





# CORPORATE PURCHASING SPECIFICATION

AA10108

Rev No.11

PREFACE SHEET

## STRUCTURAL STEEL-STANDARD QUALITY (PLATES, SECTIONS, STRIPS, FLATS & BARS)

FOR INTERNAL USE ONLY

REMOVE THIS PREFACE BEFORE ISSUE TO SUPPLIERS

### 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&amp;GPS

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# CORPORATE PURCHASING SPECIFICATION

AA10108

Rev No. 11

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## STRUCTURAL STEEL-STANDARD QUALITY (PLATES, SECTIONS, STRIPS, FLATS & BARS)

### (ORDERING DESCRIPTION)

#### 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.

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## 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. HEERWAR, HARDWAR : 0500.053  
3. HYDERABAD : HY 021 02 99

**Revisions :**

Cl. 27.2.d of MOM of MRC-S&GPS

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## CORPORATE PURCHASING SPECIFICATION

AA 101 12

Rev. No. 07

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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

#### Revisions:

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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 <sup>2</sup> , 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 <sup>2</sup> , 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	OR	Cold drawn
Tensile strength, min.	410 N/mm <sup>2</sup>		440 N/mm <sup>2</sup>
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/mm<sup>2</sup> 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 :

#### Revisions:

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AA10113

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## HOT ROLLED CARBON STEEL SHEET (330 N/mm<sup>2</sup> 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

Revisions:  
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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.



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## 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:

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Tensile strength	: 330 – 440 N/mm <sup>2</sup>
Yield strength	: 205 N/mm <sup>2</sup> , 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<sup>2</sup> Tensile)

BHEL Order No,

Supplier's name,

Identification No

Melt No,

Process of manufacture

Details of pickling, descaling and oiling

Results of dimensional inspection

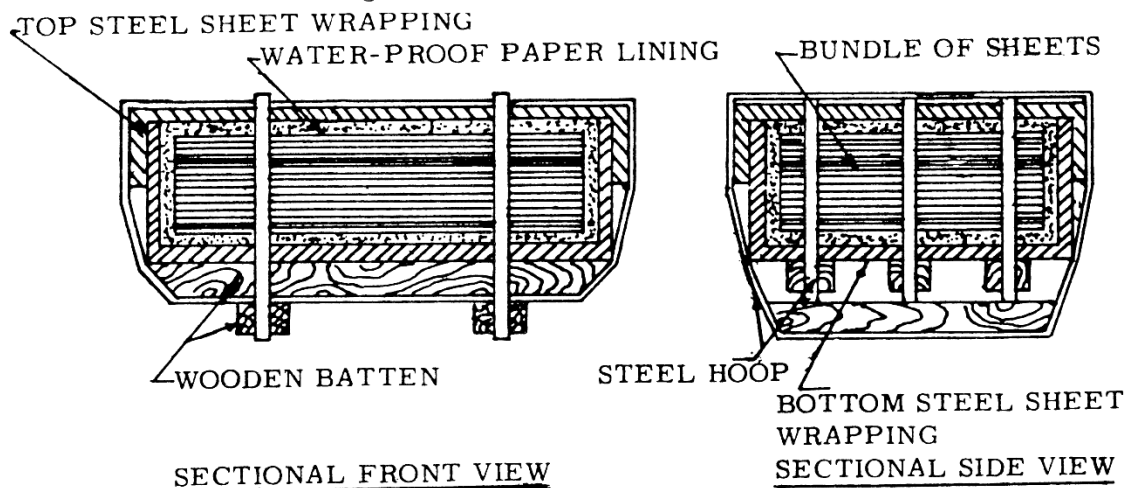
Results of Chemical analysis and Mechanical tests,

**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.





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**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<sup>2</sup> 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  
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### Comparable Standards:

- |           |  |
|-----------|--|
| 1. GERMAN | : DIN EN 10025-2:2004<br>Gr: S355 J2 G3<br>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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## CORPORATE PURCHASING SPECIFICATION

AA 101 22

Rev. No. 15

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### 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.

#### Revisions:

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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 & ≤ 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 :**

- Total Aluminum: 0.020%, minimum.
- Micro-alloying elements like niobium, boron, titanium and vanadium may be added by the manufacturer to achieve the mechanical properties specified.
- 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 <sup>2</sup> , min.	Yield strength N/mm <sup>2</sup> , 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°C). 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. HEER, HARDWAR : ---  
3. TIRUCHY : BM - 32

**Revisions :**

Cl. 26.6.13 of MOM of MRC-S&GPS

**APPROVED :**

INTERPLANT MATERIAL RATIONALISATION  
COMMITTEE-MRC (S&GPS)

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Dt :

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BHOPAL

Corp. R&amp;D

AUGUST, 1976



## CORPORATE PURCHASING SPECIFICATION

AA 101 47

Rev. No. 05

PAGE 1 OF 4

### CARBON STEEL PIPES-ELECTRIC 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 wall thickness of the pipe.

##### 5.2 Tolerances:

##### 5.2.1 Wall Thickness:

The tolerances on wall thickness of the pipes shall be  $\pm 10\%$  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.

