इंटरनेट मानक

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"पुराने को छोड नये के तरफ"
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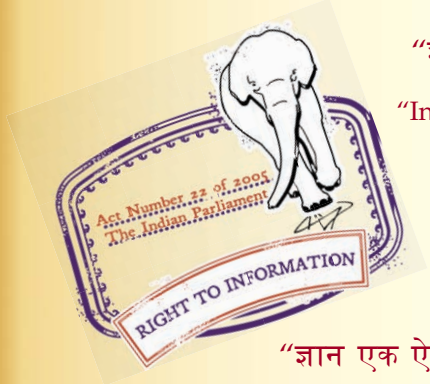
IS 2062 (2011): Hot Rolled Medium and High Tensile Structural Steel [MTD 4: Wrought Steel Products]



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"ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है"
Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

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भारतीय मानक

तप्त बेल्लित मध्यम एवं उच्च तन्यता के संरचना इस्पात — विशिष्टि

(सातवाँ पुनरीक्षण)

Indian Standard

HOT ROLLED MEDIUM AND HIGH TENSILE STRUCTURAL STEEL — SPECIFICATION

(Seventh Revision)

ICS 77.140.01

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

September 2011 **Price Group 5**

Wrought Steel Products Sectional Committee, MTD 4

FOREWORD

This Indian Standard (Seventh 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 published in 1962 and revised in 1969, 1975, 1984, 1992, 1999 and 2006. While reviewing this standard, in the light of experience gained during these years, the Committee decided to revise it to bring in line with the present practices being followed by the Indian steel industry, both in the integrated as well as secondary sectors. The Committee further decided to harmonize the standard with the overseas standards on carbon-manganese and high strength low alloy (HSLA) of structural steels.

In this revision, the following changes have been made:

a) Title has been modified and the word 'low' has been deleted, keeping in view the grades of steel contained in the standard. Requirements of low tensile structural steel are covered in IS 15911 : 2010 'Structural steel (ordinary quality) — Specification'.
b) Amendment No. 1 has been incorporated with suitable modifications.
c) Number of basic grades has been changed to nine. A new grade of E275, in line with European Standard, has been incorporated to take care of the requirements of medium tensile structural steels in the construction segment. Moreover, for each grade two to four sub-qualities have been introduced, depending upon the grade, where sub-qualities A, BR, B0 and C, in line with other international standards, indicate the mode of killing and impact test requirements.
d) The clause on 'Manufacture' has been modified, where the scope is suitably widened to include different steel making and rolling practices in vogue.
e) Silicon content of semi-killed steel has been clearly specified.

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.

While revising the standard, assistance has been derived from the following international specifications:

ASTM A 36 : 2008 Specification for structural steel

ASTM A 572 : 2007 Specification for high-strength low-alloy columbium-vanadium structural steel

EN 10025-2 : 2004 Hot rolled products of structural steels

The composition of the Committee responsible for the formulation of this standard is given in Annex A.

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.

AMENDMENT NO. 1 NOVEMBER 2012
TO
IS 2062 : 2011 HOT ROLLED MEDIUM AND HIGH TENSILE STRUCTURAL STEEL — SPECIFICATION

(Seventh Revision)

(*Page* 1, *clause* **1.1.2**) — Insert a new sub-clause **1.1.3**:

'1.1.3 This standard does not include those steels, which are covered by other Indian Standards, examples are as follows:

a) Steel plates of drawing quality (*see* IS 1079);

b) Steels for boilers and pressure vessels (*see* IS 2002 *and* IS 2041);

c) Steels for structural forming and flanging (*see* IS 5986);

d) Steels for the manufacture of welded gas cylinders/containers (*see* IS 6240 and IS 15914);

e) Steel wire rods for general engineering purposes (*see* IS 7887);

f) Steels for manufacture of agricultural tillage discs (*see* IS 9442);

g) Steels for welded tubes and pipes (IS 10748 and IS 15647);

h) Steels for cold rolling purposes (*see* IS 11513).'

(*Page* 4, *Table* 2, *col* 7) — Substitute '$5.65\sqrt{S_o}$' *for* '5.65'.

(*Page* 4, *Table* 2, *Heading* **'Internal Bend Diameter'**) — Substitute '*Max*' *for* '*Min*'.

(*Page* 6, *clauses* **10.2.1**, *line* 3) — Substitute '$5.65\sqrt{S_o}$' *for* '5.65'.

