



# इंटरनेट

# मानक

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Mazdoor Kisan Shakti Sangathan

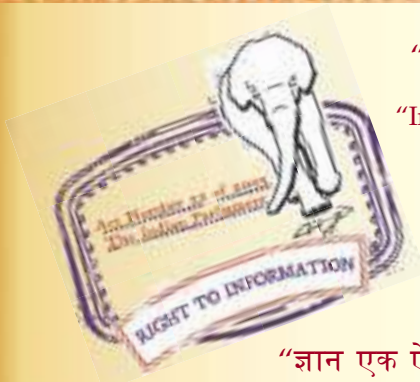
“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 2062 (2011): Hot Rolled Medium and High Tensile Structural Steel [MTD 4: Wrought Steel Products]



“ज्ञान से एक नये भारत का निर्माण”

Satyanarayan Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“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

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**BUREAU OF INDIAN STANDARDS**  
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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)



*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:

<i>IS No.</i>	<i>Title</i>
228 (in various parts)	Methods for chemical analysis of steel
808 : 1989	Dimensions for hot rolled steel beam, column, channel and angle sections ( <i>third revision</i> )
1173 : 1978	Hot rolled slit steel tee bars ( <i>second revision</i> )
1252 : 1991	Dimensions of hot rolled steel bulb angles ( <i>first revision</i> )
1599 : 1985	Method for bend test ( <i>second revision</i> )
1608 : 2005	Metallic materials — Tensile testing at ambient temperature ( <i>third revision</i> )
1730 : 1989	Dimensions for steel plates sheets, strips and flats for general engineering purposes ( <i>second revision</i> )

*IS No.**Title*

1732 : 1989	Dimensions for round and square steel bars for structural and general engineering purposes ( <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>fourth revision</i> )
1863 : 1979	Hot rolled steel bulb flats ( <i>first revision</i> )
1956 (in various parts)	Glossary of terms relating to iron and steel
2314 : 1986	Specification for steel sheet piling sections ( <i>first revision</i> )
3803 (Part 1) : 1989	Steel — Conversion of elongation values: Part 1 Carbon and low alloy steels ( <i>second revision</i> )
3954 : 1991	Hot rolled steel channel sections for general engineering purposes ( <i>first revision</i> )
8910 : 2010	General technical delivery requirements for steel and steel products ( <i>first revision</i> )
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 ( <i>first revision</i> )
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.



## IS 2062 : 2011

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

#### 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 <sup>1)</sup> (See Note 1)	Yield Stress $R_{eH}$ , Min MPa <sup>1)</sup>			Percentage Elongation $A$ , Min at Gauge Length, $L_0=5.65$	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	2t	3t	—	—
	BR								RT	27
	B0								0	27
	C								(-) 20	27
E 275	A	430	275	265	255	22	2t	3t	—	—
	BR								RT	27
	B0								0	27
	C								(-) 20	27
E 300	A	440	300	290	280	22	2t	—	—	—
	BR								RT	27
	B0								0	27
	C								(-) 20	27
E 350	A	490	350	330	320	22	2t	—	—	—
	BR								RT	27
	B0								0	27
	C								(-) 20	27
E 410	A	540	410	390	380	20	2t	—	—	—
	BR								RT	25
	B0								0	25
	C								(-) 20	25
E 450	A	570	450	430	420	20	2.5t	—	—	—
	BR								RT	20
E 550	A	650	550	530	520	12	3t	—	—	—
	BR								RT	15
E 600	A	730	600	580	570	12	3.5t	—	—	—
	BR								RT	15
E 650	A	780	650	630	620	12	4t	—	—	—
	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).

<sup>1)</sup> 1MPa = 1N/mm<sup>2</sup> = 1MN/m<sup>2</sup> = 0.102 kgf/mm<sup>2</sup> = 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

