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Indian Standard (Reaffirmed 1998)

CODE FOR DESIGNATION OF STEELS

PART I BASED ON LETTER SYMBOLS

(*First Revision*)

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(*Continued from page* 1)

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Indian Standard

CODE FOR DESIGNATION OF STEELS

PART I BASED ON LETTER SYMBOLS

(First Revision)

0. FOREWORD

0.1 This Indian Standard (Part I) (First Revision) was adopted by the Indian Standards Institution on 31 October 1974, after the draft finalized by the Metal Standards Sectional Committee had been approved by the Structural and Metals Division Council.

0.2 This standard was first published in 1962. The digital system of designation has since been adopted by many countries and is most suited for computer applications. It was, therefore, decided that this standard should be revised in two parts. This part (Part I) covers the designation of steel based on letter symbols and Part II will cover designation of steel based on numerals.

0.3 It is intended that only the minimum number of symbols shall be used in designating any steel. The Sectional Committee, therefore, decided that no symbols be used for the most common quality of steel or for most common applications. An example to illustrate this basic principle is that no symbol is used to denote semi-killed quality of steel which comprises 90 percent of the total production of steel.

0.4 While formulating this standard, the Committee has given due consideration to the Fifth draft proposal on classification of steels under consideration of ISO/TC 17/SC 2 Secretariat of which is held by India.

0.5 The units commonly used in Indian Standards and the corresponding SI units are given in Appendix A for information.

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1. SCOPE

1.1 This standard (Part I) covers the code designation of wrought steel based on letter symbols.

2. TERMINOLOGY

2.1 For the purpose of this standard, definitions given in IS: 1956-1962* shall apply.

*Glossary of terms relating to iron and steel.

3. CODE DESIGNATION OF STEELS BASED ON LETTER SYMBOLS

3.1 For the purpose of code designation, steels shall be classified as follows:

a) Steels designated on the basis of mechanical properties, and
b) Steels designated on the basis of chemical composition.

3.1.1 *Steels Designated on the Basis of Mechanical Properties* — These steels are carbon and low allow steels where the main criterion in the selection and inspection of steel is the tensile strength or yield stress. In such cases, provided the specified mechanical properties are attained, it is not usual to specify a detailed chemical composition but the quality of the material is designated where necessary by specifying certain quality levels.

The code designation shall consist of the following in the order given:

a) Symbol 'Fe' or 'FeE' depending on whether the steel has been specified on the basis of minimum tensile strength or yield stress.
b) Figure indicating the minimum tensile strength or yield stress in N/mm^2. If no minimum tensile or yield strength is guaranteed, the figure shall be 00.
c) Chemical symbols for elements the presence of which characterize the steel.
d) Symbol indicating special characteristics covering method of deoxidation, steel quality, degree of purity, weldability guarantee, resistance to brittle fracture, surface condition, formability, surface finish, heat treatment, elevated temperature and low temperature properties.
e) Symbol indicating applications, if necessary.

3.1.1.1 *Explanatory notes for special characteristics*

a) *Method of deoxidation* — Depending on whether the steel is killed, semi-killed or rimming variety, the following symbols shall be used to indicate the steel making practice:
   i) R for rimming steel, and
   ii) K for killed steel.

NOTE — If no symbol is used, it shall mean that the steel is of semi-killed type.

b) *Steel quality* — The following symbols shall be used to indicate steel quality:

Q1 — Non-ageing quality,
Q2 — Freedom from flakes,
Q3 — Grain size controlled,
Q4 — Inclusion controlled, and
Q5 — Internal homogeneity guaranteed.

c) *Degree of purity* — The sulphur and phosphorus levels (ladle analysis) shall be expressed as follows:

Symbol	*Maximum Content in Percent*	
	Phosphorus	Sulphur
P25	0·025	0·025
P35	0·035	0·035
P50	0·050	0·050
P70	0·070	0·070
No symbol will mean	0·055	0·055

The above symbols use the letter 'P' followed by 100 times the maximum percentage of sulphur and phosphorus. In case the maximum contents of sulphur and phosphorus are not same, the following procedure shall be followed:

Symbol SP shall be used to indicate the levels followed by:

1) 100 times the maximum sulphur rounded off* to the nearest integer.

2) 100 times the maximum phosphorus rounded off* to the nearest integer.

Example:

Maximum sulphur = 0·045 percent
Maximum phosphorus = 0·035 percent

Designation: SP 44.

d) *Weldability guarantee* — Guaranteed weldability of steel as determined by tests mutually agreed between supplier and manufacturer shall be indicated by the following symbols:

W = Fusion weldable, and

W_1 = Weldable by resistance welding but not fusion weldable.

e) *Resistance to brittle fracture* — Symbol 'B', 'B0', 'B2' or 'B4' indicating resistance to brittle fracture based on the results of the V-notch Charpy impact test.

