	1.4432	+AT	165	150	137	127	119	113	108	103	100	98	200	180	165	153	145	139	135	130	128	127
X2CrNiMoN17-13-3	1.4429	+AT	215	195	175	165	155	150	145	140	138	136	245	225	205	195	185	180	175	170	168	166
X3CrNiMo17-13-3	1.4436	+AT	175	158	145	135	127	120	115	112	110	108	210	190	175	165	155	150	145	141	139	137
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	155	140	127	118	110	104	98	95	92	90	190	170	155	145	135	129	125	122	120	120
X9CrNi18-9	1.4325	+AT	-[b]																			
X5CrNiN19-9	1.4315	+AT	205	175	157	145	136	130	125	121	119	118	240	210	187	175	167	161	150	152	149	147
X6CrNiNb18-10	1.4550	+AT	175	165	155	145	136	130	125	121	119	118	210	195	185	175	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
X2CrNiMo18-15-4	1.4438	+AT	172	157	147	137	127	120	115	112	110	108	206	186	177	167	157	150	144	140	138	136
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	225	200	185	175	165	155	-	-	-	-	255	230	210	200	190	180	-	-	-	-
X12CrMnNiN17-7-5	1.4372	+AT	295	260	230	220	205	185	-	-	-	-	325	295	265	250	230	205	-	-	-	-
X8CrMnNiN18-9-5	1.4374	+AT	295	260	230	220	205	185	-	-	-	-	325	295	265	250	230	205	-	-	-	-
X8CrMnCuNB17-8-3	1.4597	+AT	225	205	190	117	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	-
X2CrNiMoCuS17-10-2	1.4598	+AT	165	150	137	127	119	113	108	103	100	98	200	180	165	153	145	139	135	130	128	127
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
X1NiCrMoCuN25-20-7	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

[b] This grade is intended to be used at room temperature in the cold work hardened condition. Therefore, values for proof strength at elevated temperatures are not available. In cases where this grade is used in the solution annealed condition, the values of grade X5CrNi18-10 (1.4301) can be adopted.

*) 1 MPa = 1 N/mm²

SWISS STEEL GROUP

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

Table 24 — Minimum values for the 0,2 %-proof strength of austenitic-ferritic steels at elevated temperatures

Steel designation		Heat treatment condition[a]	Minimum 0,2 %-proof strength (MPa*) at a temperature (in °C) of			
Name	Number		100	150	200	250
Standard grades						
X3CrNiMoN27-5-2	1.4460	+AT	360	335	310	295
X2CrNiMoN22-5-3	1.4462	+AT	360	335	315	300
Special grades						
X2CrNiN23-4	1.4362	+AT	330	300	280	265
X2CrNiMnN29-7-2	1.4477	+AT ($t \leq 10$)	550	500	470	440
		+AT ($10 < t \leq 160$)	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 ($t \leq 50$)	370	350	330	325
		+AT ($50 < t \leq 160$)	320	305	290	285

[a] +AT = solution annealed

*) 1 MPa = 1 N/mm²

SAKY STEEL CO., LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

Table 25 — Mechanical properties for bars at room temperature of steels in the cold work hardened (2H) condition

Steel designation		Tensile strength level	0,2 %-proof strength	Tensile strength	Elongation after fracture
Name	Number		$R_{p0,2}$ MPa*) min.	R_m MPa*)	A % min.
Standard grade (Martensitic steel)					
X14CrMoS17	1.4104	+C550[a]	440	550 to 750	15
Standard grades (Austenitic steels)					
X10CrNi18-8	1.4310	+C800	500	800 to 1000	12
X2CrNi18-9	1.4307	+C700[b]	350	700 to 850	20
		+C800[a]	500	800 to 1000	12
X2CrNi19-11	1.4306	+C700[b]	350	700 to 850	20
		+C800[a]	500	800 to 1000	12
X5CrNi18-10	1.4301	+C700[b]	350	700 to 850	20
		+C800[a]	500	800 to 1000	12
X8CrNiS18-9	1.4305	+C700[b]	350	700 to 850	20
		+C800[a]	500	800 to 1000	12
X6CrNiTi18-10	1.4541	+C700[b]	350	700 to 850	20
		+C800[a]	500	800 to 1000	12
X2CrNiMo17-12-2	1.4404	+C700[b]	350	700 to 850	20
		+C800[a]	500	800 to 1000	12
X5CrNiMo17-12-2	1.4401	+C700[b]	350	700 to 850	20
		+C800[a]	500	800 to 1000	12
X6CrNiMoTi17-12-2	1.4571	+C700[b]	350	700 to 850	20
		+C800[a]	500	800 to 1000	12

[a] Maximum diameter for this tensile strength level shall be agreed at the time of enquiry and order; it should not be greater than 25 mm.