#### Revisions:

Cl. 26.6.13 of MOM of MRC-S&GPS

#### APPROVED:

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AUGUST, 1976

**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 from each end with the welds at 0° and 90°.

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°.

**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 $\sqrt{S_0}$ gauge length	: 18 percent , min.

**10.2 Fattening Test (For ERW pipes):**

A ring not less than 40mm in length taken from 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° 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° in a jig in accordance with Fig.2 of IS:3589.

$$1.15 (D-2t)$$

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

$$eD/t - 2e - 1$$

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:

$$P = 2 St/D$$

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

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 :

Revisions:  
Corrected the Clause 11.4 in line with IS 1239 (Part 1)

**APPROVED:**  
INTERPLANT MATERIAL RATIONALISATION  
COMMITTEE – MRC(S&GPS)

Rev No.07	Amd No.	Reaffirmed	Prepared	Issued	Dt. of 1 <sup>st</sup> Issue
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# CORPORATE PURCHASING SPECIFICATION

AA10152

Rev No. 07

PAGE 1 of 4

## 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

Revisions:  
Corrected the Clause 11.4 in line with IS 1239 (Part 1)

**APPROVED:**  
INTERPLANT MATERIAL RATIONALISATION  
COMMITTEE – MRC(S&GPS)

Rev No.07	Amd No.	Reaffirmed	Prepared	Issued	Dt. of 1 <sup>st</sup> Issue
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# CORPORATE PURCHASING SPECIFICATION



## 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



# CORPORATE PURCHASING SPECIFICATION

AA10152

Rev No.07

PAGE 3 of 4

## 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 from selected tubes, when tested in accordance with IS: 1608 shall be as follows:

Tensile strength : 320 N/mm<sup>2</sup>, min.

#### Elongations on $5.65\sqrt{S_0}$ gauge length:

Up to and including 25 mm NB : 12 percent, min.

Over 25 mm up to including 150 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° to the plane of bending. The tubes shall not be filled for this test.

Ungalvanized tubes shall be capable of being bent cold without cracking, through 180° 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° 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 from the end of each selected tubes shall be flattened between parallel plates with the weld at 90°(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<sup>2</sup> 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

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)

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HPBP, Trichy

Corp.R&amp;D

June, 1978

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# CORPORATE PURCHASING SPECIFICATION

AA10445

Rev No. 05

PAGE 1 of 2

## 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.

Revisions:

Cl: 28.2.3 of MOM of MRC – FCF+HTM

**APPROVED:**

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# CORPORATE PURCHASING SPECIFICATION



## 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)     ↑**

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

**Comparable Standards:**

- |             |   |  |   |
|-------------|---|--|---|
| 1. AMERICAN | : | ASTM A 240M<br>Type 316 L, Solution annealed.                  | ↑ |
| 2. INDIAN   | : | IS: 6911 - 1992<br>Gr: X 02 Cr17 Ni12 Mo2 Solution<br>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<br>Gr.: X 10CrNiMo 1810 |  |
| 3. TRICHY         | : | AISI 316 L                              |  |

Revisions :  
CI 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)** †**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. †

**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. †

**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 †  
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

**Revisions :**

CI 28.4.15 of MOM of MRC-S&GPS

**APPROVED :** Interplant Material  
Rationalization Committee-MRC (S&GPS)

Rev. No. 07

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Dt.:09.01.2007

Dt :

Year: 2013

HARDWAR

Corp. R&D

AUGUST, 1978

**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  $\hat{I}$  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.,  $\hat{I}$  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 N/mm <sup>2</sup>	UTS min N/mm <sup>2</sup>	% El min	Cold Bend $\hat{I}$
BHN	HRB				
217	95	170 $\hat{I}$	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) ↑**FOR INTERNAL USE ONLY  
REMOVE THIS PREFACE SHEET BEFORE ISSUE TO SUPPLIERS**Comparable Standards:**

- |             |   |   |   |
|-------------|---|---|---|
| 1. AMERICAN | : | ASTM A 240M<br>Type 304, Solution annealed.             | ↑ |
| 2. INDIAN   | : | IS: 6911 - 1992<br>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      | : | AISI 304; ASTM A 240M, Gr: TP304; |  |
| ↑                 |   | ASEA 2 2333-02                    |  |
| 4. TRICHY         | : | AISI 304                          |  |

**Revisions :**

CI 28.4.16 of MOM of MRC-S&amp;GPS

**APPROVED: Interplant Material  
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Corp. R&amp;D

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

**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. †

**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 †  
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

**Revisions :**

CI 28.4.16 of MOM of MRC-S&GPS

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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.

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.