For steels B, B0, B2, and B4 a test should be made with Charpy V-notch specimens, taken in the direction of rolling with the notch perpendicular to the surface of the plate or product.

*Rounding off shall be done according to the rules given in IS : 2-1960 Rules for rounding off numerical values (*revised*).

Steels B, B0, B2, and B4 are characterized by an average V-notch Charpy impact value according to the following table:

Steels	*Specified UTS Range*			
	370 to 520 N/mm²		500 to 700 N/mm²	
	Energy J	Temp °C	Energy J	Temp °C
(1)	(2)	(3)	(4)	(5)
B	28	27	40	27
B0	28	0	28	− 10
			40	0
B2	28	− 20	28	− 30
			40	− 20
B4	28	− 40	28	− 50
			40	− 40

f) *Surface condition* — The following symbols shall be used to indicate surface condition:

S1 — Deseamed or scarfed;

S2 — Descaled;

S3 — Pickled (including washing and neutralizing);

S4 — Shot, grit or sand blasted;

S5 — Peeled (skinned);

S6 — Bright drawn or cold rolled; and

S7 — Ground.

NOTE — If no symbol is used, it shall mean that the surface is in as rolled or as forged condition.

g) *Formability* (*applicable to sheet only*) — The following symbols shall be used to indicate drawability:

D1 — Drawing quality,

D2 — Deep drawing quality, and

D3 — Extra deep drawing quality.

NOTE — If no symbol is used, it shall mean that the steel is commercial quality.

h) *Surface finish* (*applicable to sheet only*) — The following symbols shall be used to indicate the surface finish:

F1 — General purpose finish,

F2 — Full finish,

F3 — Exposed,
F4 — Unexposed,
F5 — Matt finish,
F6 — Bright finish,
F7 — Plating finish,
F8 — Unpolished finish,
F9 — Polished finish,
F10 — Polished and coloured blue,
F11 — Polished and coloured yellow,
F12 — Mirror finish,
F13 — Vitreous enamel finish, and
F14 — Direct annealed finish.

j) *Treatment* — The following symbols shall be used to indicate the treatment given to the steel:

T1 — Shot peened,
T2 — Hard drawn,
T3 — Normalized*,
T4 — Controlled rolled,
T5 — Annealed,
T6 — Patented,
T7 — Solution treated,
T8 — Solution treated and aged,
T9 — Controlled cooled,
T10 — Bright annealed,
T11 — Spherodized,
T12 — Stress relieved,
T13 — Case hardened*, and
T14 — Hardened and tempered.

NOTE — If no symbol is used, it means that the steel is hot rolled.

k) *Elevated temperature properties* — For guarantee with regard to elevated temperature properties, the letter 'H' shall be used. However, in the designation only the room temperature properties shall be shown. Elevated temperature properties shall be intimated to the purchaser separately by the manufacturer.

*Includes tempering if done.

m) *Cryogenic quality* — For guarantee with regard to low temperature properties, the letter 'L' shall be used. However, only the room temperature properties shall be indicated in the designation.

Examples:

Fe 410 Cu K	Killed steel containing copper as alloying element with a minimum tensile strength of 410 N/mm²
FeE 300 P 35	Semi-killed steel with a minimum yield strength of 300 N/mm² and degree of purity as follows: S & P = 0·035 *Max*
Fe 470 W	Steel with a minimum tensile strength of 470 N/mm² and of guaranteed fusion welding quality
FeE 550 S6	Bright drawn or cold rolled steel with a minimum yield strength of 550 N/mm²
Fe00 R	Rimming quality steel with no guarantee of minimum tensile or yield strength
FeE 590 F7	Sheet steel of plating finish and minimum yield strength of 590 N/mm²
Fe 510 Ba	Steel in annealed condition with a minimum tensile strength of 510 N/mm² and resistance to brittle fracture = B
Fe 710 H	Steel with guaranteed elevated temperature properties and a minimum room temperature tensile strength of 710 N/mm²
Fe 410 Q1	Semi-killed non-ageing quality steel with S & P = 0·055 *Max* and minimum tensile = 410 N/mm²
Fe 600 T4	Semi-killed steel in controlled rolled condition with a minimum tensile strength of 600 N/mm²
Fe 520 L	Cryogenic quality steel with a minimum room temperature tensile strength of 520 N/mm²

3.1.2 *Steels Designated on the Basis of Chemical Composition*

3.1.2.1 *Unalloyed steels* (*as defined in* IS : 7598-1974*) — The code designation shall consist of the following in the order given:

a) Figure indicating 100 times the average percentage of carbon content,

b) Letter 'C', and

c) Figure indicating 10 times the average percentage of manganese content. The figure after multiplying shall be rounded off to the nearest integer according to the rules given in IS : 2-1960†.

