BHEL	**CORPORATE PURCHASING SPECIFICATION**	AA10108 Rev No.11 PREFACE SHEET

STRUCTURAL STEEL-STANDARD QUALITY

(PLATES, SECTIONS, STRIPS, FLATS & BARS)

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Equivalent/Comparable Standards:

1.	INDIAN	:	IS : 2062 – 2011, Gr: E250, Quality A
2.	AMERICAN	:	ASTM A131M – 2013
3.	JAPANESE	:	JIS G3106 – 2008
4.	EUROPEAN	:	EN 10025 – 2:2004 Gr. S275JR

Suggested/Probable Suppliers and Grades:

1.	M/S TISCO	:	TISTEN 42
2.	M/S SAIL	: i)	MA 300 HY
		ii)	Lloyds, Gr :A
		iii)	IS : 2062, Gr : A

User Plants and Replaced Plant Specifications/References:

1.	HEP, BHOPAL	:	PS 10108
2.	TP, JHANSI	:	PS 10108
3.	HEEP, HARDWAR	:	0500.001
4.	HPEP, HYDERABAD	:	HY0210299
5.	HPBP, TIRUCHY	:	

Revisions: As per Cl. No. 38.1 of MOM of MRC-S&GPS			**APPROVED:** INTERPLANT MATERIAL RATIONALISATION COMMITTEE – MRC(S&GPS)		
Rev No.11	Amd No.	Reaffirmed	Prepared	Issued	Dt. of 1st Issue
Dt:22-02-2014	Dt:	Year:	HPEP, Hyderabad	Corp.R&D	July, 1976

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STRUCTURAL STEEL-STANDARD QUALITY

(PLATES, SECTIONS, STRIPS, FLATS & BARS)

(ORDERING DESCRIPTION)

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1.0 GENERAL:

This specification governs the quality requirements of structural steel plates, strips, flats, bars and sections such as angles, beams, channels and tees etc. of IS: 2062 – 2011, Gr: E250, Quality A

2.0 APPLICATION:

For general engineering purpose.

3.0 CONDITION OF DELIVERY:

Plates, Bars & Sections: Hot rolled in straight lengths without twists & Bends

4.0 COMPLIANCE WITH NATIONAL STANDARDS:

Material shall comply with the requirements of IS: 2062 – 2011, Gr: E250, Quality A

Material offered to EN 10025-2:2004 Gr. S275JR is also acceptable. The tolerance on dimensions for plates shall comply with EN 10029.

5.0 DIMENSIONS AND TOLERANCES:

5.1 DIMENSIONS:

5.1.1 Sizes

Material shall be supplied to the dimensions specified on BHEL Order.

5.1.2 Length

Unless otherwise specified, hot rolled bars and sections shall be supplied in 3 to 6 metres length.

5.2 Tolerances:

5.2.1 The tolerances on hot rolled material shall comply with IS: 1852. However, no plate shall be under the specified thickness at any point.

5.2.2 Straight for hot rolled bars:

Unless otherwise specified, the permissible deviation in straightness shall not exceed 5 mm in any 1000 mm length.

6.0 HARDNESS (BRINELL):

When tested in accordance with IS: 1500, the material shall show a brinell hardness in the range of 120-156 HB.

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

7.0 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.

AA10108 Rev.11 / IS:2062 Grade: E250 Quality A / EN 10025-2 Gr. S275JR,

BHEL order no., Melt no. Size, Results of chemical analysis and Mechanical tests, Supplier's name, Identification no. TC no., Signature of competent authority etc.

8.0 PACKING AND MARKING:

Plates shall be transported suitably to avoid damage during transit.

For plates below 10 mm thick, each pile (preferably of 16 plates) and each plate 10 mm thick & over shall be marked with melt no. AA10108, BHEL order no., Supplier's name, Identification no., Size & weight on any one corner and encircled with paint preferably of white colour.

9.0 REFERRED STANDARDS (Latest publications including amendments):

1) IS: 1500 2) IS: 1852 3) EN 10029

BHEL	**CORPORATE PURCHASING SPECIFICATION**	AA10108 Rev No.11 PREFACE SHEET

STRUCTURAL STEEL-STANDARD QUALITY

(PLATES, SECTIONS, STRIPS, FLATS & BARS)

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Equivalent/Comparable Standards:

1.	INDIAN	:	IS : 2062 – 2011, Gr: E250, Quality A
2.	AMERICAN	:	ASTM A131M – 2013
3.	JAPANESE	:	JIS G3106 – 2008
4.	EUROPEAN	:	EN 10025 – 2:2004 Gr. S275JR

Suggested/Probable Suppliers and Grades:

1.	M/S TISCO	:	TISTEN 42
2.	M/S SAIL	: i)	MA 300 HY
		ii)	Lloyds, Gr :A
		iii)	IS : 2062, Gr : A

User Plants and Replaced Plant Specifications/References:

1.	HEP, BHOPAL	:	PS 10108
2.	TP, JHANSI	:	PS 10108
3.	HEEP, HARDWAR	:	0500.001
4.	HPEP, HYDERABAD	:	HY0210299
5.	HPBP, TIRUCHY	:	

Revisions: As per Cl. No. 38.1 of MOM of MRC-S&GPS			**APPROVED:** INTERPLANT MATERIAL RATIONALISATION COMMITTEE – MRC(S&GPS)		
Rev No.11	Amd No.	Reaffirmed	Prepared	Issued	Dt. of 1st Issue
Dt:22-02-2014	Dt:	Year:	HPEP, Hyderabad	Corp.R&D	July, 1976

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STRUCTURAL STEEL-STANDARD QUALITY

(PLATES, SECTIONS, STRIPS, FLATS & BARS)

(ORDERING DESCRIPTION)

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1.0 GENERAL:

This specification governs the quality requirements of structural steel plates, strips, flats, bars and sections such as angles, beams, channels and tees etc. of IS: 2062 – 2011, Gr: E250, Quality A

2.0 APPLICATION:

For general engineering purpose.

3.0 CONDITION OF DELIVERY:

Plates, Bars & Sections: Hot rolled in straight lengths without twists & Bends

4.0 COMPLIANCE WITH NATIONAL STANDARDS:

Material shall comply with the requirements of IS: 2062 – 2011, Gr: E250, Quality A

Material offered to EN 10025-2:2004 Gr. S275JR is also acceptable. The tolerance on dimensions for plates shall comply with EN 10029.

5.0 DIMENSIONS AND TOLERANCES:

5.1 DIMENSIONS:

5.1.1 Sizes

Material shall be supplied to the dimensions specified on BHEL Order.

5.1.2 Length

Unless otherwise specified, hot rolled bars and sections shall be supplied in 3 to 6 metres length.

5.2 Tolerances:

5.2.1 The tolerances on hot rolled material shall comply with IS: 1852. However, no plate shall be under the specified thickness at any point.

5.2.2 Straight for hot rolled bars:

Unless otherwise specified, the permissible deviation in straightness shall not exceed 5 mm in any 1000 mm length.

6.0 HARDNESS (BRINELL):

When tested in accordance with IS: 1500, the material shall show a brinell hardness in the range of 120-156 HB.

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

7.0 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.

AA10108 Rev.11 / IS:2062 Grade: E250 Quality A / EN 10025-2 Gr. S275JR,

BHEL order no., Melt no. Size, Results of chemical analysis and Mechanical tests, Supplier's name, Identification no. TC no., Signature of competent authority etc.

8.0 PACKING AND MARKING:

Plates shall be transported suitably to avoid damage during transit.

For plates below 10 mm thick, each pile (preferably of 16 plates) and each plate 10 mm thick & over shall be marked with melt no. AA10108, BHEL order no., Supplier's name, Identification no., Size & weight on any one corner and encircled with paint preferably of white colour.

9.0 REFERRED STANDARDS (Latest publications including amendments):

1) IS: 1500 2) IS: 1852 3) EN 10029

	CORPORATE PURCHASING SPECIFICATION	AA 101 12
		Rev. No. 07
		PREFACE SHEET

BRIGHT STEEL BARS AND SECTIONS (STANDARD QUALITY)

FOR INTERNAL USE ONLY
REMOVE THIS PREFACE SHEET BEFORE ISSUE TO SUPPLIERS

Comparable Standards:

1. INDIAN : IS : 9550-2001

Suggested/Probable Suppliers And Grades:

Refer plant vendors list

User Plant References:

1.	BHOPAL	:	PS 101 12 BP 101 72
2.	HEEP, HARDWAR	:	0500.053
3.	HYDERABAD	:	HY 021 02 99

Revisions : Cl. 27.2.d of MOM of MRC-S&GPS			APPROVED : INTERPLANT MATERIAL RATIONALISATION COMMITTEE-MRC (S&GPS)		
Rev. No. 07	Amd.No.	Reaffirmed	Prepared BHOPAL	Issued Corp. R&D	Date of 1st Issue SEP, 1976
Dt:15. 06.2005	Dt :	Year : 2013			

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BRIGHT STEEL BARS AND SECTIONS (STANDARD QUALITY)

1.0 GENERAL:

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.

2.0 APPLICATION:

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.

3.0 CONDITION OF DELIVERY:

3.1 Round Bars - Class 4, surface quality.

Upto 50 mm diameter - Cold drawn.
Above 50mm diameter - Cold drawn or Hot rolled, turned and polished

3.2 Rectangular/Square/Hexagonal Bars - Class 3, surface quality.
All sizes - Cold drawn

3.3 Sections - Class 4, surface quality.
All sizes - Cold drawn

3.4 Bars and sections shall be straight, with their ends sheared, square and true and shall have a smooth surface.

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:

i) Servo RP 150 - M/s Indian Oil Corporation
ii) HE - 1612 - M/s. BHEL, Bhopal
iii) Rustilo DW-901 - M/s. Indrol Lubricants and Specialties Ltd.
iv) Rustpro Special - M/s. Tide water oil co.
v) Any other clear TRP conforming to IS: 1154

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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 : 9550 - 2001 : Bright steel bars

:

5.0 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.

6.0 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.

7.0 MANUFACTURE:

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

8.0 FREEDOM FOR DEFECTS :

All finished steel bars and section shall be sound and free from internal and surface defects. They shall be bright and clean.

9.0 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.

10.0 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,
Carbon	0.25	± 0.02
Sulphur	0.040	+ 0.005
Phosphorus	0.04 0	+ 0.005

11.0 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.

12.0 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/mm^2, min

Elongation on 5.65 :
√So gauge length : 8-20%

12.2 Round Bars:

12.2.1 Bars Upto 50 mm Diameter - Cold Drawn:

Tensile strength	:	440 N/mm^2, min
Elongation on 5.65 √So gauge length	:	8-20%

12.2.2 Bars Above 50 mm 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
			OR	
Elongation on 5.65 √So gauge length	:	23%, min		8-20%

13.0 TEST CERTIFICATES :

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

In addition, to the above, 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:

AA 101 12: 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.

14.0 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 50 mm shall be stamped at one end with 'AA10112'. Bars 50 mm 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:

AA 10112: Bright Steel Bars And Sections (Standard Quality)

BHEL Order No.

Consignment/Identification No.

Melt No.

Size and Weight.

Supplier's Name

15.0 REFERRED STANDARDS (Latest Publications Including Amendments):

1. IS: 1154 2. IS : 1608 3. IS:9550

	CORPORATE PURCHASING SPECIFICATION	AA10113 Rev No.07 PREFACE SHEET

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

FOR INTERNAL USE ONLY

REMOVE THIS PREFACE BEFORE ISSUE TO SUPPLIERS

Comparable Standards:

1. INDIAN : IS: 5986 – 2011, Gr: 205

Suggested/Probable Suppliers and Grades:

Refer plant vendors list

User Plants References:

1. HEEP, HARDWAR	:	0500.004, Gr.: St.34
2. HPEP, HYDERABAD	:	HY0212299
3. HEP, BHOPAL	:	PS10113
4. HPBP, TRICHY	:	

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Revisions: As per Cl.No.38.1 of MOM of MRC– S&GPS			**APPROVED:** INTERPLANT MATERIAL RATIONALISATION COMMITTEE – MRC(S&GPS)		
Rev No.07	Amd No.	Reaffirmed	Prepared	Issued	Dt. of 1st Issue
Dt:22-02-2014	Dt:	Year:	HEP, Bhopal	Corp.R&D	July, 1976

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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, decaled 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:

a) SERVO RP 125 of M/s. IOC.
b) RUSTOP 387/388 of M/s. HPC
c) Bharat TCPF of M/s. Bharat Petroleum
d) 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

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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.

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:

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.

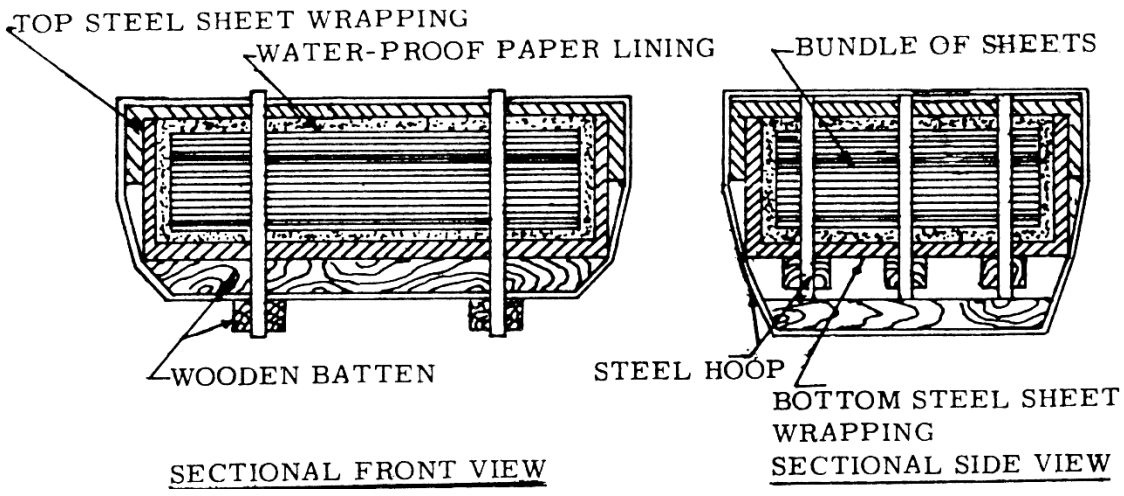
The test certificate shall bear the following information:
AA10113, Rev 07: HOT ROLLED CARBON STEEL SHEET (330 N/mm^2 Tensile)
BHEL Order No,
Supplier's name,
Identification No
Melt No,
Process of manufacture
Details of pickling, descaling and oiling
Results of dimensional inspection
Results of Chemical 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.



Note:

a) Water proof paper lining shall be preferably Volatile Corrosion Inhibitor (V.C.I.) Coated Paper with an additional polythene (100 micron) enveloped.

b) 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/mm^2 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

	CORPORATE PURCHASING SPECIFICATION	AA 101 22
		Rev. No. 15
		PREFACE SHEET

STRUCTURAL STEEL-HIGH TENSILE PLATES, FLATS & BARS

FOR INTERNAL USE ONLY
REMOVE THIS PREFACE SHEET BEFORE ISSUE TO SUPPLIERS

Comparable Standards:

1. GERMAN : DIN EN 10025-2:2004
   Gr: S355 J2 G3
   Mat. No. 1.0577
2. INDIAN : IS: 2062-2006 Grade E350 (Fe 490)

Suggested/Probable Suppliers And Grades:

Refer Plant Vendors List

User Plant References:

1.	BHOPAL	:	PS 10541
2.	JHANSI	:	PS 10541
3.	HEEP, HARDWAR	:	0500.009, HW10181
4.	HYDERABAD	:	HY 021 02 99, HY10591
5.	TRICHY	:	TDC 0:301

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Revisions :	APPROVED :
CL.32.7 of MOM of MRC-S&GPS	**INTERPLANT MATERIAL RATIONALISATION COMMITTEE-MRC (S&GPS)**

Rev. No. 15	Amd.No.	Reaffirmed:	Prepared	Issued	Dt. of 1 st Issue
Dt: 10.11.2009	Dt :	Year :	HYDERABAD	Corp. R&D	JULY, 1976

STRUCTURAL STEEL - HIGH TENSILE PLATES, FLATS & BARS

1.0 GENERAL:

This specification governs the quality requirements of High Tensile Structural Steel Plates where guaranteed weldability is required.

2.0 APPLICATION :

Steel intended for use in structures where enhanced mechanical properties are required and where saving in weight can be effected due to their greater strength.

3.0 CONDITION OF DELIVERY :

Plates shall be supplied in the normalized condition or in an equivalent condition obtained by normalizing rolling.

4.0 COMPLIANCE WITH NATIONAL STANDARDS:

Material shall comply with the requirements of DIN EN 10025-2:2004, Gr: S355J2G3 (Material Number 1.0577) or the equivalent grade of latest version.

The supply of the material as per IS:2062-2006 Grade E350 (Fe 490) (latest version) meeting the requirement of clause 3.0, 5.0, and 12.0 of this specification is also acceptable.

5.0 DIMENSIONS AND TOLERANCES :

5.1 Dimensions :

5.1.1 Sizes

Material shall be supplied to the dimensions specified on BHEL Order.

5.1.2 Length :

Unless otherwise specified, hot rolled bars and sections shall be supplied in 3 to 6 metres length.

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5.2 Tolerances:

The tolerances on dimensions for plates shall comply with DIN EN 10029.

6.0 MANUFACTURE:

Material shall be manufactured from fully killed (FF) steel having a Carbon Equivalent (melt analysis) of:

0.45 max. for plates upto & incl. 30 mm thick

0.47 max. for plates above 40 mm thick upto & incl. 150 mm thick.

0.49 max for plates > 150mm & $\leq$ 250 mm thick.

7.0 FREEDOM FROM DEFECTS :

All finished steel shall be well and cleanly rolled to the dimensions, sections and weights specified. The finished material shall be free from cracks, surface flaws, laminations; rough, jagged and imperfect edges and internal & surface defects.

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	Percent, max.	Permissible variation, percent, maximum
Carbon		
Upto&Incl 40mm thick	0.20	0.03
Above 40mm thick	0.22	0.02
Silicon	0.55	0.05
Manganese	1.60	0.10
Sulphur	0.025	0.010
Phosphorus	0.025	0.010
Copper	0.55	0.050

Note :

1. Total Aluminum: 0.020%, minimum.
2. Micro-alloying elements like niobium, boron, titanium and vanadium may be added by the manufacturer to achieve the mechanical properties specified.
3. Carbon Equivalent (CE) based on melt analysis shall be calculated as per following formula :

$$CE = C + \frac{Mn}{6} + \frac{Cr+Mo+V}{5} + \frac{Ni+Cu}{15}$$

9.0 TEST SAMPLES:

Test samples shall be selected and prepared in accordance with DIN EN 10025. One tensile test piece per 40 tonnes or part thereof shall be selected from finished steel from each melt for each class of products.

10.0 MECHANICAL PROPERTIES (On longitudinal test samples) :

i) Tensile :

The test pieces shall show the following properties, when tested in accordance with IS: 1608 / DIN EN 10025.

Nominal thickness, mm	Tensile strength N/mm^2, min.	Yield strength N/mm^2, min.	Elongation on 5.65 √So gauge length, percent, min.
From 5 to 16	470-630	355	22
Over 16 to 40	470-630	345	22
--- 40 to 63	470-630	335	21
--- 63 to 80	470-630	325	20
---- 80 to 100	470-630	315	20
---- 100 to 150	450-600	295	18
---- 150 to 200	450-600	285	17
---- 200 to 250	450-600	275	17
---- 250 to 400	450-600	265	17

ii) Impact :

The "Choppy Impact test" shall be carried out in accordance with DIN EN 10045-1/IS-1757 at (-20^0C). The impact values achieved shall be as follows.

Nominal thickness (mm)	Impact strength (KCV) (2mm 'V' notch)
< 16	Note (1)
16 ≥ to ≤ 150	27 Joules
150 > to ≤ 250	27 Joules

Note :

(1) Impact test is not required for plates below 16 mm.

The average value of the three test results shall meet the specified requirement. One individual value may be the below minimum average value specified, provided that it is not less than 2/3 rd of the same.

11.0 PROTECTIVE COATING :

Plates upto 10 mm thick shall be applied with a suitable rust preventive coating for overseas shipping only.

12.0 ULTRASONIC EXAMINATION:

Plates above 40mm shall be ultrasonically examined in accordance with BHEL standard AA 085 01 20 (or ASTM A435 / EN10160) and shall comply with the acceptance norms specified therein.

13.0 OPTIONAL:

PRESERVATION:

If specified in order, all plates shall be applied with a suitable rust preventive to avoid pitting.

14.0 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 despatch documents to facilitate quick clearance of the material.

The test certificate shall bear the following information:

(i) AA 101 22-Rev. No.15, DIN EN 10025 Gr. S355J2G3, Matl. No. 1.0577.

(ii) BHEL order No, Melt No, Size & Quantity, Batch No with heat treatment details, Results of Chemical analysis, Mechanical tests & NDT, Supplier's name, Identification No, TC No, Signature of Competent authority, etc.

15.0 PACKING AND MARKING:

Plates shall be transported suitably to avoid damage during transit.

For plates below 10 mm thick, each pile (preferably of 16 mm plates) and each plate 10 mm thick and over shall be marked with Melt No., AA 101 22, BHEL Order No, Supplier's Name, Identification No, Size & weight, on any one corner and encircled with paint preferably of white colour.

15.0 REFERRED STANDARDS (Latest Publications including amendments):

1. IS : 1608	2. IS: 2062	3. DIN EN 10025
4. DIN EN 10029	5. DIN EN 10045-1	6. AA 085 01 20
7. ASTM A435	8. EN10160	9. IS: 1757

	CORPORATE PURCHASING SPECIFICATION	**AA 101 47**
		Rev. No. 05
		PREFACE SHEET

CARBON STEEL PIPES-ELECTRIC RESISTANCE WELDED/SUBMERGED ARC WELDED

FOR INTERNAL USE ONLY
REMOVE THIS PREFACE SHEET BEFORE ISSUE TO SUPPLIERS

Comparable Standards:

1. INDIAN : IS : 3589 - 2001
Gr: ERW-Fe 410

Suggested/Probable Suppliers And Grades:

Refer plant vendors list.

User Plant References:

1. BHOPAL : - - -
2. HEEP, HARDWAR : - - -
3. TIRUCHY : BM - 32

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Revisions : **Cl. 26.6.13 of MOM of MRC-S&GPS**			**APPROVED :** **INTERPLANT MATERIAL RATIONALISATION COMMITTEE-MRC (S&GPS)**		
Rev. No. 05	**Amd.No.**	**Reaffirmed**	**Prepared**	**Issued**	**Dt. of 1st Issue**
Dt: 15.01.2004	**Dt :**	**Year : 2013**	**BHOPAL**	**Corp. R&D**	**AUGUST, 1976**

CARBON STEEL PIPES-ELETRIC RESISTANCE WELDED/SUBMERGED ARC WELDED

1.0 GENERAL:

This specification governs the quality requirements of Electric Resistance Welded/Submerged Arc Welded, Carbon Steel Pipes, of 168.3 mm to 2540 mm.

2.0 APPLICATION:

For conveying gas, water and oil.

3.0 CONDITION OF DELIVERY:

Pipes shall be supplied in straight lengths with plain ends.

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 : 3589 - 2001	: Steel pipes for water and sewage
Gr: ERW - Fe 410	:

5.0 DIMENSIONS AND TOLERANCES :

5.1 Sizes:

Pipes shall be supplied to the dimensions specified on BHEL order.
BHEL order shall clearly state the outside diameter and well thickness of the pipe.