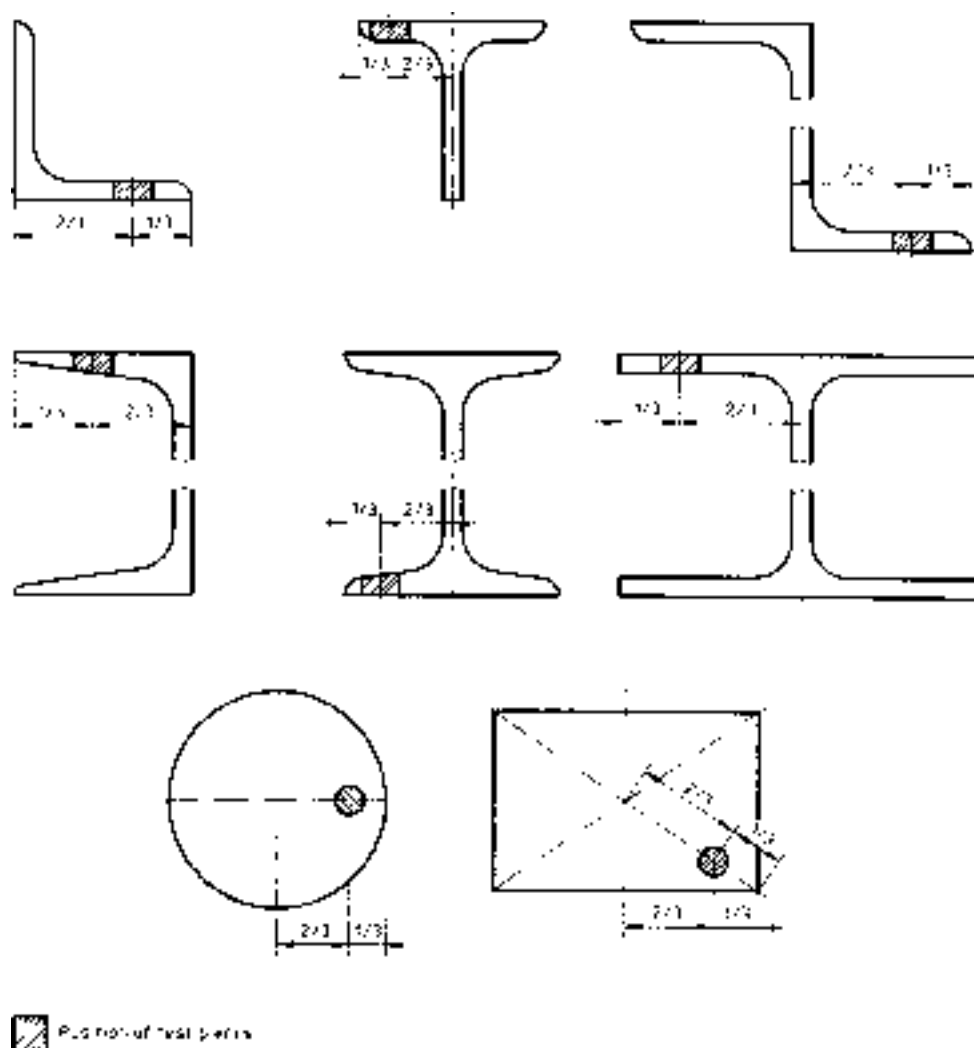


FIG. 1 STRUCTURAL STEEL SECTIONS, POSITION AND ORIENTATION OF SAMPLE

**IS 2062 : 2011**

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 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 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  $L_0 = 5.65 \sqrt{S_0}$  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 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

<i>Class of Steel Product</i>	<i>Direction of Bend Tests</i>
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 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. 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