**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 N/mm <sup>2</sup>	UTS min N/mm <sup>2</sup>	% El min	Bend Test Dia.
BHN	HRB				
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)      ↑**

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

**Comparable Standards:**

- |             |   |   |   |
|-------------|---|---|---|
| 1. AMERICAN | : | ASTM A 240M<br>Type 321, Solution annealed.             | ↑ |
| 2. INDIAN   | : | IS: 6911 - 1992<br>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. HEER - HARDWAR | : | HW 021 02 99             |
| 2. BHOPAL         | : | PS10506 Sheets & Plates  |
| 3. HYDERABAD      | : | AISI 321<br>CSN 417246.1 |

Revisions :

Cl .28.4.16 of MOM of MRC-S&GPS

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

**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. †

**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

**Revisions :**

CL28.4.16 of MOM of MRC-S&GPS

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Corp. R&D

JUNE, 1978

**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 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 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 N/mm <sup>2</sup>	UTS, min N/mm <sup>2</sup>	% El, min	Cold Bend. ↑
BHN	HRB				
217	95	205	515	40	-

**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<br>Gr : 54300           |
| 2. AMERICAN | : | ASTM : B209M – 1992a,<br>alloy 5083 (O) |
| 3. BRITISH  | : | BSEN : 485 – 1998                       |
| 4. GERMAN   | : | DIN : 1725 – 1983,<br>AlMg4.5Mn (W)     |

**Suggested/Probable Suppliers and Grades:**

Refer plant vendors list.

**User Plant References:**

- |           |   |            |
|-----------|---|------------|
| 1. BHOPAL | : | P.S. 12326 |
|-----------|---|------------|

**Revisions :**

Cl: 20.10.26 of MOM of MRC-NFCW+HE

**APPROVED :****INTERPLANT MATERIAL RATIONALISATION  
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Dt :

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HYDERABAD

Corp. R&amp;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 :

Revisions :

Cl: 20.10.26 of MOM of MRC-NFCW+HE

APPROVED :

INTERPLANT MATERIAL RATIONALISATION  
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Dt :

Year :

HYDERABAD

Corp. R&D

01-03-78



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 <sup>2</sup> , min.
0.2% Proof Stress	:	125 N/mm <sup>2</sup> , 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

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	<b>CORPORATE PURCHASE SPECIFICATION</b>	AA 193 31
		Rev. No. 11
		<b>PREFACE SHEET</b>

## CARBON STEEL FORGINGS, CLASS 2

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

### Comparable Standards:

- |           |                                      |
|-----------|--------------------------------------|
| 1. INDIAN | : IS: 2004 - 1991<br>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,<br>SAE1020, IS:2004-CI 2, CSN411373.0, |
| 4. TIRUCHY   | : IS:2004, Class 2   |

<b>REVISIONS :</b> 36 <sup>th</sup> MOM OF MRC (FCF+HTM)			<b>APPROVED :</b> INTERPLANT MATERIAL RATIONALISATION COMMITTEE-MRC (FCF+HTM)		
Rev. No. 11	Amd.No.	Reaffirmed	Prepared	Issued	Dt. of 1st Issue
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**CORPORATE PURCHASE SPECIFICATION**

AA 193 31

Rev. No. 11

PAGE 1 OF 6

**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

**REVISIONS :**

36<sup>th</sup> MOM OF MRC (FCF+HTM)

**APPROVED :**

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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



CORPORATE PURCHASE SPECIFICATION

AA 193 31

Rev. No. 11

PAGE 3 OF 6

**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:

<u>Element</u>	<u>Percent, max.</u>
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 within 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 (CI 11.3)	Limiting ruling section, mm		
		Upto & incl.100	> 100 & upto 400	> 400 & upto 800
Tensile strength, min, N/mm <sup>2</sup>	Longitudinal Transverse/ Radial/ Tangential	430	390	370
Yield strength, min, N/mm <sup>2</sup>	Longitudinal Transverse/ Radial/ Tangential	230	195	185
Elongation on 5.65√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. ↑
- 3.13.2 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. ↑



## CORPORATE PURCHASE SPECIFICATION

AA 193 31

Rev. No. 11

PAGE 5 OF 6

**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

**ANNEXURE-I: RECOMMENDED TEST CERTIFICATE FORMAT FOR FORGINGS**

SUPPLIER'S NAME AND ADDRESS										
TEST CERTIFICATE FOR FORGINGS										
1. Customer:		9. Reduction Ratio	} Ingot to Bloom							
2. TC No. & Date:		10. Batch No.:	} Bloom to Blank							
3. PO No.:		11. Heat/Melt No.								
4. Process of Melting Ingot:		12. Spec.No.								
5. Deoxidisation Process:		13. Test Bar Size & Nos.								
6. Forging Method:		14. Supplier of the ingot/billet/ Bloom and TC reference.								
7. BHEL's Reference for Approval of Bloom										
8. Discard: Top _____ %; Bottom _____ %										
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										
As Per Specn.	Min.	T.S. N/mm <sup>2</sup>	Y.S. 0.5/0.2% Proof N/mm <sup>2</sup>	% Elongation 5.65√So GL	% R.A. Min.	Hardness BHN (Min. 3 values)	Impact Value Joules	Bend Test		
								Angle of bend	Dia of mandrel	Result
	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