5.2 Tolerances:

5.2.1 Wall Thickness:

The tolerances on wall thickness of the pipes shall be ± 10% for ERW and +20%, - 12.5% for SAW.

5.2.2 Straightness:

The deviation from a straight line shall not exceed 0.2% of the length.

5.3 Length:

Pipes shall be supplied in random length of 4 to 7 metres unless exact lengths are called for in BHEL order.

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6.0 MANUFACTURE:

Electric Resistance Welded and Induction Welded, Submerged Arc Welded:

The pipes shall be made from steel plates or strips by butt welding longitudinally or spirally. The weld shall be continuous. Prior to welding, edges or plates or strips may be prepared suitably where required, by process of manufacture.

7.0 FREEDOM FOR DEFECTS :

All pipes shall be cleanly finished and when visually inspected shall be free defects such as cracks, surface flaws, laminations etc. The ends shall be cleanly cut and reasonably square with the axis of the pipes.

8.0 CHEMICAL COMPOSITION :

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

Element	Melt analysis, percent, max.	Permissible variation, for product analysis, max
Carbon	0.20	+ 0.02
Sulphur	0.040	+ 0.005
Phosphorus	0.040	+ 0.005
Manganese	1.30	+ 0.04

9.0 TEST SAMPLES :

Unless otherwise agreed between BHEL and manufacturer, the procedure for sampling of pipe for various tests and criteria for conformance shall be as given in IS:4711. Test samples shall be cut from pipes in final condition of supply.

9.1 Flattening Test:

For pipes produced in single lengths the flattening test shall be made form each end with the welds at 0^0 and 90^0.

For pipes produced in multiple lengths, tests shall also be made on two intermediate rings cut from each multiple lengths of pipe in the weld at 0^0.

10.0 MECHANICAL PROPERTIES :

10.1 Tensile:

When tested in accordance with IS:1608, the tensile properties of strip cut longitudinally (excluding weld) from selected pipe shall show properties given below :

Tensile strength	:	410 MPa, min
Yield stress	:	235 MPa, min.
Elongation on 5.65 √So gauge length	:	18 percent , min.

10.2 Fattening Test (For ERW pipes):

A ring not less than 40mm in length taken form the end of each selected tube shall be flattened between parallel plates as follows, in accordance with IS: 3589.

The test shall be made keeping, the weld at 90^0 to the direction of the force. No opening shall occur by fracture in the weld until the distance between the plates is less than 75 percent of the original diameter of the pipe or no cracks or breaks on the metal elsewhere than the weld shall occur until the distance between the plates is less than 60 percent of the original outside diameter.

10.3 Guided bend test (For SAW pipes):

Strips not less than 40mm wide cut circumferentially from pipes perpendicular to weld seam with weld near the middle of sample shall without fracture be doubled over a round bar the diameter of which shall be calculated as given below: The weld reinforcement shall be removed from faces.

One face and one root bend specimen as per fig.1 of IS:3589 shall be bent 180^0 in a jig in accordance with Fig.2 of IS:3589.

$$A = \frac{1.15\,(D-2t)}{eD/t - 2e - 1}$$

1.15 = peaking factor

D = Specified OD in mm

t = Specified wall thickness in mm

e = Strain in mm i.e. 0.1275 for grade Fe 410

Acceptance of bend test shall be as per clause 9.3.2 and 9.3.3 of IS:3589.

11.0 HYDRAULIC TEST:

Each length of the pipe shall be hydraulically tested at the manufacturer's works, before the pipes is coated, wrapped or lined at the manufacturer's works.

The hydraulic test pressure shall be the pressure calculated from the following formula, except that the maximum test pressure shall not exceed 5 MPa:

$P = 2St/D$

where P = Test pressure in MPa

S = Stress in MPa which shall be taken as 60 percent of the minimum yield stress

t = Specified thickness in mm

D = Specified outside diameter in mm

Test pressure shall be applied and maintained for sufficiently long time for proof and inspection.

NOTE: Normally 5 seconds are sufficient for the purpose of test.

12.0 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 :

AA 101 47: Rev. No. 05: Carbon Steel Pipes-ERW/SAW

BHEL order No,
Supplier's Reference :

Name
Identification
Melt No.

Results of Tests :

Results of Dimensional inspection.
Results of chemical analysis and mechanical & hydraulic tests.

13.0 PACKING AND MARKING :

As agreed to between BHEL and manufacturer, surface coating if required shall be as per guide line given in annex A to D of IS:3589. When tubes are required to be galvanised. The zinc coating shall be in accordance with IS: 4736.

Each pipe shall be die-stamped with the following information:

AA 10147: Carbon Steel Pipes - ERW/SAW

BHEL Order No.

Consignment/Identification No.

Out side Diameter and Wall Thickness.

Supplier's Name

14.0 REFERRED STANDARDS (Latest Publications Including Amendments):

1. IS: 1608 2. IS : 3589 3. IS:4711 4. IS:4736

BHEL	**CORPORATE PURCHASING SPECIFICATION**	AA10152 Rev No.07 PREFACE SHEET

STEEL TUBES – ELECTRIC RESISTANCE WELDED / SUBMERGED ARC WELDED

FOR INTERNAL USE ONLY

REMOVE THIS PREFACE BEFORE ISSUE TO SUPPLIERS

Equivalent / Comparable Standards:

1) INDIAN : IS 1239 (Part 1) – 2004, Gr.: ERW

Suggested / Probable Suppliers and Grades:

Refer plant vendors list.

User Plants and Replaced Plant Specifications / References:

1) HEP, BHOPAL : PS10152 - Ungalvanized Tubes.
2) HEEP, HARDWAR : PS10153 - Galvanized Tubes.
3) HPEP, HYDERABAD : HY0120299, HY0210299
4) HPBP, TIRUCHY :

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Revisions:			**APPROVED:**		
Corrected the Clause 11.4 in line with IS 1239 (Part 1)			INTERPLANT MATERIAL RATIONALISATION COMMITTEE – MRC(S&GPS)		
Rev No.07	Amd No.	Reaffirmed	Prepared	Issued	Dt. of 1st Issue
Dt:05-01-2015	Dt:	Year:	HEP, Bhopal	Corp.R&D	July, 1976

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STEEL TUBES – ELECTRIC RESISTANCE WELDED / SUBMERGED ARC WELDED

1.0 GENERAL:

This specification governs the quality requirements of light, medium and heavy grades of Electric Resistance Welded/Submerged Arc Welded steel tubes with plain ends in ungalvanized and galvanized condition in the range of 60mm to 150mm NB.

2.0 APPLICATION:

For general purpose, suitable for bending, welding and screwing for flanges and fittings. Not suitable for steam services.

3.0 CONDITION OF DELIVERY:

Tubes shall be supplied with plain ends.

The ends shall be cut cleanly and square with the axis of the tube.

Unless otherwise specified, tubes shall be supplied in ungalvanized condition.

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: 1239(part 1) – 2004: Steel Tubes, Tubular and other Wrought Steel Fittings
Gr: ERW.

5.0 DIMENSIONS AND TOLERANCES:

5.1 Sizes:

BHEL order shall clearly state the maximum outside diameter, and wall thickness of the tube.

5.2 Tolerances:

5.2.1 Thickness:

Light tubes	+ not limited − 8 percent
Medium and Heavy tubes	+ not limited − 10 percent

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5.2.2 Weight:

Single tube (light series)	+ 10 percent − 8 percent
Single tube (medium and heavy series)	± 10 percent
For quantities per load of 10 tonnes, min (light series)	+ 7.5 percent − 5 percent
For quantities per load of 10 tonnes, min (medium and heavy series)	± 7.5 percent

5.2.3 Internal Weld Fin:

Height of the internal weld fin shall not be greater than 60 percent of the specified thickness.

5.2.4 Length:

5.2.4.1 Random Length:

Tubes shall be supplied in random lengths of 4 to 7 meters, unless otherwise specified and in the line with IS: 1239, Part 1.

5.2.4.2 Exact Length:

When exact lengths are called for, the tolerances shall be + 6 mm, − 0 mm of the specified length.

6.0 MANUFACTURE:

Tubes shall be made from tested quality steel manufactured by any approved process and shall be fully killed.

Tubes shall not be manually welded.

7.0 FREEDOM FOR DEFECTS:

Tubes shall be cleanly finished and reasonably free from injurious defects. They shall be reasonably straight. The ends shall be cut cleanly and reasonably square with the axis of the tube.

8.0 CHEMICAL COMPOSITION:

The melt analysis of steel shall be as follows:

Element	Percent max.	Permissible variation over specified limit, ± max
Carbon	0.20	0.02
Manganese	1.30	0.04
Sulphur	0.040	0.005
Phosphorus	0.040	0.005

9.0 GALVANIZING:

When galvanized tubes are ordered, the Zinc coating on the tubes shall be in accordance with IS: 4736

10.0 TEST SAMPLES:

All tubes bearing the same designation and manufactured under a single process shall be grouped together to constitute a lot. Each lot shall be sampled separately in accordance with IS: 4711

11.0 MECHANICAL PROPERTIES:

11.1 Tensile:

The tensile strength of strips cut form selected tubes, when tested in accordance with IS: 1608 shall be as follows:

Tensile strength : 320 N/mm^2, min.

Elongations on $5.65\sqrt{S_o}$ gauge length:

Up to and including. 25 mm NB : 12 percent, min.
Over 25 mm up to including150 mm NB : 20 percent, min.

Note:

1. For welded tubes, the strip tensile test specimen shall not contain the weld.
2. For galvanized tubes, zinc coating may be removed by stripping prior to tensile test.

11.2 Bend Test (On tubes up to and including 50mm nominal bore):

When tested in accordance with IS: 2329, the tubes shall be capable of withstanding the bend test without showing any signs of fracture or failure.

Tubes shall be bent with the weld at 90^o to the plane of bending. The tubes shall not be filled for this test.

Ungalvanised tubes shall be capable of being bent cold without cracking, through 180^o around a former having a radius at the bottom of groove in the plane of bending equal to at least six times the outside diameter of the tube.

Galvanized tubes shall be capable of being bent cold without cracking of the steel, through 90^o round a former having a radius at the bottom of the groove equal to at least eight times the outside diameter of the tube.

11.3 Flattening Test (On tubes above 50mm nominal bore):

Rings not less than 40mm in length, cut form the end of each selected tubes shall be flattened between parallel plates with the weld at 90^o(point of maximum bending) in accordance with IS:2328. No opening shall occur by fracture in the weld until the distance between the plates is less than 75 percent of the original outside diameter of the tube and no cracks or breaks on the metal elsewhere than in the weld shall occur until the distance between the plates is less than 60 percent of the original outside diameter.

Test rings may have the inner and outer edges rounded.

11.4 Hydraulic Test / Eddy Current Test:

Each tube shall withstand a test pressure of 5 N/mm^2 without showing leakage defects of any kind. The pressure shall be applied and maintained for a minimum period of 3 seconds for proof and inspection.

Note: Eddy current test may be done in place of Hydrostatic test as per the procedure in Annexure – B of IS: 1239, Part-1.

CORPORATE PURCHASING SPECIFICATION

12.0 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 dispatch documents to facilitate quick clearance of the material.

The test certificate shall bear the following information:

AA10152: Rev. No.07: Steel Tubes – ERW/SAW
BHEL order No:

Supplier's Reference:
Name
Identification No.
Melt No.

Results of Tests:
Results of Chemical, Mechanical tests and Hydraulic/Eddy Current test.

13.0 PROTECTIVE COATING:

The tubes shall be protected with a rust preventive coating of varnish, externally throughout the length.

14.0 PACKING AND MARKING:

Each tube shall be plugged at both ends by means of tight fitting end caps.

The tubes shall be suitably packed in bundles/packages to prevent corrosion and damage during transit.

Each bundle/package shall bear the following information:

AA10152: Steel Tubes – ERW/SAW
BHEL Order No.
Consignment/Identification No.
Outside Diameter and Wall Thickness.
Supplier's Name

15.0 REFERRED STANDARDS (Latest Publications Including Amendments):

1) IS: 1608 2) IS: 2328 3) IS: 2329

4) IS: 4736 5) IS: 4711

BHEL	**CORPORATE PURCHASING SPECIFICATION**	AA10445 Rev No.05 PREFACE SHEET

HOT FINISHED / COLD DRAWN SEAMLESS CARBON STEEL TUBES FOR HIGH TEMPERATURE SERVICE

FOR INTERNAL USE ONLY

REMOVE THIS PREFACE BEFORE ISSUE TO SUPPLIERS

Comparable Standards:

1. AMERICAN : ASME SA192

Suggested / Probable Suppliers and Grades:

Refer Use plant vendors list

User Plant References:

1. HPBP, TRICHY : TDC 0:102, TDC:1-005/C
2. HEP, BHOPAL : PS10127, PS10138

Revisions: Cl: 28.2.3 of MOM of MRC – FCF+HTM			**APPROVED:** INTERPLANT MATERIAL RATIONALISATION COMMITTEE – MRC(FCF+HTM)		
Rev No.05	Amd No.	Reaffirmed	Prepared	Issued	Dt. of 1st Issue
Dt:01-01-2004	Dt:	Year:2014	HPBP, Trichy	Corp.R&D	June, 1978

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HOT FINISHED / COLD DRAWN SEAMLESS CARBON STEEL TUBES FOR HIGH TEMPERATURE SERVICE

ORDERING DESCRIPTION FOR ASME SA192

1.0 GENERAL

The tubes shall conform to the latest version for ASME SA192 and comply with the following additional requirements.

2.0 APPLICATION

For high temperature service at stress levels and temperatures allowed by ASME Boiler & Pressure Vessel Code, Section I & Indian Boiler Regulations.

3.0 HYDROSTATIC TEST / NDT

Each length of tube shall be subjected to Hydrostatic test as per ASME SA 450.

As an alternative to the Hydrostatic test, each length of tube shall be subjected to NDT as given below:

a) For thickness up to 3.6mm, inclusive, Eddy current test as per ASME SE309 or for Thickness up to 12mm, inclusive, Flux leakage test as per ASME SE570.

or

b) Ultrasonic test as per ASME SE213.

Norms of acceptance shall be as specified in the respective standards mentioned above.

4.0 INSPECTION AT SUPPLIER'S WORKS

BHEL's representative shall have free access at all times to all parts of the manufacture's works, until the work on the contract of BHEL is being performed. The manufacturer shall offer BHEL's representative all reasonable facilities, without charge, to satisfy the latter that the material is being furnished in accordance with the specification.

5.0 REPAIR

5.1 Repair involving fusion welding is prohibited.

5.2 When defects are repaired by mechanical means, the wall thickness requirements shall be met with and the surfaces shall be smoothly dressed up without any sharp edges.

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6.0 CERTIFICATION

Test certificate shall be provided as per IBR FORM-III E issued by WELL KNOWN TUBE MAKER who is recognised by Central Boiler Board. Copy of certification of recognition as Well Known Tube Maker in FORM XVI - F shall also be enclosed along with the test certificate.

7.0 PACKING AND MARKING

As per BHEL Corporate Standard AA0490001.

8.0 REJECTION AND REPLACEMENT

If each length of tube does not comply with the requirements of this specification during receipt inspection at BHEL or if any defect is found during further processing of pipes BHEL reserves the right to reject the whole consignment and the supplier shall replace the material free of cost. The rejected material shall be taken back by the supplier after fulfilling the commercial terms and conditions.

	CORPORATE PURCHASING SPECIFICATION	AA 107 30
		Rev. No. 07
		PREFACE SHEET

AUSTENITIC STAINLESS STEEL SHEETS, PLATES AND STRIPS - SOLUTION ANNEALED (ASTM A 240M, TYPE 316 L) Î

FOR INTERNAL USE ONLY
REMOVE THIS PREFACE SHEET BEFORE ISSUE TO SUPPLIERS

Comparable Standards:

1. AMERICAN	:	ASTM A 240M Type 316 L, Solution annealed. Î
2. INDIAN	:	IS: 6911 - 1992 Gr: X 02 Cr17 Ni12 Mo2 Solution Annealed
3. EUROPEAN	:	EN 10088-2, Gr: X2CrNiMo17-12-2

Suggested/Probable Suppliers and Grades:

Refer Plant Vendors list

User Plant References:

1.	HEEP - HARDWAR	:	AISI: 316
2.	HYDERABAD	:	DIN: 17440-1972 Gr.: X 10CrNiMo 1810
3.	TRICHY	:	AISI 316 L

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Revisions : Cl 28.4.15 of MOM of MRC-S&GPS			APPROVED: Interplant Material Rationalization Committee-MRC (S&GPS)		
Rev. No. 07	**Amd.No.**	**Reaffirmed**	**Prepared**	**Issued**	**Dt. of 1st Issue**
Dt.:09.01.2007	**Dt :**	**Year: 2013**	**HARDWAR**	**Corp. R&D**	**AUGUST, 1978**

AUSTENITIC STAINLESS STEEL SHEETS, PLATES AND STRIPS - SOLUTION ANNEALED (ASTM A 240M, TYPE 316 L) Î

ORDERING DESCRIPTION

1.0 GENERAL:

The sheets, plates and strips shall conform to the latest version of ASTM A 240M, Type 316 L and comply with the following additional requirements. Î

2.0 APPLICATION:

For general engineering purposes, where corrosion resistance is essential.

3.0 CONDITION OF DELIVERY:

Hot/Cold rolled, solution annealed and descaled (Finish number 1 or 2 B/2D).

4.0 DIMENSIONS AND TOLERANCES:

Material shall be supplied to the dimensions specified in BHEL order.

5.0 CHEMICAL COMPOSITION :

As per ASTM A 240M, Type 316 L. Î

6.0 TEST CERTIFICATES :

Three copies of test certificates shall be supplied along with the following information:

BHEL References :

AA 107 30 -Rev. No.07 / ASTM A 240M, Type:316 L Î
BHEL order No,

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

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

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7.0 PACKING AND MARKING:

Sheets shall be supplied in bundles or in packages each weighing upto a maximum of 3000kg. Plates shall be suitably packed to prevent damage during transit.

For plates below 25 mm thick, each pile (preferably of 16 plates) shall be marked with suppliers identification mark, 'AA 107 30 / ASTM A 240 M, Type:316 L, melt No., BHEL Î order No., on the top plate.

Each plate of 25mm thickness and above shall be stamped/painted with the suppliers identification mark, 'AA 107 30 / ASTM A 240 M, Type:316 L , melt No., BHEL order No., Î on the top plate

FOR INFORMATION ONLY

CHEMICAL COMPOSITION :

C	Si	Mn	Ni	Cr	Mo	S	P	N
≤ 0.03	≤ 0.75	≤ 2.0	10.0-14.0	16.0-18.0	2.0-3.0	≤ 0.030	≤ 0.045	≤ 0.10

MECHANICAL PROPERTIES :

Hardness Max		0.2% PS min	UTS min	% El min	Cold Bend Î
BHN	HRB	N/mm²	N/mm²		
217	95	170 Î	485	40	-

	CORPORATE PURCHASING SPECIFICATION	**AA 107 39**
		Rev. No. 08
		PREFACE SHEET

AUSTENITIC STAINLESS STEEL SHEETS, PLATES AND STRIPS - SOLUTION ANNEALED (ASTM A 240M, TYPE 304) Î

FOR INTERNAL USE ONLY
REMOVE THIS PREFACE SHEET BEFORE ISSUE TO SUPPLIERS

Comparable Standards:

1. AMERICAN	:	ASTM A 240M Î Type 304, Solution annealed.
2. INDIAN	:	IS: 6911 - 1992 Gr: X 04Cr 19 Ni 9 Solution annealed
3. EUROPEAN	:	EN 10088-2, Gr: X5CrNi18-10

Suggested/Probable Suppliers and Grades:

Refer Plant Vendors list

User Plant References:

1.	HEEP - HARDWAR	:	HW 021 02 99
2.	BHOPAL	:	PS10587, PS10512-Sheets & Plates
3.	HYDERABAD Î	:	AISI 304; ASTM A 240M, Gr: TP304; ASEA 2 2333-02
4.	TRICHY	:	AISI 304

Revisions : **Cl 28.4.16 of MOM of MRC-S&GPS**	**APPROVED: Interplant Material Rationalization Committee-MRC (S&GPS)**

Rev. No. 08	**Amd.No.**	**Reaffirmed**	**Prepared**	**Issued**	**Dt. of 1st Issue**
Dt.:09.01.2007	**Dt :**	**Year: 2013**	**HARDWAR**	**Corp. R&D**	**JUNE, 1978**

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AUSTENITIC STAINLESS STEEL SHEETS, PLATES AND STRIPS - SOLUTION ANNEALED (ASTM A 240M, TYPE 304) Î

ORDERING DESCRIPTION

1.0 GENERAL :

The sheets, plates and strips shall conform to the latest version of ASTM A 240M, Type 304 and comply with the following additional requirements. Î

2.0 APPLICATION :

For general engineering purposes, where corrosion resistance is essential.

3.0 CONDITION OF DELIVERY:

Hot/Cold rolled, solution annealed and descaled (Finish number 1 or 2 B/2D).

4.0 DIMENSIONS AND TOLERANCES

Material shall be supplied to the dimensions specified in BHEL order.

5.0 CHEMICAL COMPOSITION :

As per ASTM A 240M, Type 304. Î

6.0 TEST CERTIFICATES :

Three copies of test certificates shall be supplied along with the following information:

BHEL References :

AA 107 39 -Rev. No.08 / ASTM A 240M, Type:304 Î
BHEL order No,

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

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

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7.0 PACKING AND MARKING :

Sheets shall be supplied in bundles or in packages each weighing upto a maximum of 3000kg. Plates shall be suitably packed to prevent damage during transit.

For plates below 25 mm thick, each pile (preferably of 16 plates) shall be marked with suppliers identification mark, 'AA 107 39 / ASTM A 240M, Type:304, melt No., BHEL order No., on the top plate. Î

Each plate of 25mm thickness and above shall be stamped/painted with the suppliers identification mark, 'AA 107 39 / ASTM A 240M, Type:304 , melt No., BHEL order No., on the top plate. Î

FOR INFORMATION ONLY

CHEMICAL COMPOSITION

C	Si	Mn	Ni	Cr	S	P	N
≤ 0.08	≤ 0.75	≤ 2.0	8.0-10.5	18.0 -20.0	≤ 0.030	≤ 0.045	0.10

MECHANICAL PROPERTIES

Hardness Max		0.2% PS min	UTS min	% El min	Bend Test
BHN	HRB	N/mm²	N/mm²		Dia.
201	92	205	515	40	-

	CORPORATE PURCHASING SPECIFICATION	**AA 107 40**
		Rev. No. 08
		PREFACE SHEET

AUSTENITIC STAINLESS STEEL SHEETS, PLATES AND STRIPS – SOLUTION ANNEALED (ASTM A 240M, TYPE 321) Î

FOR INTERNAL USE ONLY
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Comparable Standards:

1. AMERICAN	:	ASTM A 240M Î Type 321, Solution annealed.
2. INDIAN	:	IS: 6911 - 1992 Gr: X04Cr18Ni10Ti, Solution annealed
3. EUROPEAN	:	EN 10088-2, Gr: X6CrNiTi 18-10

Suggested/Probable Suppliers And Grades:

Refer Plant Vendors list

User Plant References:

1.	HEEP - HARDWAR	:	HW 021 02 99
2.	BHOPAL	:	PS10506 Sheets & Plates
3.	HYDERABAD	:	AISI 321 CSN 417246.1

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Revisions : Cl .28.4.16 of MOM of MRC-S&GPS			**APPROVED: Interplant Material Rationalization Committee-MRC (S&GPS)**		
Rev. No. 08	**Amd.No.**	**Reaffirmed**	**Prepared**	**Issued**	**Dt. of 1st Issue**
Dt.:09.01.2007	**Dt :**	**Year: 2013**	**HARDWAR**	**Corp. R&D**	**JUNE, 1978**

AUSTENITIC STAINLESS STEEL SHEETS , PLATES AND STRIPS - SOLUTION ANNEALED (ASTM A 240M, TYPE 321) Î

ORDERING DESCRIPTION

1.0 GENERAL:

The sheets, plates and strips shall conform to the latest version of ASTM A 240M, Type 321 and comply with the following additional requirements. Î

2.0 APPLICATION :

For general engineering purposes, where corrosion resistance is essential.

