



**Bharat Heavy Electricals Limited
(A Govt. of India Undertaking)**

Piping Centre , 80, G. N. Chetty Road, CHENNAI – 600 017
Phone : 91 (044) 28161245, Fax 044 28161 341 e-mail: prs@bhelmipc.co.in

REF: ENQ NO:65

DT: 14.07.2010

Sub: Procurement of fabricated Tees and Y pieces.

Ref: Enquiry No:PC:4101000065 dt 14.07.2010

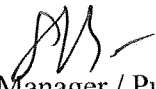
Please find the following tender documents for reference.

1. List of items and sample drawings
2. Tech. delivery condition TDG: 108:05.

Pre qualification is the criteria for consideration for other than BHEL approved vendors. After qualifying for registration, the new vendors may be considered for future requirements, in line with BHEL system and policy. Such vendors will not be considered for this enquiry.

This is a limited tender and only vendors who are contacted through e-mail/courier may submit their offers.

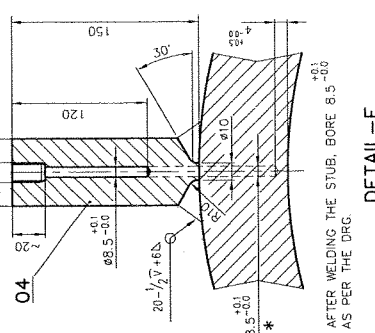
New vendors may download vendor registration forms from BHEL web site www.bhel.com and relevant data for formal registration.


Manager / Purchase
BHEL / Piping Centre
80,GN Road, T.Nagar
Chennai-600017
Ph: 044-28161245

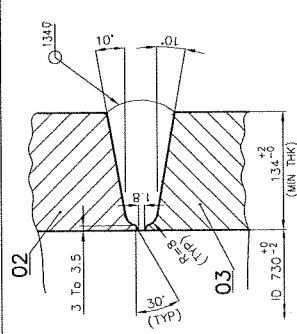
LIST OF ITEMS FOR ENQUIRY NO 4101000065

Sl no	Material	Drawing no	Description	Qty nos	Unit rate
1	925058550000	2-80-301-09943/00	FAB Y-PIECE ID500X92 / ID380X66SA182F91	2	
2	925058560000	2-80-310-09944/00	FAB Y-PIECE OD 1016x58/ 813x47SA182F91	2	
3	925058570000	2-80-320-09945/00	FAB Y-PIECE OD1016x38/OD813x31 SA105	2	
4	925058580000	3-80-301-27029/00	FABUNEQTTEE ID500X92 / ID380X66 SA182F91	2	
5	925058590000	3-80-301-27038/00	FABUNEQTTEE ID500x92/OD355.6x54 SA182F91	4	
6	925058600000	3-80-301-27039/00	FABUNEQTTEE ID500x92 /OD168.3x25 SA182F91	2	
7	925058610000	3-80-310-27030/00	FABUNEQTTEE OD1016x58/ 813x47 SA182F91	2	
8	925058620000	3-80-310-27040/00	FABUNEQTTEE OD813x47 / 610x36 SA182F91	4	
9	925058630000	3-80-320-27031/00	FABUNEQTTEOD 1016x42/813x35SA182F22 CL3	2	
10	925058640000	3-80-320-27041/00	FABUNEQTTEOD 813x35/508x27SA182F22CL3	4	
11	925058650000	3-80-320-27042/00	FABUEQTTEOD 813x35/219.1x32 SA182F22 CL3	4	
12	925058660000	3-80-320-27043/00	FABUNEQTTEE OD1016x42/406.4x25SA105	2	
13	925058670000	3-80-423-27269/00	FABUNEQUALTEEOD457X82/273X52 SA105	3	
14	925058680000	3-80-423-27270/00	FAB EQUAL TEE OD 660 X 116 SA105	1	
15	925058690000	3-80-423-27271/00	FAB UNEQUALTEE OD 660X116/457 X 82 SA105	1	
16	925058700000	3-80-423-27272/00	FAB UNEQUALTEE OD 660X116/355.6X64 SA105	2	
17	925058710000	3-80-423-27273/00	FAB EQUAL TEE OD 559 X 75 SA105	2	
18	925058720000	3-80-423-27274/00	FAB UNEQUALTEE OD 559X75/406.4X56 SA105	12	
19	925058730000	3-80-423-27275/00	FAB UNEQUALTEE OD 559X75/219.1X32 SA105	1	
20	925058740000	3-80-423-27276/00	FAB EQUAL TEE OD 406.4 X 56 SA105	4	
21	925058760000	3-80-320-27188/00	FABUNEQTTEOD864X50/508X30SA182F22CL3	4	
22	925058770000	3-80-310-27187/00	FABUNEQTTEOD864X50/711X42 SA182F91	6	
23	925058790000	2-80-301-10066/00	FAB Y PIECE ID460X85/ID350X60 SA182 F91	2	
24	925058800000	3-80-301-27186/00	FAB UN EQTEE ID460X85/OD323.9X48SA182F91	4	
25	925058810000	3-80-301-27185/00	FAB UN EQTEE ID460X85/ID350X60 SA182F91	2	
26	925058820000	3-80-301-27192/00	FABUNEQTTEE ID460X85/OD219.1X34 SA182F91	2	
27	925058830000	2-80-310-10067/00	FAB Y PIECE OD 864X50 / 711X42 SA182F91	2	
28	925058840000	2-80-320-10068/00	FAB Y PIECE OD 864X29/ OD660X23 SA105	2	
29	925058850000	3-80-320-27198/00	FABUNEQTTEE OD864X50/323.9X20 SA182F22CL3	2	
30	925058860000	3-80-320-27303/00	FAB UNEQTTEE OD864X29/355.6X15.09 SA105	6	

