UDC 669.14.001.33 : 001.4

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Definition and classification of steel

English version of DIN EN 10 020

DIN EN 10020

Begriffsbestimmungen für die Einteilung der Stähle

European Standard EN 10 020 : 1989 has the status of a DIN Standard.

A comma is used as the decimal marker.

National foreword

This standard, which conforms in all respects to EURONORM 20, has been prepared by ECISS/TC 6a.

The responsible German body involved in the preparation of this standard was the *Normenausschuß Eisen und Stahl* (Steel and Iron Standards Committee), Subcommittee *Einteilung, Benennung und Benummerung von Stählen.*

Standards referred to

See Annex D.

International Patent Classification

C 22 C 38/00

Continued overleaf.

EN comprises 13 pages.

Editor's note

This standard reproduces the official text of the English version of EN 10 020 as issued by CEN. In its preparation for publication as DIN EN 10 020 (English version), certain points have been noted which we consider to be in need of correction. These have been marked +). The suggested amendments are given below and will be forwarded to the responsible CEN Secretariat for its consideration.

In presentation, orthography, punctuation and hyphenation, the aim has been to implement the PNE Rules consistently. Obvious errors (e.g. redundancies and omissions) have been rectified without further reference.

Suggested amendments

1 *'non alloy steel' has been used throughout instead of 'unalloyed steel', and 'alloy element' instead of 'alloying element' (which are the common technical terms).*

2 *According to the International System of Units, 'by mass' is to be substituted for 'by weight' (cf. subclauses 5.1.3.2, item h), and 5.2.2.2, as well as tables 1 and 3, and annex C.2).*

3 *The layout of the table in annex B differs from that in the German version. To make the sense complete, in the heading of the last column, 'Steels with special physical properties' is to be substituted for 'Special physical properties steels'.*

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 10020

November 1988

UDC 669.14.001.33 : 001.4

Descriptors: Iron and steel products, steels, alloy steels, unalloyed steels, grades, quality, definitions, classification, chemical composition, quality classes.

English version

Definition and classification of grades of steel

Définition et classification des nuances d'acier

Begriffsbestimmungen für die Einteilung der Stähle

This European Standard was approved by CEN on 1988-11-05. 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.

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CEN

European Committee for Standardization

Comité Européen de Normalisation

Europäisches Komitee für Normung

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

Ref. No. EN 10 020 : 1988 E

Foreword

This European Standard was prepared by Technical Committee ECISS/TC 6a 'Definitions and classification of steel', the Secretariat of which is held by AFNOR.

It has been submitted to the CEN Formal Vote following the decision of the Coordinating Commission (COCOR) of the European Committee for Iron and Steel Standardization in November 1988.

It has been adopted and ratified by CEN/BT on 1988-11-05.

According to the CEN/CENELEC Internal Regulations, the following countries are bound to implement this European Standard:

Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

Contents

1 Scope

This European Standard defines the term 'steel' (clause 3) and classifies steel grades into:

- non alloy and alloy steels, by chemical composition (clause 4);
- main quality classes (clause 5), defined by main property or application characteristics for non alloy and alloy steels (see annexes A and B).

NOTE: Technical committees responsible for steel quality standards shall classify each grade in those standards as non alloy or alloy as defined in clause 4 and into one of the main quality classes defined in clause 5 of this European Standard, and indicate this classification in the text of each standard. If the requirements specified in a quality standard are not compatible with the criteria of clause 5 to the extent that there are doubts about the allocation of grades to quality classes, the technical committee responsible for EN 10 020 shall advise as to their classification. If the technical committee responsible for the quality standard disputes the advice, the matter shall be resolved by the ECISS Coordinating Commission (COCOR).

The classification given in the quality standard applies automatically regardless of the steel which is actually produced provided that the chemical composition complies with the requirement of the standard concerned.

2 Normative references

See annex D.

3 Definition

steel: a material which contains by weight +) 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.

4 Classification by chemical composition

4.1 Applicable alloy contents

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

NOTE: Classification according to the conventions of the Customs Co-operation Council Harmonized System Nomenclature is on a different basis. (See annex C, clause C.1.)