3.0 CONDITION OF DELIVERY:

Hot/Cold rolled, solution annealed and descaled (Finish number 1 or 2 B/2D).

4.0 DIMENSIONS AND TOLERANCES

Material shall be supplied to the dimensions specified in BHEL order.

5.0 CHEMICAL COMPOSITION:

As per ASTM A 240M, Type 321. Î

6.0 TEST CERTIFICATES:

Three copies of test certificates shall be supplied along with the following information:

BHEL References:

AA 107 40 -Rev. No.08 / ASTM A 240M, Type: 321
BHEL order No,

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

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

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7.0 PACKING AND MARKING:

Sheets shall be supplied in bundles or in packages each weighing upto a maximum of 3000kg. Plates shall be suitably packed to prevent damage during transit.

For plates below 25 mm thick, each pile (preferably of 16 plates) shall be marked with suppliers identification mark, 'AA 107 40 / ASTM A 240M, Type:321, melt No., BHEL Î order No., on the top plate.

Each plate of 25mm thickness and above shall be stamped/painted with the suppliers identification mark, 'AA 107 40 / ASTM A 240M, Type:321, melt No., BHEL order No., on Î the top plate.

FOR INFORMATION ONLY

CHEMICAL COMPOSITION

C	Si	Mn	Ni	Cr	S	P	Ti	N
≤ 0.08	≤ 0.75	≤ 2.0	9.0-12.0	17.0-19.0	≤ 0.030	≤ 0.045	5(C+N) - 0.70, max	0.10

MECHANICAL PROPERTIES

Hardness, max		0.2% PS, min	UTS, min	% El, min	Cold Bend. Î
BHN	HRB	N/mm^2	N/mm^2		
217	95	205	515	40	-

	CORPORATE PURCHASING SPECIFICATION	**AA 123 17**
		Rev. No. 03
		PREFACE SHEET

ALUMINIUM ALLOY PLATES, GR : 54300(M)

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Comparable Standards:

1. INDIAN	:	IS : 736 – 1986 Gr : 54300
2. AMERICAN	:	ASTM : B209M – 1992a, alloy 5083 (O)
3. BRITISH	:	BSEN : 485 –1998
4. GERMAN	:	DIN : 1725 – 1983, AlMg4.5Mn (W)

Suggested/Probable Suppliers and Grades:

Refer plant vendors list.

User Plant References:

1. BHOPAL : P.S. 12326

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Revisions : **Cl: 20.10.26 of MOM of MRC-NFCW+HE**			**APPROVED :** **INTERPLANT MATERIAL RATIONALISATION COMMITTEE-MRC (NFCW+HE)**		
Rev. No. 03	**Amd.No.**	**Reaffirmed**	**Prepared**	**Issued**	**Dt. of 1st Issue**
Dt: 15-02-06	**Dt :**	**Year :**	**HYDERABAD**	**Corp. R&D**	**01-03-78**

ALUMINIUM ALLOY PLATES, GR : 54300(M)

1.0 GENERAL:

This specification governs the quality of aluminum alloy plates of Gr: 54300 (M).

2.0 APPLICATION:

For general engineering purposes.

3.0 CONDITION OF DELIVERY:

As manufactured.
Plates shall be supplied flat with sheared, milled or sawn edges.

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: 736 – 1986, Gr: 54300 : Wrought Aluminum And Aluminum Alloy Plates For General
Condition : WP : Engineering purposes.

5.0 DIMENSIONS AND TOLERANCES:

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

5.2 Tolerances:

Tolerance shall be as per IS : 2677.

6.0 FREEDOM FROM DEFECTS :

The plates shall be sound and free from harmful defects such as scratches, cracks, laminations and other injurious imperfections.

7.0 CHEMICAL COMPOSITION :

The chemical composition of the material when analyzed in accordance with IS : 504 or any other suitable conventional/ instrumental/chemical method shall be as follows :

Element	Percent	
	Min	Max.
*Copper	--	0.1
Magnesium	4.0	4.9
*Silicon	---	0.4
*Iron	--	0.7
*Zinc	--	0.2
Manganese	0.5	1.0
*Titanium and/or/ other grain refining elements	--	0.20
*Chromium	--	0.25
Aluminum		Remainder

*Note: These elements need not be determined when the material supplied conforms to the mechanical properties specified in this specification. However, the supplier shall ensure that the composition of the material lies within the limits specified above.

8.0 TEST SAMPLES:

8.1 One sample per heat shall be taken for chemical analysis.

8.2 Material of the same thickness, produced under similar conditions, shall be grouped into batches of not more than 4000 kg.

8.3 Before the test samples are cut off, they shall be marked to identify them with the batch they represent. The test samples shall be taken from the material as supplied and shall not be further heat treated or mechanically worked (except for preparing the test piece) before being tested. The test samples may be cut from the margins of the material before cutting it to size.

8.4 The tensile test piece shall be rectangular section having dimensions as given in IS: 1608 with a gauge length of 50 mm. The test piece shall be cut transverse to the direction of rolling for plates 300 mm wide and over, and parallel to the direction of rolling for plates under 300 mm wide. When the width of the material to be tested is insufficient to permit preparation of the standard tensile test piece, a piece of the full width of the material may be used.

9.0 MECHANICAL PROPERTIES:

The test pieces, when tested in accordance with IS : 1608 (Method for tensile tests for light metals and their alloys), shall show the following properties:

Tensile strength	:	285 N/mm^2, min.
0.2% Proof Stress	:	125 N/mm^2 , min.
Elongation on 50 mm gauge length	:	12 % , min.

10.0 RETEST:

Should any of the test pieces first selected fail, two further samples from the same batch shall be selected for testing, one of which shall be from the tube from which the original test sample was taken, unless the tube has been withdrawn by the supplier. Should the test pieces from both these additional samples pass, the batch represented by the test sample shall be deemed to comply with this specification. Should be test pieces from either of these additional samples fail the batch represented by these samples shall be deemed not to comply with this specification.

11.0 INSPECTION AT SUPPLIER'S WORKS

Tests and inspection are to be conducted in the prescience of the customer's representative. The representative shall have free access at all times while the work on the contract is being performed, to all parts of the manufacture's works. The supplier shall offer the purchaser's representative all reasonable facilities, without charge, to satisfy the latter that the material is being furnished in accordance with this specification.

The supplier shall prepare and provide necessary test specimens for testing to be carried out at his premises. If facilities are not available at his works, the supplier shall make necessary arrangement for carrying out the prescribed test elsewhere.

12.0 TEST CERTIFICATES:

The supplier shall submit three copies of test certificates giving the following information:
In addition, the supplier shall make sure to enclose one copy of the test certificate along with dispatch documents for quick clearance of the material.

AA 12317 (Rev.03) Aluminium Alloy Plates, Gr: 54300 (M)
BHEL Order No,
Supplier's name :
Batch No.
Consignment/Identification No.
Results of chemical analysis, mechanical and all other tests as called for in this specification.

13.0 PACKING AND MARKING:

The material shall be suitably packed to prevent corrosion and damage during transit.

Each package or crate shall be legibly marked with the following information :

BHEL Order No.
AA 12317
Heat No,
Identification mark/No.
Size & Weight.
Supplier's reference and name.

14.0 REFERRED STADARDS (Latest Publications Including Amendments):

1. IS: 736 2. IS:504 3. IS: 1608 4. IS: 2677

बी एच ई एल BHEL	**CORPORATE PURCHASE SPECIFICATION**	**AA 193 31**
		Rev. No. 11
		PREFACE SHEET

CARBON STEEL FORGINGS, CLASS 2

FOR INTERNAL USE ONLY
REMOVE THIS PREFACE BEFORE ISSUE TO SUPPLIERS

Comparable Standards:

1. INDIAN : IS: 2004 - 1991 Class 2 (20C8),

Suggested/Probable Suppliers and Grades:

Refer plant vendors list.

User Plant References:

1. BHOPAL : PS 10124, PS 10159206
2. HARDWAR : IS:2004, Class 2
3. HYDERABAD : HY19363, CSN 412020.1, CSN412020.3, SAE1020, IS:2004-Cl 2, CSN411373.0,
4. TIRUCHY : IS:2004, Class 2

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REVISIONS :			**APPROVED :**		
36th MOM OF MRC (FCF+HTM)			**INTERPLANT MATERIAL RATIONALISATION COMMITTEE-MRC (FCF+HTM)**		
Rev. No. 11	**Amd.No.**	**Reaffirmed**	**Prepared**	**Issued**	**Dt. of 1st Issue**
Dt: 30.01.2008	**Dt :**	**Year:04-11-2011**	**HARDWAR**	**Corp. R&D**	**JULY, 1980**

CARBON STEEL FORGINGS, CLASS 2

1.0 GENERAL:

This specification governs the quality requirements of Carbon Steel Forgings, Class 2.

2.0 APPLICATION:

Suitable for general engineering purposes and for use in welded constructions.

3.0 CONDITION OF DELIVERY:

Normalised / Normalised and tempered..

Rough machining of the forgings shall be carried out, unless otherwise specified in the BHEL order/drawing.

4.0 COMPLIANCE WITH NATIONAL STANDARDS:

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

IS::2004 – 1991 (RA -2006) } Carbon Steel Forgings For General Engineering
Gr: 2 (20C8), } Purposes.

5.0 DIMENSIONS AND TOLERANCES:

The dimensions and tolerances shall be as specified on the order/ drawing. Wherever these are not specified, specified, the machining allowances and tolerances shall be as specified below:

For finish machined drawings : 3 ± 1 mm

For rough machined drawings : ± 1 mm

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6.0 MANUFACTURE:

Forgings shall be manufactured from steel produced by the open hearth, electric or such other process as may be agreed to between BHEL and the manufacturer.

Steel shall be fully killed.

Sufficient discard shall be made from each ingot to ensure freedom from pipe, segregation and other defects.

The amount of hot working and finishing temperature shall be such as to ensure complete soundness and adequate uniformity of structure and mechanical properties after heat treatment. The forgings shall not be overheated.

The minimum reduction ratio when forgings are made out of ingots shall be 4:1.

For sizes above 250 mm ruling section, the minimum reduction ratio shall be 3.5:1

Note: Raw material like Ingots/Blooms/Billets required for forgings should be procured from BHEL approved sources along with test certificate."

7.0 FREEDOM FROM DEFECTS:

The forging shall be free from defects, such as cracks, fold, flakes, seams, segregation, nonmetallic inclusions and other injurious defects which may affect the utility of the forging.

8.0 HEAT TREATMENT:

Forgings shall be normalised / normalised and tempered at suitable temperature to achieve the mechanical properties specified.

Test pieces shall also be heat treated along with the forgings they represent.

9.0 FINISH:

As mentioned in the drawing.

10.0 CHEMICAL COMPOSITION:

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

Element	Percent		Permissible variation , percent
	min.	max.	
Carbon	0.15	0.25	± 0.02
Silicon	0.15	0.35	± 0.03
Manganese	0.60	0.90	± 0.04
Sulphur	---	0.040	+ 0.005
Phosphorus	---	0.040	+ 0.005

NOTE:

1. Elements not quoted above shall not be added to the steel, other than for the purpose of finishing the heat and shall not exceed the following limits:

Element	Percent, max.
Nickel	0.30
Chromium	0.30
Copper	0.25
Molybdenum	0.05
Vanadium	0.05
Tin	0.05
Boron	0.0003

---

2. When steel is aluminium killed or killed with both aluminium and silicon, the requirements of minimum silicon content shall not apply. For aluminium killed steel the total aluminium content shall be with in 0.02 to 0.05 percent.
3. Percent Cu + 10 X (percent Tin) shall not exceed 0.5%.
4. Carbon equivalent (Melt analysis) value (C.E.) = 0.42%, max.

$$C.E. = C + \frac{Mn}{6} + \frac{Cr+Mo+V}{5} + \frac{Ni+Cu}{15}$$

5. Mo ≤ 0.15%, limiting to meeting conditions of Cr + Mo + Ni = 0.5%.

11.0 TEST SAMPLES:

11.1 Unless otherwise specified in the order/drawing, test samples shall be taken from each melt and heat treatment batch. Test samples should be cut from the heat treated forgings by cold process only and shall receive no further heat treatment.

Test samples shall be cylindrical or rectangular in shape and cut at a distance of 12.5 mm below the heat treated surface.

11.2 When integral test pieces are not called for, a test sample, having similar reduction ratio and heat treatment, as the forgings it represents, shall be provided per heat, per heat treatment batch, for check testing at BHEL, along with the forgings. The samples shall be properly identified and correlated with the Heat/Heat treatment batch No./Test certificate No. Test samples shall be taken, at a distance 12.5 mm below heat treatment surface.

11.3 Test samples shall generally be taken in the longitudinal direction. However, for economic reasons or where the size/configuration does not permit the same, test samples may be taken in the transverse or radial direction.

12.0 **MECHANICAL PROPERTIES :**

The test pieces, after being heat treated as per clause 7.0 above, shall show the following properties upto a limiting ruling section of 800 mm. Properties for thicker sections shall be subject to agreement between BHEL and the manufacturer.

Test methods are specified below:

12.1 Tensile : IS: 1608

12.2 Hardness Test (Brinell) : IS:1500

12.3 Charpy Impact Value (2mm U-Notch) : IS:1499

The test is applicable for forgings of sizes above 16mm only.

Property	**Sample (Cl 11.3)**	**Limiting ruling section, mm**		
		Upto & incl.100	**> 100 & upto 400**	**> 400 & upto 800**
Tensile strength, min, N/mm^2	Longitudinal Transverse/ Radial/ Tangential	430	390	370
Yield strength, min, N/mm^2	Longitudinal Transverse/ Radial/ Tangential	230	195	185
Elongation on $5.65\sqrt{So}$ gauge length percent, min.	Longitudinal Transverse/ Radial/ Tangential	24 12 16 18	23 11 15 17	21 9 13 15
* Hardness, Brinell, HB	----	120 – 167	111 – 156	111 - 156
Charpy Impact value (2mm U-Notch) min., joules	Longitudinal Transverse/ Radial/ Tangential	47 24 28 35	43 22 26 32	40 20 24 28

Note:

1. Unless otherwise stated on the order/drawing small forgings of non-critical nature weighing less than 300 kg shall be accepted on the basis of chemical composition and hardness.

*****2. Hardness test can be conducted only when tensile test can not be performed.

13.0 ULTRASONIC TESTS:

13.1 For forgings ordered by BHEL, Hyderabad: Unless other wise specified on the drawing, ultrasonic test shall be carried out as per BHEL standard AA 085 01 18 and norms of acceptance shall be as per category 2.

13.13.2 For forgings ordered by other units: If specified on the drawing/order, ultrasonic test shall be carried out as per BHEL standard AA 085 01 18 and norms of acceptance shall be as per category 2, unless otherwise specified.

14.0 ADDITIONAL TESTS: If specified in the drawing /order, the following tests shall be conducted:

14.1 Bend Test (Longitudinal):

The test pieces (230mm long and 32 mm square with edges rounded off, where the dimensions permit) shall be capable of being bent cold by direct pressure without fracture, until the sides are parallel, round a mandrel having a diameter of 44 mm when tested as per IS:1599.

14.2 Magnetic particle test:

14.3 Any other tests.

"Norms of acceptance shall be as specified on the drawing/order. "

15.0 SCOPE OF THIRD PARTY INSPECTION:

Wherever, separate quality plan is not attached, the scope of third party inspection shall be as follows:

1. Review of supplier's declared chemical composition.
2. Selection of test samples for mechanical tests and witness of mechanical tests.
3. Witness of Non-destructive tests as applicable.
4. Review of HT charts.
5. Dimensional inspection.

16.0 TEST CERTIFICATES:

Three copies of a test certificates shall be supplied, unless otherwise stated in the order, in the Test Certificate proforma annexed to this specification (Annexure -I).
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 following details shall be furnished in the test certificate:

Dimensional inspection.
Details of heat treatment.
Reduction ratio
Chemical composition including trace elements.
Results of mechanical tests.
Results of Ultrasonic test
Results of ultrasonic examination.
Results of additional tests called for in the drawing/order.

17.0 PACKING & MARKING:

Forgings shall be suitably packed to prevent damage during transit.
Machined surfaces shall be properly protected with anticorrosive compounds.
Each package or forging (when supplied separately) shall be legibly marked with the following information:

AA 193 31 - Carbon Steel Forgings, Class 2 (20C8).
BHEL Order No.
Suppliers Name
Consignment/ Identification No.
Batch No.
Weight.

18.0 **REFERRED STANDARDS (Latest publications Including Amendments):**

1) IS:1499 2) IS:1500 3) IS:1599 4) IS:1608
5) IS:2004 6) AA 085 01 18

CORPORATE PURCHASE SPECIFICATION

ANNEXURE-I: RECOMMENDED TEST CERTIFICATE FORMAT FOR FORGINGS

SUPPLIER'S NAME AND ADDRESS

TEST CERTIFICATE FOR FORGINGS

1. Customer:
2. TC No. & Date:
3. PO No.:
4. Process of Melting Ingot:
5. Deoxidisation Process:
6. Forging Method:
7. BHEL's Reference for Approval of Bloom
8. Discard: Top_____%; Bottom_____%
9. Reduction Ratio } Ingot to Bloom / Bloom to Blank
10. Batch No.:
11. Heat/Melt No.
12. Spec.No.
13. Test Bar Size & Nos.
14. Supplier of the ingot/billet/ Bloom and TC reference.

15. FORGINGS COVERED BY TEST CERTIFICATE

S.No.	Drawing No. & Item No.	Description	Quantity & Weight

16. CHEMICAL COMPOSITION (PERCENT)

Element		C	Si	Mn	S	P											
As Per Specn.	Min.																
	Max.																
Actual Values																	

17. HEAT TREATMENT
(To be accompanied by Recorder Chart, Whenever called for)

Condition	Heating Rate, °C/hr.	Temp.°C	Soaking Time, Hrs.	Cooling Rate, °C/hr	Cooling Medium

18. MECHANICAL PROPERTIES

		T.S. N/mm²	Y.S. 0.5/0.2% Proof N/mm²	% Elongation $5.65\sqrt{So}$ GL	%R.A. Min.	Hardness BHN(Min.3 values)	Impact Value Joules	Bend Test		
								Angle of bend	Dia of mandrel	Result
As Per Specn.	Min.									
	Max.									
Actual Values										

19.	SURFACE FINISH (When called for in the order/drg.)	
20.	DIMENSIONAL INSPECTION	

21. NON-DESTRUCTIVE TESTS

Nature of Test	Acceptance level	Instrument used	Range	Results	Any other detail
Ultrasonic					
Radiographic					
Dye penetrant/ Magnetic Particle					

22. METALLOGRAPHIC EXAMINATION
(To be conducted if called for and photo micrographs to be attached along with a report)

Location of Sample	Etchant used	Magnification	Constituent observed	Relative %	
Microstructure	Macroetch	Inclusion Rating			

23. OTHER TESTS IF ANY (MICROSCOPIC, SULPHUR PRINTS, ETC)

24. IDENTIFICATION OF FORGINGS AS PER PURCHASE .SPEC.

We hereby certify that the items mentioned above have been tested and inspected in our presence and are found to be in accordance with drawings, specifications and purchase order.

SIGNATURE, NAME & SEAL OF THE INSPECTING OFFICER
DATE:

SIGNATURE, NAME & SEAL OF THE CHIEF OF QUALITY CONTROL/ CHIEF METALLURGIST OF THE SUPPLIER
DATE:

INSTRUCTIONS

a) Details of all heat treatment processes carried out should be furnished sequentially in 17.
b) Test certificates are to be furnished as per Purchase order and specification, in A4 size preferably in transparent paper.
c) All the entries including signature should be in block colour ink.
d) If testing is done by outside agencies, the original TCs shall be furnished.
e) The actual TC may run into more than one A4 size paper, if needed, to facilitate filling up of details.

	CORPORATE PURCHASING SPECIFICATION	AA51401 Rev No.03 PREFACE SHEET

CONIFEROUS TIMBER FOR GENERAL PACKING PURPOSES

FOR INTERNAL USE ONLY

REMOVE THIS PREFACE BEFORE ISSUE TO SUPPLIERS

Equivalent/Comparable Standards:

User Plants and Replaced Plant Specifications/References:

1) BHOPAL : PS 51411E
2) EDN, BANGALORE : PS 51414
3) JHANSI
4) HEEP, HARDWAR : 0507.805
5) TRICHY : Soft wood

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Revisions: Cl. 6.2.2 of MOM of WG – (T&PM)			**APPROVED:** INTERPLANT MATERIAL RATIONALISATION COMMITTEE – MRC(T&PM)		
Rev No.03	Amd No.01	Reaffirmed	Prepared	Issued	Dt. of 1st Issue
Dt:01-10-1995	Dt:02-05-2002	Year:2013	HEP, Bhopal	Corp.R&D	MAR. '80

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CONIFEROUS TIMBER FOR GENERAL PACKING PURPOSES

1.0 GENERAL:

This specification governs the quality requirements of Coniferous timber supplied in the form of planks, battens beams and sleepers. The coniferous timber differs from non-coniferous (broad leave) timber in its gross appearance, anatomical structure and properties. In general, it works more easily under the tools and can be easily nailed.

2.0 APPLICATION:

Used for general packing purposes.

3.0 COMPLIANCE WITH NATIONAL STANDARDS:

There is no National standard covering this material. However, assistance has been derived from the following National standards:

IS: 190 – 1991 Grade I	:	Coniferous Sawn Timber(Baulks & Scantling)
IS: 6662 – 1993 Groups III & IV	:	Timber Species Suitable For Wooden Packaging

4.0 TERMINOLOGY:

For the purpose of this specification, the definitions given in IS: 707 (Glossary of terms applicable to timber and timber products) shall apply except for the beam which is defined as follows:

Beam is defined as converted timber whose cross-sectional dimensions exceed 50mm in both directions.

5.0 SPECIES:

Shall be as stated on the order.Some standard species are:

Trade Name	Botanical Name	Abbreviation
Fir	Abiespindrow	FIR
Deodar	Cedrusdeodara	DEO
Chir	Pinusroxburghil	CHR
Kali	Pinuswallichians	KAL
Khasi Pine	Pinuskhasya	KPI
Spruce	Piccasmithianaboiss	SPR

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CORPORATE PURCHASING SPECIFICATION

6.0 DIMENSIONS AND TOLERANCES:

6.1 Sizes:

Width, thickness and length of timber shall be clearly stated on the order.

6.2 Tolerances:

6.2.1 Width :50 to 250 ram Tolerance : +3 ram

6.2.2 Thickness: 20 to 250 mm Tolerance: +3 mm
- 1 mm

6.2.3 Length:

Standard length : 1 to 12 metres in multiples of 0.5 metre
Tolerance: ±2% or ±25 ram whichever is less.

Note:

1.0 Measurements:

1.1 When nominal sizes are ordered, length, width and thickness shall be measured on the basis of accepted sizes. Plus tolerances shall not be added while computing the volume.