[b] Maximum diameter for this tensile strength level shall be agreed at the time of enquiry and order; it should not be greater than 35 mm.

*) 1 MPa = 1 N/mm²

SAKY STEEL CO., LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

Table 26 — Tests to be carried out, test units and extent of testing in specific testing

Test	[a]	Test unit	Product form Rods, bars and sections	Number of test pieces per sample
Chemical analysis	m	Cast	The cast analysis is given by the manufacturer[b]	
Tensile test at ambient temperature	m	Batch[c]	1 sample per 25 t; maximum of 2 per test unit	1
Tensile test at elevated temperature	o		To be agreed at the time of ordering (see Tables 20 to 24)	1
Impact test at ambient temperature	o		To be agreed at the time of ordering (see Tables 9 to 12)	3
Resistance to intergranular corrosion	o		To be agreed at the time of ordering if intergranular corrosion is a hazard (see Tables 8, 11 and 12)	1

[a] Tests marked with an "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 ordering.

[b] Product analysis may be agreed at the time of ordering; the extent of testing shall be specified at the same time.

[c] Each batch consists of products coming from the same cast. The products must have been subject to the same heat treatment cycle in the same furnace. In the case of a continuous furnace or in process annealing a batch is the lot heat treated without intermission with the same process parameters.

The shape and size of the cross sectional area of products in a single batch may be different providing that the ratio of the largest to the smallest cross sectional areas shall be equal or less than three.

SAKY STEEL CO., LTD

Table 27 — Marking of the products

Marking of	Products	
	with specific testing[a]	without specific testing[a]
Manufacturer's name, trade mark or logo	+	+
Steel number or name	+	+
Cast number	+	+
Identification number[b]	+	(+)
Inspector's mark	(+)	-

[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 or inspection report.

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

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 metallically 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		Hot forming		Heat treatment symbol	Annealing	
Name	Number	Temperature °C	Type of cooling		Temperature[b] °C	Type of cooling
Standard grades						
X2CrNi12	1.4003	1100 to 800	air	+A	680 to 740	air
X6Cr13	1.4000				750 to 800	
X6Cr17	1.4016				750 to 850	
X6CrMoS17	1.4105				750 to 850	
X6CrMo17-1	1.4113				750 to 850	
Special grades						
X2CrTi17	1.4520	1100 to 800	air	+A	750 to 850	air
X3CrNb17	1.4511					
X2CrMoTiS18-2	1.4523				1000 to 1050	
X6CrMoNb17-1	1.4526				800 to 860	
X2CrTiNb18	1.4509				750 to 850	

[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.