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 1 <sup>st</sup> Issue
Dt:01-10-1995	Dt:02-05-2002	Year:2013	HEP, Bhopal	Corp.R&D	MAR. '80

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# CORPORATE PURCHASING SPECIFICATION

AA51401

Rev No.03

PAGE 1 of 6

## 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 leaf) 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 : Timber Species Suitable For Wooden Packaging Groups III & IV

### 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:

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

Revisions:  
Cl. 6.2.2 of MOM of WG – (T&PM)

**APPROVED:**  
INTERPLANT MATERIAL RATIONALISATION  
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Rev No.03	Amd No.01	Reaffirmed	Prepared	Issued	Dt. of 1 <sup>st</sup> Issue
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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 mm Tolerance : +3 mm

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:  $\pm 2\%$  or  $\pm 25$  mm 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 rounded off 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%

July to September (Rainy season): 40%



# CORPORATE PURCHASING SPECIFICATION

AA51401

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## 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 of infection, 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 waness 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.

# CORPORATE PURCHASING SPECIFICATION



## 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 crack 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



# CORPORATE PURCHASING SPECIFICATION

AA51401

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## 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 :

# CORPORATE PURCHASING SPECIFICATION



## 13.0 REJECTION AND REPLACEMENT:

If the material does not conform to the requirements of this specification or found defective during further processing, 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 |





TSD 6208 B

# PLANT STANDARD BHOPAL

BP 049 03 99

Rev. No. 02

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SUPERSEDES  
BP 0490399 Rev.01

## PACKING INSTRUCTIONS FOR GENERAL COMPONENTS/ASSEMBLIES/EQUIPMENTS

### 1. GENERAL:-

This standard lays down packing instructions for packing of Components/Assemblies/Equipments to be despatched against Customer's contracts, for which there are no special instructions issued by the Engineering Departments,

The Components/Assemblies need to be packed suitably to avoid physical damage & corrosion during transit & storage.

For specific applications the concerned engineering department shall issue a product standard, Reference of this product standard, must appear in the Shipping list/Packing List (H).

### 2. SCOPE:-

This standard covers 5 types of Packing Processes identified by a two digit alpha code, This two digit alpha code is to be reflected in the Shipping List/Packing List (H) under "Packing Type", Entry No.29 for Shipping List or Entry No.10 for Packing List (H) by the concerned Engineering Department. If the item described is a Despatchable Unit - "DU".

### 3. TYPE OF PACKING:

The following 5 types of packings have been standardized for packing of General Components/Assemblies.

3.1 'OP' - Open Type.

3.2 'PP' - Partially Packed.

3.3 'CP' - Crate Packing - Components/Equipments requiring physical protection.

3.4 'CQ' - Case Packing - Small & medium Components/ Assemblies/ Equipments which require corrosion & physical protection.

Revision: Brought upto date.

Issued by: *J. M. ...*

STANDARDS AND MATERIALS GROUP  
TECHNICAL SERVICES DEPARTMENT

Rev. No. : 02

Date : 12.1.1996

Date of first issue : 18.10.76

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TSD 6209 A

# PLANT STANDARD BHOPAL

BP 049 03 99

Rev. No. 02

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3.5 'CR' - Case Packing - Electrical Components/Assemblies which require special packing viz. Water Proof, Shock Proof etc.

#### 4. DESCRIPTION OF TYPRS OF PACKING:

The various types of packing, as standardized above, are described below.

##### 4.1 'OP' - Open Type

In case, of components which are not effected by water & dust & do not require special protection & are generally not machined, shall be sent as open packages. However these components may be sent in cretes, wherever necessary.

##### Typical Examples:"

Pipes, Conservator, Foundation/Turbine Parts, Draft tube, Elbow liner, Draft tube pier nose liner, Fabricated large components without machining, Pit Housing (Pelton), Pit Liner. Loose Structures Galvanised Structures, Fan Support, Transformer Tank, Radiators, Conservators etc.

##### 4.2 'PP' - Partially Packed

Components which need special protection, at selected portions only, shall be despatched partially packed. Machined surfaces should not be allowed to come directly in contact with the wood. Such surfaces after application of TRP should be protected with Polyethylene Coated Bitumen Hessain Kraft Paper to AA 51409 or Polyethylene sheet to AA 51408 of at least 100 micron thickness.

Typical Examples - Elbow liner with machined flange, Fabricated large components with machining, inlet pipe, Stay ring, Spiral casing quardrants. Foundation ring, Runner envelope, Lower cone with door etc, etc.

##### 4.3 'CP' - Crate Packing - General

Assemblies/Components which need only physical protection from the point of veiw of handling shall be despatched duly packed in crates.

