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

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STRUCTURAL STEEL-STANDARD QUALITY

(PLATES, SECTIONS, STRIPS, FLATS & BARS)

(ORDERING DESCRIPTION)

1.0 GENERAL:

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

2.0 APPLICATION:

For general engineering purpose.

3.0 CONDITION OF DELIVERY:

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

4.0 COMPLIANCE WITH NATIONAL STANDARDS:

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

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

5.0 DIMENSIONS AND TOLERANCES:

5.1 DIMENSIONS:

5.1.1 Sizes

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

5.1.2 Length

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

5.2 Tolerances:

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

5.2.2 Straight for hot rolled bars:

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

6.0 HARDNESS (BRINELL):

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

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

7.0 TEST CERTIFICATES:

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

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

The test certificate shall bear the following information.

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

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

8.0 PACKING AND MARKING:

Plates shall be transported suitably to avoid damage during transit.

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

9.0 REFERRED STANDARDS (Latest publications including amendments):

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

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

STRUCTURAL STEEL-HIGH TENSILE PLATES, FLATS & BARS

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

Comparable Standards:

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

Suggested/Probable Suppliers And Grades:

Refer Plant Vendors List

User Plant References:

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

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

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

STRUCTURAL STEEL - HIGH TENSILE PLATES, FLATS & BARS

1.0 GENERAL:

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

2.0 APPLICATION :

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

3.0 CONDITION OF DELIVERY :

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

4.0 COMPLIANCE WITH NATIONAL STANDARDS:

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

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

5.0 DIMENSIONS AND TOLERANCES :

5.1 Dimensions :

5.1.1 Sizes

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

5.1.2 Length :

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

5.2 Tolerances:

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

6.0 MANUFACTURE:

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

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

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

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

7.0 FREEDOM FROM DEFECTS :

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

8.0 CHEMICAL COMPOSITION:

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

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

Note :

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

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

9.0 TEST SAMPLES:

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

10.0 MECHANICAL PROPERTIES (On longitudinal test samples) :

i) Tensile :

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

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

ii) Impact :

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

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

Note :

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

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

11.0 PROTECTIVE COATING :

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

12.0 ULTRASONIC EXAMINATION:

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

13.0 OPTIONAL:

PRESERVATION:

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

14.0 TEST CERTIFICATES:

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

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

The test certificate shall bear the following information:

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

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

15.0 PACKING AND MARKING:

Plates shall be transported suitably to avoid damage during transit.

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

15.0 REFERRED STANDARDS (Latest Publications including amendments):

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

	CORPORATE PURCHASING SPECIFICATION	AA10501 Rev No.14 PREFACE SHEET

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

FOR INTERNAL USE ONLY

REMOVE THIS PREFACE BEFORE ISSUE TO SUPPLIERS

Comparable Standards:

1) INDIAN : IS: 5517 – 2004 Gr: 40Ni6Cr4Mo3, Type J, H&T

Suggested/Probable Suppliers and Grades:

Refer Plant Vendors list

User Plants References:

1) HEP, BHOPAL : PS10559
2) HEEP, HARDWAR : ---
3) HPEP, HYDERABAD : HY0210299
4) HPBP, TRICHY : En 24

Revisions:	**APPROVED:**				
Revised as per email dt 18.12.08 from Shri Gopal Bhatt from Bhopal.	INTERPLANT MATERIAL RATIONALISATION COMMITTEE – MRC(S&GPS)				
Rev No.14	Amd No.	Reaffirmed	Prepared	Issued	Dt. of 1st Issue
Dt:18-12-2008	Dt:	Year:2014	HEP, Bhopal	Corp.R&D	April, 1977

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

1.0 GENERAL:

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

2.0 APPLICATION:

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

3.0 CONDITION OF DELIVERY:

Hot Rolled / Forged; Hardened and tempered.

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

The ends of bars shall be reasonably square and true.

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

4.0 COMPILANCE WITH NATIONAL STANDARDS:

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

IS: 5517 – 1993 Gr: 40Ni6Cr4Mo3, Type: J Hardened & Tempered	Steels for Hardening and Tempering - Specification

5.0 DIMENSIONS AND TOLERANCES:

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

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

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

CORPORATE PURCHASING SPECIFICATION

5.2 Tolerance:

5.2.1 Hot rolled bars: The bars shall not vary from specified diameter or distance across flats by more than ± 2½ %.

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

Diameter, mm	**Tolerance, mm**
50 mm to 175 mm	+ 8.0 mm
Above 175 mm	+ 12.5 mm

Note: (Hot rolled & forged bars).

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

6.0 MANUFACTURE:

Material shall be manufactured from fully killed steel.