(*Page* 6, *clause* **10.2.1.1**, *lines* 2 *and* 3) — Substitute '$5.65\sqrt{S_o}$' *for* '5.65'.

(MTD 4)

Reprography Unit, BIS, New Delhi, India

Indian Standard

HOT ROLLED MEDIUM AND HIGH TENSILE STRUCTURAL STEEL — SPECIFICATION

(Seventh Revision)

1 SCOPE

1.1 This standard covers the requirements of steel including micro-alloyed steel plates, strips, shapes and sections (angles, tees, beams, channels, etc), flats, bars, etc, for use in structural work.

1.1.1 The steels are suitable for welded, bolted and riveted structures and for general engineering purposes:

1.1.2 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 standards listed below contain provisions, which through reference in this text constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreement based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	*Title*
228 (in various parts)	Methods for chemical analysis of steel
808 : 1989	Dimensions for hot rolled steel beam, column, channel and angle sections (*third revision*)
1173 : 1978	Hot rolled slit steel tee bars (*second revision*)
1252 : 1991	Dimensions of hot rolled steel bulb angles (*first revision*)
1599 : 1985	Method for bend test (*second revision*)
1608 : 2005	Metallic materials — Tensile testing at ambient temperature (*third revision*)
1730 : 1989	Dimensions for steel plates sheets, strips and flats for general engineering purposes (*second revision*)
1732 : 1989	Dimensions for round and square steel bars for structural and general engineering purposes (*second revision*)
1757 : 1988	Method for Charpy impact test (V-notch) for metallic material (*second revision*)
1852 : 1985	Rolling and cutting tolerances for hot rolled steel products (*fourth revision*)
1863 : 1979	Hot rolled steel bulb flats (*first revision*)
1956 (in various parts)	Glossary of terms relating to iron and steel
2314 : 1986	Specification for steel sheet piling sections (*first revision*)
3803 (Part 1) : 1989	Steel — Conversion of elongation values: Part 1 Carbon and low alloy steels (*second revision*)
3954 : 1991	Hot rolled steel channel sections for general engineering purposes (*first revision*)
8910 : 2010	General technical delivery requirements for steel and steel products (*first revision*)
10182	Dimensions and tolerances for hot rolled track shoe sections:
(Part 1) : 1982	Sections TS- L1
(Part 2) : 1985	Sections TS- H1
10842 : 1984	Evaluation procedure for Y-groove weld crackability test in structural steel
12778 : 2004	Hot rolled parallel flange steel sections for beams, columns and bearing piles — Dimensions and section properties (*first revision*)
12779 : 1989	Rolling and cutting tolerances for hot rolled parallel flange beam and column sections

3 TERMINOLOGY

For the purpose of this standard, the definitions given in IS 1956 and the following shall apply.

3.1 Micro-Alloying Elements — Elements, such as niobium, vanadium and titanium added singly or in combination to obtain higher strength to weight ratio combined with better toughness, formability and weldability as compared to unalloyed steel of similar strength level.

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.

3.3 Controlled Rolling — A hot rolling process in which the temperature of the steel and its reduction ratio are controlled, particularly during the final rolling passes, in order to achieve fine grain micro-structure and optimum mechanical properties.

3.4 Normalizing Rolling — A hot rolling process in which the final rolling passes are carried out at a suitable temperature equivalent to normalizing temperature, followed by cooling in air to a temperature below the transformation temperature, in order to produce a structure, analogous to that obtained by a separate normalizing treatment of hot rolled product.

4 SUPPLY OF MATERIAL

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

5 GRADES

There shall be nine grades of steel as given in Tables 1 and 2. For grades E 250 to E 410, there shall be four sub-qualities (A, BR, B0 and C) and for grades E 450 to E 650, there shall be two sub-qualities (A and BR). Sub-qualities A, BR, B0 and C indicate requirement of impact test and mode of de-oxidation as indicated below:

A : Impact test not required, semi-killed/killed

BR : Impact test optional; if required at room temperature; semi-killed/killed

B0 : Impact test mandatory at 0°C, semi-killed/killed

C : Impact test mandatory at –20°C, killed

While placing the order, the steel should be designated by 'Grade Designation' and 'quality' (*see* Table 1 and Table 2).

