

भारतीय मानक

सामान्य संरचना कार्यों के लिये इस्पात — विशिष्ट

( पाँचवाँ पुनरीक्षण )

*Indian Standard*

**STEEL FOR GENERAL STRUCTURAL  
PURPOSES — SPECIFICATION**

*( Fifth Revision )*

ICS 77.140.01

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**BUREAU OF INDIAN STANDARDS**  
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## FOREWORD

This Indian Standard (Fifth Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Wrought Steel Products Sectional Committee had been approved by the Metallurgical Engineering Division Council.

This standard was first issued in 1962 and subsequently revised in 1969, 1975, 1984 and 1992. It was mentioned in the foreword of IS 2062 : 1992, that Grade A steel which is supplied with a guaranteed carbon equivalent value, supersedes IS 226. While reviewing the standard in the light of experience gained during these years, Committee decided to revise it to align it with the present practices followed by the Indian industries.

In this revision, following changes have been made:

- a) Amendments number 1, 2, 3 and 4 have been incorporated.
- b) References of Indian Standards have been updated.
- c) Deoxidation mode for Grade B steel has been modified.
- d) Frequency of test samples for tensile, bend and impact tests has been modified.

Grade A steel specified in this standard, is intended for use in structures subject to normal conditions for non-critical applications. The use of Grade A steel is generally justified for these structural parts which are not prone to brittle fracture on account of its thickness, size and shape adopted and/or because of the fabrication and/or service conditions.

Grade B steel specified in this standard is intended for use in structures subject to critical loading applications, where service temperatures do not fall below 0°C. Use of Grade B steel is generally specified for those structural parts which are prone to brittle fracture and/or are subjected to severe fluctuation of stresses.

Grade C steel specified in this standard, is supplied with guaranteed low temperature impact properties. This grade is intended to be used in structures or structural parts, where the risk of brittle fracture requires consideration due to their design, size and/or service conditions. In cases where owing to increased thicknesses, loading conditions and general design of the structures, higher resistance to brittle fracture is required, use of steel of Grade C with a guarantee of impact properties at 0°C or -20°C or -40°C will be advisable.

The steel products conforming to the requirements of this specification can be rolled from the cast billet ingots, billets, blooms, slabs and continuously cast billets, blooms or slabs conforming to IS 2830 : 1992 'Carbon steel cast billet ingots, billets, blooms and slabs for re-rolling into steel for general structural purposes (*second revision*)'.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Indian Standard*

# STEEL FOR GENERAL STRUCTURAL PURPOSES — SPECIFICATION

*(Fifth Revision)*

**1 SCOPE**

**1.1** This Indian Standard covers the requirements of steel plates, strips, sections, flats, bars, etc, for use in structural work.

**1.1.1** The steels are suitable for welded, bolted and rivetted structures, and for general engineering purposes.

**1.2** Where welding is employed for fabrication and guaranteed weldability is required, welding procedure should be as specified in IS 9595 : 1996 'Metal arc welding of carbon and carbon manganese steels — Recommendations (*first revision*)'.

**2 REFERENCES**

The following Indian Standards are necessary adjuncts to this standard:

<i>IS No.</i>	<i>Title</i>
228	Methods of chemical analysis of steel
1599 : 1985	Method for bend test ( <i>second revision</i> )
1608 : 1995	Mechanical testing of metals — Tensile testing ( <i>second revision</i> )
1757 : 1988	Method for Charpy impact test (V notch) for metallic material ( <i>second revision</i> )
1852 : 1985	Rolling and cutting tolerances for hot-rolled steel products ( <i>third revision</i> )
1956	Glossary of terms relating to iron and steel
3803 (Part 1) : 1989	Steel — Conversion of elongation values: Part 1 Carbon and alloy steels ( <i>second revision</i> )
8910 : 1978	General technical delivery requirements for steel and steel products
9595 : 1996	Metal arc welding of carbon and carbon manganese steels — Recommendations ( <i>first revision</i> )
10842 : 1984	Testing and evaluation procedure for Y groove crackability test

**3 TERMINOLOGY**

For the purpose of this standard, the following definitions in addition to those given in the relevant parts of IS 1956 shall apply.