7.0 HEAT TREATMENT:

The recommended heat treatment is as follows:

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

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

8.0 FREEDOM FROM DEFECTS:

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

9.0 CHEMICAL COMPOSITION:

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

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

10.0 TEST SAMPLES:

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

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

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

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

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

11.0 MECHANICAL PROPERTIES (In Hardened and Tempered Condition):

Ruling section, mm	Tensile strength, N/mm²	0.2%/PS/YS N/mm² min	%E $5.65\sqrt{S_0}$ min	* IZOD impact J, min	Hardness ** BHN
up to 30	1200, min	1000	10	30 (25)	360 – 420
> 30 to = 60	1100 – 1250	880	11	41 (35)	330 – 390
> 63 to = 100	1000 – 1150	800	13	48 (42)	300 – 350
>100 to = 150	900 – 1050	700	15	55 (50)	270 – 300
>150	800 – 950	600	16	55 (50)	240 – 285

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

** Hardness shall be reported for information only.

12.0 ULTRASONIC TEST:

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

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

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

CORPORATE PURCHASING SPECIFICATION

13.0 TEST CERTIFICATES:

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

The test certificate shall bear the following information:

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

Supplier's References:

Name:
Identification No:
Melt No:
Details of heat treatment:

Result of Tests:

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

14.0 PACKING AND MARKING

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

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

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

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

AA10501: 1.5% Nickel-Chromium-Molybdenum Hot Rolled/Forged Steel Bars- H & T.
BHEL Order No.:
Consignment/Identification No.:
Melt No.:
Size and Weight:
Supplier's Name:

15.0 REFERRED STANDARDS (Latest Publications Including Amendments):

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

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

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

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

Comparable Standards:

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

Suggested/Probable Suppliers and Grades:

Refer Plant Vendors list

User Plant References:

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

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Rev. No. 07	**Amd.No.**	**Reaffirmed**	**Prepared**	**Issued**	**Dt. of 1st Issue**
Dt.:09.01.2007	**Dt :**	**Year: 2013**	**HARDWAR**	**Corp. R&D**	**AUGUST, 1978**

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

ORDERING DESCRIPTION

1.0 GENERAL:

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

2.0 APPLICATION:

For general engineering purposes, where corrosion resistance is essential.

3.0 CONDITION OF DELIVERY:

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

4.0 DIMENSIONS AND TOLERANCES:

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

5.0 CHEMICAL COMPOSITION :

As per ASTM A 240M, Type 316 L. Î

6.0 TEST CERTIFICATES :

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

BHEL References :

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

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

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

7.0 PACKING AND MARKING:

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

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

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

FOR INFORMATION ONLY

CHEMICAL COMPOSITION :

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

MECHANICAL PROPERTIES :

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

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

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

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

Comparable Standards:

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

Suggested/Probable Suppliers and Grades:

Refer Plant Vendors list

User Plant References:

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

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

Rev. No. 08	**Amd.No.**	**Reaffirmed**	**Prepared**	**Issued**	**Dt. of 1st Issue**
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AUSTENITIC STAINLESS STEEL SHEETS, PLATES AND STRIPS - SOLUTION ANNEALED (ASTM A 240M, TYPE 304) Î

ORDERING DESCRIPTION

1.0 GENERAL :

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

2.0 APPLICATION :

For general engineering purposes, where corrosion resistance is essential.

3.0 CONDITION OF DELIVERY:

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

4.0 DIMENSIONS AND TOLERANCES

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

5.0 CHEMICAL COMPOSITION :

As per ASTM A 240M, Type 304. Î

6.0 TEST CERTIFICATES :

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

BHEL References :

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

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

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

7.0 PACKING AND MARKING :

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

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

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

FOR INFORMATION ONLY

CHEMICAL COMPOSITION

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

MECHANICAL PROPERTIES

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

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

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

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

Comparable Standards:

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

Suggested/Probable Suppliers And Grades:

Refer Plant Vendors list

User Plant References:

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

Revisions : Cl .28.4.16 of MOM of MRC-S&GPS			**APPROVED: Interplant Material Rationalization Committee-MRC (S&GPS)**		
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Dt.:09.01.2007	**Dt :**	**Year: 2013**	**HARDWAR**	**Corp. R&D**	**JUNE, 1978**

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

ORDERING DESCRIPTION

1.0 GENERAL:

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

2.0 APPLICATION :

For general engineering purposes, where corrosion resistance is essential.

3.0 CONDITION OF DELIVERY:

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

4.0 DIMENSIONS AND TOLERANCES

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

5.0 CHEMICAL COMPOSITION:

As per ASTM A 240M, Type 321. Î

6.0 TEST CERTIFICATES:

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

BHEL References:

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

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

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

7.0 PACKING AND MARKING:

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

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

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

FOR INFORMATION ONLY

CHEMICAL COMPOSITION

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

MECHANICAL PROPERTIES

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

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

CARBON STEEL FORGINGS, CLASS 2

FOR INTERNAL USE ONLY
REMOVE THIS PREFACE BEFORE ISSUE TO SUPPLIERS

Comparable Standards:

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

Suggested/Probable Suppliers and Grades:

Refer plant vendors list.