SAKY STEEL CO., LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

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

Steel designaton		Hot forming		Heat treatment symbol	Annealing		Quenching		Tempering
Name	Number	Temperature °C	Type of cooling		Temperature[b] °C	Type of cooling	Temperature[b] °C	Type of cooling	Temperature °C
Standard grades									
X12Cr13	1.4006	1100 to 800	air	+A	745 to 825	air	-	-	-
				+QT650	-	-	950 to 1000	oil, air	680 to 780
X12CrS13	1.4005			+A	745 to 825	air	-	-	-
				+QT650	-	-	950 to 1000	oil, air	680 to 780
X15Cr13	1.4024		slow cooling	+A	750 to 800	furn.,air	-	-	-
				+QT650	-	-	950 to 1030	oil, air	700 to 750
X20Cr13	1.4021			+A	745 to 825	air	-	-	-
				+QT700	-	-	950 to 1050	oil, air	650 to 750
				+QT800	-	-	950 to 1050	oil, air	600 to 700
X30Cr13	1.4028			+A	745 to 825	air	-	-	-
				+QT850	-	-	950 to 1050	oil, air	625 to 675
X39Cr13	1.4031			+A	750 to 850	furn.,air	-	-	-
				+QT800	-	-	950 to 1050	oil, air	650 to 700
X46Cr13	1.4034			+A	750 to 850	furn.,air	-	-	-
				+QT850	-	-	950 to 1050	oil, air	650 to 700
X38CrMo14	1.4419	1100 to 800	slow cooling	+A	750 to 830	furnace, air	-	-	-
X50CrMoV15	1.4116			+A	750 to 850		-	-	-
X55CrMo14	1.4110			+A	750 to 850		-	-	-
X14CrMoS17	1.4104		air	+A	750 to 850		-	-	-
				+QT650	-	-	950 to 1070	oil, air	550 to 650
X39CrMo17-1	1.4122		slow cooling	+A	750 to 850	furn.,air	-	-	-
				+QT750	-	-	980 to 1060	oil	650 to 750
X17CrNi16-2	1.4057			+A[c]	680 to 800	furn.,air	-	-	-
				+QT800[d]	-	-	950 to 1050	oil, air	750 to 800 + 650 to 700[d]
				+QT900	-	-	950 to 1050	oil, air	600 to 650
X3CrNiMo13-4	1.4313	1150 to 900	air	+A[e]	600 to 650	furn.,air	-	-	-
				+QT650	-	-	950 to 1050	oil, air	650 to 700 + 600 to 620
				+QT780	-	-	950 to 1050	oil, air	550 to 600
				+QT900	-	-	950 to 1050	oil, air	520 to 580
X4CrNiMo16-5-1	1.4418			+A[e]	600 to 650	furn., air	-	-	-
				+QT760	-	-	950 to 1050	oil, air	590 to 620[f]
				+QT900	-	-	950 to 1050	oil, air	550 to 620
Special grades									
X29CrS13	1.4029	1100 to 800	slow cooling	+A	740 to 820	air	-	-	-
				+QT850	-	-	950 to 1050	oil, air	625 to 675
X46CrS13	1.4035			+A	750 to 850	-	-	-	-
X70CrMo15	1.4109			+A	750 to 800	furnace, air	-	-	-
X40CrMoVN16-2	1.4123	1200 to 1000		+A	800 to 850		-	-	-
X105CrMo17	1.4125	1100 to 900		+A	780 to 840	furnace, air	-	-	-
X90CrMoV18	1.4112	1100 to 800		+A	780 to 840		-	-	-
X2CrNiMoV13-5-2	1.4415	1150 to 900	air	+QT750	-	-	950 to 1050	oil, air	600 to 650 + 500 to 550
				+QT850	-	-			

[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.
[c] Double annealing might be advisable.
[d] In the case that the nickel is at the lower side of the range specified in Table 3, a single tempering at 620 to 720°C may be sufficient.
[e] Tempering after martensitic transformation.
[f] Either 2 x 4 h or 1 x 8 h as a minimum time.

SAKY STEEL CO., LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

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	Solution annealing		Precipitation hardening
Name	Number	Temperature °C	Type of cooling		Temperature[b] °C	Type of cooling	Temperature °C
Standard grades							
X5CrNiCuNb16-4	1.4542	1150 to 900	furnace, air	+AT[c]	1030 to 1050	oil, air	-
				+P800	1030 to 1050		2 h 760 °C/air + 4 h 620 °C/air
				+P930	1030 to 1050		4 h 620 °C/air
				+P960	1030 to 1050		4 h 590 °C/air
				+P1070	1030 to 1050		4 h 550 °C/air
X7CrNiAl17-7	1.4568		air	+AT	1060 to 1080	water, air	-
X5CrNiMoCuNb14-5	1.4594		furnace, air	+AT[c]	1030 to 1050	oil, air	-
				+P930	1030 to 1050		4 h 620 °C/air
				+P1000	1030 to 1050		4 h 580 °C/air
				+P1070	1030 to 1050		4 h 550 °C/air
Special grades							
X1CrNiMoAlTi12-9-2	1.4530	1200 to 800	air	+AT	820 to 860	oil, air	-
				+P1200	820 to 860	oil, air	4 h 540 to 560 °C/air
X1CrNiMoAlTi12-10-2	1.4596		air	+AT	820 to 860	oil, air	-
				+P1400	820 to 860	oil, air	4 h ≥ 530 °C/air
X5NiCrTiMoVB25-12-2	1.4606	1100 to 950	air, oil, water	+AT[c]	970 to 990	water, oil	-
				+P880			16 h 720 °C/air

[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] Not suitable for direct application, prompt precipitation hardening after solution annealing is recommended to avoid cracking.