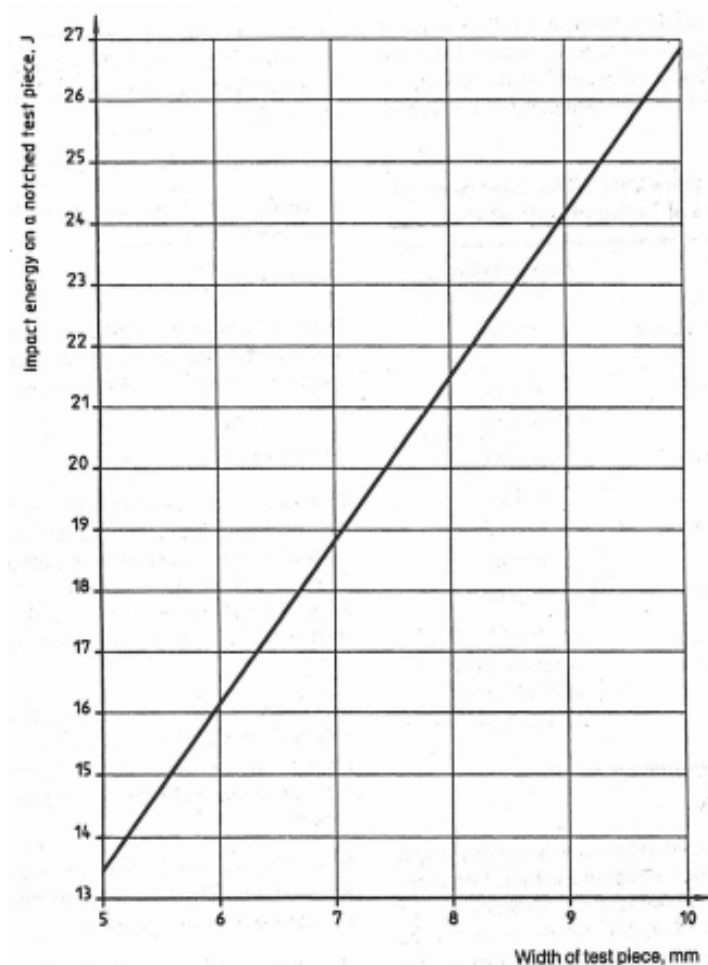


FIG. 2 MINIMUM IMPACT ENERGY VALUES FOR TEST PIECES WITH A WIDTH BETWEEN 5 mm AND 10 mm

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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<sup>3</sup>.

**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**

<i>Organization</i>	<i>Representative(s)</i>
Tata Steel Ltd, Jamshedpur	DR D. BHATTACHARJEE ( <i>Chairman</i> ) SHRI INDRANIL CHAKRABORTY ( <i>Alternate I</i> ) DR A. N. BHAGAT ( <i>Alternate II</i> )
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 ( <i>Alternate</i> )
Central Public Works Department, New Delhi	CHIEF ENGINEER (NDR) SUPERINTENDING ENGINEER (NDR) ( <i>Alternate</i> )
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 ( <i>Alternate</i> )
Institute 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 ( <i>Alternate</i> )
Ministry of Defence (DGOFB), Kolkata	SHRI P. S. BANDHOPADHYAY SHRI T. BASU ( <i>Alternate</i> )
Ministry of Defence (DGQA), Ichapur	SHRI S. K. KHILNANEY SHRI P. MEENA ( <i>Alternate</i> )
Ministry of Railways (RDSO), Lucknow	SHRI RADHEY SHAM SHRI V. D. MEHARKURE ( <i>Alternate</i> )
Ministry of Steel (Government of India), New Delhi	SHRI A. C. R. DAS SHRI B. D. GHOSH ( <i>Alternate</i> )
Power Grid Corporation of India Ltd, Gurgaon	SHRI K. N. M. RAO SHRI M.K. SETHI ( <i>Alternate</i> )
Rashtriya Ispat Nigam Ltd (VSP), Vishakhapatnam	SHRI P. K. SEN SHRI P. SRINIVAS ( <i>Alternate</i> )
SAIL, Bhilai Steel Plant, Bhilai	SHRI S. BHATTACHARYA SHRI P. K. DATTA ( <i>Alternate</i> )
SAIL, Bokaro Steel Plant, Bokaro	DR M. M. S. SODHI SHRI P. S. REDDY ( <i>Alternate</i> )
SAIL, Central Marketing Organization, Kolkata	SHRI P. C. JHA SHRI B. V. S. PANDIT ( <i>Alternate</i> )
SAIL, Research & Development Center for Iron & Steel, Ranchi	DR B. K. JHA SHRI ATUL SAXENA ( <i>Alternate</i> )
SAIL, Rourkela Steel Plant, Rourkela	SHRI C. MUTHUSWAMY SHRI S. MUKHOPADHYAYA ( <i>Alternate</i> )
Steel Re-rolling Mills Association of India, Mandi Gobindgarh	SHRI B. M. BERIWALA SHRI H. D. KHERA ( <i>Alternate</i> )
Tata Motors Limited, Pune	SHRI B. R. GALGALI SHRI U. B. PATHAK ( <i>Alternate</i> )
Tata Blue Scope Steel Ltd, Pune	SHRI RAJESH MAHESHWARI

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<i>Organization</i>	<i>Representative(s)</i>
TCE Consulting Engineers, Jamshedpur	DR M. D. MAHESHWARI
BIS Directorate General	SHRI P. GHOSH, Scientist 'F' and Head (MTD) [Representing Director General ( <i>Ex-officio</i> )]
<i>Member Secretary</i>	
SHRI DEEPAK JAIN Scientist 'E' (MTD), BIS	

