BRITISH STANDARD

BS EN
10020:2000

Definition and classification of grades of steel

The European Standard EN 10020:2000 has the status of a British Standard

ICS 01.040.77; 77.080.20

National foreword

This British Standard is the official English language version of EN 10020:2000. It supersedes BS EN 10020:1991 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee ISE/5, Technical delivery conditions, classification and designation of steels, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible 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.

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

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Summary of pages

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English version

Definition and classification of grades of steel

Définition et classification des nuances d'acier

Begriffsbestimmung für die Enteilung der Stähle

This European Standard was approved by CEN on 18 February 2000.

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

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

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Contents

Foreword

This European Standard has been prepared by Technical Committee ECISS/TC 6, Steels – Definition and classification, the secretariat of which is held by AFNOR.

This European Standard replaces EN 10020:1988.

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of an identical text or by endorsement, at the latest by September 2000, and conflicting national standards shall be withdrawn at the latest by September 2000.

At the Co-ordination Committee (COCOR) meeting of May 31/June 1, 1995, ECISS decided to revise EN 10020:1988.

That standard used EURONORM 20:1974 as the basis for work, revising it to align EN 10020 as far as possible at that time:

— with the Harmonised System nomenclature of the World Customs Organisation (WCO);

— with ISO 4948-1and ISO 4948-2;

— taking into account experience gained from using the EURONORM together with new developments in the steel industry.

This European standard is more closely aligned with the Harmonised System in that the same limit values have been adopted for alloy elements, together with deletion of the previous “70 % rule” for specified combinations of elements.

One main quality class in EN 10020:1988, base steels, has been deleted and merged with non alloy quality steels.

Further developments in the iron and steel industry and progress in European standardization have also been taken into account.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European Standard defines the term “steel” (see clause 2) and classifies steel grades into:

— non alloy, stainless steel and other alloy steels by chemical composition (see clause 3);

— main quality classes (see clause 4) defined by main property or application characteristics for non alloy, stainless and other alloy steels.

2 Term and definition

For the purposes of this standard, the following term and definition apply:

2.1
steel
material which contains by mass more iron than any other single element, having a carbon content generally less than 2 % and containing other elements. A limited number of chromium steels may contain more than 2 % of carbon, but 2 % is the usual dividing line between steel and cast iron

3 Classification by chemical composition

3.1 Applicable alloy contents

For European Standards the classification given in the product standard or specification applies regardless of the steel which is actually produced, provided that the chemical composition complies with the requirements of the standard concerned.

3.1.1 Classification is based on the ladle analysis specified in the product standard or specification and is determined by the minimum value specified for each element.

3.1.2 Where for elements other than manganese a maximum value only is specified in the product standard or specification for the ladle analysis, a value of 70 % of this maximum value shall be taken for classification as set out in Tables 1 and 2. For manganese see note a) of Table 1.

3.1.3 Where a product standard or specification is based on product analysis an equivalent ladle analysis is calculated using the permitted deviations from ladle analysis specified in the product standard or specification or corresponding European Standard or EURONORM.

3.1.4 In the absence of a product standard or specification or a precisely specified chemical composition, classification is based on the actual ladle analysis reported by the manufacturer.

3.1.5 The results of product analysis may deviate from those of the ladle analysis to an extent permitted by the appropriate product standard or specification (such deviations do not affect the classification of the steel as non alloy or alloy).

If the product analysis indicates a value, which would place the steel in a class other than intended, then its inclusion in the class originally intended shall be separately and reliably substantiated.

3.1.6 Composite or coated products are classified according to the specified chemical composition of the product, which has been coated or clad.

3.1.7 For each alloy element, the specified, calculated or actual ladle analysis value is expressed to the same number of decimal places as the corresponding limit value shown in Table 1. For example in this European Standard a specified range of 0,3 % to 0,5 % corresponds to a range of 0,30 % to 0,50 %. Similarly a specified content of 2 % is taken to mean a content of 2,00 %.

3.2 Definition of classes

3.2.1 Non alloy steels

Non alloy steels are steel grades in which none of the limit values in Table 1 is reached by the contents as defined in 3.1.

3.2.2 Stainless steels

Stainless steels are steels with at least 10,5 % of chromium and max.1,2% of carbon .

3.2.3 Other alloy steels

Other alloy steels are steel grades not complying with the definition of stainless steels in which at least one of the limit values in table 1 is reached by the contents as defined in 3.1.

Table 1 – Boundary between non alloy and alloy steels (ladle analysis)

Specified element		Limit value % by mass
Al	Aluminium	0,30
B	Boron	0,0008
Bi	Bismuth	0,10
Co	Cobalt	0,30
Cr	Chromium	0,30
Cu	Copper	0,40
La	Lanthanides (each)	0,10
Mn	Manganese	1,65 a)
Mo	Molybdenum	0,08
Nb	Niobium	0,06
Ni	Nickel	0,30
Pb	Lead	0,40
Se	Selenium	0,10
Si	Silicon	0,60
Te	Tellurium	0,10
Ti	Titanium	0,05
V	Vanadium	0,10
W	Tungsten	0,30
Zr	Zirconium	0,05
Others (except carbon, phosphorus, sulphur, nitrogen) (each)		0,10

a) Where manganese is specified only as a maximum the limit value is 1,80 % and the 70 % rule (see 3.1.2) does not apply.

4 Classification of main quality classes

4.1 Non alloy steels

4.1.1 Non alloy quality steels

4.1.1.1 General description

Non alloy quality steels are steel grades which, in general, have specified property requirements such as, for example, toughness, grain size control and/or formability.