##### 4.4 'CQ' - Case Packing - Machined Components/Assemblies/ Equipments

Small & medium sized components/assemblies/equipments due to size/weight & to avoid handling, and pilferage, problems shall be packed in Case/Containers.

Wherever required sdequate quantity of silicagel to AA 55619 or VCI Powder/ Tablets, packed in thin muslin cloth cotton bags shall be suitably placed.



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# PLANT STANDARD BHOPAL

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Small machines/components of less weight, shall be provided with suitable cushioning. Wood Wool/Expanded Polyethylene Foam Sheet, if used, shall be sandwiched between polyethylene sheet and sealed.

The components inside the case shall be entirely covered with a polyethylene sheet of at least 100 micron thickness to AA 51408, where-ever required.

### Typical Examples:

Fitted Bolts, Highly finished components like pins & shear pins, Bearing pads, Carbon and ferro-asbestos rings, Oil coolers, Springs, shaft and Inlet valve trunnion etc.

#### 4.5 'CR' - Case Packing - Electrical & Electronic Components/Assemblies .

Delicate components likely to be damaged e.g. Gauges, Instruments etc. are to be wrapped in waxed paper or polyethylene air bubble film and packed in cartons.

Adequate quantity of Silicagel to AA 55619 packed in cotton bags, of 100 grams each are to be suitably placed in the cartons. The cartons shall be entirely covered with a polyethylene sheet to AA 51408 of at least 100 micron thickness, before being packed in the cases.

VCI Powder/Tablets, can be used as an alternative to Silica Gel to AA 55619.

Empty space in the cartons shall be filled with small chips of Expanded Polystyrene (Thermocole), Wood Wool etc.

Polyethylene air bubble film shall conform to IS:12787/AA51426.

Expanded polystyrene (Thermocole) shall conform to AA 51416.

The cartons shall be manufactured from corrugated Fibre Board, meeting requirements of AA 51414.

### Typical Examples

Electrical/Electronic components, Level indicator, Gauges & instruments, Oil level relay, limit switch, Pressure relay, Resistance thermometer, Governor & its components etc.

#### 5. TYPICAL CONSTRUCTION OF PACKING CASES

##### 5.1 General:

The components/assemblies are to be packed as per clause 4.3, 4.4 & 4.5 depending on the type of the component/assemblies, before they are ready to be put into the wooden case/crates.



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## 5.2 Material:

The packing wood shall conform to AA 51401 - Coniferous Timber, for General Packing Purposes.

## 5.3 Type of Cases:

For specific requirements of packing, the cases are to be provided with Tongue and Groove joints.

## 5.4 Preparation of Packing Case

5.4.1 The base of the case shall be made of wooden battens & planks giving necessary reinforcement, such that the bottom of the equipment is at a height of 100 to 200 mm from the ground level depending upon size, & weight of equipment,

NOTE: However for packing cases of smaller size equipment can be at a height of 40 mm from the ground level.

5.4.2 In case of 'CR' - Packing Viz. Electricel & Electronic components & instruments/assemblies, a rubber sheet, strips/expanded polyethene foam sheet, preferably 10 mm thick, shall be fixed on to the base to act as cushioning to the equipment.

5.4.3 The four sides, shall be lined, from inside with packing paper water proof bitumen laminated to AA 51410 Type - I or polyethylene sheet to AA 51408 of at least 100 micron thickness and tacked at suitable places.

Whenever specified in addition to the bitumen laminated paper/polyethylene sheet the top cover will have a layer of bitumen felt over the cover. This should project about 100 - 260 mm on all sides.

It is preferable to have a single piece of the above kraft paper fixed on the four sides. In case jointing is unavoidable, it should be done by overlapping of approximately 100 mm.

5.4.4 Place the Components/cartons with corrosion inhibitors duly applied wherever necessary & place suitably, thin muslin cloths bags containing 100 grams (approx) of activated Blue Silica Gel to AA 55619, wherever necessary. Alternatively VCI Powder or Tablet may be used.

5.4.5 In case, depression is formed, at the top, after the equipment is lowered, provide plyboard/wooden battens.

5.4.6 Cover the whole equipment with polyethylene sheet of at least 100 micron thickness, on all sides preferably by a single piece.