## Long Steel Products and Wires Subcommittee, MTD 4 : 2

Rashtriya Ispat Nigam Ltd (VSP), Vishakhapatnam	SHRI P. K. SEN ( <i>Convener</i> )
All India Steel Re-Rollers Associations, New Delhi	SHRI VINOD VASHIST SHRI A. K. BHARGAVA ( <i>Alternate</i> )
National Institute of Secondary Steel Technology, Mandi Gobindgarh	DR R. K. BAGCHI
SAIL, Durgapur Steel Plant, Durgapur	SHRI A. KANAN
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 ( <i>Alternate</i> )
Steel Wires Manufacturers Association of India, Kolkata	SHRI MAHESH PODDAR SHRI S. K. GHOSH ( <i>Alternate</i> )
In personal capacity (248, Akash Darshan Society, Mayur Vihar-I, Delhi 110091)	SHRI AVTAR SINGH

## Flat Steel Products Sub-Subcommittee, MTD 4 : 3

TCE Consulting Engineers, Jamshedpur	DR M. D. MAHESHWARI ( <i>Convener</i> )
Bhushan Power and Steel Ltd, Hooghly	SHRI P. S. PAUL
Federation of Engineering Industries of India, New Delhi	SHRI H. L. BHARDWAJ SHRI H. L. BANSAL ( <i>Alternate</i> )
Indian Oil Corporation Limited, Noida	SHRI M. K. JHA SHRI T. BANDHOPADHYAY ( <i>Alternate</i> )
Ispat Industries Limited, Dolvi	REPRESENTATIVE
Metal Containers Manufacturers Association, New Delhi	SHRI SANJAY BHATIA SHRI DIWAKAR SHETTY ( <i>Alternate</i> )
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SAIL, R&D Centre for Iron & Steel, Ranchi	SHRIMATI ANJANA DEVA
SAIL, Salem Steel Plant, Salem	SHRI S. S. SISODIA
Tata Motors Limited, Pune	SHRI V. HARIHARAN
Tata Steel Ltd, Jamshedpur	SHRI M. SHOME
The Tin Plate Company of India Ltd, Jamshedpur	SHRI A. K. GHOSH SHRI R. K. SINHA ( <i>Alternate</i> )
Thyssenkrupp Electrical Steel India Pvt Ltd, Nasik	SHRI J. SREENIVAS SHRI KAPIL KAPOOR ( <i>Alternate</i> )
Welspun Gujrat Sthal Rohren Ltd, Anjar	SHRI B. LAKSHMINARASIMHAM

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This Indian Standard has been developed from Doc No.: MTD 4 (5005).

### Amendments Issued Since Publication

Amendment No.	Date of Issue	Text Affected

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# **SCHEDULE OF TECHNICAL REQUIREMENTS FOR MANUFACTURE AND SUPPLY OF MODIFIED COW CATCHER ASSEMBLY OF CONVENTIONAL & 3-PHASE LOCOMOTIVES**

**ISSUED BY**

**CHITTARANJAN LOCOMOTIVE WORKS  
CHITTARANJAN – 713331  
WEST BENGAL**

Approved by	Signature
PCEE	

Recommended by	Signature
CEE/D&D	

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## SCHEDULE OF TECHNICAL REQUIREMENTS FOR MANUFACTURE AND SUPPLY OF FOLLOWING FOR THREE PHASE ELECTRIC LOCOMOTIVES:-

### 1.0 NAME OF EQUIPMENT

Modified Cow Catcher Assembly of Conventional & 3-Phase Locomotives

### 2.0 APPLICATION

Used in Three Phase & Conventional (WAG9H / WAG9 / WAP7 / WAP5) Electric Locomotives in Indian Railways. The equipments are to be manufactured as per relevant drawings and specifications.

### 3.0 SCOPE

The Schedule of Technical Requirements (STR) is issued to serve as a guide to manufactures (called the “firm” hereafter) and should be read in conjunction with the relevant drawings and specifications with latest Revisions / Alterations. The technical requirements are meant to serve as guidelines only and are not exhaustive The firm should satisfy themselves having complied with the requirements of drawings and STR. List of relevant Drawings / Specifications is listed as Annexure – I

Wherever lacking, existing CLW approved sources must also upgrade their facilities to fulfill the requirements of this STR within a period of One year from date of issue of this STR.

### 3.0 GENERAL REQUIREMENTS

- 3.1 The firm should have currently valid ISO-9000 certification issued by an approved agency of the International Accreditation Forum (IAF) with the activity desired clearly mentioned in the scope of certification.
- 3.2 A system of regular submission of rejection details of material giving rejection rate, cause of rejection, corrective action taken etc. on quarterly basis should be followed by firm.