1.2 The measurements of length, width, thickness and computation of volume shall be as follows:

a) The length shall be measured in metres in midline of a piece. The fractions of a metre shall be roundedoff to the nearest lower 10 mm.

b) The width shall be measured at the narrowest place in millimetres and shall be rounded off to the nearest lower one millimetre.

c) The thickness shall be measured at the narrowest place in millimeters and shall be rounded off to the nearest lower one millimeter.

d) The volume shall be computed in cubic meters correct to three places of decimal on the basis of accepted sizes

2.0 Single sampling plan based on IS:2500 shall be followed.

7.0 MOISTURE CONTENT:

The timber shall have moisture content as stated below within a depth of 15mm from the surface excluding a length of 300mm from each end at the time of inspection. The moisture content will be determined in accordance with IS: 287

October to June : 30%

Julyto September (Rainy season): 40%

8.0 FREE FROM DEFECTS:

Timber shall be free from the following defects:

Brashness, splits across the grain, shakes, spring, twist, insect attack, any kind of decay (rot), any sign ofInfection, open centre heart, centres heart on planks and any other defect.

Defects to the extent specified below are permissible. These defects shall be measured in accordance with IS: 3364.

8.1 Bow:

Shall be permissible up to a maximum of 2mm for 300mm length.

8.2 Cud:

Shall be permissible up to a maximum of 6mm for 300mm width

8.3 Centre heart:

Shall be permissible only on sleepers when it is not further than 35mm from the nearest edge. This does not apply to beams of cross sections above 200 X 200 mm.

8.4 Wane:

a) For sections up to and including 150 X 150 mm:

Shall be permissible upto 1/5 of the width on the broad face subject to a maximum of 70mm and upto 1/3 of the width on the narrow face subject a maximum of 50mm, provided that one broad face is completely free from this defect. The wane shall be measured at its deepest part

b) For sections above 150 X 150 mm:

The cumulative lengths of wanes on all the sides should not be more than one length of the piece.

8.5 End splits:

The longest end split at each end shall be measured and the lengths added together. The total length of these shall not exceed 80mm per meter run of the piece.

8.6 Live knots:

8.6.1 Knots on the surface:

a) Up to & including 25mm diameter:

A maximum of 5 knots/meter length are permissible. However, the knots shall not be so grouped or located as to affect the strength of the piece.

b) Over 25mm and up to and including 70mm diameter:

A maximum of 2 knots/metre length are permissible.

8.6.2 Knots on the edges:

a) Up to and including 10mm diameter and for full thickness:

A maximum of 2 knots/metre length are permissible

b) Over 10mm and up to & including 50mm diameter and for less than half thickness:

A maximum of 2 knots/metre length are permissible.

8.7 Dead knots:

a) Below 10mm diameter:

A maximum of 3 knots/metre length are allowed provided that the knots are not so grouped or located as to affect the strength.

b) From 10mm to up to and including 25mm diameter:

A maximum of 2 knots allowed to the extent of 1 knot/metre length.

c) Above 25mm diameter:

Not allowed

Note: (For clauses 8.6 & 8.7): Major axis of the knot should be taken as the diameter of the knot

8.8 Surface cracks:

Surface cracks with a maximum depth of 10% of the thickness are permissible. A continuous rack of any depth all along the length is not permissible.

8.9 Sap Wood:

Permissible up to a maximum of 12 percent of the cross sectional area.

9.0 END COATING:

Timber shall be coated with any of the following effective compositions upto a distance of 80 mm from each end

9.1 Thick coal tar or bituminous paint.

9.2 Resin and lamp black (10:1) melted, mixed and applied hot.

9.3 Hardened gloss oil.

9.4 Paraffin wax.

9.5 Molasses and lime (3:1).

9.6 Geru/Yellow clay

10.0 INSPECTION AT SUPPLIER'S WORKS:

Whenever specified, tests and inspection are to be conducted in the presence of BHEL's representative. BHEL representative shall have free access at all times while work on the contract is being performed to all parts of the manufacturer works. The manufacture shall offer BHEL's representative all reasonable facilities, without charge, to satisfy the latter that the material is being furnished in accordance with this specification.

The manufacturer shall prepare and provide necessary test specimens for testing to be carried out at his premises. If facilities are not available at his works the manufacturer, shall make necessary arrangements for carrying out the prescribed tests elsewhere. The manufacturer shall notify BHEL in advance about the readiness of the material for inspection and testing.BHEL reserves the right to test the material at BHEL's Works and the final acceptance of the material shall be based on these test results

11.0 TEST CERTIFICATES:

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

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

The test certificate shall have the following information:

AA51401(Rev.No.03):CONIFEROUS TIMBER FOR GENERAL PACKING PURPOSES

BHEL order No.:

Supplier's References:

Type & Specie:

Treatment, if any:

Results of Dimensional Inspection:

Moisture content:

Defects as per clause 8.0:

Size:

Quantity supplied:

12.0 MARKING:

The timber shall be marked/painted with the following:

AA 514 01

BHEL order No. :

Supplier's Name :

Size & Quantity :

13.0 REJECTION AND REPLACEMENT:

If the material does not conform to the requirements of this specification or found defective during furtherprocessing, such material shall be rejected notwithstanding any previous certification of satisfactory testing and/or inspection. The supplier shall under take to replace the rejected consignment at his own cost and the rejected material shall be taken back by the supplier after fulfilling the commercial terms and conditions.

14.0 REFERRED STANDARDS:

The following is the list of the latest standards, as published by the respective issuing bodies, referred to in this specification.

1) IS: 190 2) IS: 287 3) IS: 707

4) IS: 2500 5) IS: 3364 6) IS: 6662

	CORPORATE PURCHASING SPECIFICATION	AA51401 Rev No.03 PREFACE SHEET

CONIFEROUS TIMBER FOR GENERAL PACKING PURPOSES

FOR INTERNAL USE ONLY

REMOVE THIS PREFACE BEFORE ISSUE TO SUPPLIERS

Equivalent/Comparable Standards:

User Plants and Replaced Plant Specifications/References:

1) BHOPAL : PS 51411E
2) EDN, BANGALORE : PS 51414
3) JHANSI
4) HEEP, HARDWAR : 0507.805
5) TRICHY : Soft wood

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Revisions: Cl. 6.2.2 of MOM of WG – (T&PM)			**APPROVED:** INTERPLANT MATERIAL RATIONALISATION COMMITTEE – MRC(T&PM)		
Rev No.03	Amd No.01	Reaffirmed	Prepared	Issued	Dt. of 1st Issue
Dt:01-10-1995	Dt:02-05-2002	Year:2013	HEP, Bhopal	Corp.R&D	MAR. '80

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CONIFEROUS TIMBER FOR GENERAL PACKING PURPOSES

1.0 GENERAL:

This specification governs the quality requirements of Coniferous timber supplied in the form of planks, battens beams and sleepers. The coniferous timber differs from non-coniferous (broad leave) timber in its gross appearance, anatomical structure and properties. In general, it works more easily under the tools and can be easily nailed.

2.0 APPLICATION:

Used for general packing purposes.

3.0 COMPLIANCE WITH NATIONAL STANDARDS:

There is no National standard covering this material. However, assistance has been derived from the following National standards:

IS: 190 – 1991 Grade I	:	Coniferous Sawn Timber(Baulks & Scantling)
IS: 6662 – 1993 Groups III & IV	:	Timber Species Suitable For Wooden Packaging

4.0 TERMINOLOGY:

For the purpose of this specification, the definitions given in IS: 707 (Glossary of terms applicable to timber and timber products) shall apply except for the beam which is defined as follows:

Beam is defined as converted timber whose cross-sectional dimensions exceed 50mm in both directions.

5.0 SPECIES:

Shall be as stated on the order.Some standard species are:

Trade Name	Botanical Name	Abbreviation
Fir	Abiespindrow	FIR
Deodar	Cedrusdeodara	DEO
Chir	Pinusroxburghil	CHR
Kali	Pinuswallichians	KAL
Khasi Pine	Pinuskhasya	KPI
Spruce	Piccasmithianaboiss	SPR

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CORPORATE PURCHASING SPECIFICATION

6.0 DIMENSIONS AND TOLERANCES:

6.1 Sizes:

Width, thickness and length of timber shall be clearly stated on the order.

6.2 Tolerances:

6.2.1 Width :50 to 250 ram Tolerance : +3 ram

6.2.2 Thickness: 20 to 250 mm Tolerance: +3 mm
- 1 mm

6.2.3 Length:

Standard length : 1 to 12 metres in multiples of 0.5 metre
Tolerance: ±2% or ±25 ram whichever is less.

Note:

1.0 Measurements:

1.1 When nominal sizes are ordered, length, width and thickness shall be measured on the basis of accepted sizes. Plus tolerances shall not be added while computing the volume.

1.2 The measurements of length, width, thickness and computation of volume shall be as follows:

a) The length shall be measured in metres in midline of a piece. The fractions of a metre shall be roundedoff to the nearest lower 10 mm.

b) The width shall be measured at the narrowest place in millimetres and shall be rounded off to the nearest lower one millimetre.

c) The thickness shall be measured at the narrowest place in millimeters and shall be rounded off to the nearest lower one millimeter.

d) The volume shall be computed in cubic meters correct to three places of decimal on the basis of accepted sizes

2.0 Single sampling plan based on IS:2500 shall be followed.

7.0 MOISTURE CONTENT:

The timber shall have moisture content as stated below within a depth of 15mm from the surface excluding a length of 300mm from each end at the time of inspection. The moisture content will be determined in accordance with IS: 287

October to June : 30%

Julyto September (Rainy season): 40%

8.0 FREE FROM DEFECTS:

Timber shall be free from the following defects:

Brashness, splits across the grain, shakes, spring, twist, insect attack, any kind of decay (rot), any sign ofInfection, open centre heart, centres heart on planks and any other defect.

Defects to the extent specified below are permissible. These defects shall be measured in accordance with IS: 3364.

8.1 Bow:

Shall be permissible up to a maximum of 2mm for 300mm length.

8.2 Cud:

Shall be permissible up to a maximum of 6mm for 300mm width

8.3 Centre heart:

Shall be permissible only on sleepers when it is not further than 35mm from the nearest edge. This does not apply to beams of cross sections above 200 X 200 mm.

8.4 Wane:

a) For sections up to and including 150 X 150 mm:

Shall be permissible upto 1/5 of the width on the broad face subject to a maximum of 70mm and upto 1/3 of the width on the narrow face subject a maximum of 50mm, provided that one broad face is completely free from this defect. The wane shall be measured at its deepest part

b) For sections above 150 X 150 mm:

The cumulative lengths of wanes on all the sides should not be more than one length of the piece.

8.5 End splits:

The longest end split at each end shall be measured and the lengths added together. The total length of these shall not exceed 80mm per meter run of the piece.

8.6 Live knots:

8.6.1 Knots on the surface:

a) Up to & including 25mm diameter:

A maximum of 5 knots/meter length are permissible. However, the knots shall not be so grouped or located as to affect the strength of the piece.

b) Over 25mm and up to and including 70mm diameter:

A maximum of 2 knots/metre length are permissible.

8.6.2 Knots on the edges:

a) Up to and including 10mm diameter and for full thickness:

A maximum of 2 knots/metre length are permissible

b) Over 10mm and up to & including 50mm diameter and for less than half thickness:

A maximum of 2 knots/metre length are permissible.

8.7 Dead knots:

a) Below 10mm diameter:

A maximum of 3 knots/metre length are allowed provided that the knots are not so grouped or located as to affect the strength.

b) From 10mm to up to and including 25mm diameter:

A maximum of 2 knots allowed to the extent of 1 knot/metre length.

c) Above 25mm diameter:

Not allowed

Note: (For clauses 8.6 & 8.7): Major axis of the knot should be taken as the diameter of the knot

8.8 Surface cracks:

Surface cracks with a maximum depth of 10% of the thickness are permissible. A continuous rack of any depth all along the length is not permissible.

8.9 Sap Wood:

Permissible up to a maximum of 12 percent of the cross sectional area.

9.0 END COATING:

Timber shall be coated with any of the following effective compositions upto a distance of 80 mm from each end

9.1 Thick coal tar or bituminous paint.

9.2 Resin and lamp black (10:1) melted, mixed and applied hot.

9.3 Hardened gloss oil.

9.4 Paraffin wax.

9.5 Molasses and lime (3:1).

9.6 Geru/Yellow clay

10.0 INSPECTION AT SUPPLIER'S WORKS:

Whenever specified, tests and inspection are to be conducted in the presence of BHEL's representative. BHEL representative shall have free access at all times while work on the contract is being performed to all parts of the manufacturer works. The manufacture shall offer BHEL's representative all reasonable facilities, without charge, to satisfy the latter that the material is being furnished in accordance with this specification.

The manufacturer shall prepare and provide necessary test specimens for testing to be carried out at his premises. If facilities are not available at his works the manufacturer, shall make necessary arrangements for carrying out the prescribed tests elsewhere. The manufacturer shall notify BHEL in advance about the readiness of the material for inspection and testing.BHEL reserves the right to test the material at BHEL's Works and the final acceptance of the material shall be based on these test results

11.0 TEST CERTIFICATES:

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

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

The test certificate shall have the following information:

AA51401(Rev.No.03):CONIFEROUS TIMBER FOR GENERAL PACKING PURPOSES

BHEL order No.:

Supplier's References:

Type & Specie:

Treatment, if any:

Results of Dimensional Inspection:

Moisture content:

Defects as per clause 8.0:

Size:

Quantity supplied:

12.0 MARKING:

The timber shall be marked/painted with the following:

AA 514 01

BHEL order No. :

Supplier's Name :

Size & Quantity :

13.0 REJECTION AND REPLACEMENT:

If the material does not conform to the requirements of this specification or found defective during furtherprocessing, such material shall be rejected notwithstanding any previous certification of satisfactory testing and/or inspection. The supplier shall under take to replace the rejected consignment at his own cost and the rejected material shall be taken back by the supplier after fulfilling the commercial terms and conditions.

14.0 REFERRED STANDARDS:

The following is the list of the latest standards, as published by the respective issuing bodies, referred to in this specification.

1) IS: 190 2) IS: 287 3) IS: 707

4) IS: 2500 5) IS: 3364 6) IS: 6662

बी एच ई एल BHEL	**CORPORATE PURCHASE SPECIFICATION**	**AA 193 31**
		Rev. No. 11
		PREFACE SHEET

CARBON STEEL FORGINGS, CLASS 2

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REMOVE THIS PREFACE BEFORE ISSUE TO SUPPLIERS

Comparable Standards:

1. INDIAN : IS: 2004 - 1991 Class 2 (20C8),

Suggested/Probable Suppliers and Grades:

Refer plant vendors list.

User Plant References:

1. BHOPAL : PS 10124, PS 10159206
2. HARDWAR : IS:2004, Class 2
3. HYDERABAD : HY19363, CSN 412020.1, CSN412020.3, SAE1020, IS:2004-Cl 2, CSN411373.0,
4. TIRUCHY : IS:2004, Class 2

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REVISIONS :			**APPROVED :**		
36th MOM OF MRC (FCF+HTM)			**INTERPLANT MATERIAL RATIONALISATION COMMITTEE-MRC (FCF+HTM)**		
Rev. No. 11	**Amd.No.**	**Reaffirmed**	**Prepared**	**Issued**	**Dt. of 1st Issue**
Dt: 30.01.2008	**Dt :**	**Year:04-11-2011**	**HARDWAR**	**Corp. R&D**	**JULY, 1980**

CARBON STEEL FORGINGS, CLASS 2

1.0 GENERAL:

This specification governs the quality requirements of Carbon Steel Forgings, Class 2.

2.0 APPLICATION:

Suitable for general engineering purposes and for use in welded constructions.

3.0 CONDITION OF DELIVERY:

Normalised / Normalised and tempered..

Rough machining of the forgings shall be carried out, unless otherwise specified in the BHEL order/drawing.

4.0 COMPLIANCE WITH NATIONAL STANDARDS:

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

IS::2004 – 1991 (RA -2006) } Carbon Steel Forgings For General Engineering
Gr: 2 (20C8), } Purposes.

5.0 DIMENSIONS AND TOLERANCES:

The dimensions and tolerances shall be as specified on the order/ drawing. Wherever these are not specified, specified, the machining allowances and tolerances shall be as specified below:

For finish machined drawings : 3 ± 1 mm

For rough machined drawings : ± 1 mm

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6.0 MANUFACTURE:

Forgings shall be manufactured from steel produced by the open hearth, electric or such other process as may be agreed to between BHEL and the manufacturer.

Steel shall be fully killed.

Sufficient discard shall be made from each ingot to ensure freedom from pipe, segregation and other defects.

The amount of hot working and finishing temperature shall be such as to ensure complete soundness and adequate uniformity of structure and mechanical properties after heat treatment. The forgings shall not be overheated.

The minimum reduction ratio when forgings are made out of ingots shall be 4:1.

For sizes above 250 mm ruling section, the minimum reduction ratio shall be 3.5:1

Note: Raw material like Ingots/Blooms/Billets required for forgings should be procured from BHEL approved sources along with test certificate."

7.0 FREEDOM FROM DEFECTS:

The forging shall be free from defects, such as cracks, fold, flakes, seams, segregation, nonmetallic inclusions and other injurious defects which may affect the utility of the forging.

8.0 HEAT TREATMENT:

Forgings shall be normalised / normalised and tempered at suitable temperature to achieve the mechanical properties specified.

Test pieces shall also be heat treated along with the forgings they represent.

9.0 FINISH:

As mentioned in the drawing.

10.0 CHEMICAL COMPOSITION:

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

Element	Percent		Permissible variation , percent
	min.	max.	
Carbon	0.15	0.25	± 0.02
Silicon	0.15	0.35	± 0.03
Manganese	0.60	0.90	± 0.04
Sulphur	---	0.040	+ 0.005
Phosphorus	---	0.040	+ 0.005

NOTE:

1. Elements not quoted above shall not be added to the steel, other than for the purpose of finishing the heat and shall not exceed the following limits:

Element	Percent, max.
Nickel	0.30
Chromium	0.30
Copper	0.25
Molybdenum	0.05
Vanadium	0.05
Tin	0.05
Boron	0.0003

---

2. When steel is aluminium killed or killed with both aluminium and silicon, the requirements of minimum silicon content shall not apply. For aluminium killed steel the total aluminium content shall be with in 0.02 to 0.05 percent.
3. Percent Cu + 10 X (percent Tin) shall not exceed 0.5%.
4. Carbon equivalent (Melt analysis) value (C.E.) = 0.42%, max.

$$C.E. = C + \frac{Mn}{6} + \frac{Cr+Mo+V}{5} + \frac{Ni+Cu}{15}$$

5. Mo ≤ 0.15%, limiting to meeting conditions of Cr + Mo + Ni = 0.5%.

11.0 TEST SAMPLES:

11.1 Unless otherwise specified in the order/drawing, test samples shall be taken from each melt and heat treatment batch. Test samples should be cut from the heat treated forgings by cold process only and shall receive no further heat treatment.

Test samples shall be cylindrical or rectangular in shape and cut at a distance of 12.5 mm below the heat treated surface.

11.2 When integral test pieces are not called for, a test sample, having similar reduction ratio and heat treatment, as the forgings it represents, shall be provided per heat, per heat treatment batch, for check testing at BHEL, along with the forgings. The samples shall be properly identified and correlated with the Heat/Heat treatment batch No./Test certificate No. Test samples shall be taken, at a distance 12.5 mm below heat treatment surface.

11.3 Test samples shall generally be taken in the longitudinal direction. However, for economic reasons or where the size/configuration does not permit the same, test samples may be taken in the transverse or radial direction.

12.0 **MECHANICAL PROPERTIES :**

The test pieces, after being heat treated as per clause 7.0 above, shall show the following properties upto a limiting ruling section of 800 mm. Properties for thicker sections shall be subject to agreement between BHEL and the manufacturer.

Test methods are specified below:

12.1 Tensile : IS: 1608

12.2 Hardness Test (Brinell) : IS:1500

12.3 Charpy Impact Value (2mm U-Notch) : IS:1499

The test is applicable for forgings of sizes above 16mm only.

Property	**Sample (Cl 11.3)**	**Limiting ruling section, mm**		
		Upto & incl.100	**> 100 & upto 400**	**> 400 & upto 800**
Tensile strength, min, N/mm^2	Longitudinal Transverse/ Radial/ Tangential	430	390	370
Yield strength, min, N/mm^2	Longitudinal Transverse/ Radial/ Tangential	230	195	185
Elongation on $5.65\sqrt{So}$ gauge length percent, min.	Longitudinal Transverse/ Radial/ Tangential	24 12 16 18	23 11 15 17	21 9 13 15
* Hardness, Brinell, HB	----	120 – 167	111 – 156	111 - 156
Charpy Impact value (2mm U-Notch) min., joules	Longitudinal Transverse/ Radial/ Tangential	47 24 28 35	43 22 26 32	40 20 24 28

Note:

1. Unless otherwise stated on the order/drawing small forgings of non-critical nature weighing less than 300 kg shall be accepted on the basis of chemical composition and hardness.

*****2. Hardness test can be conducted only when tensile test can not be performed.

13.0 ULTRASONIC TESTS:

13.1 For forgings ordered by BHEL, Hyderabad: Unless other wise specified on the drawing, ultrasonic test shall be carried out as per BHEL standard AA 085 01 18 and norms of acceptance shall be as per category 2.

13.13.2 For forgings ordered by other units: If specified on the drawing/order, ultrasonic test shall be carried out as per BHEL standard AA 085 01 18 and norms of acceptance shall be as per category 2, unless otherwise specified.

14.0 ADDITIONAL TESTS: If specified in the drawing /order, the following tests shall be conducted:

14.1 Bend Test (Longitudinal):

The test pieces (230mm long and 32 mm square with edges rounded off, where the dimensions permit) shall be capable of being bent cold by direct pressure without fracture, until the sides are parallel, round a mandrel having a diameter of 44 mm when tested as per IS:1599.

14.2 Magnetic particle test:

14.3 Any other tests.

"Norms of acceptance shall be as specified on the drawing/order. "

15.0 SCOPE OF THIRD PARTY INSPECTION:

Wherever, separate quality plan is not attached, the scope of third party inspection shall be as follows:

1. Review of supplier's declared chemical composition.
2. Selection of test samples for mechanical tests and witness of mechanical tests.
3. Witness of Non-destructive tests as applicable.
4. Review of HT charts.
5. Dimensional inspection.

16.0 TEST CERTIFICATES:

Three copies of a test certificates shall be supplied, unless otherwise stated in the order, in the Test Certificate proforma annexed to this specification (Annexure -I).
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 following details shall be furnished in the test certificate:

Dimensional inspection.
Details of heat treatment.
Reduction ratio
Chemical composition including trace elements.
Results of mechanical tests.
Results of Ultrasonic test
Results of ultrasonic examination.
Results of additional tests called for in the drawing/order.

17.0 PACKING & MARKING:

Forgings shall be suitably packed to prevent damage during transit.
Machined surfaces shall be properly protected with anticorrosive compounds.
Each package or forging (when supplied separately) shall be legibly marked with the following information:

AA 193 31 - Carbon Steel Forgings, Class 2 (20C8).
BHEL Order No.
Suppliers Name
Consignment/ Identification No.
Batch No.
Weight.