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BHOPAL**

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- 5.4.7 For indoor panels/equipments, provide suitable packing battons with covering of Thermocole/expanded soft polyethylene foam/polyethylene air bubble film wrapped with suitable cords, to avoid cutting of the polyethylene sheet so that finished surface is not damaged\*\*
- 5.4.8 Empty space in the box shall be filled with adequate cushioning material e.g. Thermocole Chips, Wood Wool etc. to avoid movement & shocks. alternatively put wooden blocks/battons wherever necessary.
- 5.4.9 The inner side of the top cover shall be lined with polyethylene sheet, of at least 100 micron thickness, which shall project approximately 25 to 150 mm depending upon the sine of the case on all sides of the top cover shall be provided below the top cover. This projection, after nailing the top cover, shall be folded over, on the sides of the crates & tacked, to, prevent ingress of water from the top.
- 5.4.10 Follow the General Precautions, specified in clause 6.
- 6. GENERAL PRECAUTIONS:**
- 6.1 Before packing the components, in cases, it should be ensured by the manufacturing departments that wherever required suitable rust preventives have been used for effective protection in line with Plant Standard BP 069 00 84 "Protection of Ferrous Components with Temporary Rust Preventive Systems".
- 6.2 Packing cases, crates, cradles and shooks, manufactured as per drawing & procured from outside suppliers shall conform to BP 085 14 99 "Technical Delivery Conditions For Wooden Packagings".
- 6.3 Whenever felt necessary, the top of packing boxes, of important items, shall be made tapered/inclined.
- 6.4 While fixing the nails during packing necessary care shall be taken to ensure that materials used for protection inside the case e.g. Paper, Polyethylene sheet, Coir etc. do not get damaged.
- 6.5 Rubber Sheets of diemnsions depending upon the weight/type of equipments shall be used & shall conform to the following corporate purchase specifications.
- AA 59001 : "Sheet Rubber Jointing - Gr.I, Type A".
- AA 59002 : "Sheet Rubber Jointing - Gr.II, Type A".
- 6.6 Water Proof Bitunised Paper shall conform to following Corporate Purchasing Specification.
- AA 51410 : "Packing Paper Water Proof Laminated Type I".



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**PLANT STANDARD  
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- 6.7 "Expanded Polyethylene Foam Sheet" shall conform to AA 51420.
- 6.8 Wherever possible, equipment shall be bolted to the case, and secured to the bottom in preference to the sides or ends. Large Washers are to be provided to distribute the pressure.
- 6.9 Steel packing hops shall be provided at suitable positions.
- 6.10 Sling protection brackets to be provided on cases wherever required.
- 6.11 It shall be ensured that all stencil marks outside the casing shall be of water proof material to prevent obliteration in transit.

Following materials shall be used for marking & stencilling.

BP 58187 "Yellow Marking & Stencilling Paint".

BP 56188 "Brilliant Green Marking And Stencilling Paint".

Black And Red Marking Ink to IS:1234 "Ink, Stencil, Oil Base, For Marking Porous Surfaces" or duplicating ink stencilling, oil base for marking porous surfaces.

- 6.12 Multi Layered Cross Laminated Plastic Film of 45 g.s.m. to AA 51420 may be used as an alternative to Polyethylene Film Sheet to AA 51408.
- 6.13 The following details are to be marked on the packing cases:
- i) Address of Consignee.
  - ii) W.O.No.
  - iii) Description of item or title of packing list (Optional).
  - iv) Case No.
  - v) Tare Weight, (Optional)
  - vi) Gross Weight (Optional)
  - vii) Dimensions of box.
  - viii) Marking showing upright position.
  - ix) Marking showing sling position, wherever necessary.
  - x) Marking showing umbrella (i.e. for machines/components to be stored under covered storage).



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# PLANT STANDARD BHOPAL

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- xi) All cases containing fragile items are to be stencilled with red marking and stencilling paint/ink "HANDLE WITH CARE", "FRAGILE DO NOT TURN OVER" and other International Markings if any, Refer AA 028 26 01 for details.
- xii) In case of returnable steel containers full address for return to be marked.
- xiii) Any other special markings.

## 7. STEEL CONTAINERS:

Steel containers for packing can be used in case of repeated supplies of the same equipment. Empty steel containers are to be returned back from customer's end and to be reused for the next supplies.

The containers are to be made of structural steel as per AA 10108 with proper reinforcement with I, C and T Sections.

Following precautions are to be taken during packing:-

- i) Put the machine in the steel container properly.
- ii) Cover the machine with polythene.
- iii) To arrest the movement in the steel container necessary wooden Blocks/Battons may be put.
- iv) Put cover on steel container and Bolt Properly.



OLD PR SPEC NO

TRANSFORMER DIVISIONAL STANDARDS

**TITLE – PAINTING OF TRANSFORMER/REACTOR TANK AND ACCESSORIES WITH EPOXY PRIMER (AA56180) AND EPOXY FINISHING PAINT (BP56179)**

**1. General**

This standard details the process to be followed for painting of transformer / reactor tanks, conservator, header, turret etc (to be referred as tank ) by brushing or spraying .

This standard details the schedule for the application of 2 coats of cream or white shade paint to BP 56179 by brushing / spraying for inside tank surface while 2 coats of primer paint to AA 56105 (by brushing/spraying) followed by 2 coats of grey shade finishing paint to BP 56179 (by brushing / spraying ) for out side surface of transformer tank.