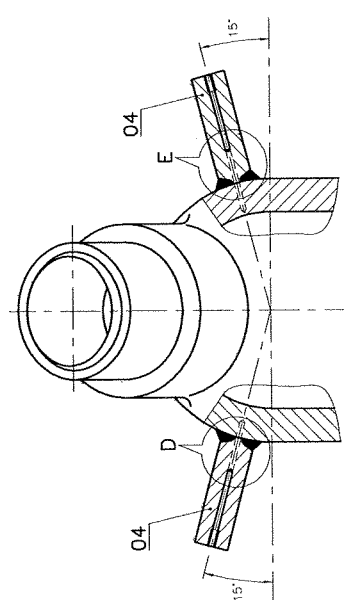
6
EDGE PREPARATION
AS PER DRG NO:
3-80-300-19825
E/C/DPF-X d1=380



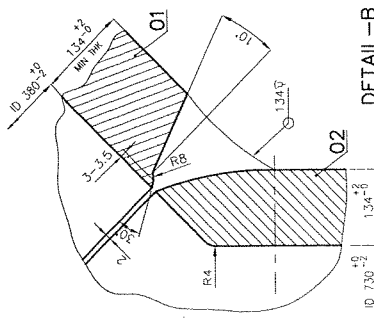
DETAIL - F



DETAILS - C



NEW-A



FTAI-B

04	TEMP. STUB. Ø50, L=150	2-80-301-099A.3	SA 182 F22 CL3	A	4 1 000
03	OUTLET FORGING ID 730 x THK 134 MIN / ID 500 x 92 MIN THK	2-80-301-099A.3	SA 182 F91	A	1100 000
02	BODY FORGING ID 730 x THK 134 MIN	2-80-301-099A.3	SA 182 F91	A	2100 000
01	INLET FORGING ID 380 x THK 134 MIN	2-80-301-099A.3	SA 182 F91	A	800 000
VAR	ITEM NO	DRAWING NO	MATERIAL CODE	A	UNIT WEIGHT
			MATERIAL SPECN	C	QUANTITY

JOB NO.	REL. NO.	DATE	NO OF ITEMS
TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT			
BHARAT HEAVY ELECTRICALS LTD. PIPING CENTRE, CHENNAI 600 017			
DEPT.	GROUP OF UN TOL DIM	C/M/P	WEIGHT (KG)
CODE			SCALE
			N.T.S.
		4808.000	
NAME DBR N. MEGANATHAN CID N. MEGANATHAN APFD K. RAMAN		SIGN --s-- --s-- --s--	
DATE 24/03/2000 24/03/2000 25/03/2000		ITEM No. -- -- --	
TITLE FABRICATED Y-PIECE (ID:500x92/ID:380x66)		MASS DRAWING NO. 2-80-301-09943 REV 00	