**3.1 Micro-Alloying Elements**

Elements, such as niobium, vanadium and titanium, added singly or in combination to obtain higher strength levels combined with better formability, weldability and toughness as compared with non-alloyed steel produced to equivalent strength levels.

**3.2 Weldability**

A metallic substance is considered to be weldable by a given process and for the given purpose, when metallic continuity to a stated degree can be obtained by welding using a suitable procedure, so that the joints comply with the requirements specified in regard to both their local properties and their influence on the construction of which they form a part.

**4 SUPPLY OF MATERIAL**

General requirements relating to supply of weldable structural steel shall conform to IS 8910.

**5 GRADES**

There shall be three grades of steel as given in Tables 1 and 3.

**6 MANUFACTURE**

The processes used in making the steel and in manufacturing hot rolled steel plates, strips, sections, flats, bars, etc, are left to the discretion of the manufacturer. If required, secondary refining may follow steel making.

**7 FREEDOM FROM DEFECTS**

**7.1** All finished steel shall be well and cleanly rolled to the dimensions, sections and masses specified. The finished material shall be reasonably free from surface flaws; laminations; rough/jagged and imperfect edges; and all other harmful defects.

**7.2** Minor surface defects may be removed by the manufacturer by grinding provided the thickness is not

reduced locally by more than 4 percent below the minimum specified thickness. Reduction in thickness by grinding greater than 4 percent, but not exceeding 7 percent, may be made subject to mutual agreement between the purchaser and the manufacturer.

**7.2.1** Subject to agreement with the purchaser, surface defects which cannot be dealt with as in 7.2 may be repaired by chipping or grinding followed by welding and inspection by a mutually agreed procedure such that:

- after complete removal of the defects and before welding, the thickness of the item is in no place reduced by more than 20 percent;
- welding is carried out by approved procedure by competent operators with approved electrodes and that the welding is ground smooth to the correct nominal thickness; and
- subsequent to the finish grinding, the item may be required to be normalized or otherwise heat-treated at the purchaser's direction.

**7.3** However, welding as mentioned in 7.2.1 is not permissible for Grade C material.

**7.4** The material may be subjected to non-destructive testing to determine soundness of material subject to mutual agreement between the purchaser and the manufacturer.

## 8 CHEMICAL COMPOSITION

**8.1** The ladle analysis of the steel, when carried out by the method specified in the relevant parts of IS 228 or any other established instrumental/chemical method, shall be as given in Table 1. In case of dispute, the procedure given in IS 228 and its relevant parts shall be the referee method. However, where the method is not given in IS 228 and its relevant parts, the referee method shall be as agreed to between the purchaser and the manufacturer.

### 8.2 Product Analysis

The product analysis shall be carried out on the finished product from the standard position. Permissible limits of variation in case of product analysis from the limits specified in Table 1 shall be as given in Table 2.

**Table 1 Chemical Composition**  
(Clauses 5, 8.1 and 8.2)

Grade Designation		Ladle Analysis, Percent, Max					Carbon Equivalent (CE), Max	Deoxidation Mode	Supply Condition
		C	Mn	S	P	Si			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
A	Fe 410W A	0.23	1.50	0.050	0.050	0.40	0.42	Semi-killed or Killed	As rolled
B	Fe 410W B	0.22	1.50	0.045	0.045	0.40	0.41	Killed	As rolled Plates above 12 mm may be normalized/controlled cooled if agreed to between the purchaser and the manufacturer
C	Fe 410W C	0.20	1.50	0.040	0.040	0.40	0.39	Killed	As rolled Plates above 12 mm shall be normalized/controlled cooled

#### NOTES

1 CE based on ladle analysis =  $C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15}$

2 When the steel is killed by aluminium alone, the total aluminium content shall not be less than 0.02 percent. When the steel is killed by silicon alone, the silicon content shall not be less than 0.10 percent. When the steel is silicon-aluminium killed, the silicon content shall not be less than 0.03 percent and total aluminium content shall not be less than 0.01 percent.