4.1.2 Where for elements other than manganese a maximum value only is specified for the ladle analysis, a value of 70 % of this maximum value shall be taken for classification. For manganese, see note 3 to table 1.

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

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

4.1.5 The results of product analysis may deviate from those of the ladle analysis to an extent permitted by the appropriate product standard (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.

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

4.1.7 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%.

4.2 Definition of classes

4.2.1 Non alloy [1]) steels

Steel grades in which none of the limit values in table 1 is reached by the contents as defined in 4.1, taking account of the notes to table 1 relating to certain alloy elements specified in combination.

4.2.2 Alloy steels

Steel grades in which at least one of the limit values given in table 1 is reached by the contents as defined in 4.1 taking account of the notes to table 1 relating to certain alloy elements specified in combination.

5 Classification of main quality classes

5.1 Main classes of non alloy steels

5.1.1 Non alloy base steels

5.1.1.1 General description

Base steels are those steels manufactured by normal steelmaking operations and which do not require special processing.

5.1.1.2 Definition

Base steels are non alloy steels which meet the following four conditions:

a) no heat treatment is required [1]);

b) the properties specified in the standard or product specification for products delivered in the as rolled or normalized condition comply with the limit values in table 2;

c) no other quality requirement (e.g. suitability for cold drawing, wire drawing, cold forming, etc.) is specified;

d) no particular requirements for alloy elements except mangenese and silicon are specified.

NOTE: Tinplate, black plate and chromium or chromium oxide coated steels (ECCS) are not base steels.

5.1.2 Non alloy quality steels

5.1.2.1 General description

Non alloy quality steels are steel grades which generally do not have specified requirements for consistent response to heat treatment or for cleanness in terms of non-metallic inclusions. Because of the conditions under which quality steels are used, their quality requirements (e.g. fracture toughness, grain size control, formability) are more stringent than those for base steels, so that particular care is needed during their manufacture.

[1]) Throughout this European Standard, annealing (e.g. full annealing, sub-critical annealing) or normalizing is not regarded as heat treatment. See EURONORM 52.

Table 1: Boundary between non alloy and alloy steel (see 4.2)

Specified element		Limit value (% by weight)
Al	Aluminium	0,10
B	Boron	0,0008
Bi	Bismuth	0,10
Co	Cobalt	0,10
Cr	Chromium [1])	0,30
Cu	Copper [1])	0,40
La	Lanthanides (each)	0,05
Mn	Manganese	1,65 [3])
Mo	Molybdenum [1])	0,08
Nb	Niobium [2])	0,06
Ni	Nickel [1])	0,30
Pb	Lead	0,40
Se	Selenium	0,10
Si	Silicon	0,50
Te	Tellurium	0,10
Ti	Titanium [2])	0,05
V	Vanadium [2])	0,10
W	Tungsten	0,10
Zr	Zirconium [2])	0,05
Others (except carbon, phosphorus, sulfur, nitrogen), each		0,05

[1]) Where elements are specified in combinations of two, three or four and have alloy contents (see 4.1) less than those given in the table, the limit value to be applied for classification is 70% of the sum of the individual limit values shown above for the two, three or four elements concerned.

[2]) The rule in footnote above applies to this group of elements.

[3]) Where manganese is specified only as a maximum, the limit value is 1,80% and the 70% rule does not apply.

5.1.2.2 Definition

Non alloy quality steels are non alloy steels other than those defined in 5.1.1 (base steels) and 5.1.3 (special steels).

5.1.3 Non alloy special steels

5.1.3.1 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 a high or closely controlled yield strength or hardenability values sometimes associated with suitability for cold forming, welding, or toughness.

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

a) specified impact strength in the quenched and tempered condition;

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

c) particularly low contents of non-metallic inclusions are specified.

NOTE: This class includes grades where the 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.

d) specified maximum phosphorous or sulfur content:
- for ladle analysis: $\leq$ 0,020 %
- for product analysis: $\leq$ 0,025 %

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

e) specified impact strength greater than 27 J at −50 °C on an ISO V-notch test piece taken in the longitudinal direction [2];

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

copper $\leq$ 0,10 %, cobalt $\leq$ 0,05 %, vanadium $\leq$ 0,05 %;

g) specified electrical conductivity: > 9 S m/mm²;

h) 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;

i) prestressing steels.