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- 3.3 The firm must have system of documentation in respect of rejection at customer end, warranty replacement and failure of item supplied by them during service.
- 3.4 The firm shall have all latest relevant Standards like IS, DIN, BS etc. pertaining to product specification.
- 3.5 The firm shall have system of recording the plant, machinery and control equipments remaining out of service, nature of repairs done etc.
- 3.6 The testing & measuring equipments shall be duly calibrated and the validity of calibration should be current and verified by physically checking the calibration certificate issued by Calibration Agency from whom it was calibrated. Calibration shall be done by NABL accredited labs whose accreditation is valid on the date of calibration.
- 3.7 Firm should have adequate trained personnel and service after sales network.
- 3.8 Whenever there is any change with respect to approved QAP, the same shall be promptly submitted to CLW for approval.

#### 4.0 QUALITY ASSURANCE PLAN (QAP)

The firm shall prepare a Quality Assurance Plan (QAP) before approval is sought and submit the same as part of compliance of this STR. The QAP shall be a comprehensive document covering the following aspects.

- i) Details of Quality Control Organization of the firm along with key personnel engaged in the QC function.
- ii) Qualification log sheet of the personnel manning the quality control set up.
- iii) Process flow chart indicating process of manufacture of an individual product or for a family of products for which the process is same.
- iv) Details of Sub-Vendors:

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- The name of item for which sub-vendor is approved.
- The name of approving agency
- Quality manual submitted by sub-vendor to primary vendor
- The sub-vendor to have all the requisite infrastructure of manufacturing and testing facilities, preferably under one roof. The sub-vendor to broadly meet with all the technical requirements laid down in this STR.
- The primary vendor is following periodical inspection schedule for sub-vendor strictly.
- ISO Certification details of sub-vendor also.
- The sub-vendor is also liable for assessment by Vendor approving agency.

v) Inspection and testing plan of

- a) Incoming Material as per format in Annexure – IV clause – 2
- b) Process control & stage inspection as per format in Annexure – IV, Clause – 3&4
- c) Product (Final inspection) as per format in Annexure – IV, clause – 5

vi) All the formats used for recording inspection results.

vii) System of traceability, traceability diagram linking traceability from raw material stage to internal check and finally lot offered for inspection.

viii) All internal checks to be carried out during manufacturing shall be summarized and furnished. List of documents to be maintained for these internal checks; that need to be signed by inspecting official before issue of Inspection Certificate shall also be furnished.

ix) QAP Format

QAP must be submitted in the form of single document indicating name of the firm and page no. 'x' of 'y' on each page. Each page should be signed by Quality Control in-charge. The approved QAP must be a controlled document and a quality record of ISO 9001:2000 quality control

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system of the firm. A certificate to this effect shall be provided along with the QAP by the firm. The QAP shall be submitted in duplicate.

Details of the above aspect are described in the following paragraphs. The QAP shall be approved by CLW and shall form basis of approval process.

## 5.1 QUALITY CONTROL ORGANISATION

5.1.1 The complete organizational setup of the Quality Control Key personnel and official along with their qualification and experience should be furnished.

5.1.2 The Quality Control Organization should be headed by a senior level official having degree in engineering who shall directly report to plant in charge.

## 5.2 INCOMING MATERIAL

5.2.1 A complete bill of material indicating all input material items required for manufacturing of the products, governing specification and their sources of supplies as approved by the firm should be furnished.

5.2.2 Raw material shall be procured from CLW/RDSO approved sources wherever applicable or from reputed suppliers if no CLW/RDSO source is specified. Documentary proof of purchase and test certificate of each component shall be maintained and produced.

5.2.3 Record of each sub-supplier clearly showing the quantity purchased and rejected as well as cases of late delivery, if any shall be kept

5.2.4 Incoming raw material shall be 100% inspected by Quality Control Department of the firm for any defect and deviation. The test results of incoming raw material with references to test certificate issued by the supplier and the results of internal tests carried out by the firm for verification may be submitted as part of QAP.

## 5.3 PROCESS OF MANUFACTURE

5.3.1 Complete process flow chart covering all steps of process of manufacture for an individual product (or for a family of product if the process is same), including the

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process flow of outsourced activities along with its integration with main process, shall be clearly enlisted as part of QAP.

5.3.2 The following details of machine used for all the steps of machining operations should be included.

- Make, model and commissioning date of the machine.
- Accuracy.
- Details of machining operations.

5.3.3 Machining process should be such that all critical dimensions are final. Vague language like available or will install is not acceptable.

5.3.4 Details of jigs and fixtures used during manufacture should be furnished along with the manufacturing process wherever used.