**2. Material:**

- |  |                                  |
|--|----------------------------------|
| 2.1 Chemical Resisting epoxy primer  | AA56105                          |
| 2.2 Chemical and good thermal resistant epoxy enamel<br>light grey shade no 631 of IS : 5<br>Dark grey shade no 632 of IS : 5<br>Pale cream shade no. 352 of IS : 5<br>white shade . | BP56179                          |
| 2.3 Thinner for chemical resisting epoxy primer finishing paint  | Thinner for BP56179              |
| 2.4 White spirit Grade 145/205   | AA56105<br>AA56701               |
| 2.5 Water proof abrasive paper Grit 220  |                                  |
| 2.6 Degreasing agent   | Teepol or chemokleen liquid 1009 |

**3.0 Preparation of the paint**

**3.1 Mixing of paint**

The paints as supplied , consist of two separate ingredients, namely base and accelerator , shortly before mixing and use , these shall be thoroughly stirred. The base and the accelerator shall be accurately mixed together in the proportions as given in the table.

Rev.2B  
date  
15.5.10

Drg. Retraced

AKG/ *[Signature]*

Dist

STANDARD SECTION

Issued by TRE Jhansi

Date 08-09-94

Prepared SD

Approved SD



OLD PR SPEC NO

TRANSFORMER DIVISIONAL STANDARDS

**3. Preparation of the paints ( contd.)**

TYPE	COLOR/ SHADE	SUPPLIERS NAME	SUPPLIERS GRADE	PAINT MI	XING RATIO
				IN PARTS	BY VOLUME
				BASE	ACCELERATOR
primer	Red Yellow yellow	Shalimar paint	Epigard-4	3	1
		Asian paint	Red oxide Zinc phosphate	3	1
		Garware paint	Apcodur cp-684 HPR3971 (90+/K4306)	5	1
Finishing	Light grey (no 631 of IS :5)	Asian paint	apcodur cp -692	4	1
		Shalimar paint	Epigard-4	3	1
Finishing	Dark grey (no 632 of IS :5)	Shalimar paint	3970/1 and 3970/2	2	1
		Asian paint	CF -691	4	1
Finishing	Pale cream	Shalimar paint	Epigard-4	3	1
		Asian paint	CF -691	4	1
		Garware paint	EPA 352	3	2
Finishing	white	Shalimar paint	Epigard-4	3	1

Accelerator should be added to the base and not the base to the accelerator. The paints shall be mixed with continuous stirring until a uniform consistency is obtained.

**3.1.1 Consistencies of the paints**

The paints mixed as per cl 3.1 shall be used at the consistencies as given below

Description	Flow time of the paints in cup no 4 of IS: 3944	
	Spraying	Brushing
Primer as well as finishing paint	30 +/- 2 sec	50 +/- 10 sec

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10.9.09

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Date 08-09-94

Prepared SD

Approved SD



TR10206P

PRODUCT STANDARD TRANSFORMER

Page 3 of 6

OLD PR SPEC NO

The above consistencies shall be adjusted using epoxy thinner of these paints and these flow times shall be maintained independently of temperature within normal shop variation..

**Important notes:**

After mixing , the paint shall be allowed to mature for 30 minutes. The mixed paint shall be used within 4 hours.

**4. SURFACE PREPARATION**

TR10206P

**4.1 Dressing and Grinding**

Page 4 of 6

OLD PR SPEC NO

TRANSFORMER DIVISIONAL STANDARDS

After welding all welds and flame cut edges shall be dressed and any major surface imperfections removed by grinding.

**NOTE:** After dressing and grinding the tank shall be subjected to air/oil pressure tests vacuum test as per drawing. The surface shall be visually examined. In case of any deficiency the surface shall be cleaned by suitable mean, i.e. brushing etc.

**4.2 Degreasing**

The surface shall be degreased by using degreasing agent (cl 2.6) mixed with water in 15% approx concentration i.e. 1 liter of water with 150 to 160 ml of degreasing agent. These shall be warmed to 60 to 70 deg C and shall be applied at a low pressure.

After degreasing, the operator shall carry out a visual inspection of the results.

Surfaces that are difficult to wash shall be inspected carefully. If impurities still remain on the objects, these shall be degreased again..

Afterwards before drying, clean the surface with fresh water at about 60 deg C by means of high pressure water ejection pump..

Finally dry the surface using compressed air.

**5.0 Safety Precautions**

Protect the eyes against splashes, use protective goggles and plastic gloves. Use breathing protection with pre filter, fine filter and gas filter..

**4.3 De scaling and cleaning**

**4.3.1.1 Tanks smaller than shot blasting plant**

After degreasing operation as per cl 4.2 the tank shall be shot blasted to Swedish standard SIS 055900 Gr. SA 2.5 and then painted with priming paint or finishing paint as required.

Above time shall be maintained after attaining the temp of 90 +/- 10 deg C

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**5.1.1 Application of first coat of cream/white shade paint**

The first coat of cream/white shade paint as prepared in clause 3.1 above shall be applied by brushing / spraying .

The painted surface shall be allowed to dry for 20 minutes at room temperature

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**5.1.2 Application of second coat of cream/white shade paint**

The second coat of cream /white shade paint shall be applied as in clause 5.1.1 above.  
In case of damage to painted surface , it shall be retouched with the cream / white shade paint..