5.2 Main classes of alloy steels

5.2.1 Alloy quality steels

5.2.1.1 General description
Alloy quality steels are used in applications similar to those of non alloy quality steels, but the specified properties require additions of alloy elements above the limit values of table 1. Alloy quality steels are not generally intended for quenching and tempering or surface hardening.

5.2.1.2 Definition
Alloy quality steels are given in 5.2.1.2.1 to 5.2.1.2.5.

5.2.1.2.1 Weldable fine-grained structural steels, including steels for pressure vessels and tubes, other than those defined in 5.2.1.2.4, which meet all the following conditions:

a) minimum specified yield strength: < 380 N/mm² for thicknesses $\leq$ 16 mm;

b) alloy contents as defined in 4.1 are less than the limit values given in table 3, taking account of the footnotes relating to certain alloy elements specified in combination;

c) specified impact strength: $\geq$ 27 J at −50 °C on an ISO V-notch test piece taken in the longitudinal direction. [3].

[2] If no impact value is specified at −50 °C, the value specified between −50 °C and −60 °C shall be used.

[3] Excluding steels for pressure vessels or tubes.

Table 2: Limit values for specified properties of base steels

Specified properties		Test according to EU	Limit value
	Thickness mm		
Minimum tensile strength	$\leq$ 16	2 or 11	$\leq$ 690 N/mm²
Minimum yield strength	$\leq$ 16	2 or 11	$\leq$ 360 N/mm²
Minimum elongation [1]	$\leq$ 16	2 or 11	$\leq$ 26 %
Minimum diameter of bend test mandrel	$\geq$ 3	6	$\geq$ 1 e [2]
Minimum impact value at +20 °C on longitudinal ISO V-notch test piece	$\geq$ 10 $\leq$ 16	45	$\leq$ 27 J
Maximum carbon content			$\geq$ 0,10 %
Maximum phosphorus content			$\geq$ 0,045 %
Maximum sulfur content			$\geq$ 0,045 %

[1] Where the standard or specification does not specify an original gauge length of $L_0 = 5{,}65\sqrt{S_0}$ (S_0 being the original cross-sectional area of the test piece), the value specified shall be converted to this gauge length as described in ISO 2566.

[2] e = represents the thickness of the test piece.

5.2.1.2.2 Electrical steels containing only silicon or silicon and aluminium as alloy elements to meet specified requirements for magnetic losses or minimum values for magnetic induction, polarization or permeability.

5.2.1.2.3 Alloy steels for rails, sheetpiling and mining frames.

5.2.1.2.4 Alloy steels for hot and cold rolled flat products for severe cold forming applications [3] containing grain-refining elements such as boron, niobium, titanium, vanadium and/or zirconium or 'dual phase' steels [4].

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

5.2.2 Alloy special steels

5.2.2.1 General description

Alloy special steels 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.

This class includes stainless steels, heat and creep resisting steels, steels for bearings or tools, engineering steels, special structural steels and steels with special physical properties.

5.2.2.2 Definition

Alloy special steels are alloy steels other than the alloy quality steel categories defined in 5.2.1. They are classified by chemical composition as defined in 4.1 into the following principal categories.

5.2.2.2.1 Stainless steels containing by weight $\leq$ 1,20 % of carbon, and $\geq$ 10,50 % of chromium, subdivided by nickel content into:

a) Ni $<$ 2,50 %
b) Ni $\geq$ 2,50 %

5.2.2.2.2 High speed steels containing by weight, with or without other elements, at least two of the three elements molybdenum, tungsten or vanadium, with a combined content by weight of 7 % or more, 0,60 % or more of carbon and 3 to 6 % of chromium.

5.2.2.2.3 Other alloy steels.

[4] 'Dual phase' steels have a microstructure which is essentially ferritic, with about 10 to 35 % of martensite in small isolated areas uniformly dispersed throughout.