3 When micro-alloying elements like Nb, V and Ti are used individually or in combination, the total content shall not exceed 0.20 percent.

4 If mutually agreed to between the purchaser and the manufacturer, the steel may be supplied in the copper bearing quality in which case the copper shall be present between 0.20 to 0.35 percent on ladle analysis. In case of product analysis, the copper content shall be between 0.17 and 0.38 percent. The copper bearing quality steel shall be designated with a suffix Cu, for example, Fe 410Cu-WA.

5 Nitrogen content of the steel should not exceed 0.012 percent, which shall be ensured by the manufacturer by occasional check analysis.

6 Details of elements other than those specified may be supplied if agreed at the time of inquiry and order.

**Table 2 Permissible Variations for Product Analysis**  
(Clauses 5 and 8.2)

Constituent	Permissible Variations Over the Specified Limit, Percent, Max
(1)	(2)
Carbon	0.02
Manganese	0.05
Silicon	0.03
Sulphur	0.005
Phosphorus	0.005

## 9 SELECTION AND PREPARATION OF TEST SAMPLES

**9.1** The position from which test samples are taken shall be so located in the product as to yield the clearest possible information regarding properties in the cross-sectional and longitudinal planes. The recommended locations for taking test samples for plates, sections and bars are indicated in Fig. 1. Alternatively, in case of sections, the samples may be taken from the web.

**9.2** Wherever practicable, the rolled surface of the steel shall be retained on the two opposite sides of the test samples.

**9.3** In case of flat test samples for tensile test, both surfaces are normally to be left on the test samples for strips and plates up to 32 mm thick. At least one rolled surface shall be left on rectangular test samples taken from plates exceeding 32 mm in thickness. Round test samples are permitted, but should only be adopted for thickness exceeding 28 mm.

**9.4** In case of flats up to 16 mm thick, the test sample shall undergo, if possible, no machining whatever, prior to use as a test piece. If this is not possible, the test sample shall undergo the minimum amount of machining.

**9.5** Bars below 28 mm shall be tested without machining. In case of bars having diameters or thickness between 28 mm and 71 mm, the bars may be symmetrically reduced by machining. For bars having diameters or thicknesses exceeding 71 mm, the test sample may be taken from the position shown in Fig. 1.

**9.6** In case of plates, strips, sections and flats, bend tests shall be carried out on rectangular test samples which, as far as possible, should be of the full thickness of the product. In case of plates, sections and flats exceeding 28 mm in thickness, it is permissible to remove metal from one side of the test sample before using it as a test piece. The rolled surface of the test piece shall be on the outer side of the bend during the test.

**9.7** Before test samples are detached, full particulars regarding cast number, size and mass of plates, strips, sections, flats and bars in each cast shall be furnished by the manufacturer to the purchaser. In case of plates, the number of plates in each cast shall also be given.

**9.8** Test samples shall be cut in such a manner that the deformation is avoided as far as possible. If shearing or flame-cutting is employed, an adequate allowance shall be left for removal by machining.

**9.9** Test samples shall not be subjected to heat treatment unless the material from which they are cut is similarly treated, in which case the test samples shall be similarly and simultaneously treated with the material before testing. Any slight straightening of test samples which may be required shall be done cold.

## 10 TENSILE TEST

### 10.1 Number of Tensile Tests

#### 10.1.1 Plates, Strips, Sections (Angles, Tees, Beams, Channels, etc) and Flats

One tensile test shall be made from finished steel for every 50 tonnes or part thereof rolled continuously from each cast, a separate test being made for each class of steel product (namely, plates, strips, sections and flats) rolled from a cast.

**10.1.1.1** Where plates, strips, sections or flats of more than one thickness are rolled from the same cast, one additional tensile test shall be made from the material in each class of product for each variations in thickness of 6 mm.