SAKY STEEL CO., LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

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

Steel designation		Hot forming		Heat treatment symbol	Solution annealing	
Name	Number	Temperature °C	Type of cooling		Temperature[b, c, d] °C	Type of cooling
Standard grades						
X10CrNi18-8	1.4310	1200 to 900	air	+AT	1000 to 1100	water,air[e]
X2CrNi18-9	1.4307	1200 to 900	air	+AT	1000 to 1100	water,air[e]
X2CrNi19-11	1.4306				1000 to 1100	
X2CrNiN18-10	1.4311	1200 to 900	air	+AT	1000 to 1100	water,air[e]
X5CrNi18-10	1.4301				1000 to 1100	
X8CrNiS18-9	1.4305				1000 to 1100	
X6CrNiTi18-10	1.4541				1020 to 1120	
X5CrNi18-12	1.4303				1000 to 1100	
X2CrNiMo17-12-2	1.4404				1020 to 1120	
X2CrNiMoN17-11-2	1.4406				1020 to 1120	
X5CrNiMo17-12-2	1.4401				1020 to 1120	
X6CrNiMoTi17-12-2	1.4571				1020 to 1120	
X2CrNiMo17-12-3	1.4432				1020 to 1120	
X2CrNiMoN17-13-3	1.4429				1020 to 1120	
X3CrNiMo17-13-3	1.4436				1020 to 1120	
X2CrNiMo18-14-3	1.4435				1020 to 1120	
X2CrNiMoN17-13-5	1.4439				1020 to 1120	
X6CrNiCuS18-9-2	1.4570	1150 to 900			1000 to 1100	
X3CrNiCu18-9-4	1.4567	1200 to 900			1000 to 1100	
X1NiCrMoCu25-20-5	1.4539				1050 to 1150	
Special grades						
X5CrNi17-7	1.4319	1200 to 900	air	+AT	1000 to 1100	water,air[e]
X9CrNi18-9	1.4325	1200 to 900			1000 to 1100	
X5CrNiN19-9	1.4315	1150 to 850			1000 to 1100	
X6CrNiNb18-10	1.4550	1150 to 850			1020 to 1120	
X1CrNiMoN25-22-2	1.4466	1150 to 850			1070 to 1150	

SAKY STEEL CO., LTD

Table A.4 (*continued*)

Steel designation		Hot forming		Heat treatment symbol	Solution annealing	
Name	Number	Temperature °C	Type of cooling		Temperature [b, c, d] °C	Type of cooling
Special grades						
X6CrNiMoNb17-12-2	1.4580	1150 to 850	air	+AT	1020 to 1120	water,air[e]
X2CrNiMo18-15-4	1.4438				1020 to 1120	
X1CrNiMoCuN24-22-8	1.4652	1200 to 1000			1150 to 1200	
X1CrNiSi18-15-4	1.4361	1150 to 900			1100 to 1160	
X11CrNiMnN19-8-6	1.4369	1150 to 850			1000 to 1100	
X12CrMnNiN17-7-5	1.4372	1150 to 850			1000 to 1100	
X8CrMnNiN18-9-5	1.4374	1150 to 850			1000 to 1100	
X8CrMnCuNB17-8-3	1.4597	1200 to 900			1000 to 1100	
X3CrNiCu19-9-2	1.4560	1150 to 900			1000 to 1100	
X3CrNiCuMo17-11-3-2	1.4578				1000 to 1100	
X1NiCrMoCu31-27-4	1.4563	1150 to 850			1050 to 1150	
X1CrNiMoCuN25-25-5	1.4537	1200 to 950			1120 to 1180	
X1CrNiMoCuN20-18-7	1.4547	1200 to 1000			1140 to 1200	
X2CrNiMoCuS17-10-2	1.4598				1020 to 1120	
X1CrNiMoCuNW24-22-6	1.4659				1150 to 1200	
X1NiCrMoCuN25-20-7	1.4529	1200 to 950			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] If heat treatment is carried out in a continuous furnace, the upper part of the range specified is usually preferred, or even exceeded.

[c] 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.

[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 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.