*Classification of steels.

†Rules for rounding off numerical values (*revised*).

c) Symbol indicating special characteristics including guaranteed hardenability for which symbol 'G' shall be used at the end of the designation. (For special characteristics, *see* **3.1.1**.)

Examples:

25C5B0	Semi-killed steel with average 0·25 percent carbon and 0·5 percent manganese content and resistance to brittle fracture grade B0.
45C10G	Steel with average 0·45 percent carbon, 1 percent manganese and guaranteed hardenability

3.1.2.2 *Unalloyed tool steels* — The designation shall consist of:

a) Figure indicating 100 times the average percentage of carbon;

b) Symbol 'T' for tool steel; and

c) Figure indicating 10 times the average percent manganese content.

Examples:

75T5	Unalloyed tool steel with average 0·75 percent carbon and 0·5 percent manganese
80T11	Unalloyed tool steel with average carbon content of 0·80 percent and 1·1 percent manganese

3.1.2.3 *Unalloyed free cutting steels* — The designation shall consist of:

a) Figure indicating 100 times the average percentage of carbon;

b) Letter 'C';

c) Figure indicating 10 times the average percentage of manganese;

d) Symbol 'S', 'Se', 'Te' or 'Pb' depending on the element present which makes the steel free cutting followed by the figure indicating 100 times the percentage content of the element. In the case of the phosphorized steels the symbol 'P' shall be included; and

e) Symbol indicating special characteristics covering the method of deoxidation, surface condition and heat treatment (for explanatory notes on special characteristics, *see* **3.1.1**).

Examples:

35C10S14K	Free cutting steel with average 0·35 percent carbon, 1 percent manganese and 0·14 percent sulphur, killed quality.
20C12Pb15T14	Free cutting steel with average 0·15 percent lead, 0·20 percent carbon and 1·2 percent manganese, hardened and tempered.

3.1.2.4 *Alloy steels* (*as defined in* IS : 7598-1974*):

a) *Low and medium alloy steels* (*total alloying elements not exceeding* 10 *percent*) — The designation of steels shall consist of:

1) Figure indicating 100 times the average percentage carbon.
2) Chemical symbols for alloying elements each followed by the figure for its average percentage content multiplied by a factor as given below:

Element	*Multiplying Factor*
Cr, Co, Ni, Mn, Si and W	4
Al, Be, V, Pb, Cu, Nb, Ti, Ta, Zr and Mo	10
P, S, N	100

NOTE 1 — The figure after multiplying shall be rounded off to the nearest integer.

NOTE 2 — Symbol 'Mn' for manganese shall be included in case manganese content is equal to or greater than 1 percent.

NOTE 3 — The chemical symbols and their figures shall be listed in the designation in the order of decreasing content.

3) Symbol indicating special characteristics covering degree of purity hardenability, weldability guarantee, elevated temperature properties, surface condition, surface finish and heat treatment (for details *see* explanatory notes under **3.1.1** and **3.1.2.1**).

Examples:

25Cr4Mo2G Steel with guaranteed hardenability and having average 0·25 percent carbon, 1 percent chromium and 0·25 percent molybdenum

40Ni8Cr8V2 Hot rolled steel with average 0·40 percent carbon, 2 percent chromium, 2 percent nickel and 0·2 percent vanadium

b) *High alloy steels* (*total alloying elements more than 10 percent*) — The designation shall consist of:

1) Letter 'X'.
2) Figure indicating 100 times the percentage carbon content.
3) Chemical symbol for alloying elements each followed by the figure for its average percentage content rounded off to the nearest integer (*see* Note 2 under **3.1.2.4**).
4) Chemical symbol to indicate specially added element to attain the desired properties.
5) Symbol indicating specific characteristics covering hardenability, weldability guarantee, elevated temperature properties, surface condition, surface finish and heat treatment (for explanatory notes on special characteristics *see* **3.1.1**).

*Classification of steels.

Examples:

X10Cr18Ni9S3 Steel in pickled condition with average carbon 0·10 percent, chromium 18 percent and nickel 9 percent.