5.3.5 List of typical Machinery & Plant, testing and measuring instruments required for manufacture is mentioned in Annexure – II. The list is for general guidance only and manufacturing operation shall be submitted and got approved by the firm as a part of QAP.

5.3.6 In case any structural work is involved, the welders shall be qualified in accordance with AWS Structural Welding Code D.1.1 or IS 817 with radiographic test. They should have undergone refresher course from reputed agencies as per IS: 817 & IS: 7310 and proper record should be maintained.

#### **5.4 INSPECTION AND TESTING PLAN**

5.4.1 Testing setup should be available in the firm's own premises capable of testing the equipments as specified in the relevant technical specification.

5.4.2 Complete Inspection and Testing Chart covering all steps of process of manufacture for an individual product including final inspection should be clearly enlisted as part of QAP.

5.4.3 The following details of Testing / measuring instruments / equipments / tools / jigs / fixtures used for all the steps of measurement and testing operations should be included:

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- Make and Model of the equipment
- Name of the manufacturer
- Accuracy
- Capacity or Range
- Date of Calibration
- Due date of calibration
- Agency of Calibration

Vague language like available or will install is not acceptable.

5.4.4 The accuracy and capacity of the testing and measuring equipments shall be adequate to meet the requirements of the specification and drawing.

5.4.5 Stage inspection detailing inspection procedure, inspection parameters and method of testing / test procedure including sample sizes for destructive and non-destructive testing. Record of test results of stage inspection should be available and furnished.

5.4.6 List of typical Testing and measuring instruments required for manufacture is mentioned in Annexure – III. The list is for general guidance only. However, the specific Testing & measuring instruments, gauges used by the firm will also form part of QAP and shall be submitted.

## 5.5 **FORMAT TO BE SUBMITTED WITH QAP**

Format to be submitted with QAP is enclosed as Annexure – IV. Firms shall fill these formats keeping in view Para 5.0

## 6.0 **REQUIREMENTS OF ELECTRICAL AND ELECTRONICS LAB**

Wherever applicable, Firms shall have electrical and electronics labs which should have dust free, clean and non – humid environment preferably air conditioned. The lab shall have minimum following equipments in addition to equipments mentioned at Annexure – III:

- Digital Ammeter & Voltmeter suitable for Product
- L, C, R Meter
- Continuity Tester

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- Megger 1/2.5 KV
- Vernier Caliper & Micrometer
- Oscilloscope
- Variable voltage Source 0 – 500/1000/2500 V AC/DC
- Variable Current Source both AC & DC
- Variable mA Source suitable for Product
- High Voltage Test Kit – 5KV
- Digital Temperature Indicator 0 – 600.C

7.0 **STORAGE FACILITY**

- Adequate Dust free, clean and non - humid environment for storage of raw material and finished product separately
- Adequate Dust free, clean and non-humid environment for product assembly area
- Adequate Stacking / Handling tables and racks in above storage area.

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## ANNEXURE – I

**LIST OF DRAWINGS, SPECIFICATIONS AND STANDARDS**

Item Description	Drawing No	Specification No
Cattle Guard / Modified Caw catcher Assly for conventional and 3-phase loco	05/1/62/44(G-7) 03/1/62/83(P-4) 03/1/62/84(P-4)  1209-02.140-032 (G9HC/P-7) IA021-00029(P-5)	CLW/MS/3/154 CLW/MS/3/107

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**ANNEXURE – II****LIST OF MACHINERY AND PLANT**

Sl. No.	DESCRIPTION	CAPACITY	PURPOSE	Essential / Optional **
1.	Hand Shearing M/c	For Thickness-Up to 6mm	Required for shearing plates/ angles to required sizes (of smaller dimensions).	Essential
2.	Power Shearing M/c	For Thickness – 2 to 10 mm	Required for shearing plates/angles to required sizes (of larger dimensions).	Essential
3.	Power press	60T Capacity	Required for straightening and levelling plates up to 10 mm thk.	Essential
4.	Plate Bending M/c	For Thickness Up to 10 mm and Length Up to 3m	Required for bending plates 10 mm thk. (max.) x 3m lg. (max.).	Essential
5.	Angle Grinder	5" & 9" Capacity	Required for de-burring, cleaning & removing extra material left after machining /oxy-cutting.	Essential
6.	Portable Grinder	4" & 5" dia.	Required for de-burring, cleaning & removing extra material left after machining /oxy-cutting.	Essential
7.	Drilling M/c	½" to 1-1/4" dia.	Required for drilling holes of sizes on plates/ angles in position.	Essential
8.	Oxy-cutting Arrgt.	Standard	Required for cutting plates up to 20 mm thk.	Essential
9.	Arc Welding Arrgt.	300 Amps.	Required for welding plates / angles in position.	Essential
10.	Painting-facility	As specified in related Drg.	Required for painting.	Essential
11.	Material handling Equipment (EOT Crane / Lifting Hoist / Chain Pulley Block)	1 MT Capacity	Required for accommodating Modified Cow Catcher Assly. of all types of locos for shifting from one location to the other on Shop-floor.	Essential
12.	Floor-area	2500 sq. ft. (minimum)	Required for handling, moving and stacking of jobs/ finished products.	Essential