#### 10.1.2 Bars (Round, Square and Hexagonal)

One tensile test shall be made from finished product for each 50 tonnes or part thereof. If more than one diameter or thickness of the bar is processed, one additional tensile test shall be made for each variation of 3 mm above or below the diameter or thickness of the bar ordered.

### 10.2 Tensile Test Pieces

The tensile strength, yield strength and percentage elongation of steel shall be determined from standard test pieces cut crosswise from plates and strips and lengthwise from sections, flats and bars. The test shall be carried out on the standard test pieces prepared in accordance with IS 1608.

**10.2.1** As a rule, test pieces with a proportional gauge length complying with the requirements  $L_0 = 5.65 \sqrt{S_0}$  should be used for the tensile test, where  $L_0$  is the gauge length and  $S_0$  is the cross sectional area of the test piece.

**10.2.1.1** Test pieces with a non-proportional gauge lengths, other than  $5.65 \sqrt{S_0}$ , may also be used in which

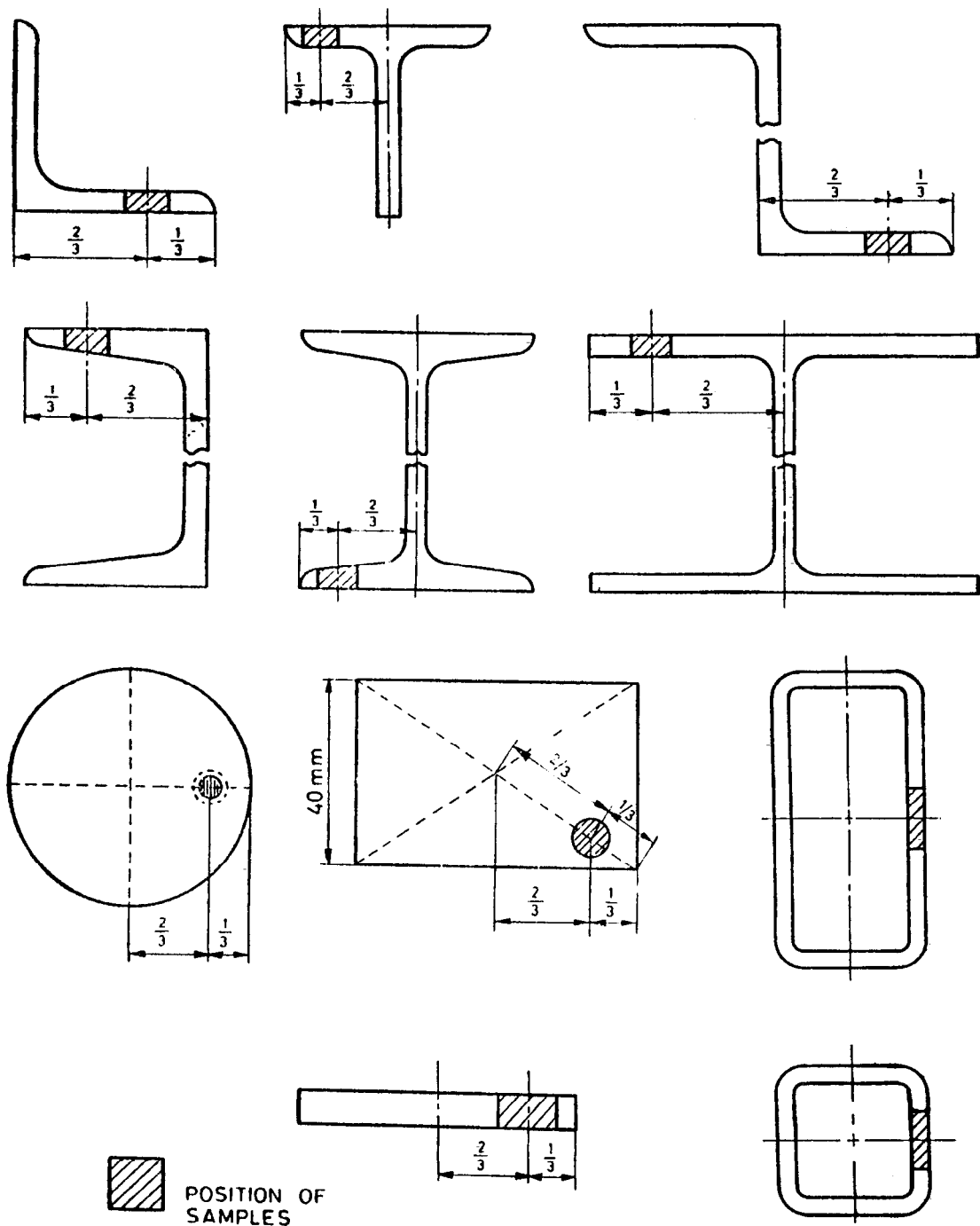


FIG. 1 STRUCTURAL STEEL SECTIONS, POSITION AND ORIENTATION OF SAMPLES

case the elongation values shall be converted to  $5.65 \sqrt{S_0}$  in accordance with IS 3803 (Part 1).

### 10.3 Tensile Test

Tensile strength, yield strength and percentage elongation when determined in accordance with IS 1608 shall be as given in Table 3.

**10.3.1** In case of sections the thickness of which is not uniform throughout the profile, the limits of sizes given in Table 3 shall be applied according to the actual maximum thickness of the piece adopted for testing.

**10.3.2** Should a tensile test piece break outside the middle half of the gauge length (*see* IS 1608) and the percentage elongation obtained is less than that specified, the test may be discarded at the manufacturer's option and another test made from the sample plate, strip, section, flat or bar.

## 11 BEND TEST

### 11.1 Number of Bend Tests

Bend test shall be made from finished steel from each cast. The number of tests for every 50 tonnes of material or part thereof, rolled continuously, shall be as given below. One additional test shall be made for

