
	CORPORATE PURCHASING SPECIFICATION	AA10112 Rev No. 07 PAGE 1 of 4			
BRIGHT STEEL BARS AND SECTIONS (STANDARD QUALITY)					
<p>1 GENERAL:</p> <p>This specification governs the quality requirements of Bright Steel Bars and Sections of standard quality, such as I-beams and equal angles required in very small sections.</p> <p>2 APPLICATION:</p> <p>Bars are used in the manufacture of threaded and machined components for general engineering purposes. Sections are used as stator spacer plate vents in generators.</p> <p>3 CONDITION OF DELIVERY:</p> <p>3.1 Round Bars - Class 4, surface quality. Up to 50 mm diameter - Cold drawn. Above 50mm diameter - Cold drawn or Hot rolled, turned and polished</p> <p>3.2 Rectangular/Square/Hexagonal Bars - Class 3, surface quality. All sizes - Cold drawn.</p> <p>3.3 Sections - Class 4, surface quality. All sizes - Cold drawn</p> <p>3.4 Bars and sections shall be straight, with their ends sheared, square and true and shall have a smooth surface.</p> <p>3.5 The bars and sections shall be given a clear temporary rust preventive (TRP) coating to avoid corrosion during transit and storage. Black TRP coating is not acceptable. Clear TRP used shall be free from pungent smell. The following clear TRP's are suggested:</p> <p style="margin-left: 20px;">a) Servo RP 150 - M/s Indian Oil Corporation b) HE - 1612 - M/s. BHEL, Bhopal c) Rustilo DW-901 - M/s. Indrol Lubricants and Specialties Ltd. d) Rustpro Special - M/s. Tide water oil co. e) Any other clear TRP conforming to IS: 1154</p> <p>4 COMPLIANCE WITH NATIONAL STANDARDS:</p> <p>The material shall comply with the requirements of the following National standards and also meet the requirements of this specification.</p> <p style="margin-left: 40px;">IS: 9550-2001 : Bright steel bars</p>					
Revisions: CI 27.2.d of MOM of MRC-S&GPS		APPROVED: INTERPLANT MATERIAL RATIONALISATION COMMITTEE – MRC(S&GPS)			
Rev No.07	Amd No.	Reaffirmed	Prepared	Issued	Dt. of 1 st Issue
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AA10112	CORPORATE PURCHASING SPECIFICATION 
Rev No. 07	
PAGE 2 of 4	

5 DIMENSIONS AND TOLERANCES:

5.1 Sizes:
Bars shall be supplied to the dimensions specified in BHEL order.

5.2 Tolerances:

5.2.1 Rectangular/Square/Hexagonal/Flat Bars:
Unless otherwise specified, tolerances on dimensions shall be as follows:
For drawn round bars and turned bars h10 to table 2 of IS:9550
For hexagonal and square drawn bars upto and including 80mm h11 and above 80mm h12 according to table 2 of IS:9550
For drawn flats in accordance with table 3 and 4 of IS:9550
For ground products in accordance with table 1 and 2 of IS:9550

5.2.2 Sections:
As specified in BHEL order/drawing.

5.3 Length:
Bar and sections shall be supplied in lengths of 2.5 to 4.5 meters with maximum 10% of shorts of not less than 1.5 meters.

5.4 Straightness:
Unless otherwise agreed to, the permissible deviation shall not exceed 1.5mm in any one meter length. Bars and sections shall be free from twists and bends.

6 MATERIAL:
The rolled bars used for purpose of producing the bright bars shall be such, so as to ensure freedom from segregation, piping and other harmful defects.

7 MANUFACTURE:
Steel shall be manufactured by the open-hearth, electric, basic oxygen or a combination of these processes.


8 FREEDOM FROM DEFECTS:
All finished steel bars and section shall be sound and free from internal and surface defects. They shall be bright and clean.