18.0 **REFERRED STANDARDS (Latest publications Including Amendments):**

1) IS:1499 2) IS:1500 3) IS:1599 4) IS:1608
5) IS:2004 6) AA 085 01 18

CORPORATE PURCHASE SPECIFICATION

ANNEXURE-I: RECOMMENDED TEST CERTIFICATE FORMAT FOR FORGINGS

SUPPLIER'S NAME AND ADDRESS

TEST CERTIFICATE FOR FORGINGS

1. Customer:
2. TC No. & Date:
3. PO No.:
4. Process of Melting Ingot:
5. Deoxidisation Process:
6. Forging Method:
7. BHEL's Reference for Approval of Bloom
8. Discard: Top_____%; Bottom_____%
9. Reduction Ratio } Ingot to Bloom / Bloom to Blank
10. Batch No.:
11. Heat/Melt No.
12. Spec.No.
13. Test Bar Size & Nos.
14. Supplier of the ingot/billet/ Bloom and TC reference.

15. FORGINGS COVERED BY TEST CERTIFICATE

S.No.	Drawing No. & Item No.	Description	Quantity & Weight

16. CHEMICAL COMPOSITION (PERCENT)

Element		C	Si	Mn	S	P											
As Per Specn.	Min.																
	Max.																
Actual Values																	

17. HEAT TREATMENT
(To be accompanied by Recorder Chart, Whenever called for)

Condition	Heating Rate, °C/hr.	Temp.°C	Soaking Time, Hrs.	Cooling Rate, °C/hr	Cooling Medium

18. MECHANICAL PROPERTIES

		T.S. N/mm²	Y.S. 0.5/0.2% Proof N/mm²	% Elongation $5.65\sqrt{So}$ GL	%R.A. Min.	Hardness BHN(Min.3 values)	Impact Value Joules	Bend Test		
								Angle of bend	Dia of mandrel	Result
As Per Specn.	Min.									
	Max.									
Actual Values										

19.	SURFACE FINISH (When called for in the order/drg.)	
20.	DIMENSIONAL INSPECTION	

21. NON-DESTRUCTIVE TESTS

Nature of Test	Acceptance level	Instrument used	Range	Results	Any other detail
Ultrasonic					
Radiographic					
Dye penetrant/ Magnetic Particle					

22. METALLOGRAPHIC EXAMINATION
(To be conducted if called for and photo micrographs to be attached along with a report)

Location of Sample	Etchant used	Magnification	Constituent observed	Relative %	
Microstructure	Macroetch	Inclusion Rating			

23. OTHER TESTS IF ANY (MICROSCOPIC, SULPHUR PRINTS, ETC)

24. IDENTIFICATION OF FORGINGS AS PER PURCHASE .SPEC.

We hereby certify that the items mentioned above have been tested and inspected in our presence and are found to be in accordance with drawings, specifications and purchase order.

SIGNATURE, NAME & SEAL OF THE INSPECTING OFFICER
DATE:

SIGNATURE, NAME & SEAL OF THE CHIEF OF QUALITY CONTROL/ CHIEF METALLURGIST OF THE SUPPLIER
DATE:

INSTRUCTIONS

a) Details of all heat treatment processes carried out should be furnished sequentially in 17.
b) Test certificates are to be furnished as per Purchase order and specification, in A4 size preferably in transparent paper.
c) All the entries including signature should be in block colour ink.
d) If testing is done by outside agencies, the original TCs shall be furnished.
e) The actual TC may run into more than one A4 size paper, if needed, to facilitate filling up of details.

	CORPORATE PURCHASING SPECIFICATION	**AA 123 17**
		Rev. No. 03
		PREFACE SHEET

ALUMINIUM ALLOY PLATES, GR : 54300(M)

FOR INTERNAL USE ONLY
REMOVE THIS PREFACE BEFORE ISSUE TO SUPPLIERS

Comparable Standards:

1. INDIAN	:	IS : 736 – 1986 Gr : 54300
2. AMERICAN	:	ASTM : B209M – 1992a, alloy 5083 (O)
3. BRITISH	:	BSEN : 485 –1998
4. GERMAN	:	DIN : 1725 – 1983, AlMg4.5Mn (W)

Suggested/Probable Suppliers and Grades:

Refer plant vendors list.

User Plant References:

1. BHOPAL : P.S. 12326

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Revisions : **Cl: 20.10.26 of MOM of MRC-NFCW+HE**			**APPROVED :** **INTERPLANT MATERIAL RATIONALISATION COMMITTEE-MRC (NFCW+HE)**		
Rev. No. 03	**Amd.No.**	**Reaffirmed**	**Prepared**	**Issued**	**Dt. of 1st Issue**
Dt: 15-02-06	**Dt :**	**Year :**	**HYDERABAD**	**Corp. R&D**	**01-03-78**

ALUMINIUM ALLOY PLATES, GR : 54300(M)

1.0 GENERAL:

This specification governs the quality of aluminum alloy plates of Gr: 54300 (M).

2.0 APPLICATION:

For general engineering purposes.

3.0 CONDITION OF DELIVERY:

As manufactured.
Plates shall be supplied flat with sheared, milled or sawn edges.

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: 736 – 1986, Gr: 54300 : Wrought Aluminum And Aluminum Alloy Plates For General
Condition : WP : Engineering purposes.

5.0 DIMENSIONS AND TOLERANCES:

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

5.2 Tolerances:

Tolerance shall be as per IS : 2677.

6.0 FREEDOM FROM DEFECTS :

The plates shall be sound and free from harmful defects such as scratches, cracks, laminations and other injurious imperfections.

7.0 CHEMICAL COMPOSITION :

The chemical composition of the material when analyzed in accordance with IS : 504 or any other suitable conventional/ instrumental/chemical method shall be as follows :

Element	Percent	
	Min	Max.
*Copper	--	0.1
Magnesium	4.0	4.9
*Silicon	---	0.4
*Iron	--	0.7
*Zinc	--	0.2
Manganese	0.5	1.0
*Titanium and/or/ other grain refining elements	--	0.20
*Chromium	--	0.25
Aluminum		Remainder

*Note: These elements need not be determined when the material supplied conforms to the mechanical properties specified in this specification. However, the supplier shall ensure that the composition of the material lies within the limits specified above.

8.0 TEST SAMPLES:

8.1 One sample per heat shall be taken for chemical analysis.

8.2 Material of the same thickness, produced under similar conditions, shall be grouped into batches of not more than 4000 kg.

8.3 Before the test samples are cut off, they shall be marked to identify them with the batch they represent. The test samples shall be taken from the material as supplied and shall not be further heat treated or mechanically worked (except for preparing the test piece) before being tested. The test samples may be cut from the margins of the material before cutting it to size.

8.4 The tensile test piece shall be rectangular section having dimensions as given in IS: 1608 with a gauge length of 50 mm. The test piece shall be cut transverse to the direction of rolling for plates 300 mm wide and over, and parallel to the direction of rolling for plates under 300 mm wide. When the width of the material to be tested is insufficient to permit preparation of the standard tensile test piece, a piece of the full width of the material may be used.

9.0 MECHANICAL PROPERTIES:

The test pieces, when tested in accordance with IS : 1608 (Method for tensile tests for light metals and their alloys), shall show the following properties:

Tensile strength	:	285 N/mm^2, min.
0.2% Proof Stress	:	125 N/mm^2 , min.
Elongation on 50 mm gauge length	:	12 % , min.

10.0 RETEST:

Should any of the test pieces first selected fail, two further samples from the same batch shall be selected for testing, one of which shall be from the tube from which the original test sample was taken, unless the tube has been withdrawn by the supplier. Should the test pieces from both these additional samples pass, the batch represented by the test sample shall be deemed to comply with this specification. Should be test pieces from either of these additional samples fail the batch represented by these samples shall be deemed not to comply with this specification.

11.0 INSPECTION AT SUPPLIER'S WORKS

Tests and inspection are to be conducted in the prescience of the customer's representative. The representative shall have free access at all times while the work on the contract is being performed, to all parts of the manufacture's works. The supplier shall offer the purchaser's representative all reasonable facilities, without charge, to satisfy the latter that the material is being furnished in accordance with this specification.

The supplier shall prepare and provide necessary test specimens for testing to be carried out at his premises. If facilities are not available at his works, the supplier shall make necessary arrangement for carrying out the prescribed test elsewhere.

12.0 TEST CERTIFICATES:

The supplier shall submit three copies of test certificates giving the following information:
In addition, the supplier shall make sure to enclose one copy of the test certificate along with dispatch documents for quick clearance of the material.

AA 12317 (Rev.03) Aluminium Alloy Plates, Gr: 54300 (M)
BHEL Order No,
Supplier's name :
Batch No.
Consignment/Identification No.
Results of chemical analysis, mechanical and all other tests as called for in this specification.

13.0 PACKING AND MARKING:

The material shall be suitably packed to prevent corrosion and damage during transit.

Each package or crate shall be legibly marked with the following information :

BHEL Order No.
AA 12317
Heat No,
Identification mark/No.
Size & Weight.
Supplier's reference and name.

14.0 REFERRED STADARDS (Latest Publications Including Amendments):

1. IS: 736 2. IS:504 3. IS: 1608 4. IS: 2677

	CORPORATE PURCHASING SPECIFICATION	**AA 107 40**
		Rev. No. 08
		PREFACE SHEET

AUSTENITIC STAINLESS STEEL SHEETS, PLATES AND STRIPS – SOLUTION ANNEALED (ASTM A 240M, TYPE 321) Î

FOR INTERNAL USE ONLY
REMOVE THIS PREFACE SHEET BEFORE ISSUE TO SUPPLIERS

Comparable Standards:

1. AMERICAN	:	ASTM A 240M Î Type 321, Solution annealed.
2. INDIAN	:	IS: 6911 - 1992 Gr: X04Cr18Ni10Ti, Solution annealed
3. EUROPEAN	:	EN 10088-2, Gr: X6CrNiTi 18-10

Suggested/Probable Suppliers And Grades:

Refer Plant Vendors list

User Plant References:

1.	HEEP - HARDWAR	:	HW 021 02 99
2.	BHOPAL	:	PS10506 Sheets & Plates
3.	HYDERABAD	:	AISI 321 CSN 417246.1

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Revisions : Cl .28.4.16 of MOM of MRC-S&GPS			**APPROVED: Interplant Material Rationalization Committee-MRC (S&GPS)**		
Rev. No. 08	**Amd.No.**	**Reaffirmed**	**Prepared**	**Issued**	**Dt. of 1st Issue**
Dt.:09.01.2007	**Dt :**	**Year: 2013**	**HARDWAR**	**Corp. R&D**	**JUNE, 1978**

AUSTENITIC STAINLESS STEEL SHEETS , PLATES AND STRIPS - SOLUTION ANNEALED (ASTM A 240M, TYPE 321) Î

ORDERING DESCRIPTION

1.0 GENERAL:

The sheets, plates and strips shall conform to the latest version of ASTM A 240M, Type 321 and comply with the following additional requirements. Î

2.0 APPLICATION :

For general engineering purposes, where corrosion resistance is essential.

3.0 CONDITION OF DELIVERY:

Hot/Cold rolled, solution annealed and descaled (Finish number 1 or 2 B/2D).

4.0 DIMENSIONS AND TOLERANCES

Material shall be supplied to the dimensions specified in BHEL order.

5.0 CHEMICAL COMPOSITION:

As per ASTM A 240M, Type 321. Î

6.0 TEST CERTIFICATES:

Three copies of test certificates shall be supplied along with the following information:

BHEL References:

AA 107 40 -Rev. No.08 / ASTM A 240M, Type: 321
BHEL order No,

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

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

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7.0 PACKING AND MARKING:

Sheets shall be supplied in bundles or in packages each weighing upto a maximum of 3000kg. Plates shall be suitably packed to prevent damage during transit.

For plates below 25 mm thick, each pile (preferably of 16 plates) shall be marked with suppliers identification mark, 'AA 107 40 / ASTM A 240M, Type:321, melt No., BHEL Î order No., on the top plate.

Each plate of 25mm thickness and above shall be stamped/painted with the suppliers identification mark, 'AA 107 40 / ASTM A 240M, Type:321, melt No., BHEL order No., on Î the top plate.

FOR INFORMATION ONLY

CHEMICAL COMPOSITION

C	Si	Mn	Ni	Cr	S	P	Ti	N
≤ 0.08	≤ 0.75	≤ 2.0	9.0-12.0	17.0-19.0	≤ 0.030	≤ 0.045	5(C+N) - 0.70, max	0.10

MECHANICAL PROPERTIES

Hardness, max		0.2% PS, min	UTS, min	% El, min	Cold Bend. Î
BHN	HRB	N/mm^2	N/mm^2		
217	95	205	515	40	-

	CORPORATE PURCHASING SPECIFICATION	**AA 107 39**
		Rev. No. 08
		PREFACE SHEET

AUSTENITIC STAINLESS STEEL SHEETS, PLATES AND STRIPS - SOLUTION ANNEALED (ASTM A 240M, TYPE 304) Î

FOR INTERNAL USE ONLY
REMOVE THIS PREFACE SHEET BEFORE ISSUE TO SUPPLIERS

Comparable Standards:

1. AMERICAN	:	ASTM A 240M Î Type 304, Solution annealed.
2. INDIAN	:	IS: 6911 - 1992 Gr: X 04Cr 19 Ni 9 Solution annealed
3. EUROPEAN	:	EN 10088-2, Gr: X5CrNi18-10

Suggested/Probable Suppliers and Grades:

Refer Plant Vendors list

User Plant References:

1.	HEEP - HARDWAR	:	HW 021 02 99
2.	BHOPAL	:	PS10587, PS10512-Sheets & Plates
3.	HYDERABAD Î	:	AISI 304; ASTM A 240M, Gr: TP304; ASEA 2 2333-02
4.	TRICHY	:	AISI 304

Revisions : **Cl 28.4.16 of MOM of MRC-S&GPS**	**APPROVED: Interplant Material Rationalization Committee-MRC (S&GPS)**

Rev. No. 08	**Amd.No.**	**Reaffirmed**	**Prepared**	**Issued**	**Dt. of 1st Issue**
Dt.:09.01.2007	**Dt :**	**Year: 2013**	**HARDWAR**	**Corp. R&D**	**JUNE, 1978**

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AUSTENITIC STAINLESS STEEL SHEETS, PLATES AND STRIPS - SOLUTION ANNEALED (ASTM A 240M, TYPE 304) Î

ORDERING DESCRIPTION

1.0 GENERAL :

The sheets, plates and strips shall conform to the latest version of ASTM A 240M, Type 304 and comply with the following additional requirements. Î

2.0 APPLICATION :

For general engineering purposes, where corrosion resistance is essential.

3.0 CONDITION OF DELIVERY:

Hot/Cold rolled, solution annealed and descaled (Finish number 1 or 2 B/2D).

4.0 DIMENSIONS AND TOLERANCES

Material shall be supplied to the dimensions specified in BHEL order.

5.0 CHEMICAL COMPOSITION :

As per ASTM A 240M, Type 304. Î

6.0 TEST CERTIFICATES :

Three copies of test certificates shall be supplied along with the following information:

BHEL References :

AA 107 39 -Rev. No.08 / ASTM A 240M, Type:304 Î
BHEL order No,

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

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

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7.0 PACKING AND MARKING :

Sheets shall be supplied in bundles or in packages each weighing upto a maximum of 3000kg. Plates shall be suitably packed to prevent damage during transit.

For plates below 25 mm thick, each pile (preferably of 16 plates) shall be marked with suppliers identification mark, 'AA 107 39 / ASTM A 240M, Type:304, melt No., BHEL order No., on the top plate. Î

Each plate of 25mm thickness and above shall be stamped/painted with the suppliers identification mark, 'AA 107 39 / ASTM A 240M, Type:304 , melt No., BHEL order No., on the top plate. Î

FOR INFORMATION ONLY

CHEMICAL COMPOSITION

C	Si	Mn	Ni	Cr	S	P	N
≤ 0.08	≤ 0.75	≤ 2.0	8.0-10.5	18.0 -20.0	≤ 0.030	≤ 0.045	0.10

MECHANICAL PROPERTIES

Hardness Max		0.2% PS min	UTS min	% El min	Bend Test
BHN	HRB	N/mm²	N/mm²		Dia.
201	92	205	515	40	-

	CORPORATE PURCHASING SPECIFICATION	AA 107 30
		Rev. No. 07
		PREFACE SHEET

AUSTENITIC STAINLESS STEEL SHEETS, PLATES AND STRIPS - SOLUTION ANNEALED (ASTM A 240M, TYPE 316 L) Î

FOR INTERNAL USE ONLY
REMOVE THIS PREFACE SHEET BEFORE ISSUE TO SUPPLIERS

Comparable Standards:

1. AMERICAN	:	ASTM A 240M Type 316 L, Solution annealed. Î
2. INDIAN	:	IS: 6911 - 1992 Gr: X 02 Cr17 Ni12 Mo2 Solution Annealed
3. EUROPEAN	:	EN 10088-2, Gr: X2CrNiMo17-12-2

Suggested/Probable Suppliers and Grades:

Refer Plant Vendors list

User Plant References:

1.	HEEP - HARDWAR	:	AISI: 316
2.	HYDERABAD	:	DIN: 17440-1972 Gr.: X 10CrNiMo 1810
3.	TRICHY	:	AISI 316 L

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Revisions : Cl 28.4.15 of MOM of MRC-S&GPS			APPROVED: Interplant Material Rationalization Committee-MRC (S&GPS)		
Rev. No. 07	**Amd.No.**	**Reaffirmed**	**Prepared**	**Issued**	**Dt. of 1st Issue**
Dt.:09.01.2007	**Dt :**	**Year: 2013**	**HARDWAR**	**Corp. R&D**	**AUGUST, 1978**

AUSTENITIC STAINLESS STEEL SHEETS, PLATES AND STRIPS - SOLUTION ANNEALED (ASTM A 240M, TYPE 316 L) Î

ORDERING DESCRIPTION

1.0 GENERAL:

The sheets, plates and strips shall conform to the latest version of ASTM A 240M, Type 316 L and comply with the following additional requirements. Î

2.0 APPLICATION:

For general engineering purposes, where corrosion resistance is essential.

3.0 CONDITION OF DELIVERY:

Hot/Cold rolled, solution annealed and descaled (Finish number 1 or 2 B/2D).

4.0 DIMENSIONS AND TOLERANCES:

Material shall be supplied to the dimensions specified in BHEL order.

5.0 CHEMICAL COMPOSITION :

As per ASTM A 240M, Type 316 L. Î

6.0 TEST CERTIFICATES :

Three copies of test certificates shall be supplied along with the following information:

BHEL References :

AA 107 30 -Rev. No.07 / ASTM A 240M, Type:316 L Î
BHEL order No,

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

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

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7.0 PACKING AND MARKING:

Sheets shall be supplied in bundles or in packages each weighing upto a maximum of 3000kg. Plates shall be suitably packed to prevent damage during transit.

For plates below 25 mm thick, each pile (preferably of 16 plates) shall be marked with suppliers identification mark, 'AA 107 30 / ASTM A 240 M, Type:316 L, melt No., BHEL Î order No., on the top plate.

Each plate of 25mm thickness and above shall be stamped/painted with the suppliers identification mark, 'AA 107 30 / ASTM A 240 M, Type:316 L , melt No., BHEL order No., Î on the top plate

FOR INFORMATION ONLY

CHEMICAL COMPOSITION :

C	Si	Mn	Ni	Cr	Mo	S	P	N
≤ 0.03	≤ 0.75	≤ 2.0	10.0-14.0	16.0-18.0	2.0-3.0	≤ 0.030	≤ 0.045	≤ 0.10

MECHANICAL PROPERTIES :

Hardness Max		0.2% PS min	UTS min	% El min	Cold Bend Î
BHN	HRB	N/mm²	N/mm²		
217	95	170 Î	485	40	-

BHEL	**CORPORATE PURCHASING SPECIFICATION**	AA10445 Rev No.05 PREFACE SHEET

HOT FINISHED / COLD DRAWN SEAMLESS CARBON STEEL TUBES FOR HIGH TEMPERATURE SERVICE

FOR INTERNAL USE ONLY

REMOVE THIS PREFACE BEFORE ISSUE TO SUPPLIERS

Comparable Standards:

1. AMERICAN : ASME SA192

Suggested / Probable Suppliers and Grades:

Refer Use plant vendors list

User Plant References:

1. HPBP, TRICHY : TDC 0:102, TDC:1-005/C
2. HEP, BHOPAL : PS10127, PS10138

Revisions: Cl: 28.2.3 of MOM of MRC – FCF+HTM			**APPROVED:** INTERPLANT MATERIAL RATIONALISATION COMMITTEE – MRC(FCF+HTM)		
Rev No.05	Amd No.	Reaffirmed	Prepared	Issued	Dt. of 1st Issue
Dt:01-01-2004	Dt:	Year:2014	HPBP, Trichy	Corp.R&D	June, 1978

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HOT FINISHED / COLD DRAWN SEAMLESS CARBON STEEL TUBES FOR HIGH TEMPERATURE SERVICE

ORDERING DESCRIPTION FOR ASME SA192

1.0 GENERAL

The tubes shall conform to the latest version for ASME SA192 and comply with the following additional requirements.

2.0 APPLICATION

For high temperature service at stress levels and temperatures allowed by ASME Boiler & Pressure Vessel Code, Section I & Indian Boiler Regulations.

3.0 HYDROSTATIC TEST / NDT

Each length of tube shall be subjected to Hydrostatic test as per ASME SA 450.

As an alternative to the Hydrostatic test, each length of tube shall be subjected to NDT as given below:

a) For thickness up to 3.6mm, inclusive, Eddy current test as per ASME SE309 or for Thickness up to 12mm, inclusive, Flux leakage test as per ASME SE570.

or

b) Ultrasonic test as per ASME SE213.

Norms of acceptance shall be as specified in the respective standards mentioned above.

4.0 INSPECTION AT SUPPLIER'S WORKS

BHEL's representative shall have free access at all times to all parts of the manufacture's works, until the work on the contract of BHEL is being performed. The manufacturer shall offer BHEL's representative all reasonable facilities, without charge, to satisfy the latter that the material is being furnished in accordance with the specification.

5.0 REPAIR

5.1 Repair involving fusion welding is prohibited.

5.2 When defects are repaired by mechanical means, the wall thickness requirements shall be met with and the surfaces shall be smoothly dressed up without any sharp edges.

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6.0 CERTIFICATION

Test certificate shall be provided as per IBR FORM-III E issued by WELL KNOWN TUBE MAKER who is recognised by Central Boiler Board. Copy of certification of recognition as Well Known Tube Maker in FORM XVI - F shall also be enclosed along with the test certificate.

7.0 PACKING AND MARKING

As per BHEL Corporate Standard AA0490001.

8.0 REJECTION AND REPLACEMENT

If each length of tube does not comply with the requirements of this specification during receipt inspection at BHEL or if any defect is found during further processing of pipes BHEL reserves the right to reject the whole consignment and the supplier shall replace the material free of cost. The rejected material shall be taken back by the supplier after fulfilling the commercial terms and conditions.

BHEL	**CORPORATE PURCHASING SPECIFICATION**	AA10152 Rev No.07 PREFACE SHEET

STEEL TUBES – ELECTRIC RESISTANCE WELDED / SUBMERGED ARC WELDED

FOR INTERNAL USE ONLY

REMOVE THIS PREFACE BEFORE ISSUE TO SUPPLIERS

Equivalent / Comparable Standards:

1) INDIAN : IS 1239 (Part 1) – 2004, Gr.: ERW

Suggested / Probable Suppliers and Grades:

Refer plant vendors list.