Table 3: Weldable fine grained alloy steels. Chemical composition boundary between quality steels and special steels

Specified element		Limit value (% by weight)
Cr	Chromium [1]	0,50
Cu	Copper [1]	0,50
La	Lanthanides (each)	0,06
Mn	Manganese	1,80
Mo	Molybdenum [1]	0,10
Nb	Niobium [2]	0,08
Ni	Nickel [1]	0,50
Ti	Titanium [2]	0,12
V	Vanadium [2]	0,12
Zr	Zirconium [2]	0,12
Others elements not mentioned each		(see table 1)

[1] Where these elements are specified in combinations of two, three or four and have alloy contents (see 4.1) less than those given in the table, the limit value to be applied for classification is 70 % of the sum of the individual limit values shown above for the two, three or four elements concerned.

[2] The rule in footnote 1 above applies to this group of elements.

6 Examples for classification of steels

Annex A gives examples of the classification of non alloy steels in accordance with the main quality classes defined in 5.1 and in which the steels are additionally divided into main groups according to their properties and end use.

Similarly, annex B gives examples of the classification of alloy steels in accordance with the main quality classes defined in 5.2 and the main characteristics defined in the second line of the table in annex B.

Annex A

Main classes of non alloy steels (examples)

	Main characteristics	Other characteristics	Main quality classes			
			B Base steels (5.1.1.2)	Q Quality steels (5.1.2.2)	S Special steels (5.1.3.2)	
						Item
1	$R_{e,max}$, $R_{m,max}$ or HB_{max} (low carbon steels)		Commercial quality flat products: grade FeP 10 of EU 111 and grades P 01 of EU's 130, 142, 153 and 154	Flat products for cold forming: all grades of EU's 111, 130, 139, 142, 153 and 154, except those defined as base steels		
2	$R_{e,min}$ or $R_{m,min}$	Structural and pressure vessel steels	Grades O, B and 2 of EU 25	a) Grades with P and $S_{max.} < 0{,}045\,\%$ not meeting the requirements of clause 5.1.3.2: – grades C and D of EU 25 – grades FeE 235 to FeE 355 of EU 113 (HS steels) – grades of EU 156 (shipbuilding) – grades of EU 147 (galvanized) – grades of EU 120 (for gas bottles) – grades of EU 28 (boilers and pressure vessels) b) Grades with specified forming requirements: grades KP, KQ and KZ of EU 25 c) Structural steels with specified Cu minimum	a) Steels with impact strength > 27 J at -50 °C on a longitudinal ISO test piece b) Certain steels for nuclear reactors	5.1.3.2 e) 5.1.3.2 f)
		Steels for reinforcement of concrete		d) Reinforcing steels of EU 80	c) Prestressing steels: EU 138	5.1.3.2 i)
		Steels for rails		e) Grades of ISO 5003		

3	Carbon steels	Free cutting		All grades of EU 87		
		Drawing, wire drawing	Grade 1 CD 9 of EU 16	All grade 2 steels of EU 16	All grade 3 steels of EU 16	5.1.3.2 c)
		Cold heading		Grades of EU 119 Part 2, not intended for heat treatment	Non alloy case hardening grades of EU 119 Part 3 Hardening and tempering grades of EU 119 Part 4	5.1.3.2 a), b), c) [3] 5.1.3.2 a), b), c) [3]
		Case hardening [1]			All non alloy grades of EU 84	5.1.3.2 a), b), c) [3]
		Quenching and tempering [1], [2]		Non alloy grades 1 of EU 83	Non alloy grades 2 and 3 of EU 83	5.1.3.2 a), c) [3]
		Spring steels		Non alloy grades 1 of EU 132	Non alloy grades 2 of EU 132	5.1.3.2 c)
		Tool steels			Non alloy grades of EU 96	5.1.3.2 b)
4	Steels with specified magnetic or electrical properties			a) Steels with specified limitation of magnetic losses and minimum values for induction polarization or permeability: EU 126 b) Steels with specified electrical conductivity ≤ 9 S m/mm²	Steels with specified electrical conductivity > 9 S m/mm²	5.1.3.2 g)
5	Applications	For coating		Steels for tinplate, blackplate and ECCS: EU's 145, 148, 158, 170, 172 and 173		
		For welding		Steels for covered electrodes or submerged arc welding with P_{max} and S_{max} each $> 0{,}020\,\%$: Grades to EU 133	Steels for covered electrodes or arc welding with P_{max} and S_{max} each $\leq 0{,}020\,\%$: Grades to EU 133	5.1.3.2 d)

[1] See also 'cold heading'

[2] See also 'cold heading', 'spring steels' and 'tool steels'.