each class of product and for each variation of thickness.

Class of Steel Product	Number of Bend Tests
Plates, strips	One crosswise
Sections	One lengthwise for each type
Flats and bars (round, hexagonal, etc)	One lengthwise

### 11.2 Bend Test Piece

The test pieces shall be cut crosswise from plates and strips and lengthwise from sections, flats and bars. When section permits, these shall be not less than 40 mm wide. If the manufacturer so desires, round, square, hexagonal and flat bars and structural sections shall be bent in the full section as rolled.

**11.2.1** In all bend test pieces, the rough edge or arris resulting from shearing may be removed by filing or grinding or machining but the test pieces shall receive no other preparation.

### 11.3 Bend Test

Bend test shall be conducted in accordance with IS 1599.

**Table 3 Mechanical Properties**  
(Clauses 5, 10.3, 10.3.1, 11.3.1, 12.1.1, 12.2 and 12.4)

Grade	Designation	Tensile Strength Min, MPa	Yield Stress, Min, MPa			Percent Elongation at Gauge Length $5.65 \sqrt{S_0}$	Internal Diameter of Bend	Charpy V-Notch Impact Energy J, Min
			<20	20-40	> 40			
(1)	(2)	(3)	mm	mm	mm	Min	Min	(9)
A	Fe 410W A	410	250	240	230	23	3t	—
B	Fe 410W B	410	250	240	230	23	2t for less than or equal to 25 mm thick products 3t for more than 25 mm thick products	27 (see Note 1)
C	Fe 410W C	410	250	240	230	23	2t	27

#### NOTES

1 For Grade B material, the minimum Charpy V-notch impact energy is to be guaranteed at 0°C, if agreed to between the manufacturer and the purchaser.

2 For Grade C material, the minimum Charpy V-notch impact energy shall be guaranteed at any one of the three temperatures, namely 0°C or -20°C or -40°C, as specified by the purchaser.

3 't' is the thickness of the material.

4 The impact values are given for a standard test piece. When tested with subsidiary test pieces, the values shall not be less than the following.

Test Piece Size mm	Charpy V-Notch Impact Energy J, Min
10 × 7.5	22
10 × 5	19.5

**11.3.1** For bend test, the test piece at room temperature shall withstand bending through 180° to an internal diameter not greater than that given in Table 3 without cracking.