User Plant References:

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

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

CARBON STEEL FORGINGS, CLASS 2

1.0 GENERAL:

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

2.0 APPLICATION:

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

3.0 CONDITION OF DELIVERY:

Normalised / Normalised and tempered..

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

4.0 COMPLIANCE WITH NATIONAL STANDARDS:

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

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

5.0 DIMENSIONS AND TOLERANCES:

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

For finish machined drawings : 3 ± 1 mm

For rough machined drawings : ± 1 mm

6.0 MANUFACTURE:

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

Steel shall be fully killed.

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

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

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

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

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

7.0 FREEDOM FROM DEFECTS:

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

8.0 HEAT TREATMENT:

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

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

9.0 FINISH:

As mentioned in the drawing.

10.0 CHEMICAL COMPOSITION:

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

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

NOTE:

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

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

---

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

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

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

11.0 TEST SAMPLES:

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

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

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

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

12.0 **MECHANICAL PROPERTIES :**

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

Test methods are specified below:

12.1 Tensile : IS: 1608

12.2 Hardness Test (Brinell) : IS:1500

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

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

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

Note:

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

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

13.0 ULTRASONIC TESTS:

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

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

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

14.1 Bend Test (Longitudinal):

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

14.2 Magnetic particle test:

14.3 Any other tests.

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

15.0 SCOPE OF THIRD PARTY INSPECTION:

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

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

16.0 TEST CERTIFICATES:

Three copies of a test certificates shall be supplied, unless otherwise stated in the order, in the Test Certificate proforma annexed to this specification (Annexure -I).
In addition, the supplier shall ensure to enclose one copy of the test certificate along with their dispatch documents to facilitate quick clearance of the material.

The following details shall be furnished in the test certificate:

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

17.0 PACKING & MARKING:

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

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

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

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

CORPORATE PURCHASE SPECIFICATION

ANNEXURE-I: RECOMMENDED TEST CERTIFICATE FORMAT FOR FORGINGS

SUPPLIER'S NAME AND ADDRESS

TEST CERTIFICATE FOR FORGINGS

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

15. FORGINGS COVERED BY TEST CERTIFICATE

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

16. CHEMICAL COMPOSITION (PERCENT)

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

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

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

18. MECHANICAL PROPERTIES

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

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

21. NON-DESTRUCTIVE TESTS

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

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

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

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

24. IDENTIFICATION OF FORGINGS AS PER PURCHASE .SPEC.

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

SIGNATURE, NAME & SEAL OF THE INSPECTING OFFICER
DATE:

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

INSTRUCTIONS

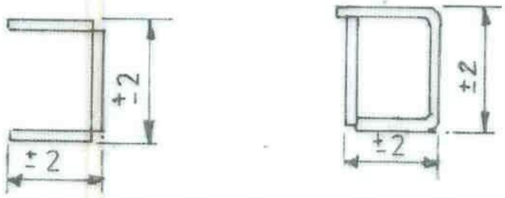
a) Details of all heat treatment processes carried out should be furnished sequentially in 17.
b) Test certificates are to be furnished as per Purchase order and specification, in A4 size preferably in transparent paper.
c) All the entries including signature should be in block colour ink.
d) If testing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

बी एच ई एल BHEL	उत्पाद मानक PRODUCT STANDARD परिणामित्र TRANSFORMER शाप/अ.का. निर्देश SHOP/DO INSTRUCTION	TR 10199 T 2 पृष्ठों में 1 PAGE 1 OF 2

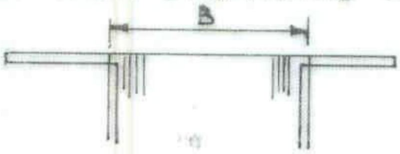
शीर्षक TITLE TOLERANCES ON DIMENSIONS OF END FRAMES AND CLAMP PLATE

TOLERANCES ON DIMENSIONS OF END FRAMES (AEI TYPE & ALSTHOM TYPE) SHALL BE AS GIVEN BELOW.