6 MANUFACTURE

6.1 Steel may be supplied in semi-killed/killed condition, where killed steel shall be supplied by mutual agreement between the purchaser and the manufacturer/supplier. The steel may be ingot cast or continuously cast.

6.2 The processes used in the steel making, casting and further hot rolling into steel plates, strips, sections, flats, bars, etc, are left to the discretion of the manufacturer/supplier. If required, secondary refining in the form of ladle refining, Vacuum degassing may follow steel making. The products may be rolled and supplied in as-rolled/normalizing/normalizing rolling/controlled rolling/accelerated cooling conditions as per the agreement between the purchaser and the manufacturer/supplier.

6.3 Material produced by re-rolling finished products (virgin or used or scrap), or by rolling material for which the metallurgical history is not fully documented or not known, are not acceptable as per this standard.

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/supplier 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/supplier.

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,

a) after complete removal of the defects and before welding, the thickness of the item is in no place reduced by more than 20 percent;

b) 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

c) subsequent to the finish grinding, the item may be required to be normalized or otherwise heat-treated at the purchaser's discretion.

7.3 Welding as mentioned in **7.2.1** is not permissible for grade designation E 250C, E 275C, E 300 to E 650 material.

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

Grade Designation	Quality	Ladle Analysis, Percent, *Max*					Carbon Equivalent (CE), *Max*	Mode of Deoxidation
		C	Mn	S	P	Si		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
E 250	**A**	0.23	1.50	0.045	0.045	0.40	0.42	Semi-killed/killed
	BR B0	0.22	1.50	0.045	0.045	0.40	0.41	Semi-killed/killed
	C	0.20	1.50	0.040	0.040	0.40	0.39	Killed
E 275	**A**	0.23	1.50	0.045	0.045	0.40	0.43	Semi-killed/killed
	BR B0	0.22	1.50	0.045	0.045	0.40	0.42	Semi-killed/killed
	C	0.20	1.50	0.040	0.040	0.40	0.41	Killed
E 300	**A BR B0**	0.20	1.50	0.045	0.045	0.45	0.44	Semi-killed/killed
	C	0.20	1.50	0.040	0.040	0.45	0.44	Killed
E 350	**A BR B0**	0.20	1.55	0.045	0.045	0.45	0.47	Semi-killed/killed
	C	0.20	1.55	0.040	0.040	0.45	0.45	Killed
E 410	**A BR B0**	0.20	1.60	0.045	0.045	0.45	0.50	Semi-killed/killed
	C	0.20	1.60	0.040	0.040	0.45	0.50	Killed
E 450	**A**	0.22	1.65	0.045	0.045	0.45	0.52	Semi-killed/killed
	BR							
E 550	**A**	0.22	1.65	0.020	0.025	0.50	0.54	Semi-killed/killed
	BR							
E 600	**A**	0.22	1.70	0.020	0.025	0.50	0.54	Semi-killed/killed
	BR							
E 650	**A**	0.22	1.70	0.015	0.025	0.50	0.55	Semi-killed/killed
	BR							

NOTES

1 New grade designation system based on minimum yield stress has been adopted.

2 For semi-killed steel, silicon shall be less than 0.10 percent. For killed steel, 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 Steels of qualities A, BR, B0 and C are generally suitable for welding processes. The weldability increases from quality A to C for grade designation E 250 and E 275.

4 Carbon equivalent (CE) would be calculated based on ladle analysis, only. $CE = C + \frac{Mn}{6} + \frac{(Cr + Mo + V)}{5} + \frac{(Ni + Cu)}{15}$

5 Micro-alloying elements like Nb, V and Ti may be added singly or in combination. Total micro-alloying elements shall not be more than 0.25 percent.

6 Alloying elements such as Cr, Ni, Mo and B may be added under agreement between the purchaser and the manufacturer. In case of E 600 and E 650 the limit of Cr and Ni, either singly or in combination, shall not exceed 0.50 percent and 0.60 percent respectively.

7 Copper may be present between 0.20 to 0.35 percent as mutually agreed to between the purchaser and the manufacturer. The copper bearing quality shall be designated with a suffix Cu, for example E 250 Cu. In case of product analysis the copper content shall be between 0.17 and 0.38 percent.

8 *Incidental element* — Elements not quoted in Table 1 shall not be intentionally added to steel without the agreement of the purchaser, other than for the purpose of finishing the heat. All reasonable precautions shall be taken to prevent the addition from scrap or other materials used in manufacture of such elements which affect the hardenability, mechanical properties and applicability.