9 SURFACE CONDITION:

9.1 Round Bars and Sections:
Shall be entirely free from cracks and other surface defects.

9.2 Rectangular/Square/Hexagonal Bar-Type '3' Finish:
Shall comply with IS: 9550, Class 3 of table 5.

10 CHEMICAL COMPOSITION:
The melt analysis of steel and the permissible variation in the composition of the material form the melt analysis shall be as follows:

	CORPORATE PURCHASING SPECIFICATION	AA10112
		Rev No. 07
		PAGE 3 of 4

Element	Melt analysis percent, max	Permissible variation percent
Carbon	0.25	± 0.02
Sulphur	0.040	+ 0.005
Phosphorus	0.040	+ 0.005

11 TEST SAMPLES:

One sample for chemical and tensile test shall be selected from finished steel for every 20,000 kg or part thereof, with a minimum one per heat.

12 MECHANICAL PROPERTIES:

When tested in accordance with IS:1608, the test pieces shall show the following properties:

12.1 Rectangular/Square/Hexagonal/Section - Cold Drawn:

Tensile Strength : 440 N/mm², min

Elongation on $5.65\sqrt{S_0}$ gauge length : 8 – 20%

12.2 Round Bars:

12.2.1 Bars upto 50mm Diameter – Cold Drawn

Tensile Strength : 440 N/mm², min

Elongation on $5.65\sqrt{S_0}$ gauge length : 8 – 20%

12.2.2 Bars above 50mm Diameter:

Cold drawn or hot rolled, turned and polished.

Property	Hot rolled, turned and polished	Cold drawn
Tensile strength, min.	410 N/mm ²	440 N/mm ²
Elongation on $5.65\sqrt{S_0}$ gauge length	23%, min	8-20%

13 TEST CERTIFICATES:

Three copies of test certificates shall be supplied, unless otherwise stated on the order.

In addition, to the above, the supplier shall ensure to enclose one copy of the test certificate along with their despatch documents to facilitate quick clearance of the material.

The test certificate shall bear the following information:

AA10112; Rev. No. 07 :

BHEL order No,

Supplier's Reference:

Name

Identification No.

Melt No.

Results of Tests:

Dimensional inspection.

Results of Chemical analysis and mechanical tests.

AA10112	CORPORATE PURCHASING SPECIFICATION	
Rev No. 07		
PAGE 4 of 4		

14 PACKING AND MARKING

The material shall be suitably packed in bundles – polythene wrapped to prevent sagging, corrosion and damage during transit. A suitable clear temporary rust preventive shall be applied all the bars as per clause 3.5 above and finally dispatched in wooden boxes.

Each bar over 50mm shall be stamped at one end with 'AA10112'. Bars 50mm and below shall be bundle together and tied with wire at 3 to 4 places along the length of the bar.

A metal label shall be securely attached to each bundle and shall bear the following information:

AA10112: BRIGHT STEEL BARS AND SECTIONS (STANDARD QUALITY)

BHEL Order No.

Consignment/Identification No.

Melt No.

Size and Weight.

Supplier's Name.

15 REFERRED STANDARDS (Latest Publications Including Amendments):

- 1) IS: 1154 2) IS: 1608 3) IS: 9550



CORPORATE PURCHASING SPECIFICATION

AA10113

Rev No. 07

PAGE 1 of 5

HOT ROLLED CARBON STEEL SHEET (330 N/mm² Tensile)

1.0 GENERAL:

This specification governs the quality requirements of Hot Rolled Carbon Steel Sheet of thickness of 2.5 mm to 4.0 mm (both inclusive).

2.0 APPLICATION:

Suitable for cold forming / drawing / fabrication by welding.

3.0 CONDITION OF DELIVERY:

Sheets shall be supplied in hot rolled, decaded and oiled condition. Imported sheets shall be supplied in straight lengths. The edges shall be flattened and sheared. Mill edges are not acceptable. Sheets shall be free from waviness and shall have a uniformly dull (matt) finish.