**5.2 Painting of outside of transformer tank**

**5.2.1 Application of first coat of primer**

The first coat of primer as prepared in clause 3.1 above shall be applied by brushing / spraying .Before application of primer coat surfaces shall be cleaned by compressed air to remove dust etc if any.

The painted surface shall be allowed to dry for 20 minutes at room temperature after paint application..

Thereafter it shall be dried by baking in ann oven at 90 +/- 10 deg C as per clause 5.0

**5.2.2 Application of second coat of primer**

The second coat of primer shall be applied as in cl 5.2.1 above

**5.2.3 APPLICATION OF FIRST COAT OF FINISHING PAINTS**

(Light Grey or Dark Grey) :

Same as clause 5.1.1 except that paint shall be in light grey/ dark grey shade (as required) finishing paint.

**5.2.4 APPLICATION OF SECOND COAT OF FINISHING PAINT**

(Light Grey or Dark Grey) :

Same as clause 5.1.2 except that paint shall be in light grey/ dark grey shade (as required) finishing paint.

In case of damage of painted surface , it shall be retouched with the light grey/ dark grey shade paint as required.

**NOTE:**

1. The time gap between any two successive coats shall not be more than 7 days.
2. In case baking facility is not available , surface shall be allowed to air dry for 16 hours.

The test shall be carried out generally in line with ASIM D 3359 except that pressure sensitive adhesive tape of 25 mm width shall conform to IS : 2880

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**7. REPAIR OF DAMAGED PAINT WORK**

7.1. Remove the damaged paint by using chisel/grinder or other convenient tool.

7.2 Roughen the surface by using a rough emery/ wire brush.



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It is recommended that first coat of paint is applied within 24 hours of completion of shot blasting to control onset of corrosion on the surface . Before application of the paint condition of the surface shall be visually examined. In case of any deficiency the surface shall be cleaned by suitable mean. i.e. brushing etc.

**4.3.2 Tanks larger than shot blasting plant**

Such tank shall be shot blasted in parts. To start with a portion of tank shall be shot blasted to Swedish standard SIS 055900 Gr SA 2.5 and first coat of primer or finishing paint as required shall be applied preferably within 24 hours of completion of shot blasting to control onset of corrosion on the surface. Before application of the paint condition of the surface shall be visually examined. In case of any deficiency the surface shall be cleaned by suitable mean i.e. by wire brushing etc.

**Note :** In case shot blasting facility is not available the tank shall be sand blasted as per plant standard BP0690098

**5.0 APPLICATION OF PAINTS**

The paints shall be applied by spraying/brushing and then stoved in painting booth.

Setting temperature and indicating temperature shall be 90 +/- 10 deg C.

Stoving time shall be adjusted as per following given time.

Transformer tanks - 1 hour

Accessories/pipework - 1 hour

Smaller item less than 100 Kg - 1 hour

Above time shall be maintained after attaining the temp of 90 +/- 10 deg C

**5.1 Painting on inside of transformer tank**

**5.1.1 Application of first coat of cream/white shade paint**

The first coat of cream/white shade paint as prepared in clause 3.1 above shall be applied by brushing / spraying .

The painted surface shall be allowed to dry for 20 minutes at room temperature after paint application.

Thereafter it shall be dried by baking it in oven at 90 +/- 10 deg C as per clause 5.0.

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TRANSFORMER DIVISIONAL STANDARDS

**6.0 INSPECTION FOR PROCESS CONTROL****6.1 Thickness****6.1.1 Outside paint film thickness**

The average total dried paint film thickness shall be with in 80 to 150 micron. However at certain local points, dry paint film thickness up to 300 microns shall be acceptable

**6.1.2 Inside paint film thickness**

The average total dried paint film thickness shall be with in 35 to 100 micron. However at certain local points, dry paint film thickness up to 200 microns shall be acceptable.

**6.2 Visual Finish**

Finish of the painted surface shall be smooth and glossy.

**6.3 Adhesion by Tape test**

This test is carried out by applying & removing pressure sensitive adhesion tape over cuts made in the paint film to ensure that adhesion of paint film to metallic substrate is adequate.

The test shall be carried out generally in line with ASIM D 3359 except that pressure sensitive adhesive tape of 25 mm width shall conform to IS : 2880 Method A of ASIM D 3359 shall be followed in case thickness of film is greater than 125 microns & acceptance criterion shall be "4A" and method B of ASIM D 3359 shall be followed when thickness of paint film is between 50 to 125 microns and acceptance criterion shall be "4B",

**7. REPAIR OF DAMAGED PAINT WORK**

- 7.1 Remove the damaged paint by using chisel/grinder or other convenient tool.
- 7.2 Roughen the surface by using a rough emery/ wire brush.
- 7.3 Remove oil or grease from the surface by swabbing with white spirit soaked cotton cloth.. Allow the residual white spirit to evaporate from the surface.
- 7.4. Apply primer/ finishing paint as per relevant clauses above.

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