X15Cr25Ni12 Steel with 0·15 percent carbon, 25 percent chromium and 12 percent nickel

c) *Alloy tool steels* — The steel designation shall be as for low, medium and high alloy steels as given under (a) and (b) above except that the symbol 'T' will be included in the beginning of the designation of low alloy and medium alloy tool steels and 'XT' instead of 'X' in the case of high alloy tool steels.

Examples:

XT75W18Cr4Vi High alloy tool steel with average carbon 0·75 percent, tungsten 18 percent, chromium 4 percent and vanadium 1 percent

XT98W6Mo5Cr4Vi High alloy steel with average carbon 0·98 percent, tungsten 6 percent, molybdenum 5 percent, chromium 4 percent and vanadium 1 percent

d) *Free cutting alloy steels* — The steel designation shall be as for low, medium and high alloy steels as given under (a) and (b) above except that depending on the percentage of S, Se, Te and Zr present, the designation shall also consist of the chemical symbol of the element present followed by the figure indicating 100 times its content.

Examples:

X15Cr25Ni15S40 Alloy free cutting steel with carbon 0·15 percent, chromium 25 percent, nickel 15 percent and sulphur 0·40 percent,

X12Cr18Ni3S25 Alloy free cutting steel with 18 percent chromium, nickel 3 percent and sulphur 0·25 percent.

APPENDIX A

(*Clause* 0.5)

UNITS USED IN INDIAN STANDARDS AND THE CORRESPONDING SI UNITS

Units in Metric System	*Corresponding SI Units*
kgf	Newtons (N)
kgf/mm^2	N/mm^2
kgf.m	joules

BUREAU OF INDIAN STANDARDS

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Southern : C.I.T. Campus, IV Cross Road, CHENNAI 600113	235 23 15
†Western : Manakalaya, E9, Behind Marol Telephone Exchange, Andheri (East), MUMBAI 400093	832 92 95
Branch Offices::	
'Pushpak', Nurmohamed Shaikh Marg, Khanpur, AHMEDABAD 380001	550 13 48
‡Peenya Industrial Area, 1st Stage, Bangalore-Tumkur Road, BANGALORE 560058	839 49 55
Gangotri Complex, 5th Floor, Bhadbhada Road, T.T. Nagar, BHOPAL 462003	55 40 21
Plot No. 62-63, Unit VI, Ganga Nagar, BHUBANESHWAR 751001	40 36 27
Kalaikathir Buildings, 670 Avinashi Road, COIMBATORE 641037	21 01 41
Plot No. 43, Sector 16 A, Mathura Road, FARIDABAD 121001	8-28 88 01
Savitri Complex, 116 G.T. Road, GHAZIABAD 201001	8-71 19 96
53/5 Ward No.29, R.G. Barua Road, 5th By-lane, GUWAHATI 781003	54 11 37
5-8-56C, L.N. Gupta Marg, Nampally Station Road, HYDERABAD 500001	20 10 83
E-52, Chitaranjan Marg, C- Scheme, JAIPUR 302001	37 29 25
117/418 B, Sarvodaya Nagar, KANPUR 208005	21 68 76
Seth Bhawan, 2nd Floor, Behind Leela Cinema, Naval Kishore Road, LUCKNOW 226001	23 89 23
NIT Building, Second Floor, Gokulpat Market, NAGPUR 440010	52 51 71
Patliputra Industrial Estate, PATNA 800013	26 23 05
Institution of Engineers (India) Building 1332 Shivaji Nagar, PUNE 411005	32 36 35
T.C. No. 14/1421, University P. O. Palayam, THIRUVANANTHAPURAM 695034	6 21 17

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*Sales Office is at 5 Chowringhee Approach, P.O. Princep Street, CALCUTTA 700072	27 10 85
†Sales Office is at Novelty Chambers, Grant Road, MUMBAI 400007	309 65 28
‡Sales Office is at 'F' Block, Unity Building, Narashimaraja Square, BANGALORE 560002	222 39 71

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 1 NOVEMBER 1980

TO

IS:1762(Part I)-1974 CODE FOR DESIGNATION OF STEELS PART I BASED ON LETTER SYMBOLS

(First Revision)

Corrigendum

(*Page 8, clause 3.1.1.1, Examples, line 14*) - Substitute 'Fe 510 B' *for* 'Fe 510 Ba'.

Alteration

(*Page 5, clause 3.1.1.1*):

a) *Item* (c), *para 2, line 1* - Substitute '1 000 times' *for* '100 times'.

b) *Item* (c)(1) *and* (c)(2), *line 1* - Substitute '1 000 times' *for* '100 times' at both the places.

(SMDC 1)

Reprography Unit, BIS, New Delhi, India