## 12 IMPACT TEST

**12.1** Impact test shall normally be carried out on products having thickness/diameter greater than or equal to 12 mm. The test specimen shall be so machined that the axis of the test specimen is parallel to the direction of rolling and the base closer to the rolled surface is more than 1 mm from it. The notch axis shall be perpendicular to the rolled surface.

**12.1.1** If stated in the order, impact tests may be carried out on products having a thickness less than 12 mm; the dimensions of the test pieces shall be in conformity with IS 1757 (see also Note 4 of Table 3).

**12.2** This test is carried out using a V-notch test piece (see IS 1757) the value for consideration being the arithmetic mean of the results obtained on three test pieces taken side by side from the same product (see Table 3).

**12.3** The test sample shall be taken from the thickest product. If the test sample taken from the thickest product rolled from a cast meets the requirements, the whole cast shall be deemed to meet the requirements of the test. If not, the test shall be performed on a section of next lower thickness rolled from the same cast and if it meets the requirements specified, this particular thickness as also other sections of lower thickness shall be deemed to satisfy the specification. If this thickness also does not meet the requirements, the test shall be carried out on the next lower thickness and so on, because the toughness of the product will be dependent on the rolling direction as well as on the section size.

**12.3.1** A test sample shall be taken from each 50 tonnes or part thereof from the same cast.

**12.4** The material represented shall be deemed to comply with the standard, if the average value of 3 test specimens, meets the requirements given in Table 3 provided no individual value shall be less than 70 percent of the specified value. If the average value of the three Charpy impact tests fails to comply by an amount not exceeding 15 percent of the specified minimum average value, three additional test pieces from the same sample shall be tested and the results added to those previously obtained and a new average calculated. Provided this new average complies with the specified requirement, the material represented shall be deemed to comply with this standard.

## 13 Y GROOVE CRACKABILITY TEST

Y groove crackability tests may be carried out in accordance with IS 10842 for products of only Grade C material having thickness above 12 mm, if

specifically agreed to between the manufacturer and the purchaser.

NOTE – The Y groove crackability test will not be applicable for rounds and it is mainly for plates and sections.

## 14 DIMENSIONS

Unless otherwise agreed to between the purchaser and the manufacturer, the nominal dimensions of rolled products conforming to this standard shall be in accordance with the relevant Indian Standard. Currently available Indian Standards are listed in Table 4.

## 15 TOLERANCES

The rolling and cutting tolerances for steel products conforming to this standard shall be those specified in IS 1852. Stricter tolerances may be followed if agreed to between the purchaser and the manufacturer.

## 16 RETEST

Should any one of test pieces first selected fail to pass any of the tests specified in this standard, two further samples shall be selected for testing in respect of each failure. Should the test pieces from both these additional samples pass, the material represented by the test samples shall be deemed to comply with the requirements of that particular test. Should the test pieces from either of these additional samples fail, the material represented by the test samples shall be considered as not having complied with this standard.

**Table 4 Indian Standards Which Give Nominal Dimensions of Rolled Steel Products**  
(Clause 14)

Product (1)	Relevant Indian Standard (2)
Beam, column, channel and angle sections	IS 808 : 1989 Dimensions for hot rolled steel beam, column, channel and angle sections ( <i>third revision</i> )
Tee bars	IS 1173 : 1978 Hot rolled slit steel tee bars ( <i>second revision</i> )
Bulb angles	IS 1252 : 1991 Hot rolled steel bulb angles—Dimensions ( <i>first revision</i> )
Plates, strips and flats	IS 1730 : 1989 Steel plates sheets, strips and flats for structural and general engineering purposes ( <i>second revision</i> )
Round and square bars	IS 1732 : 1989 Dimensions for round and square steel bars for structural and general engineering purposes ( <i>first revision</i> )
Bulb flats	IS 1863 : 1979 Hot rolled steel bulb flats ( <i>first revision</i> )
Sheet piling sections	IS 2314 : 1986 Steel sheet piling sections ( <i>first revision</i> )
Channel sections	IS 3954 : 1991 Hot rolled steel channel sections for general engineering purposes ( <i>first revision</i> )
Track shoe sections	IS 10182 (Part 1) : 1982 Dimensions and tolerances for hot rolled track shoe sections : Part 1 Section TS-L1 IS 10182 (Part 2) : 1985 Dimensions and tolerances for hot rolled track shoe sections : Part 2 Section TS-H1