FABRICATED Y-PIECE
(ID500x92/ID380x66)

ARD
CODE
01

REV 00
-09943

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92861-008-08-E

ON DRAWING

NOTES:-

01. APPLICABLE FOR P91 MATERIAL
02. FOR OD MISMATCHING REF. FIGURE-Xa.
03. $\alpha = 6^\circ$ FOR WALL THICKNESS ≤ 30 mm
04. $\alpha = 10^\circ$ FOR WALL THICKNESS > 30 mm

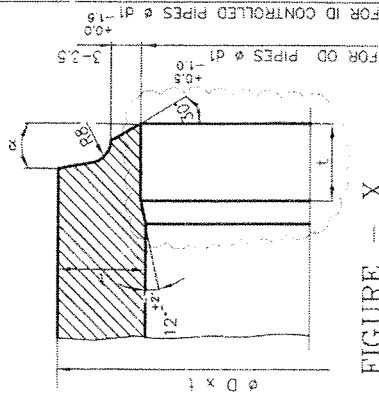


FIGURE - X

MATCHING EDGE PREPARATION FOR MISMATCH OD

DIAMETRICALLY GREATER THAN 8 mm
(ie OD1 - OD2 > 8mm) APPLICABLE FOR
ELBOWS OTHER THAN P91 MATERIALS

NOTES:-

01. OD = OUTSIDE DIA OF CONNECTING PIPE (STRAIGHT) TO BE PHYSICALLY MEASURED/VERIFIED.
02. t = THK OF CONN.Pipe (STRAIGHT)

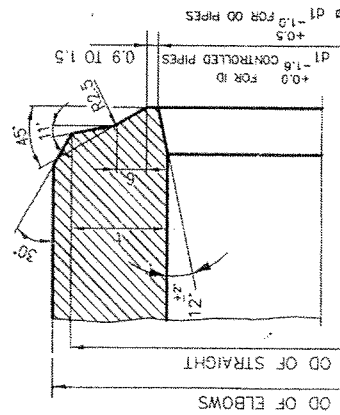


FIGURE - Z

MATCHING EDGE PREPARATION FOR MISMATCH OD
DIAMETRICALLY GREATER THAN 8 mm
(ie OD1 - OD2 > 8mm) APPLICABLE FOR
BENDS/FITTINGS OF P91 MATERIALS

NOTES:-

01. OD OF STRAIGHT TO BE PHYSICALLY MEASURED/VERIFIED.
02. $\alpha = 6^\circ$ FOR WALL THICKNESS ≤ 30 mm
03. $\alpha = 10^\circ$ FOR WALL THICKNESS > 30 mm

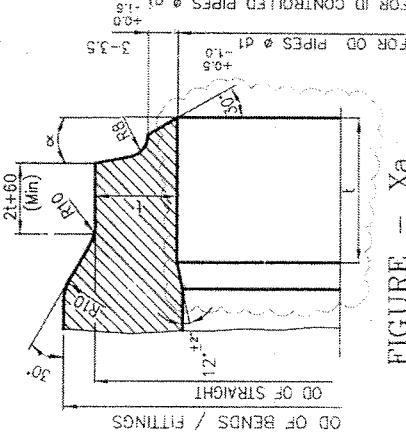


FIGURE - Xa

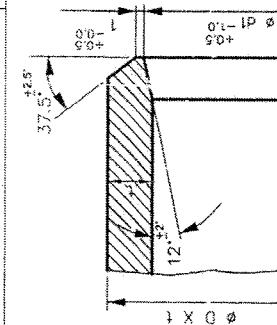


FIGURE - D

NOTES:-

01. USE WHEN t < 14.2 mm.

DATE: 11-05-04
APPROVED: A. V. V. V.
PROJECT NAME: REMOVAL AND STANDARDIZATION OF TITLE BLOCK.