[3] Current editions of EURONORMS 83, 84 and EURONORM 119 Parts 3 and 4 do not limit non-metallic inclusions because national standards have not been harmonized with respect to the cleanness requirements. Nevertheless, the steels set out in the column headed 'Special steels' follow the traditional practice for special steels with respect to cleanness.

Annex B

Main classes of alloy steels (examples) [1], [2]

Use / Chemical Composition	Quality steels (5.2.1)		Special steels (5.2.2)						
	Structural steels	Others	Structural steels (EU 113, 137, 155)	Engineering steels (EU 83, 84, 85, 86, 89, 119)	Corrosion heat resisting and creep resisting steels (EU 88, 90, 95)	Tool steels (EU 96)	Bearing steels (EU 94)	Special physical properties steels [+]
Stainless steels (5.2.2.2.1)					Ni < 2,50 % [3]: Cr 411/421	Cr 511	Cr	
					Ni < 2,50 % [3]: CrNi(x) 412/422	CrNi(x) 512		
					Ni < 2,50 % [3]: CrMo(x) 413/423 CrCo(x)	CrMo(x) 513	CrMo(x)	
					Ni < 2,50 % [3]: CrAl(x) 414/424 CrSi(x)			
					Ni < 2,50 % [3]: Others 415/425	Others 516		
					Ni ≥ 2,50 % [4]: CrNi 431			62 a Non-magnetic steels
					Ni ≥ 2,50 % [4]: CrNiMo 432			
					Ni ≥ 2,50 % [4]: CrNiTi 433 or CrNiNb			
					Ni ≥ 2,50 % [4]: CrNiMoTi 434 or CrNiMoNb			
					Ni ≥ 2,50 % [4]: + V, W, Co 435			
					Ni ≥ 2,50 % [4]: CrNiSi 436			
					Ni ≥ 2,50 % [4]: Others 437			
High-speed steels (5.2.2.2.2)						Mo(W)VCo Mo(W)V 521	80 MoCrV 40 16 X 80 WMoCrV 6 5 4 X 75 WCrV 18 4 1	
						W(Mo)VCo W(Mo)V 522		

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Other alloy steels (5.2.2.2.3)	(11) Weldable fine grained structural steels corresponding to conditions in 5.2.1.2.1	15 Electrical steels (5.2.1.2.2)	(21) Weldable fine grained structural steels not corresponding to conditions in 5.2.1.2.1	Mn(x) 31	X 40 CrAl 7	Cr(x) 511		62 c Magnetic steels other than those defined in 5.2.1.2.2
				Cr(x) 32	X 45 CrSi 8	Ni(x) CrNi(x) 512		
				CrMo(x) 33	X 40 CrSiMo 10			
	Alloy steels containing only copper 12 (5.2.1.2.5)	Steels for rails, sheet piling or mining frames (13) (5.2.1.2.3)	Weather-resistant steels 22 other than those defined in B (5.2.1.2.5)	CrNiMo(x) NiCrMo(x) 34		Mo(x) CrMo(x) 513		
				Ni(x) 35		V(x) CrV(x) 514		
				Others: Mo(x) Si(x), etc 36		W(x) CrW(x) 515	1 C – 1,5 Cr	
		Steels for flat products for severe cold forming (16) (5.2.1.2.4)		B		Others 516	Case hardening steels	Steels 62 b with specified coefficients of thermal expansion

1) The numbering system corresponds with that in ISO 4948-2. When the text, referring to definitions in EN 10 020, differs from that in ISO 4948-2, the numbers for the steel groups concerned are in brackets.