Oil used for rust prevention should be free from pungent smell. The following oils are suggested:

- SERVO RP 125 of M/s. IOC.
- RUSTOP 387/388 of M/s. HPC
- Bharat TCPF of M/s. Bharat Petroleum
- Any other TRP conforming to IS : 1154

4.0 COMPLIANCE WITH NATIONAL STANDARDS:

The material shall comply with the requirements of the following National standards and also meet the requirements of this specification.

IS: 5986 – 2011, Gr.: 205: Hot rolled steel flat products for structural forming and flanging purposes - Specification.

5.0 DIMENSIONS AND TOLERANCES:

5.1 Sizes:

Hot rolled carbon steel sheets shall be supplied to the dimensions in BHEL order.

5.2 Tolerances:

The tolerances on sheets shall comply with the following:

5.2.1 Thickness (IS: 1852):

Thickness, mm	Tolerance, mm
2.50	± 0.20
3.15	± 0.22
4.0	± 0.25

Revisions:

As per Cl.No.38.1 of MOM of MRC– S&GPS

APPROVED:

INTERPLANT MATERIAL RATIONALISATION
COMMITTEE – MRC(S&GPS)

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AA10113

Rev No. 07

PAGE 2 of 5

CORPORATE PURCHASING SPECIFICATION



5.2.2 Width (IS: 1852):

Width, mm	Tolerance, mm
Upto & incld. 1250 mm	+ 6 mm - 0 mm
Over 1250 mm & upto and incld. 1550 mm	+ 0.5 percent - 0.0 percent
Over 1550 mm	+ 0.6 percent - 0.0 percent

5.2.3 Length (Continuous mill) IS: 1852:

Length, mm	Tolerance, mm
Upto & incld. 2500 mm	+ 25 mm - 00 mm
Over 2500 mm	+ 1 percent subject to a maximum of 70 mm - 0 percent

5.2.4 Flatness (for cut lengths):

Thickness, mm	Width, mm	Flatness tolerance, mm
From 2.5 to 4.0	Upto & incld. 1200	15
	Over 1200 & upto incld. 1500	20
	Over 1500	25

5.2.5 Edge camber IS: 5986:


The edge camber (i.e. lateral departure of the edge of the material from a straight line forming a chord) of sheets in cut lengths and coil shall not exceed the following values:

5.2.5.1 For Cut Lengths:

Length in meters		Tolerance, mm
Over	Upto & incld.	
--	1.25	5
1.25	1.80	6
1.80	2.50	8
2.50	3.15	10
3.15	3.55	12
3.55	4.00	16
4.00	5.00	19

5.2.5.2 For Coils:

25 mm in any 5000 mm length.

	<h1 style="text-align: center;">CORPORATE PURCHASING SPECIFICATION</h1>	AA10113
Rev No.07		
PAGE 3 of 5		

6.0 MANUFACTURE:

Process of manufacture is left to the discretion of the manufacturer except Bessemer process.

Material shall be manufactured from semi killed or killed steel.

7.0 FREEDON FROM DEFECTS:

The sheets shall be free from harmful defects, twists, buckle, rust, scale and waviness and shall be reasonably smooth, flat and square.

8.0 CHEMICAL COMPOSITION:

The melt analysis of steel and the permissible variation in the composition of the material from the melt analysis shall be as follows:

Element	Melt analysis, percent, max.	Permissible variation, percent, max.
Carbon	0.15	0.03
Manganese	0.80	0.05
Sulphur	0.040	0.005
Phosphorus	0.040	0.005

9.0 TEST SAMPLES:

9.1 Tensile Test:

One sample shall be taken per thickness per consignment from each melt.

As far as possible test pieces shall be cut transverse to the direction of rolling and shall be of full thickness of the sheet rolled.

9.2 Bend Test:

One sample shall be taken per thickness per consignment from each melt.

Bend test pieces shall be cut so that the axis of the bend is parallel to the direction of rolling viz. transverse.

Note: When more than one thickness is rolled from the same melt, one additional test piece for each thickness shall be taken.

10.0 MECHANICAL PROPERTIES:

10.1 Bend:

When tested in accordance with IS: 1599, the test pieces shall be capable of being bent cold through 180° close. The outer convex surface of the test piece shall be free from cracks.