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

10 The steel, if required, may be treated with calcium based compound or rare earth element for better formability.

11 Lower limits for carbon equivalent and closer limits for other elements may be mutually agreed to between the purchaser and the manufacturer.

Table 2 Mechanical Properties
(*Clauses* 5, 10.3, 10.3.1, 11.3.1, 12.2 *and* 12.4)

Grade Designation	Quality	Tensile Strength R_m, *Min* MPa[1)] (*See* Note 1)	Yield Stress R_{eH}, *Min* MPa[1)]			Percentage Elongation *A*, *Min* at Gauge Length, L_o=5.65	Internal Bend Diameter *Min* (*See* Note 2)		Charpy Impact Test (*See* Note 3)	
			<20	20-40	>40		≤ 25	>25	Temp °C	*Min* J
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
E 250	A	410	250	240	230	23	2*t*	3*t*	—	—
	BR								RT	27
	B0								0	27
	C								(–) 20	27
E 275	A	430	275	265	255	22	2*t*	3*t*	—	—
	BR								RT	27
	B0								0	27
	C								(–) 20	27
E 300	A	440	300	290	280	22	2*t*	—	—	—
	BR								RT	27
	B0								0	27
	C								(–) 20	27
E 350	A	490	350	330	320	22	2*t*	—	—	—
	BR								RT	27
	B0								0	27
	C								(–) 20	27
E 410	A	540	410	390	380	20	2*t*	—	—	—
	BR								RT	25
	B0								0	25
	C								(–) 20	25
E 450	A	570	450	430	420	20	2.5*t*	—	—	—
	BR								RT	20
E 550	A	650	550	530	520	12	3*t*	—	—	—
	BR								RT	15
E 600	A	730	600	580	570	12	3.5*t*	—	—	—
	BR								RT	15
E 650	A	780	650	630	620	12	4*t*	—	—	—
	BR								RT	15

NOTES

1 In case of product thickness/diameter more than 100 mm, lower minimum limit of tensile strength may be mutually agreed to between the purchaser and the manufacturer/supplier.

2 Bend test not required for thickness > 25 mm for grades E 300 to E 650. '*t*' is the thickness of the test piece.

3 For sub-quality BR, impact test is optional; if required, at room temperature (25 ± 2°C).

[1)] 1MPa = 1N/mm^2 = 1MN/m^2 = 0.102 kgf/mm^2 = 144.4 psi.

8 CHEMICAL COMPOSITION

8.1 Ladle Analysis

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 conform to the requirements as given in Table 1. This analysis shall be made from a test sample, preferably taken during casting/teeming of the heat. In case of dispute, the procedure given in IS 228 and its relevant parts shall be the referee method and where test methods are not specified shall be as agreed to between the purchaser and the manufacturer/supplier. The ladle analysis shall be reported in the test certificate.

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 3.

Table 3 Permissible Variation for Product Analysis
(*Clauses* 5 *and* 8.2)

Sl No.	Constituent	Permissible Variation Over the Specified Limit, Percent, *Max*
(1)	(2)	(3)
i)	a) Carbon <0.20	0.02
	b) Carbon >0.20	0.03
ii)	Manganese	0.05
iii)	Silicon	0.03
iv)	Copper	0.03
v)	Sulphur	0.005
vi)	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. For testing of flat products like plates tensile and bend test pieces may be cut in the transverse direction. Selection of location of test pieces may also be mutually agreed to between the purchaser and the manufacturer/supplier.

NOTE — However, in case of the plates beyond 12 mm in thickness, produced from cutting of HR coil, the sample for tensile testing shall be taken only in transverse direction.