2) The suffix x indicates that alloys with additional alloying elements should also be covered by the relevant class, in so far as there are no special classes for them.

3) This group generally corresponds to ferritic/martensitic stainless steels.

4) This group generally corresponds to austenitic steels.

Annex C
Notes on chapter 72 'Iron and Steel' of the Customs Co-operation Council Harmonized System Nomenclature

C.1 Boundary between non alloy and alloy steels

In EN 10 020, the classification of non alloy steels and alloy steels is based on the specified ladle analysis, whereas in the Customs Co-operation Council Nomenclature, any doubtful cases are resolved only on the basis of the actual analysis of the product.

This difference of principle in classification between EN 10 020 and the Harmonized System Nomenclature of the Customs Co-operation Council may lead to different results, even though the limit values for most elements are identical.

For some alloy elements, there are differences in the limit values which define alloy steel between the Harmonized System Nomenclature and table 1 of EN 10 020 as shown below.

Alloy element	EN 10 020 Specified ladle analysis (%)	Harmonized System Actual product analysis (%)
Al Aluminium	0,10	0,30
Co Cobalt	0,10	0,30
La Lanthanides (each)	0,05	0,10
Si Silicon	0,50	0,60
W Tungsten	0,10	0,30
Others (except carbon, phosphorus, sulfur, nitrogen)	0,05	0,10

Moreover, the Harmonized System definition does not have the additional rules for classification of manganese and elements in combination set out in the footnotes to table 1 of EN 10 020.

For all other alloy elements (bismuth, boron, chromium, copper, lead, manganese, nickel, niobium, selenium, tellurium, titanium, vanadium, zirconium), the limit values are identical.

C.2 The Harmonized System contains the following definitions based on actual product analysis for summary classification of steel grades.

C.2.1 Non alloy free cutting steels (not used in EN 10 020)

Non alloy steel containing, by weight, one or more of the following elements in the specified proportions:

- 0,08 % or more of sulfur;
- 0,1 % or more of lead;
- more than 0,05 % of selenium;
- more than 0,01 % of tellurium;
- more than 0,05 % of bismuth.

C.2.2 Silicon electrical steel
(not used in EN 10 020)

Alloy steels containing, by weight, at least 0,6 % but not more than 6 % of silicon and not more than 0,08 % of carbon. They may also contain, by weight, not more than 1 % of aluminium but no other element in a proportion that would give the steel the characteristics of another alloy steel.

C.2.3 High speed steel

Alloy steels containing, with or without other elements, at least two of the three elements molybdenum, tungsten and vanadium, with a combined content by weight of 7 % or more, 0,6 % or more of carbon and 3 to 6 % of chromium. See also the definition in 5.2.2.2.2 of EN 10 020.

C.2.4 Silicon manganese steel
(not provided in EN 10 020)

Alloy steels containing by weight:

- 0,35 % or more, but not more than 0,70 % of carbon;
- 0,50 % or more, but not more than 1,20 % of manganese, and
- 0,60 % or more, but not more than 2,30 % of silicon, but not containing any other element in a proportion that would give the steel the characteristics of another alloy steel.

C.2.5 Stainless steel

Alloy steels containing, by weight, 1,20 % or less of carbon and 10,50 % or more of chromium, with or without other elements. See also the definition in 5.2.2.2.1 of EN 10 020.

Annex D
List of EURONORMs and ISO Standards referred to

D.1 EURONORMs and European Standards

This appendix lists EURONORMs:

- referred to in EN 10 020
- for which EN 10 020 may be used to classify grades which are valid on 1989-05-05.

These EURONORMs will be transformed into European Standards and are liable to be revised, in which case it will be necessary to consider the European Standard in place of the EURONORMs listed in this appendix.