SAKY STEEL CO., LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

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] °C	Type of cooling
Standard grades						
X3CrNiMoN27-5-2	1.4460	1200 to 950	air	+AT	1020 to 1100	water, air[d]
X2CrNiMoN22-5-3	1.4462	1200 to 950			1020 to 1100	water, air[d]
Special grades						
X2CrNiN23-4	1.4362	1200 to 1000	air	+AT	950 to 1050	water, air
X2CrNiMoN29-7-2	1.4477				1040 to 1120	water
X2CrNiMoCuN25-6-3	1.4507				1040 to 1120	water
X2CrNiMoN25-7-4	1.4410				1040 to 1120	water
X2CrNiMoCuWN25-7-4	1.4501				1040 to 1120	water
X2CrNiMoSi18-5-3	1.4424				1000 to 1100	water, air[d]

[a] Temperature 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] 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.

[d] Cooling sufficiently rapidly in order to avoid precipitation.

SAKY STEEL CO., LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

Annex B
(informative)

Availability of corrosion resistant steel wire in the cold work-hardened condition

Tables B.1 to B.4 give an overview of ferritic, martensitic, precipitation hardening, austenitic and austenitic-ferritic steels available as wire in the cold work-hardened condition (see Table 18).

Table B.1 — Ferritic grades

Steel designation		Typically available tensile strength levels for diameters in mm				
Name	Number	+C500	+C600	+C700	+C800	+C900
X6Cr17	1.4016	all diam.	< 20	< 20	< 15	< 10
X6CrMoS17	1.4105	all diam.	< 20	< 20	< 15	< 10
X6CrMo17-1	1.4113	< 25	< 20	< 20	< 15	< 10
X3CrNb17	1.4511	1 to 25	< 20	< 20	< 15	< 10

Table B.2 — Martensitic and precipitation hardening grades

Steel designation		Typically available tensile strength levels for diameters in mm										
Name	Number	+C500	+C600	+C700	+C800	+C900	+C1000	+C1100	+C1200	+C1400	+C1600	+C1800
X12Cr13	1.4006	all diam.	< 20	< 20	< 15	< 10	0,5 to 2	-	-	-	-	-
X12CrS13	1.4005	all diam.	< 20	< 20	< 15	< 10	-	-	-	-	-	-
X20Cr13	1.4021	all diam.	< 20	< 20	< 15	< 10	< 3	-	-	-	-	-
X30Cr13	1.4028	all diam.	< 20	< 20	< 15	< 10	< 3	-	-	-	-	-
X46Cr13	1.4034	all diam.	< 20	< 20	< 15	< 10	-	-	-	-	-	-
X14CrMoS17	1.4104	all diam.	< 20	< 20	< 15	< 10	-	-	-	-	-	-
X7CrNiAl17-7	1.4568	-	-	-	-	-	< 4	< 4	< 4	< 4	< 3	< 2
X5NiCrTiMoVB25-12-2	1.4606	-	< 25	< 20	< 15	< 15	< 15	< 10	< 6	-	-	-