## 17 CALCULATION OF MASS

The mass of steel shall be calculated on the basis that steel weighs  $7.85 \text{ g/cm}^3$ .

## 18 DELIVERY

Subject to prior agreement between the purchaser and the manufacturer, suitable protective treatment may be given to the material after rolling.

## 19 MARKING

**19.1** Each product, with the exception of round, square and hexagonal bars and flats, shall carry a tag or be marked with the manufacturer's name or trade-mark. Bars and flats shall carry a tag bearing the manufacturer's name or trade-mark. Designation of steel should also be similarly marked on the product or tag.

**19.2** Every heavy and medium structural mill product and each plate of thickness 10 mm and over shall be marked with the cast number. In case of plates below 10 mm thickness, the top plate of each pile (which may consist of approximately 16 plates) shall be marked

with the cast number and the remaining plates have suitable identification marking.

**19.3** The ends of the rolled product shall be painted with a colour code as given below:

Grade A	Green
Grade B	Grey
Grade C	Orange

**19.3.1** For the copper bearing quality, in addition to the colour code as specified in **19.3**, a white colour band shall be painted.

### 19.4 BIS Certification Marking

The material may also be marked with Standard Mark.

**19.4.1** The use of the Standard Mark is governed by the provisions of *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

**AMENDMENT NO. 1 JUNE 2001**  
**TO**  
**IS 2062 : 1999 STEEL FOR GENERAL STRUCTURAL**  
**PURPOSES — SPECIFICATION**

*( Fifth Revision )*

*( Page 3, clause 10.1.1 )* — Substitute the following for the existing clause:

**'10.1.1 Plates, Strips, Sections (Angles, Tees, Beams, Channels, etc) and Flats**

**Number of samples to be tested from a cast/heat and a class of steel product (namely, plates, strips, sections and flats) shall be as follows:**

- a) For cast/heat size up to 100 tonnes — 2 samples
- b) For cast size between 100-200 tonnes — 3 samples
- c) For cast size over 200 tonnes — 4 samples.'

( MTD 4 )

**AMENDMENT NO. 2 NOVEMBER 2002  
TO  
IS 2062 : 1999 STEEL FOR GENERAL STRUCTURAL  
PURPOSES — SPECIFICATION**

*( Fifth Revision )*

*( Foreword )* — Insert the following before last para:

‘For all the tests specified in this standard (chemical/physical/others), the method as specified in relevant ISO standard may also be followed as an alternate method.’

( MTD 4 )

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Reprography Unit, BIS, New Delhi, India

**AMENDMENT NO. 3 JUNE 2003**  
**TO**  
**IS 2062 : 1999 STEEL FOR GENERAL STRUCTURAL**  
**PURPOSES — SPECIFICATION**

*( Fifth Revision )*

*( Page 3, clause 10.1.2 )* — Substitute the following for the existing clause:

**‘10.1.2 Bars (Round, Square and Hexagonal)**

Number of samples to be tested from a cast/heat and a class of steel product (namely, bars) shall be as follows:

- a) For cast/heat size up to 100 tonnes — 2 samples,
- b) For cast/heat size between 100-200 tonnes — 3 samples, and
- c) For cast/heat size over 200 tonnes — 4 samples.’

*( Page 6, clause 13 )* — Substitute the following for the existing:

**‘13 Y GROOVE CRACKABILITY TEST**

Y groove crackability tests may be carried out in accordance with IS 10842 for products of only Grade C material having thickness 12 mm and above, if specifically agreed to between the manufacturer and the purchaser.’

(MTD 4)