4.1.1.2 Definition

Non alloy quality steels are non alloy steels other than those defined in 4.1.2.2 as non alloy special steels.

Non alloy electrical steels are defined as: non alloy quality steels with specified requirements for maximum values of specific total loss or minimum values of magnetic induction, polarization or permeability

4.1.2 Non alloy special steels

4.1.2.1 General description

Non alloy special steels have a higher degree of cleanness than quality steels particularly in respect of non-metallic inclusions. In most cases they are intended for quenching and tempering or surface hardening and are characterized by consistent response to such treatment. Precise control of chemical composition and special care in manufacture and process control ensure improved properties to meet exacting requirements. These properties which are generally in combination and within closely controlled limits include high or closely controlled yield strength or hardenability values sometimes associated with suitability for cold forming, welding or toughness.

4.1.2.2 Definition

Non alloy special steels are steel grades, which comply with one or more of the following requirements:

— specified minimum impact strength in the quenched and tempered condition;

— specified hardness penetration depth or surface hardness in the quenched, quenched and tempered or surface hardened condition;

— particularly low contents of non-metallic inclusions are specified;

NOTE This class includes grades where the product standard or specification specifies such limitations of inclusions subject to agreement at the time of ordering. However, specified through thickness reduction of area properties do not change the classification of the original steel.

— specified maximum phosphorus and sulphur content:

  — for ladle analysis $\leq$ 0,020 %;

  — for product analysis $\leq$ 0,025 %.

  (e.g. rod for high strength springs, electrodes, tyre cord wire);

— specified minimum impact strength on Charpy-V-notch test pieces at - 50 °C greater than 27 J for test pieces taken in the longitudinal direction or greater than 16 J for test pieces taken in the transverse direction[1)];

[1)] If no impact value is specified at - 50 °C the value specified between - 50 °C and - 60 °C shall be used.

— steels for nuclear reactors having the following specified elements simultaneously restricted on product analysis to:

  — copper ≤ 0,10 %, cobalt ≤ 0,05 %, vanadium ≤ 0,05 %;

— specified electrical conductivity > 9 S·m/mm^2;

— precipitation hardening steels with minimum specified carbon contents of 0,25 % or more in the ladle analysis and a ferritic/pearlitic microstructure, containing one or more micro alloy elements such as niobium or vanadium with contents less than the limit values for alloy steels. Precipitation hardening is generally achieved by controlled cooling from the hot forming temperature;

— prestressing steels.

4.2 Stainless steels

Stainless steels are defined by chemical composition in 3.2.2. They are subdivided further according to the following criteria:

— by nickel content into:

  — nickel less than 2,5 %;
  — nickel 2,5 % or more.

— by main property into:

  — corrosion resisting;
  — heat resisting;
  — creep resisting.

4.3 Other alloy steels

4.3.1 Alloy quality steels

4.3.1.1 General description

Alloy quality steels are steel grades for which requirements exist with regard to, for example, toughness, grain size control and/or formability.

Alloy quality steels are not generally intended for quenching and tempering or for surface hardening.

4.3.1.2 Definition

Alloy quality steels are given in 4.3.1.2.1 to 4.3.1.2.5.

4.3.1.2.1 Weldable fine grained structural steels, including steels for pressure vessels and tubes, other than those defined in 4.3.1.2.3 which meet all the following conditions:

— specified minimum yield strength < 380 N/mm^2 for thickness ≤ 16 mm;

— alloy contents as defined by 3.1 are less than the limit values given in Table 2;

— specified minimum impact strength on Charpy-V-notch test pieces at - 50 °C ≤ 27 J for test pieces taken in the longitudinal direction or ≤ 16 J for test pieces taken in the transverse direction[1)].

Table 2 - Weldable fine grained alloy steels.
Chemical composition boundary between quality steels and special steels

Specified element		Limit value % by mass
Cr	Chromium	0,50
Cu	Copper	0,50
Mn	Manganese	1,80
Mo	Molybdenum	0,10
Nb	Niobium	0,08
Ni	Nickel	0,50
Ti	Titanium	0,12
V	Vanadium	0,12
Zr	Zirconium	0,12

4.3.1.2.2 Alloy steels for rails, sheet piling and mining frames.

4.3.1.2.3 Alloy steels for hot or cold rolled flat products for severe cold forming applications[2)] containing grain refining elements such as boron, niobium, titanium, vanadium and/or zirconium or dual phase steels[3)].

4.3.1.2.4 Alloy steels in which copper is the only specified alloy element.

4.3.1.2.5 Alloy electrical steels are steels mainly containing silicon or silicon and aluminium as alloying elements to meet specified requirements for maximum values of specific total loss or minimum values of magnetic induction, polarization or permeability

1) If no impact value is specified at - 50°C the value specified between - 50°C and - 60°C shall be used.

2) Excluding steels for pressure vessels or tubes.

3) Dual phases steels have a microstructure which is essentially ferritic, with about 10% to 35 % of martensite in small isolated areas uniformly dispersed throughout.

4.3.2 Alloy special steels

4.3.2.1 General description

This class includes steel grades other than stainless steels for which are characterized by precise control of chemical composition and particular conditions of manufacture and process control to ensure improved properties which are frequently specified in combination and within closely controlled limits.

4.3.2.2 Definition

All other alloy steels, which are not excluded by the definition given in 4.3.1 for alloy quality steels are alloy special steels.

Alloy special steels include alloy engineering steels and alloy steels for pressure vessels, bearing steels, tool steels, high-speed steels, and steels with special physical properties such as ferritic-nickel steels with controlled expansion coefficient, or electrical resistance steels.

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