SAKY STEEL CO., LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

Table B.3 — Austenitic grades

Steel designation		Typically available tensile strength levels for diameters in mm										
Name	Number	+C500	+C600	+C700	+C800	+C900	+C1000	+C1100	+C1200	+C1400	+C1600	+C1800
X10CrNi18-8	1.4310	-	1 to 25	< 25	< 20	< 15	< 15	< 15	< 15	< 10	< 5	< 2
X2CrNi18-9	1.4307	-	1 to 25	< 25	< 20	< 15	< 15	< 15	< 10	< 5	-	-
X2CrNi19-11	1.4306	> 20	1 to 25	< 25	< 20	< 15	< 15	< 15	< 10	< 5	-	-
X5CrNi18-10	1.4301	-	1 to 25	< 25	< 20	< 15	< 15	< 15	< 10	< 5	-	-
X8CrNiS18-9	1.4305	-	1 to 25	< 25	< 20	< 15	< 15	-	< 10	< 5	-	-
X6CrNiTi18-10	1.4541	-	1 to 25	< 25	< 20	< 15	< 15	< 15	< 10	< 5	-	-
X4CrNi18-12	1.4303	> 20	1 to 25	< 25	< 20	< 15	< 15	< 15	< 10	< 5	-	-
X2CrNiMo17-12-2	1.4404	-	< 25	< 25	< 20	< 15	< 15	< 15	< 10	< 5	-	-
X5CrNiMo17-12-2	1.4401	> 20	< 25	< 25	< 20	< 15	< 15	< 15	< 10	< 5	-	-
X6CrNiMoTi17-12-2	1.4571	-	< 25	< 25	< 20	< 15	< 15	< 15	< 10	< 5	-	-
X2CrNiMo17-12-3	1.4432	-	< 25	< 25	< 20	< 15	< 15	< 15	< 10	< 5	-	-
X3CrNiMo17-13-3	1.4436	-	< 25	< 25	< 20	< 15	< 15	< 15	< 10	< 5	-	-
X2CrNiMo18-14-3	1.4435	-	< 25	< 25	< 20	< 15	< 15	< 15	< 10	< 5	-	-
X6CrNiCuS18-9-2	1.4570	-	< 25	< 25	< 20	< 15	< 15	< 15	< 10	< 5	-	-
X3CrNiCu18-9-4	1.4567	6 to 25	1 to 25	< 20	< 20	< 15	< 15	< 15	< 10	< 6	-	-
X1CrNiMoCu25-20-5	1.4539	-	< 25	< 25	< 20	< 15	< 15	< 15	< 10	< 5	-	-
X1CrNiMoN25-22-2	1.4466		< 25	< 25	< 20	< 15	< 15	< 15	< 10	< 5	-	-
X8CrNiMnN18-9-5	1.4374	-	-	0,5 to 25	< 20	< 15	< 15	< 15	< 15	< 10	< 10	< 4
X8CrMnCuNB17-8-3	1.4597	-	1 to 25	< 25	< 20	< 15	< 15	< 15	< 10	< 5	-	-
X1NiCrMoCuN25-20-7	1.4529	-	2 to 22	< 22	< 16	< 10	< 6	< 4	< 3	-	-	-

Table B.4 — Austenitic-ferritic grade

Steel designation		Typically available tensile strength levels for diameters in mm								
Name	Number	+C500	+C600	+C700	+C800	+C900	+C1000	+C1100	+C1200	+C1400
X2CrNiMoN22-5-3	1.4462	-	-	-	< 20	< 20	< 15	< 15	< 15	< 6

SAKY STEEL CO., LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

Annex C
(informative)

Applicable dimensional standards

EN 10017, S*teel rod for drawing and/or cold rolling – Dimensions and tolerances.*

EN 10024[1], *Hot-rolled taper flange I sections – Tolerances on shape and dimensions.*

EN 10034[1], *Structural steel I and H sections – Tolerances on shape and dimensions.*

EN 10055[1], *Hot rolled steel equal flange tees with radiused root and toes – Dimensions and tolerances on shape and dimensions.*

EN 10056-2[1], *Structural steel equal and unequal leg angles – Part 2: Tolerances on shape and dimensions.*

EN 10058, *Hot rolled flat steel bars for general purposes – Dimensions and tolerances on shape and dimensions.*

EN 10059, *Hot rolled square steel bars for general purposes – Dimensions and tolerances on shape and dimensions.*

EN 10060, *Hot rolled round steel bars for general purposes – Dimensions and tolerances on shape and dimensions.*

EN 10061, *Hot rolled hexagon steel bars for general purposes – Dimensions and tolerances on shape and dimensions.*

EN 10218-2, *Steel wire and wire products – General – Part 2: Wire dimensions and tolerances.*

EN 10278, *Dimensions and tolerances of bright steel products.*

EN 10279[1)], *Hot rolled steel channels – Tolerances on shape, dimensions and mass.*

SAKY STEEL CO., LTD

1) In the scopes of these dimensional standards, stainless steels are expressly excluded. On the other hand, these standards are used in practice for stainless steels, too. Therefore, they are listed here.

Bibliography

[1] EN 10095, *Heat resisting steels and nickel alloys*

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

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

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

[5] CR 10261, *Iron and steel – Review of available methods of chemical analysis.*

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

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

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

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

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

SAKY STEEL CO., LTD

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

Licensed Copy: Institute Of Technology Tallaght, Institute of Technology, Fri Aug 11 10:17:35 BST 2006, Uncontrolled Copy, (c) BSI

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.

BSI
389 Chiswick High Road
London
W4 4AL

SAKI STEEL CO., LTD