10.2 Tensile:

When tested as per IS: 1608, the test pieces shall show the following properties:

AA10113

Rev No. 07

PAGE 4 of 5

CORPORATE PURCHASING SPECIFICATION



Tensile strength	: 330 – 440 N/mm ²
Yield strength	: 205 N/mm ² , min.
Elongation:	
For sheets up to & Incl. 3 mm, thick	: 20 %, minimum on 80 mm gauge length
For sheets above 3 mm, thick	: 28 %, minimum in 5.65 √So gauge length

11.0 HARDNESS (VICKERS):

When tested in accordance with IS: 1501, the material shall show a Vickers hardness in the range of 100 – 140 HV.

Note: Hardness test shall be conducted only when tensile test cannot be performed.

12.0 TEST CERTIFICATES:

Unless otherwise specified, three copies of test certificates shall be supplied.

In addition, the supplier shall ensure to enclose one copy of the test certificate along with their dispatch documents to facilitate quick clearance of the material.

The test certificate shall bear the following information:

AA10113, Rev 07: HOT ROLLED CARBON STEEL SHEET (330 N/mm² Tensile)

BHEL Order No,

Supplier's name,

Identification No

Melt No,

Process of manufacture

Details of pickling, descaling and oiling

Results of dimensional inspection

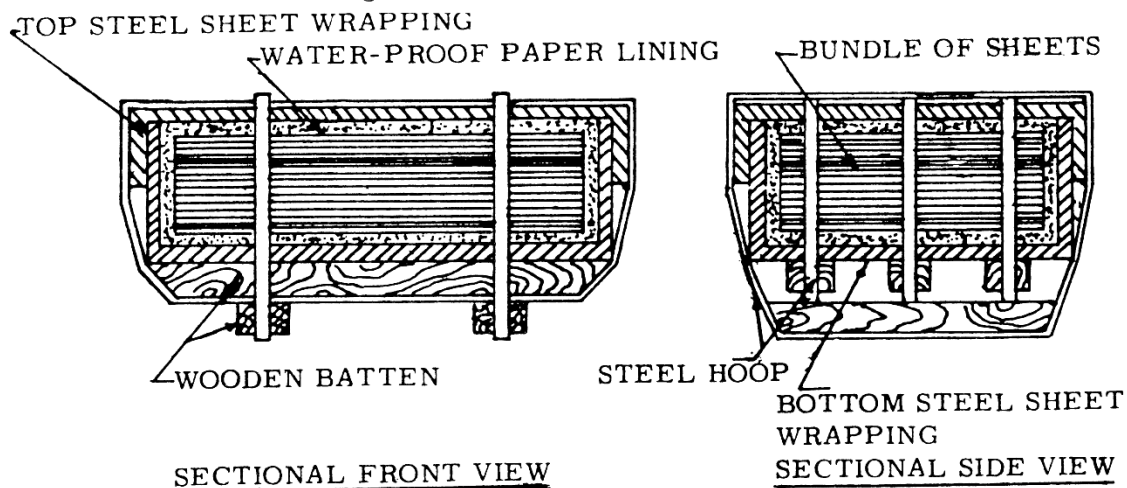
Results of Chemical analysis and Mechanical tests,


Note: Material procured, supplied and certified as AA10113 / IS: 5986, Gr.:205 and comply with the requirements of this specification is acceptable.

13.0 PACKING AND MARKING:

Steel sheets shall be supplied in bundles and shall be suitably packed in bundles to prevent corrosion and damage during transit.

The recommended packing for imported material shall be as shown below.



	<h1 style="text-align: center;">CORPORATE PURCHASING SPECIFICATION</h1>	AA10113
Rev No.07		
PAGE 3 of 5		

Note:

- Water proof paper lining shall be preferably Volatile Corrosion Inhibitor (V.C.I.) Coated Paper with an additional polythene (100 micron) enveloped.
- Approximate weight of each bundle shall be 2 to 3 tonnes. Bundle weighing 2 metric tonnes is however preferred.