MATCHING EDGE PREPARATION FOR MISMATCH OD
DIAMETRICALLY GREATER THAN 8 mm
(ie OD1 - OD2 > 8mm) APPLICABLE FOR
BENDS/FITTINGS OTHER THAN P91 MATERIALS

NOTES:-

01. OD OF STRAIGHT TO BE PHYSICALLY MEASURED/VERIFIED.
02. WHEN t < 5, S+A = 65 Min. & t > 5, S=65 Min. WHERE t=THK OF CONN.Pipe (STRAIGHT).

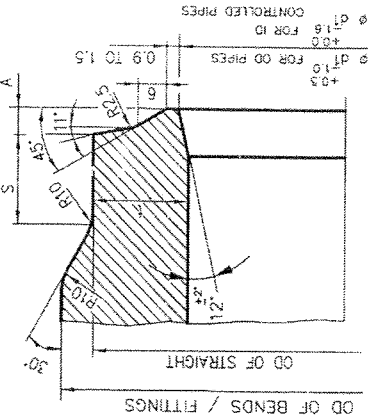


FIGURE - Pa

GENERAL NOTES:-

01. THE MINIMUM THICKNESS AT WELD END SHALL NOT BE LESS THAN
a) 0.875 TIMES t NOM. FOR OD PIPES.
b) t MIN. FOR ID CONTROLLED PIPES.
02. t NOM & t MIN SHALL BE AS PER SPECIFIED PIPE SIZE.

NOTES FOR WELDING:

01. WELD REINFORCEMENT TO BE FLUSH GROUND AND MERGED WITH PARENT METAL WITHOUT ANY UNEVENNESS.

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT

STANDARD

BHARAT HEAVY ELECTRICALS LTD.
PIPING CENTRE, CHENNAI

NAME: K.B. RAGUNATH
SIGN: K.B. RAGUNATH
DATE: 11.10.01

DRN: M.C. SEKARAN
CHD: M.C. SEKARAN
ITEM No.: 11.10.01

APPROVAL: A. VELAYUTHAM
NAME OF ORIGINAL ORGANIZATION: BHARAT HEAVY ELECTRICALS LTD.

WEIGHT (KG):
SCALE: 1:1

GRADE OF UN TOL DIM: C/M/F

CODE: U 01

TITLE: EDGE PREPARATION DETAILS

DRAWING No.: 3-80-300-19825

REV: 01



1.0 GENERAL

Fabricated Tees and Y-piece shall meet Indian Boiler Regulations (IBR) and the following requirements in addition to the latest version of relevant material specifications namely ASME SA 105, SA 106, SA 182, SA 335.

2.0 FORGINGS.

- 2.1 Material : SA 105, SA 182 F11, F12, F22, F91.
- 2.2 Carbon content of SA105 items shall be restricted to 0.25% maximum.
- 2.3 SA 182 F91 forgings shall be normalised at 1040 to 1070 deg C (for wall thickness larger than 75 mm, accelerated cooling may be done to obtain a fully martensitic structure) and tempered at 760 ± 10 deg C
- 2.4 Unless otherwise specified in the P.O, items of SA182 F11/12 shall be supplied as per class 2 and SA182 F22 shall be supplied as per class 3 only
- 2.5 Product analysis shall be carried out on One piece / Heat / HT lot / Size.
- 2.6 Tension test shall be carried out on one Test piece for each specification, heat, heat treatment lot and size.
- 2.7 Bend test for CS (SA 105) : One sample of 19 mm thick and 25mm width to be bent 180 deg around mandrel of radius 6.35mm.
- 2.8 Bend test for AS (SA182): One Sample of 25.4 mm width and thickness = t to be bent 180 deg around mandrel of radius = 1.5 t. Test on representative sample is also acceptable.
- 2.9 Hardness test shall be carried out on all items of F91, and minimum 10% for other material Grades; acceptance norm shall be as per SA 105 / SA 182.
- 2.10 All fittings shall be tested by MT as per ASTM E-709 and acceptance norm shall be as per ASME B 31.1 Clause 136.4.3
- 2.11 Forgings of all thickness shall be ultrasonically tested as per SA 388 and acceptance norms shall be as per 3.3.4 of ASME Section VIII Division 2.
- 2.12 Metallography:- Metallography shall be carried out on one per heat, per size, per heat treatment lot of WP91 / F91 fittings. Acceptance norms - The Material shall be free from any micro fissures. Microstructure shall show tempered martensite and also to be examined for any grain growth. Photomicrograph with 500x (Min) magnification along with Metallography report to be provided. The actual magnification shall be indicated.