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

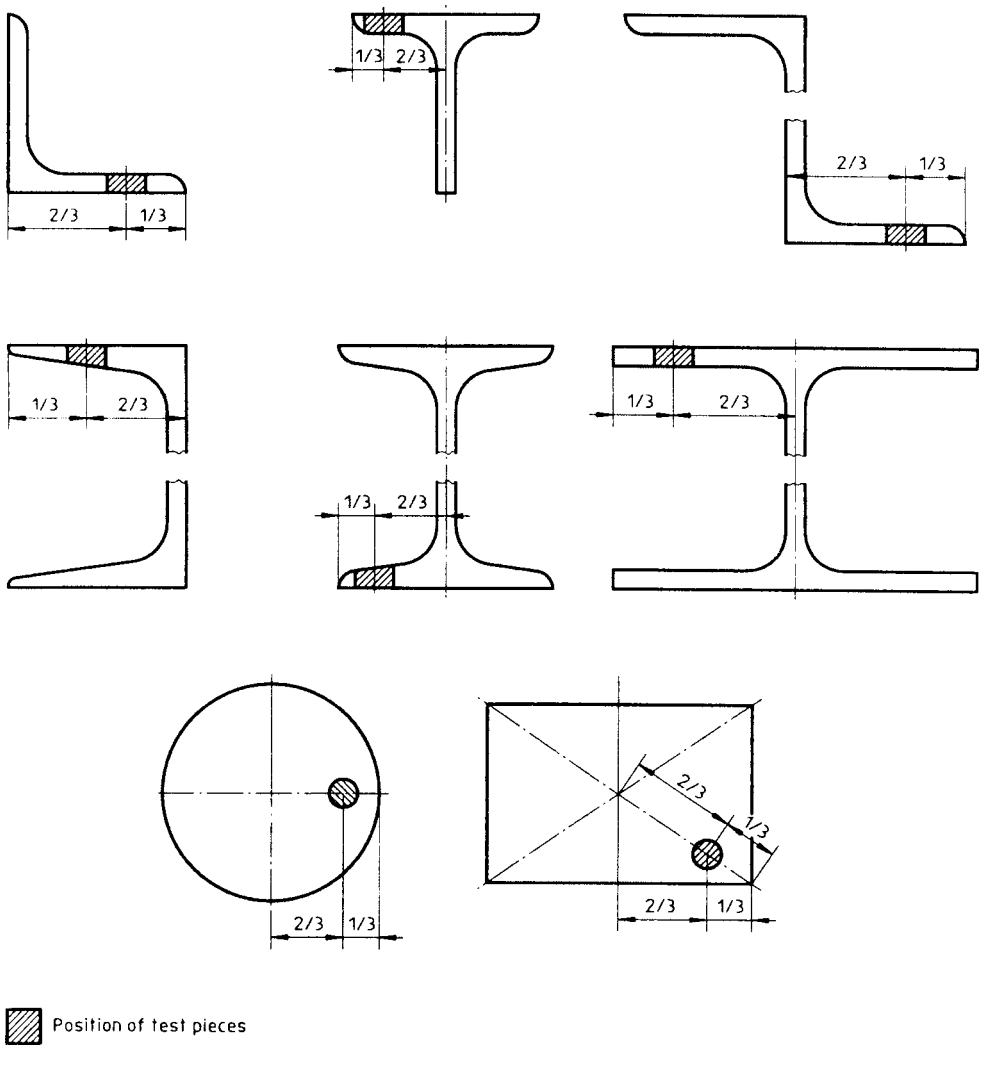

FIG. 1 STRUCTURAL STEEL SECTIONS, POSITION AND ORIENTATION OF SAMPLE

thickness. Round test samples are permitted, but should only be adopted for thickness exceeding 20 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 of 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 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

Number of test samples shall be 2/cast/heat and a class of steel product irrespective of cast/heat size.

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 as 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 $L_o = 5.65$ should be used for the tensile test, where L_o is the gauge length and S_o is the cross-sectional area of the test piece.

10.2.1.1 Test pieces with a non-proportional gauge length, other than 5.65 may be used in which case the elongation values shall be converted to 5.65 in accordance with IS 3803 (Part 1).

10.3 Tensile Test

Yield strength, tensile strength and percentage elongation, when determined in accordance with IS 1608, shall conform to the requirements as given in Table 2.

10.3.1 In case of sections, the thickness of which is not uniform throughout the profile, the limits of sizes given in Table 2 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/supplier's option and another test made from the sample plate, strip, section, flat or bar.

11 BEND TEST

11.1 Number of Bend Test

Number of bend test shall be 2/cast/heat

Class of Steel Product	*Direction of Bend Tests*
Plates strips	Crosswise
Sections	Lengthwise for each type
Flats and bars (round hexagonal, etc)	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/supplier 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 arises 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.