A metal label shall be securely attached to each bundle and shall bear the following information:

AA10113:HOT ROLLED CARBON STEEL SHEET (330 N/mm² Tensile)
 BHEL Order No,
 Supplier's Name & Identification No,
 Size & Thickness of sheets
 Weight

14.0 REFERRED STANDARDS (Latest publications including amendments):

1) IS: 1154	2) IS: 1501	3) IS: 1852	4) IS: 1599	5) IS: 1608
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36



CORPORATE PURCHASING SPECIFICATION

AA10501

Rev No. 14

PAGE 1 of 4

1.5% NICKEL-CHROMIUM-MOLYBDENUM HOT ROLLED/FORGED STEEL BARS- H & T

1.0 GENERAL:

This specification governs the quality requirements of 1.5% Nickel-Chromium-Molybdenum Hot rolled/forged Steel Bars, Gr: 40Ni6Cr4Mo3 in Hardened and Tempered condition.

2.0 APPLICATION:

For the manufacture of bolts, studs and various components of machines.

3.0 CONDITION OF DELIVERY:

Hot Rolled / Forged; Hardened and tempered.

Note: Sizes up to 100mm in hot rolled
>100 to 180mm in hot rolled or forged
above 180mm in forged

The ends of bars shall be reasonably square and true.

The bars shall be supplied in straight lengths without twists and bends.

4.0 COMPLIANCE WITH NATIONAL STANDARDS:

The material shall comply with the requirements of the following National standard and also meet the requirements of this specification.

IS: 5517 – 1993 Gr: 40Ni6Cr4Mo3, Type: J
Hardened & Tempered

Steels for Hardening and Tempering -
Specification

5.0 DIMENSIONS AND TOLERANCES:

5.1 Sizes: Bars shall be supplied to the dimensions specified on the order.

5.1.1 Length: Unless otherwise specified, hot rolled bars shall be supplied in 3 to 6 metres length or in multiples with maximum 10%, shorts down to 1 metre.

Forged bars shall be supplied in lengths of 1.5 to 3.0 metres

Revisions:

Revised as per email dt 18.12.08 from Shri Gopal Bhatt from Bhopal.

APPROVED:

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COMMITTEE – MRC(S&GPS)

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37 HEP, Bhopal

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AA10501	<h2 style="margin: 0;">CORPORATE PURCHASING SPECIFICATION</h2>	
Rev No. 14		
PAGE 2 of 4		

5.2 Tolerance:

5.2.1 Hot rolled bars: The bars shall not vary from specified diameter or distance across flats by more than $\pm 2\frac{1}{2}$ %.

5.2.2 Forged bars: The tolerance on the forged bars shall be as follows.

<u>Diameter, mm</u>	<u>Tolerance, mm</u>
50 mm to 175 mm	+ 8.0 mm
Above 175 mm	+ 12.5 mm

Note: (Hot rolled & forged bars).

Insignificant surface defects in the form of dent and ripple marks are permissible provided their depth does not exceed half the tolerance on each size.

6.0 MANUFACTURE:

Material shall be manufactured from fully killed steel.

7.0 HEAT TREATMENT:

The recommended heat treatment is as follows:

Harden in oil / water from a temperature of 830 – 850°C.

Temper at a suitable temperature between 550 – 660°C.


8.0 FREEDOM FROM DEFECTS:

The bars shall be sound, straight and free from internal and surface defects, such as seams, laps, cracks or any other defects which may impair the end use.