\*\* Optional activity of Machinery & Plant facility may be outsourced. However the sub vendor is also to be assessed.

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ANNEXURE – III

LIST OF MEASURING ,TESTING EQUIPMENTS

Sl. No.	Name of Measuring & Testing	Purpose	Essential / Optional **
1	Measuring Instruments & Gauges Vernier Calipers, scales, Micrometers etc.	Required for linear / circular measurements.	Essential

\*\* Optional activity of measuring & testing facility may be outsourced. However the sub-vendor is also to be assessed.

Quality Requirements :-

1. Metallurgical Test for Input raw-materials is to be done & source(s) of raw-material to be specified.
2. Stage-wise Inspections are to be done & Check Lists for the same to be made.
3. Welding-quality & ‘Finish’ are to be ensured at each stage.
4. Final Inspection is to be done & Check List for the same is to be made.
5. Jigs & fixture, as required, are to be made.
6. Valid NSIC / SSIC-registration Certificate.
7. Valid ISO accreditation Certificate (desirable).

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ANNEXURE – IV

FORMATS TO BE SUBMITTED WITH QAP

Item	Enter Item Name here	Date:	Enterdate
Specification:	Enter Specification No. here		

FIRM DETAILS:

Firm Name	
Address	
Contact Person	
Email	
Phone	
Mobile No.	

Firm Name & Logo		
	Signature of Quality Head	Page No

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Item	Enter Item Name here	Date:	Enterdate
Specification:	Enter Specification No. here		

Amendment History:

Sl.No.	Amendment Date	Version	Reason for Amendment

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Item	Enter Item Name here	Date:	Enterdate
Specification:	Enter Specification No. here		

1. Purpose:  
Purpose of QAP.....

2. Scope of Application:  
Applicable for .....

3. Item Details:

Item Name	
Specification no.	
Drawing no.	
STR No.	

4. Reference Documents:  
If Any.....

5. OrganizationSetup

5.1. Organization Chart

- Complete Organization setup to be given including:
- a) Production setup
  - b) Quality Control setup
  - c) After Sales & Service setup
  - d) R&D/Design setup

5.2. Qualification of Personals

- a) Production

Sl.No.	Name	Dsgn.	Qualification	Experience	Remarks

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b) Quality Control

Sl.No.	Name	Dsgn.	Qualification	Experience	Remarks

c) After Sales & Service

Sl.No.	Name	Dsgn.	Qualification	Experience	Remarks

d) R&D/Design

Sl.No.	Name	Dsgn.	Qualification	Experience	Remarks

6. Manufacturing Process

6.1. Process Flow Chart

- Stage wise manufacturing process flow chart to be given
- Clearly state work instruction/checklist to be followed

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6.2. Machinery and Plant (M&P)

Sl.No.	IS/STR/Specification para no	Requirement of M&P as per IS/STR/Specification		Details of the M&P available with the firm					
		M&P name	Range / Capacity of M&P	Name of M&P	Model	Make	Machine no.	Year of Built	Range/ Capacity

6.3. Testing & Plant

Sl.No.	IS/STR/Specification para no	Requirement of T&P as per IS/STR/Specification		Details of the T&P available with the firm					
		T&P name	Range / Capacity of T&P	Name of T&P	Model	Make	Machine no.	Year of Built	Range/ Capacity

6.4. Details of Sub-assemblies/Components Manufactured

a) Part I: Details of in-house manufactured (Components/sub-assemblies)

Sl.No.	Item Name	Drawing No

b) Part II: Details of components/Sub-assemblies purchased from CLW/RDSO approved vendors

Sl.No.	Item Name	Drawing No	Approved source of RDSO/CLW	Name/Address of the source

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Item	Enter Item Name here	Date:	Enter date
Specification:	Enter Specification No. here		

c) Part III: Details of items outsourced from other than CLW/RDSO approved items

Sl.No.	Item Name	Drawing No	Name/Address of the source

## 6.5. Details of Sub-vendors

Sl.No.	Vendor Name	Item Name	ISO Certified (Yes/No)	QAP Approved (Yes/No)	Frequency of review of the performance of sublet source