EU 6-55	Bend test for steel
EU 16-70	Non alloy steel wire rod for cold drawing and/or cold rolling (revision approved in November 1986)
EU 28-85 [2]	Steel plate, sheet and strip with elevated temperature properties; technical delivery conditions
EU 52-83	Vocabulary of heat treatment terms for ferrous products
EU 80-85 [2]	Reinforcing steel (not for prestressing); technical delivery conditions
EU 83-70 [2]	Steels for hardening and tempering
EU 84-70	Case hardening steels
EU 85-70	Nitriding steels
EU 86-70	Steels for flame and induction hardening
EU 87-70	Free cutting steels.
	Part 1: General requirements
	Part 2: Quality specification relating to steels not intended for heat treatment
	Part 3: Quality specification relating to steels for hardening and tempering
	Part 4: Quality specification relating to case-hardening steels
EU 88-86	Stainless steels.
	Part 1: Bars, rod, and forged products
	Part 2: Plate, sheet and strip for general use
	Part 3: Plate, sheet and strip for boilers and pressure vessels
EU 89-71	Alloy steels for hot formed and treated springs; quality requirements
EU 90-71	Steels for exhaust valves for internal combustion engines
EU 94-73	Bearing steel; quality requirements
EU 95-79	Heat resisting steels; quality requirements
EU 96-79	Tool steels; quality requirements
EU 106-84	Cold rolled non-oriented magnetic steel sheet and strip
EU 107-86	Grain-oriented magnetic steel and strip
EU 111-77	Continuously hot rolled non-coated, non-alloy mild steel sheet and strip for cold forming; quality requirements
EU 113-72 [1]	Weldable structural steels of higher quality.
	Part 1: General requirements
	Part 2: Additional requirements for wide flats, plates, sheet and strip
EU 119-74	Steels for cold heading and cold extrusion; quality requirements.
	Part 1: General
	Part 2: Steels not intended for heat treatment
	Part 3: Case hardened steels
	Part 4: Quenched and tempered steels
	Part 5: Stainless steels
EU 120-83	Plate, sheet and strip for welded steel gas bottles
EU 126-77	Semi-processed steel strip for the construction of magnetic circuits
EU 129-76	Nickel alloy steel plate and strip for application at low temperature; quality requirements
EU 132-79	Cold rolled steel strip for springs; quality requirements
EU 133-79	Round wire rod in non-alloy and alloy steel for the manufacture of wire for covered electrodes for gas-shielded arc welding and for submerged arc welding; quality requirements
EU 137-83	Plates and wide flats made of weldable fine grained structural steels in the quenched and tempered condition; technical delivery conditions
EU 138-79 [1]	Prestressing steels
EU 139-81	Cold rolled uncoated non-alloy mild steel narrow strip for cold forming; quality requirements
EU 144-79	Round wire rod in stainless and heat resisting steel intended for the production of welding consumables; quality requirements
EU 145-78 [2]	Tinplate and blackplate in sheet form
EU 146-80 [1]	Tinplate and blackplate in coil form
EU 149-80	Flat products in high yield strength steel for cold forming
EU 150-87	Patented drawn non-alloy steel wire for springs; technical delivery conditions (revision approved in November 1986)
EU 152-80	Electrolytic zinc coated steel flat rolled product
EU 153-80	Hot-dip terne (lead alloy) coated cold reduced carbon steel flat rolled products of commercial and drawing qualities; technical delivery conditions
EU 154-80	Hot-dip aluminium-silicon coated carbon steel flat rolled products of commercial and drawing qualities; technical delivery conditions
EU 155-80 [2]	Weathering steels for structural purposes; quality requirements
EU 156-80	Steels for shipbuilding; normal and high strength qualities

[1] These EURONORMs are being revised and will be published as European Standards.

[2] Superseded by European Standard EN 10 203.

EU 158-83 [1])	Double reduced electrolytic tinplate sheet; qualities, dimensions and tolerances
EU 159-86 [1])	Double cold reduced electrolytic tinplate, coil for cutting into sheet, qualities, dimensions and tolerances (revision approved in November 1986)
EU 165-81	Cold rolled non-oriented magnetic alloy steel strip delivered in the semi-processed condition
EU 169-86	Continuously organic coated steel flat products

For [1]), see page 11.