1. ON OVER ALL LENGTHS $^{-0}_{+3}$
2. ON DEPTH & FLANGES : AS SHOWN BELOW.



3. ON WIDTH OVER END FRAME & CORE ASSLY AS SHOWN BELOW:



B = $^{+3}_{-0}$ UP TO Ø 500

= $^{+4.5}_{-0}$ ABOVE Ø 500

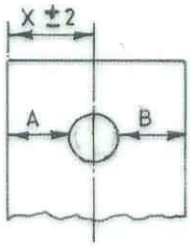
4. DEVIATION FROM SQUARENESS OF FLANGES WHEN HV & LV ARE CHECKED TOGETHER KEEPING WEB ON FLAT SURFACE.
   a. TOP END FRAMES — TOP & BOTTOM FLANGES = 3MM
   b. BOTTOM END FRAMES — BOTTOM FLANGES WHERE FEET ARE FITTED = 1.5 MM
      TOP FLANGES = 2 MM
5. DEVIATION FROM FLATNESS OF FLANGES OR WEB WHEN CHECKED WITH STRAIGHT EDGE.
   a. BOTTOM ENE FRAME:
      COIL SUPPORT AREA OF TOP FLANGE = 2 MM
      STRAIGHT EDGE MUST TOUCH END FRAME ON BOTH SIDES OF LV. LEAD SLOT
      BOTTOM FLANGE = 2 MM
   b. TOP END FRAME:
      BOTTOM FLANGE = 3 MM
      TOP FLANGE = 5 MM
   c. WEB OF END FRAME 2 MM
6. FOR TOLERANCES REQD ON ASEA TYPE END FRAMES ARE TO BE MENTIONED ON CONCERNED MFG. DRG.

(NOTE: THIS DRG. RETRACED DRG. C600724 (E-108))

पुनः REV 01 दि DT. 9 12/97	PAGE 1 OF 2 WAS 1 OF 1	वितरण DISTRIBU.	स.	स्वीकृत किया APPROVED		
REV 02 4 5/05	SHEETS REAFFIRMED Ravindra / AKG 18/1/10	TRE/TRM TCX(TR)T TG QC/QA JHANSI		तैयार किया PREPD. P.M. PATIL	जारी किया ISSUED टी आरई/मानक TRE/STD	DATE 27 08 93

शीर्षक TITLE TOLERANCES ON DIMENSIONS OF END FRAMES AND CLAMP PLATE ASSY.

7. TOLERANCES ON DIAGONALS WILL BE ± 1·5 mm.
8. TOLERANCE ON HOLE TO HOLE DIMENSION = ±1 mm.
9. TOLERANCE ON LEGAMENT OF HOLES = ± 2 mm.
   A − B = 4 mm. MAX. (SEE FIG. BELOW).



10. TOLERANCES ON TOTAL WIDTH OF LEGAMENT AND OTHER OPEN DIMENSIONS UNLESS SPECIFIED ON DRG. SHALL BE AS PER TR10100T.
11. TOLERANCE ON FLATNESS (WAVINESS) FOR WIDTH OR LENGTH OF INDIVIDUAL LEGMENTS AND WIDTH OF INDIVIDUAL TOP OR BOTTOM END FRAME SHALL BE
    i) WIDTH UP TO 600 mm. : 1 mm. MAX.
    ii) WIDTH OR LENGTH ABOVE 600 mm. & UP TO 4000 mm. ———— = 2 mm. MAX.
    iii) WIDTH OR LENGTH ABOVE 4000 mm. ———— = 3 mm. MAX.

NOTE :—

SURFACE WHICH ARE IN CONTACT WITH CRGO LAMINATIONS OF CORE SHALL BE CONSIDERED FOR ABOVE.

12. TOLERANCE ON BOW (EDGE CAMBER OR STRAIGHTNESS) SHALL BE 1 mm. PER METER SUBJECT TO A MAX. OF 3 mm. FOR DIMENSION UP TO 4 METER AND 5 mm. MAX. FOR DIMENSION ABOVE 4 METER.

REF. Comp. drg.

पुन: Rev. / दि. Dt.	वितरण DISTRIBU.	सं.	स्वीकृत किया : APPROVED :		
01 / 9/12/97; Rev 02 / 4/5/05	TRE / TRM / FTM TRX / TTG / QC · TCB / QA · TCB / JHANSI		तैयार किया PREPD.	जारी किया ISSUED टीआर इं/मानक TRE/STD.	दिनांक DATE 9.12.97

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 light grey shade no 631 of IS : 5 Dark grey shade no 632 of IS : 5 Pale cream shade no. 352 of IS : 5 white shade .	BP56179
2.3 Thinner for chemical resisting epoxy primer finishing paint	Thinner for BP56179
2.4 White spirit Grade 145/205	AA56105 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.

3. Preparation of the paints (contd.)

TYPE	COLOR/ SHADE	SUPPLIERS NAME	SUPPLIERS GRADE	PAINT MI IN PARTS BASE	XING RATIO BY VOLUME ACCELERATOR
primer	Red Yellow yellow	Shalimar paint	Epigard-4 Red oxide Zinc phosphate	3	1
		Asian paint	Apcodur cp-684	3	1
		Garware paint	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

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

4.1 Dressing and Grinding

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.

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.

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.

OLD PR SPEC NO

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.

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.

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.