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 2 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 is parallel to the direction of rolling and the base closer to the rolled surface is more than 1mm 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. The minimum impact energy values of reduced sizes shall be as shown in Fig. 2 for grades E 250, E 275, E 300, E 350. For other grades, the values shall be reduced in direct proportion to the cross-sectional area of the test piece.

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 2).

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 same cast, if it meets the requirements specified, this particular thickness as also other sections of lower thickness shall be deemed to satisfy this 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 One test sample shall be taken from thickest product per cast/heat.

12.4 The material represented shall be deemed to comply with this standard, if the average value of 3 test specimens, meets the requirements given in Table 2 provided no individual value shall be less

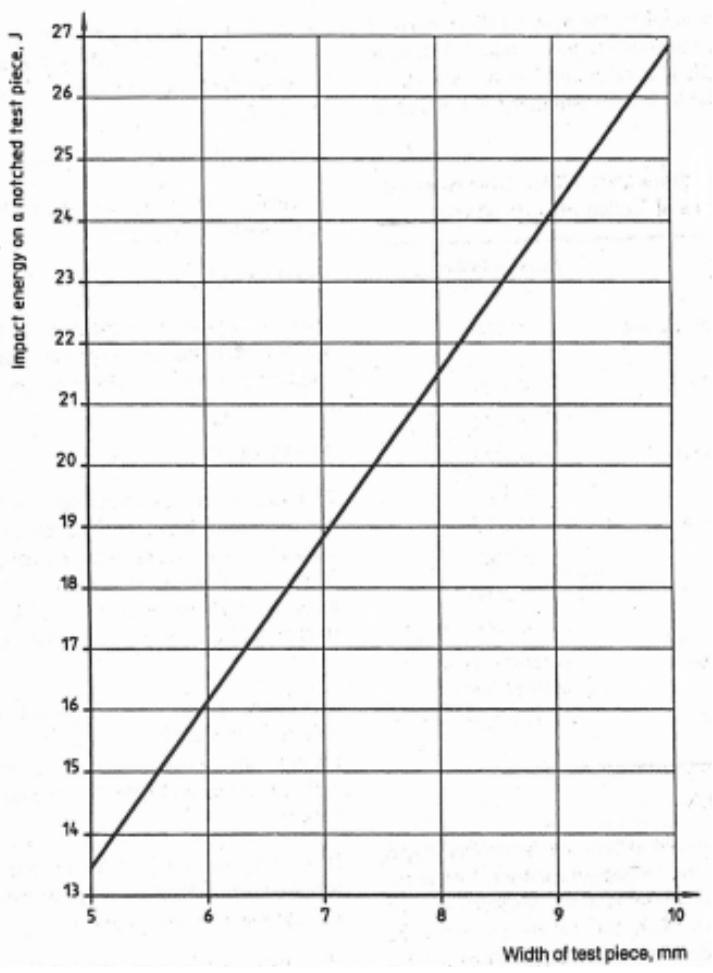

FIG. 2 MINIMUM IMPACT ENERGY VALUES FOR TEST PIECES WITH A WIDTH BETWEEN 5 mm AND 10 mm

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 E 250 C material having thickness 12 mm and above, if specifically agreed to between the purchaser and the manufacturer/supplier.

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

14 OTHER TESTS

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

14.2 Metallurgical tests for grain size, directionality, inclusion content may be carried out subject to mutual agreement between the purchaser and the manufacturer/supplier.

15 DIMENSIONS

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

Table 4 Indian Standards Which Give Nominal Dimensions of Rolled Steel Products

Sl No.	Products	Relevant Indian Standard
(1)	(2)	(3)
i)	Beam, column, channel and angle sections	IS 808
ii)	Tee bars	IS 1173
iii)	Bulb angles	IS 1252
iv)	Plates, strips and flats	IS 1730
v)	Round and square bars	IS 1732
vi)	Bulb flats	IS 1863
vii)	Sheet piling sections	IS 2314
viii)	Channel sections	IS 3954
ix)	Track shoe sections	IS 10182 (Parts 1 and 2)
x)	Parallel beam and column sections	IS 12778

16 TOLERANCES

Unless otherwise agreed to between the purchaser and the manufacturer, the rolling and cutting tolerances for steel products conforming to this standard shall be those specified in IS 1852 except for parallel flange beams and columns covered by IS 12778 for which the tolerances shall be as per IS 12779. Other tolerances may be followed within the total tolerance range as specified in IS 1852 and IS 12779 as applicable.