User Plants and Replaced Plant Specifications / References:

1) HEP, BHOPAL : PS10152 - Ungalvanized Tubes.
2) HEEP, HARDWAR : PS10153 - Galvanized Tubes.
3) HPEP, HYDERABAD : HY0120299, HY0210299
4) HPBP, TIRUCHY :

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Revisions:			**APPROVED:**		
Corrected the Clause 11.4 in line with IS 1239 (Part 1)			INTERPLANT MATERIAL RATIONALISATION COMMITTEE – MRC(S&GPS)		
Rev No.07	Amd No.	Reaffirmed	Prepared	Issued	Dt. of 1st Issue
Dt:05-01-2015	Dt:	Year:	HEP, Bhopal	Corp.R&D	July, 1976

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STEEL TUBES – ELECTRIC RESISTANCE WELDED / SUBMERGED ARC WELDED

1.0 GENERAL:

This specification governs the quality requirements of light, medium and heavy grades of Electric Resistance Welded/Submerged Arc Welded steel tubes with plain ends in ungalvanized and galvanized condition in the range of 60mm to 150mm NB.

2.0 APPLICATION:

For general purpose, suitable for bending, welding and screwing for flanges and fittings. Not suitable for steam services.

3.0 CONDITION OF DELIVERY:

Tubes shall be supplied with plain ends.

The ends shall be cut cleanly and square with the axis of the tube.

Unless otherwise specified, tubes shall be supplied in ungalvanized condition.

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: 1239(part 1) – 2004: Steel Tubes, Tubular and other Wrought Steel Fittings
Gr: ERW.

5.0 DIMENSIONS AND TOLERANCES:

5.1 Sizes:

BHEL order shall clearly state the maximum outside diameter, and wall thickness of the tube.

5.2 Tolerances:

5.2.1 Thickness:

Light tubes	+ not limited − 8 percent
Medium and Heavy tubes	+ not limited − 10 percent

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5.2.2 Weight:

Single tube (light series)	+ 10 percent − 8 percent
Single tube (medium and heavy series)	± 10 percent
For quantities per load of 10 tonnes, min (light series)	+ 7.5 percent − 5 percent
For quantities per load of 10 tonnes, min (medium and heavy series)	± 7.5 percent

5.2.3 Internal Weld Fin:

Height of the internal weld fin shall not be greater than 60 percent of the specified thickness.

5.2.4 Length:

5.2.4.1 Random Length:

Tubes shall be supplied in random lengths of 4 to 7 meters, unless otherwise specified and in the line with IS: 1239, Part 1.

5.2.4.2 Exact Length:

When exact lengths are called for, the tolerances shall be + 6 mm, − 0 mm of the specified length.

6.0 MANUFACTURE:

Tubes shall be made from tested quality steel manufactured by any approved process and shall be fully killed.

Tubes shall not be manually welded.

7.0 FREEDOM FOR DEFECTS:

Tubes shall be cleanly finished and reasonably free from injurious defects. They shall be reasonably straight. The ends shall be cut cleanly and reasonably square with the axis of the tube.

8.0 CHEMICAL COMPOSITION:

The melt analysis of steel shall be as follows:

Element	Percent max.	Permissible variation over specified limit, ± max
Carbon	0.20	0.02
Manganese	1.30	0.04
Sulphur	0.040	0.005
Phosphorus	0.040	0.005

9.0 GALVANIZING:

When galvanized tubes are ordered, the Zinc coating on the tubes shall be in accordance with IS: 4736

10.0 TEST SAMPLES:

All tubes bearing the same designation and manufactured under a single process shall be grouped together to constitute a lot. Each lot shall be sampled separately in accordance with IS: 4711

11.0 MECHANICAL PROPERTIES:

11.1 Tensile:

The tensile strength of strips cut form selected tubes, when tested in accordance with IS: 1608 shall be as follows:

Tensile strength : 320 N/mm^2, min.

Elongations on $5.65\sqrt{S_o}$ gauge length:

Up to and including. 25 mm NB : 12 percent, min.
Over 25 mm up to including150 mm NB : 20 percent, min.

Note:

1. For welded tubes, the strip tensile test specimen shall not contain the weld.
2. For galvanized tubes, zinc coating may be removed by stripping prior to tensile test.

11.2 Bend Test (On tubes up to and including 50mm nominal bore):

When tested in accordance with IS: 2329, the tubes shall be capable of withstanding the bend test without showing any signs of fracture or failure.

Tubes shall be bent with the weld at 90^o to the plane of bending. The tubes shall not be filled for this test.

Ungalvanised tubes shall be capable of being bent cold without cracking, through 180^o around a former having a radius at the bottom of groove in the plane of bending equal to at least six times the outside diameter of the tube.

Galvanized tubes shall be capable of being bent cold without cracking of the steel, through 90^o round a former having a radius at the bottom of the groove equal to at least eight times the outside diameter of the tube.

11.3 Flattening Test (On tubes above 50mm nominal bore):

Rings not less than 40mm in length, cut form the end of each selected tubes shall be flattened between parallel plates with the weld at 90^o(point of maximum bending) in accordance with IS:2328. No opening shall occur by fracture in the weld until the distance between the plates is less than 75 percent of the original outside diameter of the tube and no cracks or breaks on the metal elsewhere than in the weld shall occur until the distance between the plates is less than 60 percent of the original outside diameter.

Test rings may have the inner and outer edges rounded.

11.4 Hydraulic Test / Eddy Current Test:

Each tube shall withstand a test pressure of 5 N/mm^2 without showing leakage defects of any kind. The pressure shall be applied and maintained for a minimum period of 3 seconds for proof and inspection.

Note: Eddy current test may be done in place of Hydrostatic test as per the procedure in Annexure – B of IS: 1239, Part-1.

CORPORATE PURCHASING SPECIFICATION

12.0 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 dispatch documents to facilitate quick clearance of the material.

The test certificate shall bear the following information:

AA10152: Rev. No.07: Steel Tubes – ERW/SAW
BHEL order No:

Supplier's Reference:
Name
Identification No.
Melt No.

Results of Tests:
Results of Chemical, Mechanical tests and Hydraulic/Eddy Current test.

13.0 PROTECTIVE COATING:

The tubes shall be protected with a rust preventive coating of varnish, externally throughout the length.

14.0 PACKING AND MARKING:

Each tube shall be plugged at both ends by means of tight fitting end caps.

The tubes shall be suitably packed in bundles/packages to prevent corrosion and damage during transit.

Each bundle/package shall bear the following information:

AA10152: Steel Tubes – ERW/SAW
BHEL Order No.
Consignment/Identification No.
Outside Diameter and Wall Thickness.
Supplier's Name

15.0 REFERRED STANDARDS (Latest Publications Including Amendments):

1) IS: 1608 2) IS: 2328 3) IS: 2329

4) IS: 4736 5) IS: 4711

	CORPORATE PURCHASING SPECIFICATION	**AA 123 17**
		Rev. No. 03
		PREFACE SHEET

ALUMINIUM ALLOY PLATES, GR : 54300(M)

FOR INTERNAL USE ONLY
REMOVE THIS PREFACE BEFORE ISSUE TO SUPPLIERS

Comparable Standards:

1. INDIAN	:	IS : 736 – 1986 Gr : 54300
2. AMERICAN	:	ASTM : B209M – 1992a, alloy 5083 (O)
3. BRITISH	:	BSEN : 485 –1998
4. GERMAN	:	DIN : 1725 – 1983, AlMg4.5Mn (W)

Suggested/Probable Suppliers and Grades:

Refer plant vendors list.

User Plant References:

1. BHOPAL : P.S. 12326

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Revisions : **Cl: 20.10.26 of MOM of MRC-NFCW+HE**			**APPROVED :** **INTERPLANT MATERIAL RATIONALISATION COMMITTEE-MRC (NFCW+HE)**		
Rev. No. 03	**Amd.No.**	**Reaffirmed**	**Prepared**	**Issued**	**Dt. of 1st Issue**
Dt: 15-02-06	**Dt :**	**Year :**	**HYDERABAD**	**Corp. R&D**	**01-03-78**

ALUMINIUM ALLOY PLATES, GR : 54300(M)

1.0 GENERAL:

This specification governs the quality of aluminum alloy plates of Gr: 54300 (M).

2.0 APPLICATION:

For general engineering purposes.

3.0 CONDITION OF DELIVERY:

As manufactured.
Plates shall be supplied flat with sheared, milled or sawn edges.

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: 736 – 1986, Gr: 54300 : Wrought Aluminum And Aluminum Alloy Plates For General
Condition : WP : Engineering purposes.

5.0 DIMENSIONS AND TOLERANCES:

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

5.2 Tolerances:

Tolerance shall be as per IS : 2677.

6.0 FREEDOM FROM DEFECTS :

The plates shall be sound and free from harmful defects such as scratches, cracks, laminations and other injurious imperfections.

7.0 CHEMICAL COMPOSITION :

The chemical composition of the material when analyzed in accordance with IS : 504 or any other suitable conventional/ instrumental/chemical method shall be as follows :

Element	Percent	
	Min	Max.
*Copper	--	0.1
Magnesium	4.0	4.9
*Silicon	---	0.4
*Iron	--	0.7
*Zinc	--	0.2
Manganese	0.5	1.0
*Titanium and/or/ other grain refining elements	--	0.20
*Chromium	--	0.25
Aluminum		Remainder

*Note: These elements need not be determined when the material supplied conforms to the mechanical properties specified in this specification. However, the supplier shall ensure that the composition of the material lies within the limits specified above.

8.0 TEST SAMPLES:

8.1 One sample per heat shall be taken for chemical analysis.

8.2 Material of the same thickness, produced under similar conditions, shall be grouped into batches of not more than 4000 kg.

8.3 Before the test samples are cut off, they shall be marked to identify them with the batch they represent. The test samples shall be taken from the material as supplied and shall not be further heat treated or mechanically worked (except for preparing the test piece) before being tested. The test samples may be cut from the margins of the material before cutting it to size.

8.4 The tensile test piece shall be rectangular section having dimensions as given in IS: 1608 with a gauge length of 50 mm. The test piece shall be cut transverse to the direction of rolling for plates 300 mm wide and over, and parallel to the direction of rolling for plates under 300 mm wide. When the width of the material to be tested is insufficient to permit preparation of the standard tensile test piece, a piece of the full width of the material may be used.

9.0 MECHANICAL PROPERTIES:

The test pieces, when tested in accordance with IS : 1608 (Method for tensile tests for light metals and their alloys), shall show the following properties:

Tensile strength	:	285 N/mm^2, min.
0.2% Proof Stress	:	125 N/mm^2 , min.
Elongation on 50 mm gauge length	:	12 % , min.

10.0 RETEST:

Should any of the test pieces first selected fail, two further samples from the same batch shall be selected for testing, one of which shall be from the tube from which the original test sample was taken, unless the tube has been withdrawn by the supplier. Should the test pieces from both these additional samples pass, the batch represented by the test sample shall be deemed to comply with this specification. Should be test pieces from either of these additional samples fail the batch represented by these samples shall be deemed not to comply with this specification.

11.0 INSPECTION AT SUPPLIER'S WORKS

Tests and inspection are to be conducted in the prescience of the customer's representative. The representative shall have free access at all times while the work on the contract is being performed, to all parts of the manufacture's works. The supplier shall offer the purchaser's representative all reasonable facilities, without charge, to satisfy the latter that the material is being furnished in accordance with this specification.

The supplier shall prepare and provide necessary test specimens for testing to be carried out at his premises. If facilities are not available at his works, the supplier shall make necessary arrangement for carrying out the prescribed test elsewhere.

12.0 TEST CERTIFICATES:

The supplier shall submit three copies of test certificates giving the following information:
In addition, the supplier shall make sure to enclose one copy of the test certificate along with dispatch documents for quick clearance of the material.

AA 12317 (Rev.03) Aluminium Alloy Plates, Gr: 54300 (M)
BHEL Order No,
Supplier's name :
Batch No.
Consignment/Identification No.
Results of chemical analysis, mechanical and all other tests as called for in this specification.

13.0 PACKING AND MARKING:

The material shall be suitably packed to prevent corrosion and damage during transit.

Each package or crate shall be legibly marked with the following information :

BHEL Order No.
AA 12317
Heat No,
Identification mark/No.
Size & Weight.
Supplier's reference and name.

14.0 REFERRED STADARDS (Latest Publications Including Amendments):

1. IS: 736 2. IS:504 3. IS: 1608 4. IS: 2677

BHEL	**CORPORATE PURCHASING SPECIFICATION**	AA10445 Rev No.05 PREFACE SHEET

HOT FINISHED / COLD DRAWN SEAMLESS CARBON STEEL TUBES FOR HIGH TEMPERATURE SERVICE

FOR INTERNAL USE ONLY

REMOVE THIS PREFACE BEFORE ISSUE TO SUPPLIERS

Comparable Standards:

1. AMERICAN : ASME SA192

Suggested / Probable Suppliers and Grades:

Refer Use plant vendors list

User Plant References:

1. HPBP, TRICHY : TDC 0:102, TDC:1-005/C
2. HEP, BHOPAL : PS10127, PS10138

Revisions: Cl: 28.2.3 of MOM of MRC – FCF+HTM			**APPROVED:** INTERPLANT MATERIAL RATIONALISATION COMMITTEE – MRC(FCF+HTM)		
Rev No.05	Amd No.	Reaffirmed	Prepared	Issued	Dt. of 1st Issue
Dt:01-01-2004	Dt:	Year:2014	HPBP, Trichy	Corp.R&D	June, 1978

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HOT FINISHED / COLD DRAWN SEAMLESS CARBON STEEL TUBES FOR HIGH TEMPERATURE SERVICE

ORDERING DESCRIPTION FOR ASME SA192

1.0 GENERAL

The tubes shall conform to the latest version for ASME SA192 and comply with the following additional requirements.

2.0 APPLICATION

For high temperature service at stress levels and temperatures allowed by ASME Boiler & Pressure Vessel Code, Section I & Indian Boiler Regulations.

3.0 HYDROSTATIC TEST / NDT

Each length of tube shall be subjected to Hydrostatic test as per ASME SA 450.

As an alternative to the Hydrostatic test, each length of tube shall be subjected to NDT as given below:

a) For thickness up to 3.6mm, inclusive, Eddy current test as per ASME SE309 or for Thickness up to 12mm, inclusive, Flux leakage test as per ASME SE570.

or

b) Ultrasonic test as per ASME SE213.

Norms of acceptance shall be as specified in the respective standards mentioned above.

4.0 INSPECTION AT SUPPLIER'S WORKS

BHEL's representative shall have free access at all times to all parts of the manufacture's works, until the work on the contract of BHEL is being performed. The manufacturer shall offer BHEL's representative all reasonable facilities, without charge, to satisfy the latter that the material is being furnished in accordance with the specification.

5.0 REPAIR

5.1 Repair involving fusion welding is prohibited.

5.2 When defects are repaired by mechanical means, the wall thickness requirements shall be met with and the surfaces shall be smoothly dressed up without any sharp edges.

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6.0 CERTIFICATION

Test certificate shall be provided as per IBR FORM-III E issued by WELL KNOWN TUBE MAKER who is recognised by Central Boiler Board. Copy of certification of recognition as Well Known Tube Maker in FORM XVI - F shall also be enclosed along with the test certificate.

7.0 PACKING AND MARKING

As per BHEL Corporate Standard AA0490001.

8.0 REJECTION AND REPLACEMENT

If each length of tube does not comply with the requirements of this specification during receipt inspection at BHEL or if any defect is found during further processing of pipes BHEL reserves the right to reject the whole consignment and the supplier shall replace the material free of cost. The rejected material shall be taken back by the supplier after fulfilling the commercial terms and conditions.

	CORPORATE PURCHASING SPECIFICATION	AA 107 30
		Rev. No. 07
		PREFACE SHEET

AUSTENITIC STAINLESS STEEL SHEETS, PLATES AND STRIPS - SOLUTION ANNEALED (ASTM A 240M, TYPE 316 L) Î

FOR INTERNAL USE ONLY
REMOVE THIS PREFACE SHEET BEFORE ISSUE TO SUPPLIERS

Comparable Standards:

1. AMERICAN	:	ASTM A 240M Type 316 L, Solution annealed. Î
2. INDIAN	:	IS: 6911 - 1992 Gr: X 02 Cr17 Ni12 Mo2 Solution Annealed
3. EUROPEAN	:	EN 10088-2, Gr: X2CrNiMo17-12-2

Suggested/Probable Suppliers and Grades:

Refer Plant Vendors list

User Plant References:

1.	HEEP - HARDWAR	:	AISI: 316
2.	HYDERABAD	:	DIN: 17440-1972 Gr.: X 10CrNiMo 1810
3.	TRICHY	:	AISI 316 L

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Revisions : Cl 28.4.15 of MOM of MRC-S&GPS			APPROVED: Interplant Material Rationalization Committee-MRC (S&GPS)		
Rev. No. 07	**Amd.No.**	**Reaffirmed**	**Prepared**	**Issued**	**Dt. of 1st Issue**
Dt.:09.01.2007	**Dt :**	**Year: 2013**	**HARDWAR**	**Corp. R&D**	**AUGUST, 1978**

AUSTENITIC STAINLESS STEEL SHEETS, PLATES AND STRIPS - SOLUTION ANNEALED (ASTM A 240M, TYPE 316 L) Î

ORDERING DESCRIPTION

1.0 GENERAL:

The sheets, plates and strips shall conform to the latest version of ASTM A 240M, Type 316 L and comply with the following additional requirements. Î

2.0 APPLICATION:

For general engineering purposes, where corrosion resistance is essential.

3.0 CONDITION OF DELIVERY:

Hot/Cold rolled, solution annealed and descaled (Finish number 1 or 2 B/2D).

4.0 DIMENSIONS AND TOLERANCES:

Material shall be supplied to the dimensions specified in BHEL order.

5.0 CHEMICAL COMPOSITION :

As per ASTM A 240M, Type 316 L. Î

6.0 TEST CERTIFICATES :

Three copies of test certificates shall be supplied along with the following information:

BHEL References :

AA 107 30 -Rev. No.07 / ASTM A 240M, Type:316 L Î
BHEL order No,

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

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

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7.0 PACKING AND MARKING:

Sheets shall be supplied in bundles or in packages each weighing upto a maximum of 3000kg. Plates shall be suitably packed to prevent damage during transit.

For plates below 25 mm thick, each pile (preferably of 16 plates) shall be marked with suppliers identification mark, 'AA 107 30 / ASTM A 240 M, Type:316 L, melt No., BHEL Î order No., on the top plate.

Each plate of 25mm thickness and above shall be stamped/painted with the suppliers identification mark, 'AA 107 30 / ASTM A 240 M, Type:316 L , melt No., BHEL order No., Î on the top plate

FOR INFORMATION ONLY

CHEMICAL COMPOSITION :

C	Si	Mn	Ni	Cr	Mo	S	P	N
≤ 0.03	≤ 0.75	≤ 2.0	10.0-14.0	16.0-18.0	2.0-3.0	≤ 0.030	≤ 0.045	≤ 0.10

MECHANICAL PROPERTIES :

Hardness Max		0.2% PS min	UTS min	% El min	Cold Bend Î
BHN	HRB	N/mm²	N/mm²		
217	95	170 Î	485	40	-

	CORPORATE PURCHASING SPECIFICATION	**AA 107 39**
		Rev. No. 08
		PREFACE SHEET

AUSTENITIC STAINLESS STEEL SHEETS, PLATES AND STRIPS - SOLUTION ANNEALED (ASTM A 240M, TYPE 304) Î

FOR INTERNAL USE ONLY
REMOVE THIS PREFACE SHEET BEFORE ISSUE TO SUPPLIERS

Comparable Standards:

1. AMERICAN	:	ASTM A 240M Î Type 304, Solution annealed.
2. INDIAN	:	IS: 6911 - 1992 Gr: X 04Cr 19 Ni 9 Solution annealed
3. EUROPEAN	:	EN 10088-2, Gr: X5CrNi18-10

Suggested/Probable Suppliers and Grades:

Refer Plant Vendors list

User Plant References:

1.	HEEP - HARDWAR	:	HW 021 02 99
2.	BHOPAL	:	PS10587, PS10512-Sheets & Plates
3.	HYDERABAD Î	:	AISI 304; ASTM A 240M, Gr: TP304; ASEA 2 2333-02
4.	TRICHY	:	AISI 304

Revisions : **Cl 28.4.16 of MOM of MRC-S&GPS**	**APPROVED: Interplant Material Rationalization Committee-MRC (S&GPS)**

Rev. No. 08	**Amd.No.**	**Reaffirmed**	**Prepared**	**Issued**	**Dt. of 1st Issue**
Dt.:09.01.2007	**Dt :**	**Year: 2013**	**HARDWAR**	**Corp. R&D**	**JUNE, 1978**

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AUSTENITIC STAINLESS STEEL SHEETS, PLATES AND STRIPS - SOLUTION ANNEALED (ASTM A 240M, TYPE 304) Î

ORDERING DESCRIPTION

1.0 GENERAL :

The sheets, plates and strips shall conform to the latest version of ASTM A 240M, Type 304 and comply with the following additional requirements. Î

2.0 APPLICATION :

For general engineering purposes, where corrosion resistance is essential.

3.0 CONDITION OF DELIVERY:

Hot/Cold rolled, solution annealed and descaled (Finish number 1 or 2 B/2D).

4.0 DIMENSIONS AND TOLERANCES

Material shall be supplied to the dimensions specified in BHEL order.

5.0 CHEMICAL COMPOSITION :

As per ASTM A 240M, Type 304. Î

6.0 TEST CERTIFICATES :

Three copies of test certificates shall be supplied along with the following information:

BHEL References :

AA 107 39 -Rev. No.08 / ASTM A 240M, Type:304 Î
BHEL order No,

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

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

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7.0 PACKING AND MARKING :

Sheets shall be supplied in bundles or in packages each weighing upto a maximum of 3000kg. Plates shall be suitably packed to prevent damage during transit.

For plates below 25 mm thick, each pile (preferably of 16 plates) shall be marked with suppliers identification mark, 'AA 107 39 / ASTM A 240M, Type:304, melt No., BHEL order No., on the top plate. Î

Each plate of 25mm thickness and above shall be stamped/painted with the suppliers identification mark, 'AA 107 39 / ASTM A 240M, Type:304 , melt No., BHEL order No., on the top plate. Î

FOR INFORMATION ONLY

CHEMICAL COMPOSITION

C	Si	Mn	Ni	Cr	S	P	N
≤ 0.08	≤ 0.75	≤ 2.0	8.0-10.5	18.0 -20.0	≤ 0.030	≤ 0.045	0.10

MECHANICAL PROPERTIES

Hardness Max		0.2% PS min	UTS min	% El min	Bend Test
BHN	HRB	N/mm²	N/mm²		Dia.
201	92	205	515	40	-

BHEL	**CORPORATE PURCHASING SPECIFICATION**	AA10152 Rev No.07 PREFACE SHEET

STEEL TUBES – ELECTRIC RESISTANCE WELDED / SUBMERGED ARC WELDED

FOR INTERNAL USE ONLY

REMOVE THIS PREFACE BEFORE ISSUE TO SUPPLIERS

Equivalent / Comparable Standards:

1) INDIAN : IS 1239 (Part 1) – 2004, Gr.: ERW

Suggested / Probable Suppliers and Grades:

Refer plant vendors list.

User Plants and Replaced Plant Specifications / References:

1) HEP, BHOPAL : PS10152 - Ungalvanized Tubes.
2) HEEP, HARDWAR : PS10153 - Galvanized Tubes.
3) HPEP, HYDERABAD : HY0120299, HY0210299
4) HPBP, TIRUCHY :

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Revisions:			**APPROVED:**		
Corrected the Clause 11.4 in line with IS 1239 (Part 1)			INTERPLANT MATERIAL RATIONALISATION COMMITTEE – MRC(S&GPS)		
Rev No.07	Amd No.	Reaffirmed	Prepared	Issued	Dt. of 1st Issue
Dt:05-01-2015	Dt:	Year:	HEP, Bhopal	Corp.R&D	July, 1976

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STEEL TUBES – ELECTRIC RESISTANCE WELDED / SUBMERGED ARC WELDED

1.0 GENERAL:

This specification governs the quality requirements of light, medium and heavy grades of Electric Resistance Welded/Submerged Arc Welded steel tubes with plain ends in ungalvanized and galvanized condition in the range of 60mm to 150mm NB.