3.0 PIPES.

- 3.1 Material : SA 106 Gr.C, SA 335 P11, P12, P22, P91.

S. Jayakumar, Engg

P. Elangovan, QA

Approved by

K. Vedaprasad, QC

K. Ganeshan, MPL

- 3.2 The pipes used shall meet the requirements indicated in Technical delivery condition ref. TDG : 101. The applicable / latest revision number of this document is indicated in the Tender / Purchase order.

4.0 FABRICATION OF Y Piece and Tees

- 4.1 Fit up, fabrication, dimension and tolerance shall be as per BHEL drawing
- 4.2 Welding : WPS and PQR shall be approved by well known independent inspecting agencies like Lloyds, BV, SGS, Copy of approved WPS & PQR shall be furnished along with the Technical part of the bid for approval by BHEL

4.2.1 Welding of F91 / P91 material :

GTAW rods (ER 90S – B9) and SMAW electrodes (E9015 – B9) used shall be of following makes.

- a) Bohler Schweisstechnik Austria, Austria
- b) Bohler Thyssen Schweisstechnik, Germany
- c) Kobe Steels Ltd., Japan
- d) Oerlikon Welding Ltd, Switzerland
- e) Metrode Products, U.K

The core wire chemistry shall be equivalent to F91/ P91 . Synthetic electrodes are not permitted.

- 4.3 PWHT for F91 / P91 material shall be 760 ± 10 deg C. Holding time shall be minimum 2 hours for thickness up to 50mm; minimum 4 hours for thickness 51 to 100 mm. PWHT for other material shall be as per ASME B31.1.

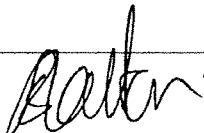
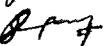
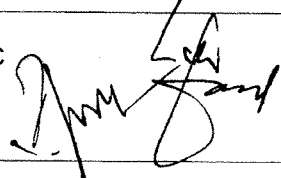
5.0 NON DESTRUCTIVE EXAMINATION

- 5.1 All NDE shall be done after PWHT only – and witnessed by Inspection authorities.
- 5.2 NDE procedures (MT-Wet, PT,RT,UT and Hardness)shall be approved by BHEL
- 5.3 All welds shall be subjected to RT, Wet MT and PT as per ASME Sec V. Evaluation and acceptance norms shall be as per ASME B31.1 Clause 136.4.5 for RT, Clause 136.4.3 for MT, Clause 136.4.4 for PT. Hardness shall be as per SA 234.
- 5.4 All welds shall also be subjected to UT and its methodology and acceptance shall be as per AD 2000 Merkblatt HP 5/3-2002 Edition, with additional requirements as in 5.4.1 through 5.4.3 below.

5.4.1 The examination shall be conducted by Pulse Echo contact testing.

The following digital equipments or its equivalent models with A-scan presentation that generates and receives frequencies in the range of 1 MHz to 5 MHz. shall be used for examination:

GE Inspection Technology (Krautkramer make), Olympus (EPOCH IV, XT), Sonatest (Master scan series-350M/380M)U.K

S. Jayakumar, Engg P. Elangovan, QA	  Approved by K. Vedaprasad, QC K. Ganeshan, MPL 
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The calibration blocks used shall be of same material specification, diameter & thickness.

The UT equipment shall be calibrated at the beginning of each period of extended use or every 3 months whichever is less.