17 RE-TESTS

17.1 If a test does not give the specified results, two additional tests shall be carried out at random on the same lot. Both retests shall conform to the requirements of this standard; otherwise, the lot shall be rejected.

17.2 Re-heat Treatment

If any heat treated material fails to meet the mechanical requirements specified, the supplier may re-heat treat the material and in that case, all mechanical properties shall be re-evaluated.

18 CALCULATION OF MASS

The mass of steel shall be calculated on the basis that steel weighs 7.85 g/cm^3.

19 DELIVERY

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

20 MARKING

20.1 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.

20.2 Every heavy, medium structural mill and plate mill product shall be marked with the cast number. Plates produced from strip in coil form shall be marked with cast/heat number on top plate of each pile/packet.

20.3 The ends of the rolled products shall be painted with a colour code, as agreed to between the purchaser and the manufacturer/supplier.

20.4 BIS Certification Marking

The material may also be marked with Standard Mark.

20.4.1 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.

ANNEX A
(*Foreword*)

COMMITTEE COMPOSITION

Wrought Steel Products Sectional Committee, MTD 4

Organization	*Representative(s)*
Tata Steel Ltd, Jamshedpur	Dr D. Bhattachrjee **(*Chairman*)** Shri Indranil Chakraborty (*Alternate* I) Dr A. N. Bhagat (*Alternate* II)
All India Induction Furnace Association, New Delhi	Shri L. N. Goswami
Bharat Heavy Electricals Ltd, Tiruchirapalli	Shri V. Rajasekharan
Central Boilers Board, New Delhi	Shri T. S. G. Narayannen Shri S. K. Jain (*Alternate*)
Central Public Works Department, New Delhi	Chief Engineer (NDR) Superintending Engineer (NDR) (*Alternate*)
DGS & D, Bhilai Nagar/Delhi	Representative
Escorts Knowledge Management Centre, Faridabad	Shri Alok Nayar
Essar Steels Ltd, Hazira	Dr A. K. Das Shri R. K. Balasubramaniam (*Alternate*)
Instiute of Steel Development and Growth, Kolkata	Shri Jayanta Kumar Saha
Jindal South West Ltd, Vasind	Shri M.K. Maheshwari
M.N. Dastur & Co Ltd, Kolkata/Delhi	Shri Partha Bhattacharya Shri Satyabrata Bhattacharya (*Alternate*)
Ministry of Defence (DGOFB), Kolkata	Shri P. S. Bandhopadhyay Shri T. Basu (*Alternate*)
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SAIL, Central Marketing Organization, Kolkata	Shri P. C. Jha Shri B. V. S.Pandit (*Alternate*)
SAIL, Research & Development Center for Iron & Steel, Ranchi	Dr B. K. Jha Shri Atul Saxena (*Alternate*)
SAIL, Rourkela Steel Plant, Rourkela	Shri C. Muthuswamy Shri S. Mukhopadhyaya (*Alternate*)
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Tata Blue Scope Steel Ltd, Pune	Shri Rajesh Maheshwari

Organization	*Representative(s)*
TCE Consulting Engineers, Jamshedpur	DR M. D. MAHESHWARI
BIS Directorate General	SHRI P. GHOSH, Scientist 'F' and Head (MTD) [Representing Director General (*Ex-officio*)]

Member Secretary
SHRI DEEPAK JAIN
Scientist 'E' (MTD), BIS

Long Steel Products and Wires Subcommittee, MTD 4 : 2

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All India Steel Re-Rollers Associations, New Delhi	SHRI VINOD VASHISHT SHRI A. K. BHARGAVA (*Alternate*)
National Institute of Secondary Steel Technology, Mandi Gobindgarh	DR R. K. BAGCHI
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SAIL, IISCO Steel Plant, Burnpur	SHRI A. K. SINGH
SAIL, Research & Development Center for Iron & Steel, Ranchi	SHRI D. S. GUPTA DR A. P. SINGH (*Alternate*)
Steel Wires Manufacturers Association of India, Kolkata	SHRI MAHESH PODDAR SHRI S. K. GHOSH (*Alternate*)
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Ispat Industries Limited, Dolvi	REPRESENTATIVE
Metal Containers Manufacturers Association, New Delhi	SHRI SANJAY BHATIA SHRI DIWAKAR SHETTY (*Alternate*)
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Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

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