2.0 APPLICATION:

For general purpose, suitable for bending, welding and screwing for flanges and fittings. Not suitable for steam services.

3.0 CONDITION OF DELIVERY:

Tubes shall be supplied with plain ends.

The ends shall be cut cleanly and square with the axis of the tube.

Unless otherwise specified, tubes shall be supplied in ungalvanized condition.

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: 1239(part 1) – 2004: Steel Tubes, Tubular and other Wrought Steel Fittings
Gr: ERW.

5.0 DIMENSIONS AND TOLERANCES:

5.1 Sizes:

BHEL order shall clearly state the maximum outside diameter, and wall thickness of the tube.

5.2 Tolerances:

5.2.1 Thickness:

Light tubes	+ not limited − 8 percent
Medium and Heavy tubes	+ not limited − 10 percent

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5.2.2 Weight:

Single tube (light series)	+ 10 percent − 8 percent
Single tube (medium and heavy series)	± 10 percent
For quantities per load of 10 tonnes, min (light series)	+ 7.5 percent − 5 percent
For quantities per load of 10 tonnes, min (medium and heavy series)	± 7.5 percent

5.2.3 Internal Weld Fin:

Height of the internal weld fin shall not be greater than 60 percent of the specified thickness.

5.2.4 Length:

5.2.4.1 Random Length:

Tubes shall be supplied in random lengths of 4 to 7 meters, unless otherwise specified and in the line with IS: 1239, Part 1.

5.2.4.2 Exact Length:

When exact lengths are called for, the tolerances shall be + 6 mm, − 0 mm of the specified length.

6.0 MANUFACTURE:

Tubes shall be made from tested quality steel manufactured by any approved process and shall be fully killed.

Tubes shall not be manually welded.

7.0 FREEDOM FOR DEFECTS:

Tubes shall be cleanly finished and reasonably free from injurious defects. They shall be reasonably straight. The ends shall be cut cleanly and reasonably square with the axis of the tube.

8.0 CHEMICAL COMPOSITION:

The melt analysis of steel shall be as follows:

Element	Percent max.	Permissible variation over specified limit, ± max
Carbon	0.20	0.02
Manganese	1.30	0.04
Sulphur	0.040	0.005
Phosphorus	0.040	0.005

9.0 GALVANIZING:

When galvanized tubes are ordered, the Zinc coating on the tubes shall be in accordance with IS: 4736

10.0 TEST SAMPLES:

All tubes bearing the same designation and manufactured under a single process shall be grouped together to constitute a lot. Each lot shall be sampled separately in accordance with IS: 4711

11.0 MECHANICAL PROPERTIES:

11.1 Tensile:

The tensile strength of strips cut form selected tubes, when tested in accordance with IS: 1608 shall be as follows:

Tensile strength : 320 N/mm^2, min.

Elongations on $5.65\sqrt{S_o}$ gauge length:

Up to and including. 25 mm NB : 12 percent, min.
Over 25 mm up to including150 mm NB : 20 percent, min.

Note:

1. For welded tubes, the strip tensile test specimen shall not contain the weld.
2. For galvanized tubes, zinc coating may be removed by stripping prior to tensile test.

11.2 Bend Test (On tubes up to and including 50mm nominal bore):

When tested in accordance with IS: 2329, the tubes shall be capable of withstanding the bend test without showing any signs of fracture or failure.

Tubes shall be bent with the weld at 90^o to the plane of bending. The tubes shall not be filled for this test.

Ungalvanised tubes shall be capable of being bent cold without cracking, through 180^o around a former having a radius at the bottom of groove in the plane of bending equal to at least six times the outside diameter of the tube.

Galvanized tubes shall be capable of being bent cold without cracking of the steel, through 90^o round a former having a radius at the bottom of the groove equal to at least eight times the outside diameter of the tube.

11.3 Flattening Test (On tubes above 50mm nominal bore):

Rings not less than 40mm in length, cut form the end of each selected tubes shall be flattened between parallel plates with the weld at 90^o(point of maximum bending) in accordance with IS:2328. No opening shall occur by fracture in the weld until the distance between the plates is less than 75 percent of the original outside diameter of the tube and no cracks or breaks on the metal elsewhere than in the weld shall occur until the distance between the plates is less than 60 percent of the original outside diameter.

Test rings may have the inner and outer edges rounded.

11.4 Hydraulic Test / Eddy Current Test:

Each tube shall withstand a test pressure of 5 N/mm^2 without showing leakage defects of any kind. The pressure shall be applied and maintained for a minimum period of 3 seconds for proof and inspection.

Note: Eddy current test may be done in place of Hydrostatic test as per the procedure in Annexure – B of IS: 1239, Part-1.

CORPORATE PURCHASING SPECIFICATION

12.0 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 dispatch documents to facilitate quick clearance of the material.

The test certificate shall bear the following information:

AA10152: Rev. No.07: Steel Tubes – ERW/SAW
BHEL order No:

Supplier's Reference:
Name
Identification No.
Melt No.

Results of Tests:
Results of Chemical, Mechanical tests and Hydraulic/Eddy Current test.

13.0 PROTECTIVE COATING:

The tubes shall be protected with a rust preventive coating of varnish, externally throughout the length.

14.0 PACKING AND MARKING:

Each tube shall be plugged at both ends by means of tight fitting end caps.

The tubes shall be suitably packed in bundles/packages to prevent corrosion and damage during transit.

Each bundle/package shall bear the following information:

AA10152: Steel Tubes – ERW/SAW
BHEL Order No.
Consignment/Identification No.
Outside Diameter and Wall Thickness.
Supplier's Name

15.0 REFERRED STANDARDS (Latest Publications Including Amendments):

1) IS: 1608 2) IS: 2328 3) IS: 2329

4) IS: 4736 5) IS: 4711

	CORPORATE PURCHASING SPECIFICATION	**AA 101 47**
		Rev. No. 05
		PREFACE SHEET

CARBON STEEL PIPES-ELECTRIC RESISTANCE WELDED/SUBMERGED ARC WELDED

FOR INTERNAL USE ONLY
REMOVE THIS PREFACE SHEET BEFORE ISSUE TO SUPPLIERS

Comparable Standards:

1. INDIAN : IS : 3589 - 2001
Gr: ERW-Fe 410

Suggested/Probable Suppliers And Grades:

Refer plant vendors list.

User Plant References:

1. BHOPAL : - - -
2. HEEP, HARDWAR : - - -
3. TIRUCHY : BM - 32

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Revisions : **Cl. 26.6.13 of MOM of MRC-S&GPS**			**APPROVED :** **INTERPLANT MATERIAL RATIONALISATION COMMITTEE-MRC (S&GPS)**		
Rev. No. 05	**Amd.No.**	**Reaffirmed**	**Prepared**	**Issued**	**Dt. of 1st Issue**
Dt: 15.01.2004	**Dt :**	**Year : 2013**	**BHOPAL**	**Corp. R&D**	**AUGUST, 1976**

CARBON STEEL PIPES-ELETRIC RESISTANCE WELDED/SUBMERGED ARC WELDED

1.0 GENERAL:

This specification governs the quality requirements of Electric Resistance Welded/Submerged Arc Welded, Carbon Steel Pipes, of 168.3 mm to 2540 mm.

2.0 APPLICATION:

For conveying gas, water and oil.

3.0 CONDITION OF DELIVERY:

Pipes shall be supplied in straight lengths with plain ends.

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 : 3589 - 2001	: Steel pipes for water and sewage
Gr: ERW - Fe 410	:

5.0 DIMENSIONS AND TOLERANCES :

5.1 Sizes:

Pipes shall be supplied to the dimensions specified on BHEL order.
BHEL order shall clearly state the outside diameter and well thickness of the pipe.

5.2 Tolerances:

5.2.1 Wall Thickness:

The tolerances on wall thickness of the pipes shall be ± 10% for ERW and +20%, - 12.5% for SAW.

5.2.2 Straightness:

The deviation from a straight line shall not exceed 0.2% of the length.

5.3 Length:

Pipes shall be supplied in random length of 4 to 7 metres unless exact lengths are called for in BHEL order.

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6.0 MANUFACTURE:

Electric Resistance Welded and Induction Welded, Submerged Arc Welded:

The pipes shall be made from steel plates or strips by butt welding longitudinally or spirally. The weld shall be continuous. Prior to welding, edges or plates or strips may be prepared suitably where required, by process of manufacture.

7.0 FREEDOM FOR DEFECTS :

All pipes shall be cleanly finished and when visually inspected shall be free defects such as cracks, surface flaws, laminations etc. The ends shall be cleanly cut and reasonably square with the axis of the pipes.

8.0 CHEMICAL COMPOSITION :

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

Element	Melt analysis, percent, max.	Permissible variation, for product analysis, max
Carbon	0.20	+ 0.02
Sulphur	0.040	+ 0.005
Phosphorus	0.040	+ 0.005
Manganese	1.30	+ 0.04

9.0 TEST SAMPLES :

Unless otherwise agreed between BHEL and manufacturer, the procedure for sampling of pipe for various tests and criteria for conformance shall be as given in IS:4711. Test samples shall be cut from pipes in final condition of supply.

9.1 Flattening Test:

For pipes produced in single lengths the flattening test shall be made form each end with the welds at 0^0 and 90^0.

For pipes produced in multiple lengths, tests shall also be made on two intermediate rings cut from each multiple lengths of pipe in the weld at 0^0.

10.0 MECHANICAL PROPERTIES :

10.1 Tensile:

When tested in accordance with IS:1608, the tensile properties of strip cut longitudinally (excluding weld) from selected pipe shall show properties given below :

Tensile strength	:	410 MPa, min
Yield stress	:	235 MPa, min.
Elongation on 5.65 √So gauge length	:	18 percent , min.

10.2 Fattening Test (For ERW pipes):

A ring not less than 40mm in length taken form the end of each selected tube shall be flattened between parallel plates as follows, in accordance with IS: 3589.

The test shall be made keeping, the weld at 90^0 to the direction of the force. No opening shall occur by fracture in the weld until the distance between the plates is less than 75 percent of the original diameter of the pipe or no cracks or breaks on the metal elsewhere than the weld shall occur until the distance between the plates is less than 60 percent of the original outside diameter.

10.3 Guided bend test (For SAW pipes):

Strips not less than 40mm wide cut circumferentially from pipes perpendicular to weld seam with weld near the middle of sample shall without fracture be doubled over a round bar the diameter of which shall be calculated as given below: The weld reinforcement shall be removed from faces.

One face and one root bend specimen as per fig.1 of IS:3589 shall be bent 180^0 in a jig in accordance with Fig.2 of IS:3589.

$$A = \frac{1.15\,(D-2t)}{eD/t - 2e - 1}$$

1.15 = peaking factor

D = Specified OD in mm

t = Specified wall thickness in mm

e = Strain in mm i.e. 0.1275 for grade Fe 410

Acceptance of bend test shall be as per clause 9.3.2 and 9.3.3 of IS:3589.

11.0 HYDRAULIC TEST:

Each length of the pipe shall be hydraulically tested at the manufacturer's works, before the pipes is coated, wrapped or lined at the manufacturer's works.

The hydraulic test pressure shall be the pressure calculated from the following formula, except that the maximum test pressure shall not exceed 5 MPa:

$P = 2St/D$

where P = Test pressure in MPa

S = Stress in MPa which shall be taken as 60 percent of the minimum yield stress

t = Specified thickness in mm

D = Specified outside diameter in mm

Test pressure shall be applied and maintained for sufficiently long time for proof and inspection.

NOTE: Normally 5 seconds are sufficient for the purpose of test.

12.0 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 :

AA 101 47: Rev. No. 05: Carbon Steel Pipes-ERW/SAW

BHEL order No,
Supplier's Reference :

Name
Identification
Melt No.

Results of Tests :

Results of Dimensional inspection.
Results of chemical analysis and mechanical & hydraulic tests.

13.0 PACKING AND MARKING :

As agreed to between BHEL and manufacturer, surface coating if required shall be as per guide line given in annex A to D of IS:3589. When tubes are required to be galvanised. The zinc coating shall be in accordance with IS: 4736.

Each pipe shall be die-stamped with the following information:

AA 10147: Carbon Steel Pipes - ERW/SAW

BHEL Order No.

Consignment/Identification No.

Out side Diameter and Wall Thickness.

Supplier's Name

14.0 REFERRED STANDARDS (Latest Publications Including Amendments):

1. IS: 1608 2. IS : 3589 3. IS:4711 4. IS:4736

	CORPORATE PURCHASING SPECIFICATION	AA 101 22
		Rev. No. 15
		PREFACE SHEET

STRUCTURAL STEEL-HIGH TENSILE PLATES, FLATS & BARS

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REMOVE THIS PREFACE SHEET BEFORE ISSUE TO SUPPLIERS

Comparable Standards:

1. GERMAN : DIN EN 10025-2:2004
   Gr: S355 J2 G3
   Mat. No. 1.0577
2. INDIAN : IS: 2062-2006 Grade E350 (Fe 490)

Suggested/Probable Suppliers And Grades:

Refer Plant Vendors List

User Plant References:

1.	BHOPAL	:	PS 10541
2.	JHANSI	:	PS 10541
3.	HEEP, HARDWAR	:	0500.009, HW10181
4.	HYDERABAD	:	HY 021 02 99, HY10591
5.	TRICHY	:	TDC 0:301

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Revisions :	APPROVED :
CL.32.7 of MOM of MRC-S&GPS	**INTERPLANT MATERIAL RATIONALISATION COMMITTEE-MRC (S&GPS)**

Rev. No. 15	Amd.No.	Reaffirmed:	Prepared	Issued	Dt. of 1 st Issue
Dt: 10.11.2009	Dt :	Year :	HYDERABAD	Corp. R&D	JULY, 1976

STRUCTURAL STEEL - HIGH TENSILE PLATES, FLATS & BARS

1.0 GENERAL:

This specification governs the quality requirements of High Tensile Structural Steel Plates where guaranteed weldability is required.

2.0 APPLICATION :

Steel intended for use in structures where enhanced mechanical properties are required and where saving in weight can be effected due to their greater strength.

3.0 CONDITION OF DELIVERY :

Plates shall be supplied in the normalized condition or in an equivalent condition obtained by normalizing rolling.

4.0 COMPLIANCE WITH NATIONAL STANDARDS:

Material shall comply with the requirements of DIN EN 10025-2:2004, Gr: S355J2G3 (Material Number 1.0577) or the equivalent grade of latest version.

The supply of the material as per IS:2062-2006 Grade E350 (Fe 490) (latest version) meeting the requirement of clause 3.0, 5.0, and 12.0 of this specification is also acceptable.

5.0 DIMENSIONS AND TOLERANCES :

5.1 Dimensions :

5.1.1 Sizes

Material shall be supplied to the dimensions specified on BHEL Order.

5.1.2 Length :

Unless otherwise specified, hot rolled bars and sections shall be supplied in 3 to 6 metres length.

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5.2 Tolerances:

The tolerances on dimensions for plates shall comply with DIN EN 10029.

6.0 MANUFACTURE:

Material shall be manufactured from fully killed (FF) steel having a Carbon Equivalent (melt analysis) of:

0.45 max. for plates upto & incl. 30 mm thick

0.47 max. for plates above 40 mm thick upto & incl. 150 mm thick.

0.49 max for plates > 150mm & $\leq$ 250 mm thick.

7.0 FREEDOM FROM DEFECTS :

All finished steel shall be well and cleanly rolled to the dimensions, sections and weights specified. The finished material shall be free from cracks, surface flaws, laminations; rough, jagged and imperfect edges and internal & surface defects.

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	Percent, max.	Permissible variation, percent, maximum
Carbon		
Upto&Incl 40mm thick	0.20	0.03
Above 40mm thick	0.22	0.02
Silicon	0.55	0.05
Manganese	1.60	0.10
Sulphur	0.025	0.010
Phosphorus	0.025	0.010
Copper	0.55	0.050

Note :

1. Total Aluminum: 0.020%, minimum.
2. Micro-alloying elements like niobium, boron, titanium and vanadium may be added by the manufacturer to achieve the mechanical properties specified.
3. Carbon Equivalent (CE) based on melt analysis shall be calculated as per following formula :

$$CE = C + \frac{Mn}{6} + \frac{Cr+Mo+V}{5} + \frac{Ni+Cu}{15}$$

9.0 TEST SAMPLES:

Test samples shall be selected and prepared in accordance with DIN EN 10025. One tensile test piece per 40 tonnes or part thereof shall be selected from finished steel from each melt for each class of products.

10.0 MECHANICAL PROPERTIES (On longitudinal test samples) :

i) Tensile :

The test pieces shall show the following properties, when tested in accordance with IS: 1608 / DIN EN 10025.

Nominal thickness, mm	Tensile strength N/mm^2, min.	Yield strength N/mm^2, min.	Elongation on 5.65 √So gauge length, percent, min.
From 5 to 16	470-630	355	22
Over 16 to 40	470-630	345	22
--- 40 to 63	470-630	335	21
--- 63 to 80	470-630	325	20
---- 80 to 100	470-630	315	20
---- 100 to 150	450-600	295	18
---- 150 to 200	450-600	285	17
---- 200 to 250	450-600	275	17
---- 250 to 400	450-600	265	17

ii) Impact :

The "Choppy Impact test" shall be carried out in accordance with DIN EN 10045-1/IS-1757 at (-20^0C). The impact values achieved shall be as follows.

Nominal thickness (mm)	Impact strength (KCV) (2mm 'V' notch)
< 16	Note (1)
16 ≥ to ≤ 150	27 Joules
150 > to ≤ 250	27 Joules

Note :

(1) Impact test is not required for plates below 16 mm.

The average value of the three test results shall meet the specified requirement. One individual value may be the below minimum average value specified, provided that it is not less than 2/3 rd of the same.

11.0 PROTECTIVE COATING :

Plates upto 10 mm thick shall be applied with a suitable rust preventive coating for overseas shipping only.

12.0 ULTRASONIC EXAMINATION:

Plates above 40mm shall be ultrasonically examined in accordance with BHEL standard AA 085 01 20 (or ASTM A435 / EN10160) and shall comply with the acceptance norms specified therein.

13.0 OPTIONAL:

PRESERVATION:

If specified in order, all plates shall be applied with a suitable rust preventive to avoid pitting.

14.0 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 despatch documents to facilitate quick clearance of the material.

The test certificate shall bear the following information:

(i) AA 101 22-Rev. No.15, DIN EN 10025 Gr. S355J2G3, Matl. No. 1.0577.

(ii) BHEL order No, Melt No, Size & Quantity, Batch No with heat treatment details, Results of Chemical analysis, Mechanical tests & NDT, Supplier's name, Identification No, TC No, Signature of Competent authority, etc.

15.0 PACKING AND MARKING:

Plates shall be transported suitably to avoid damage during transit.

For plates below 10 mm thick, each pile (preferably of 16 mm plates) and each plate 10 mm thick and over shall be marked with Melt No., AA 101 22, BHEL Order No, Supplier's Name, Identification No, Size & weight, on any one corner and encircled with paint preferably of white colour.

15.0 REFERRED STANDARDS (Latest Publications including amendments):

1. IS : 1608	2. IS: 2062	3. DIN EN 10025
4. DIN EN 10029	5. DIN EN 10045-1	6. AA 085 01 20
7. ASTM A435	8. EN10160	9. IS: 1757

	CORPORATE PURCHASING SPECIFICATION	AA10113 Rev No.07 PREFACE SHEET

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

FOR INTERNAL USE ONLY

REMOVE THIS PREFACE BEFORE ISSUE TO SUPPLIERS

Comparable Standards:

1. INDIAN : IS: 5986 – 2011, Gr: 205

Suggested/Probable Suppliers and Grades:

Refer plant vendors list

User Plants References:

1. HEEP, HARDWAR	:	0500.004, Gr.: St.34
2. HPEP, HYDERABAD	:	HY0212299
3. HEP, BHOPAL	:	PS10113
4. HPBP, TRICHY	:	

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Revisions: As per Cl.No.38.1 of MOM of MRC– S&GPS			**APPROVED:** INTERPLANT MATERIAL RATIONALISATION COMMITTEE – MRC(S&GPS)		
Rev No.07	Amd No.	Reaffirmed	Prepared	Issued	Dt. of 1st Issue
Dt:22-02-2014	Dt:	Year:	HEP, Bhopal	Corp.R&D	July, 1976

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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, decaled 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:

a) SERVO RP 125 of M/s. IOC.
b) RUSTOP 387/388 of M/s. HPC
c) Bharat TCPF of M/s. Bharat Petroleum
d) 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

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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.

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:

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.

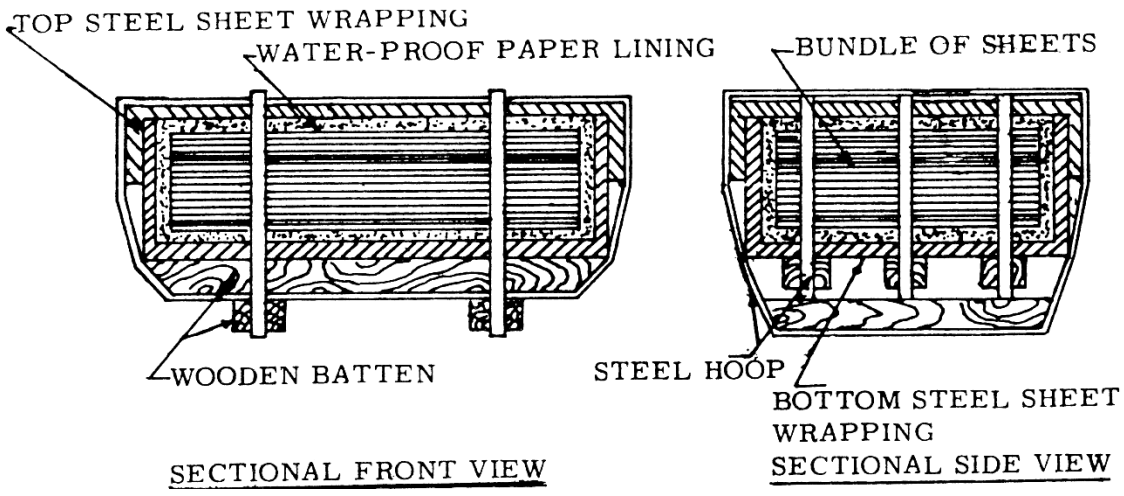
The test certificate shall bear the following information:
AA10113, Rev 07: HOT ROLLED CARBON STEEL SHEET (330 N/mm^2 Tensile)
BHEL Order No,
Supplier's name,
Identification No
Melt No,
Process of manufacture
Details of pickling, descaling and oiling
Results of dimensional inspection
Results of Chemical 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.