9.0 CHEMICAL COMPOSITION:

The melt analysis of steel and the permissible variation in the composition of the finished product from the melt analysis shall be follows:

Element	Melt analysis percent		Permissible variation, percent, in product analysis
	Min.	Max.	
Carbon	0.35	0.45	± 0.02
Silicon	0.10	0.35	± 0.03
Manganese	0.40	0.70	± 0.04
Nickel	1.25	1.75	± 0.05
Chromium	0.90	1.30	± 0.05
Molybdenum	0.20	0.35	± 0.03
Sulphur	---	0.035	+ 0.005
Phosphorus	---	0.035	+ 0.005

	<h2 style="margin: 0;">CORPORATE PURCHASING SPECIFICATION</h2>	AA10501 Rev No.14 PAGE 3 of 4
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10.0 TEST SAMPLES:

10.1 One sample shall be taken from each melt for chemical analysis.

10.2 One sample shall be taken from each heat treatment batch for testing of mechanical properties. Test pieces for mechanical tests shall be taken in the longitudinal direction of the piece.

For ruling section up to & including 40mm, the test piece shall be machined coaxially from the test bars. For ruling section above 40mm the longitudinal axis shall be at least 12.5 mm from surface of the test bars.

Test methods for determining mechanical properties shall be as per IS: 1598 (For IZOD impact test)/IS: 1757 (For impact test in ISO-V Charpy) and IS: 1608 (For tensile test) or any other reputed International Standard.

10.3 For ruling section above 200mm, tensile test samples can be taken in tangential or transverse direction.

11.0 MECHANICAL PROPERTIES (In Hardened and Tempered Condition):

Ruling section, mm	Tensile strength, N/mm ²	0.2%/PS/YS N/mm ² min	%E $5.65\sqrt{S_0}$ min	* IZOD impact J, min	Hardness ** BHN
up to 30	1200, min	1000	10	30 (25)	360 – 420
> 30 to = 63	1100 – 1250	880	11	41 (35)	330 – 390
> 63 to = 100	1000 – 1150	800	13	48 (42)	300 – 350
>100 to = 150	900 – 1050	700	15	55 (50)	270 – 300
>150	800 – 950	600	16	55 (50)	240 – 285

* Average of 3 samples applicable for sizes above 16 mm ruling section only. Values in bracket are in ISO - V Charpy.


** Hardness shall be reported for information only.

12.0 ULTRASONIC TEST:

12.1 Each bar above 100 mm shall be tested ultrasonically in accordance with BHEL standard AA0850118 to ensure freedom from internal defects.

The norms of acceptance shall be as per category 2 of the above standard.

12.2 Optional tests: If specified on order, each bar > 40 to 100 mm shall be tested ultrasonically in accordance with BHEL standard AA0850118 to ensure freedom from internal defects and the norms of acceptance shall be as per category 2.

AA10501	<h1 style="text-align: center;">CORPORATE PURCHASING SPECIFICATION</h1>	
Rev No. 14		
PAGE 4 of 4		

13.0 TEST CERTIFICATES:

Three copies of test certificates shall be supplied, unless otherwise stated on the order. In addition, the supplier shall ensure to enclose one copy of the test certificate along with their dispatch documents to facilitate quick clearance of the material.

The test certificate shall bear the following information:

BHEL References:
AA10501, Rev.No.14: 1.5% Nickel-Chromium-Molybdenum Hot Rolled/Forged Steel Bars- H&T
BHEL order No,

Supplier's References:
Name:
Identification No:
Melt No:
Details of heat treatment:

Result of Tests:
Dimensional inspection.
Results of chemical analysis, mechanical and & Ultrasonic tests.

14.0 PACKING AND MARKING

The bars shall be suitably packed in bundles to prevent corrosion and damage during transit.

Each bar equal to or greater than 50 mm in diameter or of equivalent cross sectional area shall be stamped with 'AA10501' and melt number on the side near the end or on the face.

Bars below 50 mm shall be bundled together and tied with wire at 3 to 4 places along the length of the bars.

A metal label shall be securely attached to each bundle and shall bear the following information:
AA10501: 1.5% Nickel-Chromium-Molybdenum Hot Rolled/Forged Steel Bars- H & T.
BHEL Order No.:
Consignment/Identification No.:
Melt No.:
Size and Weight:
Supplier's Name:

15.0 REFERRED STANDARDS (Latest Publications Including Amendments):

1. IS: 1598	2. IS: 1608	3. IS: 1757
4. IS: 5517	5. AA0850118	