D.2 ISO Standards

ISO 2566-1:1984	Steel; conversion of elongation values. Part 1: Carbon and non alloy steels
ISO 2566-2:1984	Steel; conversion of elongation values Part 2: Austenitic steels
ISO 4948-1:1982	Steels; classification. Part 1: Classification of steels into unalloyed and alloy steels based on chemical composition
ISO 4948-2:1981	Steels; classification. Part 2: Classification of unalloyed and alloy steels according to main quality classes and main property or application characteristics
ISO 5003:1980	Flat bottom railway rails and special rail sections for switches and crossings for non-treated steel; technical delivery requirements

Annex E
Commentary

E.1 Aims of revision

The 1974 edition of EURONORM 20 is revised to align it, as far as possible, with:

a) the Harmonized System Nomenclature of the Customs Co-operation Council (see annex C);

b) ISO 4948.

The revision has also taken into account experience gained from using the 1974 edition together with new developments in the steel industry.

E.2 Alignment of EN 10 020 with the Harmonized System Nomenclature

E.2.1 In EN 10 020 the classification of non alloy and alloy steels is based on the specified ladle analysis, whereas in the Customs Co-operation Council Nomenclature any doubtful cases are resolved on the basis of the actual analysis of the product. Nevertheless, there is generally a good correlation between classification in EN 10 020 and that of the Nomenclature (see annex C, clause C.1).

E.2.2 The Harmonized System Nomenclature provides supplementary subdivisions by chemical composition of non alloy and alloy steels based on actual analysis (see annex C, clause C.2).

Moreover, for non alloy steels, the Harmonized System features supplementary classifications of long products by carbon content, and flat products bei yield strength.

EN 10 020 does not use these classifications. Effectively, standards for steel products already reflect a classification by carbon content, distinguishing between case hardening steels, quenched and tempered steels, spring steels and tool steels. On the other hand, the concept of 'high-strength steels' is still being developed technically.

E.3 Alignment of EN 10 020 with ISO 4948

In general, close alignment has been achieved, particularly:

- for limit values of manganese and niobium;
- by adopting a residual definition of non alloy quality steels as opposed to base steels and non alloy special steels which are defined by specified characteristics;
- by introducing a further dimension of classification based on main property or application characteristics.

However, the following differences remain and should be noted:

E.3.1 Notes 1 and 2 to tables 1 and 3 of EN 10 020, which modify the limit values for the boundary between non alloy and alloy steels for certain elements in combinations, have been retained on technical grounds, though they do not appear in ISO 4948.

E.3.2 Steels with reqirements for resistance to lamellar tearing (i.e. specified through-thickness reduction of area properties) are covered by a quality standard which does not designate them as special steels. Thus, EN 10 020 does not recognize these supplementary requirements and so differs from ISO 4948-2, 4.2.4.2.

E.3.3 In 4.2.4.2 of ISO 4948-2, a distinction is made between steels intended for heat treatment and those not intended for heat treatment. This could not be justified and has consequently been discarded from EN 10 020.

E.3.4 For other differences, see E.4 below.

E.4 Principal changes based on experience and new developments in the steel industry

E.4.1 Previously, steels belonging to the same class by main property or application characteristics might overlap slightly the boundary of a main quality class, leading to difficulties in statistical analysis. For this reason and also with a pragmatic aim to achieve greater clarity, the following amendments were agreed:

a) all non alloy prestressing steels are to be treated as non alloy special steels (see 5.1.3.2 i));

b) the yield strength limit value to differentiate alloy quality structural steel from alloy special structural steel reduced from 420 to 380 N/mm² (see 5.2.1.2.1);

c) for silicon and silicon/aluminium alloy steels, not only those with requirements for magnetic losses are classified as quality steels, but also steels with requirements for magnetic induction, polarization or permeability (see 5.2.1.2.2);

d) all alloy steels for rails, sheetpiling and mining frames are classified as quality steels (see 5.2.1.2.3);

e) all flat products intended for severe cold forming applications containing only the alloy elements boron, niobium, titanium, vanadium or zirconium separately or in combination, together with 'dual phase' steels are classified as alloy quality steels (see 5.2.1.2.4).

E.4.2 A new group of precipitation-hardening non alloy steels are classified as non alloy special steels (see 5.1.3.2 h)).