Note:

a) Water proof paper lining shall be preferably Volatile Corrosion Inhibitor (V.C.I.) Coated Paper with an additional polythene (100 micron) enveloped.

b) 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/mm^2 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

	CORPORATE PURCHASING SPECIFICATION	AA 101 12
		Rev. No. 07
		PREFACE SHEET

BRIGHT STEEL BARS AND SECTIONS (STANDARD QUALITY)

FOR INTERNAL USE ONLY
REMOVE THIS PREFACE SHEET BEFORE ISSUE TO SUPPLIERS

Comparable Standards:

1. INDIAN : IS : 9550-2001

Suggested/Probable Suppliers And Grades:

Refer plant vendors list

User Plant References:

1.	BHOPAL	:	PS 101 12 BP 101 72
2.	HEEP, HARDWAR	:	0500.053
3.	HYDERABAD	:	HY 021 02 99

Revisions : Cl. 27.2.d of MOM of MRC-S&GPS			APPROVED : INTERPLANT MATERIAL RATIONALISATION COMMITTEE-MRC (S&GPS)		
Rev. No. 07	Amd.No.	Reaffirmed	Prepared BHOPAL	Issued Corp. R&D	Date of 1st Issue SEP, 1976
Dt:15. 06.2005	Dt :	Year : 2013			

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BRIGHT STEEL BARS AND SECTIONS (STANDARD QUALITY)

1.0 GENERAL:

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.

2.0 APPLICATION:

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.

3.0 CONDITION OF DELIVERY:

3.1 Round Bars - Class 4, surface quality.

Upto 50 mm diameter - Cold drawn.
Above 50mm diameter - Cold drawn or Hot rolled, turned and polished

3.2 Rectangular/Square/Hexagonal Bars - Class 3, surface quality.
All sizes - Cold drawn

3.3 Sections - Class 4, surface quality.
All sizes - Cold drawn

3.4 Bars and sections shall be straight, with their ends sheared, square and true and shall have a smooth surface.

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:

i) Servo RP 150 - M/s Indian Oil Corporation
ii) HE - 1612 - M/s. BHEL, Bhopal
iii) Rustilo DW-901 - M/s. Indrol Lubricants and Specialties Ltd.
iv) Rustpro Special - M/s. Tide water oil co.
v) Any other clear TRP conforming to IS: 1154

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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 : 9550 - 2001 : Bright steel bars

:

5.0 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.

6.0 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.

7.0 MANUFACTURE:

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

8.0 FREEDOM FOR DEFECTS :

All finished steel bars and section shall be sound and free from internal and surface defects. They shall be bright and clean.

9.0 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.

10.0 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,
Carbon	0.25	± 0.02
Sulphur	0.040	+ 0.005
Phosphorus	0.04 0	+ 0.005

11.0 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.

12.0 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/mm^2, min

Elongation on 5.65 :
√So gauge length : 8-20%

12.2 Round Bars:

12.2.1 Bars Upto 50 mm Diameter - Cold Drawn:

Tensile strength	:	440 N/mm^2, min
Elongation on 5.65 √So gauge length	:	8-20%

12.2.2 Bars Above 50 mm 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
			OR	
Elongation on 5.65 √So gauge length	:	23%, min		8-20%

13.0 TEST CERTIFICATES :

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

In addition, to the above, 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:

AA 101 12: 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.

14.0 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 50 mm shall be stamped at one end with 'AA10112'. Bars 50 mm 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:

AA 10112: Bright Steel Bars And Sections (Standard Quality)

BHEL Order No.

Consignment/Identification No.

Melt No.

Size and Weight.

Supplier's Name

15.0 REFERRED STANDARDS (Latest Publications Including Amendments):

1. IS: 1154 2. IS : 1608 3. IS:9550

	CORPORATE PURCHASING SPECIFICATION	**AA 101 47**
		Rev. No. 05
		PREFACE SHEET

CARBON STEEL PIPES-ELECTRIC RESISTANCE WELDED/SUBMERGED ARC WELDED

FOR INTERNAL USE ONLY
REMOVE THIS PREFACE SHEET BEFORE ISSUE TO SUPPLIERS

Comparable Standards:

1. INDIAN : IS : 3589 - 2001
Gr: ERW-Fe 410

Suggested/Probable Suppliers And Grades:

Refer plant vendors list.

User Plant References:

1. BHOPAL : - - -
2. HEEP, HARDWAR : - - -
3. TIRUCHY : BM - 32

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Revisions : **Cl. 26.6.13 of MOM of MRC-S&GPS**			**APPROVED :** **INTERPLANT MATERIAL RATIONALISATION COMMITTEE-MRC (S&GPS)**		
Rev. No. 05	**Amd.No.**	**Reaffirmed**	**Prepared**	**Issued**	**Dt. of 1st Issue**
Dt: 15.01.2004	**Dt :**	**Year : 2013**	**BHOPAL**	**Corp. R&D**	**AUGUST, 1976**

CARBON STEEL PIPES-ELETRIC RESISTANCE WELDED/SUBMERGED ARC WELDED

1.0 GENERAL:

This specification governs the quality requirements of Electric Resistance Welded/Submerged Arc Welded, Carbon Steel Pipes, of 168.3 mm to 2540 mm.

2.0 APPLICATION:

For conveying gas, water and oil.

3.0 CONDITION OF DELIVERY:

Pipes shall be supplied in straight lengths with plain ends.

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 : 3589 - 2001	: Steel pipes for water and sewage
Gr: ERW - Fe 410	:

5.0 DIMENSIONS AND TOLERANCES :

5.1 Sizes:

Pipes shall be supplied to the dimensions specified on BHEL order.
BHEL order shall clearly state the outside diameter and well thickness of the pipe.

5.2 Tolerances:

5.2.1 Wall Thickness:

The tolerances on wall thickness of the pipes shall be ± 10% for ERW and +20%, - 12.5% for SAW.

5.2.2 Straightness:

The deviation from a straight line shall not exceed 0.2% of the length.

5.3 Length:

Pipes shall be supplied in random length of 4 to 7 metres unless exact lengths are called for in BHEL order.

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6.0 MANUFACTURE:

Electric Resistance Welded and Induction Welded, Submerged Arc Welded:

The pipes shall be made from steel plates or strips by butt welding longitudinally or spirally. The weld shall be continuous. Prior to welding, edges or plates or strips may be prepared suitably where required, by process of manufacture.

7.0 FREEDOM FOR DEFECTS :

All pipes shall be cleanly finished and when visually inspected shall be free defects such as cracks, surface flaws, laminations etc. The ends shall be cleanly cut and reasonably square with the axis of the pipes.

8.0 CHEMICAL COMPOSITION :

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

Element	Melt analysis, percent, max.	Permissible variation, for product analysis, max
Carbon	0.20	+ 0.02
Sulphur	0.040	+ 0.005
Phosphorus	0.040	+ 0.005
Manganese	1.30	+ 0.04

9.0 TEST SAMPLES :

Unless otherwise agreed between BHEL and manufacturer, the procedure for sampling of pipe for various tests and criteria for conformance shall be as given in IS:4711. Test samples shall be cut from pipes in final condition of supply.

9.1 Flattening Test:

For pipes produced in single lengths the flattening test shall be made form each end with the welds at 0^0 and 90^0.

For pipes produced in multiple lengths, tests shall also be made on two intermediate rings cut from each multiple lengths of pipe in the weld at 0^0.

10.0 MECHANICAL PROPERTIES :

10.1 Tensile:

When tested in accordance with IS:1608, the tensile properties of strip cut longitudinally (excluding weld) from selected pipe shall show properties given below :

Tensile strength	:	410 MPa, min
Yield stress	:	235 MPa, min.
Elongation on 5.65 √So gauge length	:	18 percent , min.

10.2 Fattening Test (For ERW pipes):

A ring not less than 40mm in length taken form the end of each selected tube shall be flattened between parallel plates as follows, in accordance with IS: 3589.

The test shall be made keeping, the weld at 90^0 to the direction of the force. No opening shall occur by fracture in the weld until the distance between the plates is less than 75 percent of the original diameter of the pipe or no cracks or breaks on the metal elsewhere than the weld shall occur until the distance between the plates is less than 60 percent of the original outside diameter.

10.3 Guided bend test (For SAW pipes):

Strips not less than 40mm wide cut circumferentially from pipes perpendicular to weld seam with weld near the middle of sample shall without fracture be doubled over a round bar the diameter of which shall be calculated as given below: The weld reinforcement shall be removed from faces.

One face and one root bend specimen as per fig.1 of IS:3589 shall be bent 180^0 in a jig in accordance with Fig.2 of IS:3589.

$$A = \frac{1.15\,(D-2t)}{eD/t - 2e - 1}$$

1.15 = peaking factor

D = Specified OD in mm

t = Specified wall thickness in mm

e = Strain in mm i.e. 0.1275 for grade Fe 410

Acceptance of bend test shall be as per clause 9.3.2 and 9.3.3 of IS:3589.

11.0 HYDRAULIC TEST:

Each length of the pipe shall be hydraulically tested at the manufacturer's works, before the pipes is coated, wrapped or lined at the manufacturer's works.

The hydraulic test pressure shall be the pressure calculated from the following formula, except that the maximum test pressure shall not exceed 5 MPa:

$P = 2St/D$

where P = Test pressure in MPa

S = Stress in MPa which shall be taken as 60 percent of the minimum yield stress

t = Specified thickness in mm

D = Specified outside diameter in mm

Test pressure shall be applied and maintained for sufficiently long time for proof and inspection.

NOTE: Normally 5 seconds are sufficient for the purpose of test.

12.0 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 :

AA 101 47: Rev. No. 05: Carbon Steel Pipes-ERW/SAW

BHEL order No,
Supplier's Reference :

Name
Identification
Melt No.

Results of Tests :

Results of Dimensional inspection.
Results of chemical analysis and mechanical & hydraulic tests.

13.0 PACKING AND MARKING :

As agreed to between BHEL and manufacturer, surface coating if required shall be as per guide line given in annex A to D of IS:3589. When tubes are required to be galvanised. The zinc coating shall be in accordance with IS: 4736.

Each pipe shall be die-stamped with the following information:

AA 10147: Carbon Steel Pipes - ERW/SAW

BHEL Order No.

Consignment/Identification No.

Out side Diameter and Wall Thickness.

Supplier's Name

14.0 REFERRED STANDARDS (Latest Publications Including Amendments):

1. IS: 1608 2. IS : 3589 3. IS:4711 4. IS:4736

	CORPORATE PURCHASING SPECIFICATION	AA 101 22
		Rev. No. 15
		PREFACE SHEET

STRUCTURAL STEEL-HIGH TENSILE PLATES, FLATS & BARS

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REMOVE THIS PREFACE SHEET BEFORE ISSUE TO SUPPLIERS

Comparable Standards:

1. GERMAN : DIN EN 10025-2:2004
   Gr: S355 J2 G3
   Mat. No. 1.0577
2. INDIAN : IS: 2062-2006 Grade E350 (Fe 490)

Suggested/Probable Suppliers And Grades:

Refer Plant Vendors List

User Plant References:

1.	BHOPAL	:	PS 10541
2.	JHANSI	:	PS 10541
3.	HEEP, HARDWAR	:	0500.009, HW10181
4.	HYDERABAD	:	HY 021 02 99, HY10591
5.	TRICHY	:	TDC 0:301

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Revisions :	APPROVED :
CL.32.7 of MOM of MRC-S&GPS	**INTERPLANT MATERIAL RATIONALISATION COMMITTEE-MRC (S&GPS)**

Rev. No. 15	Amd.No.	Reaffirmed:	Prepared	Issued	Dt. of 1 st Issue
Dt: 10.11.2009	Dt :	Year :	HYDERABAD	Corp. R&D	JULY, 1976

STRUCTURAL STEEL - HIGH TENSILE PLATES, FLATS & BARS

1.0 GENERAL:

This specification governs the quality requirements of High Tensile Structural Steel Plates where guaranteed weldability is required.

2.0 APPLICATION :

Steel intended for use in structures where enhanced mechanical properties are required and where saving in weight can be effected due to their greater strength.

3.0 CONDITION OF DELIVERY :

Plates shall be supplied in the normalized condition or in an equivalent condition obtained by normalizing rolling.

4.0 COMPLIANCE WITH NATIONAL STANDARDS:

Material shall comply with the requirements of DIN EN 10025-2:2004, Gr: S355J2G3 (Material Number 1.0577) or the equivalent grade of latest version.

The supply of the material as per IS:2062-2006 Grade E350 (Fe 490) (latest version) meeting the requirement of clause 3.0, 5.0, and 12.0 of this specification is also acceptable.

5.0 DIMENSIONS AND TOLERANCES :

5.1 Dimensions :

5.1.1 Sizes

Material shall be supplied to the dimensions specified on BHEL Order.

5.1.2 Length :

Unless otherwise specified, hot rolled bars and sections shall be supplied in 3 to 6 metres length.

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5.2 Tolerances:

The tolerances on dimensions for plates shall comply with DIN EN 10029.

6.0 MANUFACTURE:

Material shall be manufactured from fully killed (FF) steel having a Carbon Equivalent (melt analysis) of:

0.45 max. for plates upto & incl. 30 mm thick

0.47 max. for plates above 40 mm thick upto & incl. 150 mm thick.

0.49 max for plates > 150mm & $\leq$ 250 mm thick.

7.0 FREEDOM FROM DEFECTS :

All finished steel shall be well and cleanly rolled to the dimensions, sections and weights specified. The finished material shall be free from cracks, surface flaws, laminations; rough, jagged and imperfect edges and internal & surface defects.

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	Percent, max.	Permissible variation, percent, maximum
Carbon		
Upto&Incl 40mm thick	0.20	0.03
Above 40mm thick	0.22	0.02
Silicon	0.55	0.05
Manganese	1.60	0.10
Sulphur	0.025	0.010
Phosphorus	0.025	0.010
Copper	0.55	0.050

Note :

1. Total Aluminum: 0.020%, minimum.
2. Micro-alloying elements like niobium, boron, titanium and vanadium may be added by the manufacturer to achieve the mechanical properties specified.
3. Carbon Equivalent (CE) based on melt analysis shall be calculated as per following formula :

$$CE = C + \frac{Mn}{6} + \frac{Cr+Mo+V}{5} + \frac{Ni+Cu}{15}$$

9.0 TEST SAMPLES:

Test samples shall be selected and prepared in accordance with DIN EN 10025. One tensile test piece per 40 tonnes or part thereof shall be selected from finished steel from each melt for each class of products.

10.0 MECHANICAL PROPERTIES (On longitudinal test samples) :

i) Tensile :

The test pieces shall show the following properties, when tested in accordance with IS: 1608 / DIN EN 10025.

Nominal thickness, mm	Tensile strength N/mm^2, min.	Yield strength N/mm^2, min.	Elongation on 5.65 √So gauge length, percent, min.
From 5 to 16	470-630	355	22
Over 16 to 40	470-630	345	22
--- 40 to 63	470-630	335	21
--- 63 to 80	470-630	325	20
---- 80 to 100	470-630	315	20
---- 100 to 150	450-600	295	18
---- 150 to 200	450-600	285	17
---- 200 to 250	450-600	275	17
---- 250 to 400	450-600	265	17

ii) Impact :

The "Choppy Impact test" shall be carried out in accordance with DIN EN 10045-1/IS-1757 at (-20^0C). The impact values achieved shall be as follows.

Nominal thickness (mm)	Impact strength (KCV) (2mm 'V' notch)
< 16	Note (1)
16 ≥ to ≤ 150	27 Joules
150 > to ≤ 250	27 Joules

Note :

(1) Impact test is not required for plates below 16 mm.

The average value of the three test results shall meet the specified requirement. One individual value may be the below minimum average value specified, provided that it is not less than 2/3 rd of the same.

11.0 PROTECTIVE COATING :

Plates upto 10 mm thick shall be applied with a suitable rust preventive coating for overseas shipping only.

12.0 ULTRASONIC EXAMINATION:

Plates above 40mm shall be ultrasonically examined in accordance with BHEL standard AA 085 01 20 (or ASTM A435 / EN10160) and shall comply with the acceptance norms specified therein.

13.0 OPTIONAL:

PRESERVATION:

If specified in order, all plates shall be applied with a suitable rust preventive to avoid pitting.

14.0 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 despatch documents to facilitate quick clearance of the material.

The test certificate shall bear the following information:

(i) AA 101 22-Rev. No.15, DIN EN 10025 Gr. S355J2G3, Matl. No. 1.0577.

(ii) BHEL order No, Melt No, Size & Quantity, Batch No with heat treatment details, Results of Chemical analysis, Mechanical tests & NDT, Supplier's name, Identification No, TC No, Signature of Competent authority, etc.

15.0 PACKING AND MARKING:

Plates shall be transported suitably to avoid damage during transit.

For plates below 10 mm thick, each pile (preferably of 16 mm plates) and each plate 10 mm thick and over shall be marked with Melt No., AA 101 22, BHEL Order No, Supplier's Name, Identification No, Size & weight, on any one corner and encircled with paint preferably of white colour.

15.0 REFERRED STANDARDS (Latest Publications including amendments):

1. IS : 1608	2. IS: 2062	3. DIN EN 10025
4. DIN EN 10029	5. DIN EN 10045-1	6. AA 085 01 20
7. ASTM A435	8. EN10160	9. IS: 1757

	CORPORATE PURCHASING SPECIFICATION	AA10113 Rev No.07 PREFACE SHEET

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

FOR INTERNAL USE ONLY

REMOVE THIS PREFACE BEFORE ISSUE TO SUPPLIERS

Comparable Standards:

1. INDIAN : IS: 5986 – 2011, Gr: 205

Suggested/Probable Suppliers and Grades:

Refer plant vendors list

User Plants References:

1. HEEP, HARDWAR	:	0500.004, Gr.: St.34
2. HPEP, HYDERABAD	:	HY0212299
3. HEP, BHOPAL	:	PS10113
4. HPBP, TRICHY	:	

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Revisions: As per Cl.No.38.1 of MOM of MRC– S&GPS			**APPROVED:** INTERPLANT MATERIAL RATIONALISATION COMMITTEE – MRC(S&GPS)		
Rev No.07	Amd No.	Reaffirmed	Prepared	Issued	Dt. of 1st Issue
Dt:22-02-2014	Dt:	Year:	HEP, Bhopal	Corp.R&D	July, 1976

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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, decaled 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:

a) SERVO RP 125 of M/s. IOC.
b) RUSTOP 387/388 of M/s. HPC
c) Bharat TCPF of M/s. Bharat Petroleum
d) 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

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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.

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:

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.

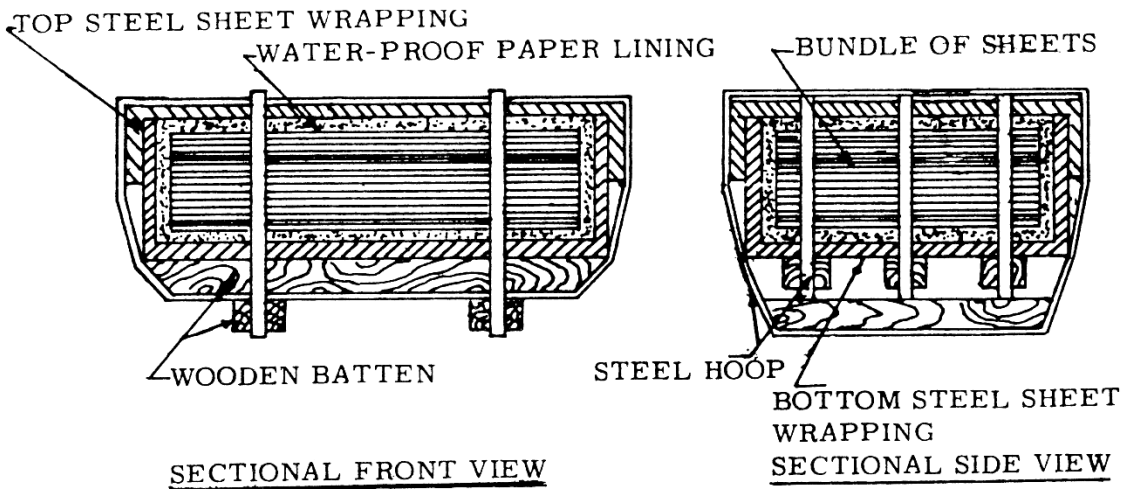
The test certificate shall bear the following information:
AA10113, Rev 07: HOT ROLLED CARBON STEEL SHEET (330 N/mm^2 Tensile)
BHEL Order No,
Supplier's name,
Identification No
Melt No,
Process of manufacture
Details of pickling, descaling and oiling
Results of dimensional inspection
Results of Chemical 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.



Note:

a) Water proof paper lining shall be preferably Volatile Corrosion Inhibitor (V.C.I.) Coated Paper with an additional polythene (100 micron) enveloped.

b) 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/mm^2 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

	CORPORATE PURCHASING SPECIFICATION	AA 101 12
		Rev. No. 07
		PREFACE SHEET

BRIGHT STEEL BARS AND SECTIONS (STANDARD QUALITY)

FOR INTERNAL USE ONLY
REMOVE THIS PREFACE SHEET BEFORE ISSUE TO SUPPLIERS

Comparable Standards:

1. INDIAN : IS : 9550-2001

Suggested/Probable Suppliers And Grades:

Refer plant vendors list

User Plant References:

1.	BHOPAL	:	PS 101 12 BP 101 72
2.	HEEP, HARDWAR	:	0500.053
3.	HYDERABAD	:	HY 021 02 99

Revisions : Cl. 27.2.d of MOM of MRC-S&GPS			APPROVED : INTERPLANT MATERIAL RATIONALISATION COMMITTEE-MRC (S&GPS)		
Rev. No. 07	Amd.No.	Reaffirmed	Prepared BHOPAL	Issued Corp. R&D	Date of 1st Issue SEP, 1976
Dt:15. 06.2005	Dt :	Year : 2013			

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BRIGHT STEEL BARS AND SECTIONS (STANDARD QUALITY)

1.0 GENERAL:

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.

2.0 APPLICATION:

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.

3.0 CONDITION OF DELIVERY:

3.1 Round Bars - Class 4, surface quality.

Upto 50 mm diameter - Cold drawn.
Above 50mm diameter - Cold drawn or Hot rolled, turned and polished

3.2 Rectangular/Square/Hexagonal Bars - Class 3, surface quality.
All sizes - Cold drawn

3.3 Sections - Class 4, surface quality.
All sizes - Cold drawn

3.4 Bars and sections shall be straight, with their ends sheared, square and true and shall have a smooth surface.

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:

i) Servo RP 150 - M/s Indian Oil Corporation
ii) HE - 1612 - M/s. BHEL, Bhopal
iii) Rustilo DW-901 - M/s. Indrol Lubricants and Specialties Ltd.
iv) Rustpro Special - M/s. Tide water oil co.
v) Any other clear TRP conforming to IS: 1154

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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 : 9550 - 2001 : Bright steel bars

:

5.0 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.

6.0 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.

7.0 MANUFACTURE:

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

8.0 FREEDOM FOR DEFECTS :

All finished steel bars and section shall be sound and free from internal and surface defects. They shall be bright and clean.

9.0 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.

10.0 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,
Carbon	0.25	± 0.02
Sulphur	0.040	+ 0.005
Phosphorus	0.04 0	+ 0.005

11.0 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.

12.0 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/mm^2, min

Elongation on 5.65 :
√So gauge length : 8-20%

12.2 Round Bars:

12.2.1 Bars Upto 50 mm Diameter - Cold Drawn:

Tensile strength	:	440 N/mm^2, min
Elongation on 5.65 √So gauge length	:	8-20%

12.2.2 Bars Above 50 mm 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
			OR	
Elongation on 5.65 √So gauge length	:	23%, min		8-20%

13.0 TEST CERTIFICATES :

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

In addition, to the above, 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:

AA 101 12: 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.

14.0 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 50 mm shall be stamped at one end with 'AA10112'. Bars 50 mm 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:

AA 10112: Bright Steel Bars And Sections (Standard Quality)

BHEL Order No.

Consignment/Identification No.

Melt No.

Size and Weight.

Supplier's Name

15.0 REFERRED STANDARDS (Latest Publications Including Amendments):

1. IS: 1154 2. IS : 1608 3. IS:9550