Note: Following points to be taken in due consideration in providing information about manufacturing process:

- Details of Work Instruction for each stage as mentioned in process flow chart.
- Inspection in Plant (Stage & Final)
- Bill of Material
- Stages of manufacturing should be clearly indicating that
- M&P and T&P required for each stage should be clearly mentioned.
- Pre manufacturing stage and after manufacturing stage inspection & testing should be clearly mentioned along with checklist.
- Checklist should be attached with the QAP.
- Please attach ISO certificates of sub-vendors.

## 7. Quality Control

### 7.1. Quality Certification

- ISO
- Any other Document/certification

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Item	Enter Item Name here	Date:	Enter date
Specification:	Enter Specification No. here		

## 7.2. Calibration Plan for Testing & Measuring Equipment

a) Part I : Inhouse Testing facilities available for calibration with the firm

Sl.No.	Name of Master	Make	Range	Frequency of calibration	Traceability to national standard

b) Part II : Personnel trained for inhouse calibration

Sl.No.	Name	Qualification	Experience

c) Part III : Calibration plan for the items identified for specified calibration in STR/Specification

Sl.No.	Measuring Equipment	Ref. para of STR/Spec.	Range/ Accuracy	Frequency Specified in STR/Spec	Inhouse/ Outsourced	Name of agency if outsourced

d) Part IV : Calibration plan for other measuring equipment

Sl.No.	Measuring Equipment	Range/ Accuracy	Frequency	Inhouse/ Outsourced	Name of calibration agency

## 7.3. Incoming Raw Material & In-process/Final Inspection

Stage inspection detailing inspection procedure, inspection parameters, method of testing/test procedure including sample sizes for destructive and non-destructive testing etc.

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Item	Enter Item Name here	Date:	Enter date
Specification:	Enter Specification No. here		

**a) Part I: Incoming raw materials/parts/sub-assemblies**

Sl.No.	Incoming Product/ assembly	Sample Size & its Frequency of inspection	In-house / outsourced	Checklist no.	Mode of inspection / equipment used	Rejection & Disposal	Traceability register no
						Reprocessed / Scrapped	

**b) Part II: In process inspection (of the product)**

Sl.No.	Name of the process	Sample Size & its Frequency of inspection	Checklist no.	Mode of inspection / equipment used	Rejection / Disposal	Corrective & preventive action	Traceability register no

**c) Part III: Final internal inspection of the product by the firm**

Sl.No.	Name of the test/ process	Sample Size & its Frequency of inspection	Checklist no.	Mode of inspection / equipment used	Rejection & Disposal	Traceability register no
					Reprocessed / Scrapped	

## 7.4. Handling of Rejected Material

- Please provide details

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Item	Enter Item Name here	Date:	Enter date
Specification:	Enter Specification No. here		

### 7.5. System for Customer Complaints/Warranty Failures

Warranty failures/In-service failures reported from customers

Sl.No.	Date of report of complaint	Letter no	Complaint received from	Brief details of complaint	Classification of failure	Whether any person deputed for collecting field sample	Date of joint inspection	Failure analysis & cause of failure	Date of compliance in case of warranty	C & P action taken
					Warranty failure/ In service failure/ Call for joint inspection / Consignee end rejection / General complaints					

\* The firm shall maintain a complaint register in the above format and the summary required to be given during renewal

### 7.6. Details of after Sales & Service

Name of Service Engineer	Location/Place	Contact Detail

## 8. Additional Information

- The firm can furnish any other information which they wish to submit on items other than furnished above.

### Annexure:

- Work Instruction for each stage
- Inspection check sheet for:
  - Incoming material
  - In-process/stage inspection
  - Final material
- ISO Certificate
- Any other quality/design certification

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Item	Enter Item Name here	Date:	Enterdate
Specification:	Enter Specification No. here		

Note:

- QAP covering all the information as asked above under section ‘0’ to ‘l’ must be given in the form of single document indicating name and works address of the firm and page no. ‘x’ of ‘y’ on each page. Each page should be signed by Quality Control in-charge. The approved QAP must be a controlled document and a quality record of ISO Quality Control System of the vendor. A certificate to this effect shall be provided along with the QAP by the vendor.
- One copy of the QAP, after final approval will be given back to the vendor for implementation.

Firm Name & Logo		
	Signature of Quality Head	Page No.

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