- 5.4.2 All recordable indications will be stored in memory of either the digital flaw detector or a PC for review at a later period.
- 5.4.3 The equipment calibration data for specific weld as well as the hard copy of 'Static echo-trace pattern'— showing the flaw-echo amplitude with respect to DAC, flaw depth, projection surface distance (probe position) and beam-path shall be attached to UT test report. This hard-copy of echo-trace with equipment calibration data will form part of test documentation.
- 5.5 Qualified Level II personnel shall perform the examination as well as evaluation, and a test report shall be issued.
- 5.6 Hardness test shall be carried out and report to be furnished. The maximum hardness (HV10) shall be 300 for F91 material; and 225 for F11,F12,F22.

6.0 POSITIVE MATERIAL IDENTIFICATION (PMI) FOR ALLOY STEEL FITTINGS.

Each alloy steel fitting shall be checked for the correctness of the material during manufacturing and final inspection using X-ray fluorescence principle or spark emission spectrography.

7.0 WORKMANSHIP, FINISH AND REPAIR

All items shall have smooth, workman like finish, and to be free from scale & defects like laps, seams, folds, cracks, etc. Surface defects can be removed by mechanical means and defective areas smoothly dressed up with the adjacent surface. Minimum dimension after repair shall meet drawing / Specification. Repairs by fusion welding are prohibited.

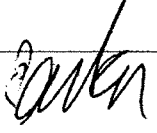
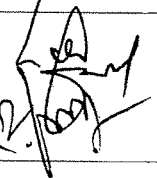
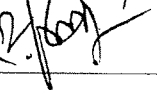
8.0 PAINTING , COLOUR CODING, MARKING

8.1 PAINTING : All fittings shall be painted on the external surface as given below

- a) Surface preparation : Blast cleaning
- b) Painting : Seaworthy Epoxy painting of DFT – 100 microns with colour shades as given below.
- c) Shade : (i) smoke grey -- for all carbon steel fittings
(ii) Sea green -- for all Alloy steel fittings

The internal surface shall be protected with rust preventive coating or rust inhibitor. Stainless steel fittings need not be painted.

8.2 COLOUR CODING : All fittings shall be colour coded circumferentially at ends as given below

S. Jayakumar, Engg		Approved by	K. Vedaprasad, QC	
P. Elangovan, QA		K. Ganeshan, MPL		



SA 105 / SA 106 Gr.C	=	Blue
SA 182 F11 / SA 335 P11	=	Green & White
SA 182 F12 / SA 335 P12	=	Black & Red
SA 182 F22 / SA 335 P22	=	Blue & Red
SA 182 F91 / SA 335 P91	=	Brown & Red

8.3 MARKING:

8.3.1 The fittings dispatched to **BHEL Stores** shall be punched / etched with Material code, Heat number, material specification, maker's emblem, Inspectors seal and Statutory authorities seal (as applicable) .

In addition, the above details along with size shall be paint stenciled on the fittings.

8.3.2 The fittings dispatched directly to project site as **DTS** shall be punched and paint stenciled with DU code (14 digit work order du detail) as given by purchase in addition to marking done as per para 8.3.1.

9.0 **PACKING AND END PROTECTION:** Machined ends of the fittings shall be well protected using end caps and fittings shall be suitably packed in box / crate to avoid transit & other damages.

10.0 MANUFACTURING QUALITY PLAN.

Vendor shall submit manufacturing Quality plan along with technical part of the bid for BHEL approval.

11.0 INSPECTION & CERTIFICATION

11.1 All items are to be inspected at the manufacturer's works by the Inspection agencies / authorities as per IBR. Inspection certificate for finished product in IBR Form III shall be submitted along with the Work Test Certificate (EN 10204 Type 3.2) countersigned by authorities as per IBR and shall include the following details. (Three ink signed originals required)

- i. Test Certificate Number & date.
- ii. BHEL P.O Number & Amendment Number(if any)
- iii. BHEL P.O. Serial Number
- iv. BHEL TDC Number, Drawing number
- v. Size-wise Quantity
- vi. Specification, Grade & Year of code.
- vii. Heat / Melt Number
- viii. Steel making process.
- ix. Material details
- x. Ladle and product Analysis of Raw Material.
- xi. Tensile Test
- xii. Bend Test
- xiii. Guarantee of HTP shall be given in the test certificate as follows, if hydro test is not carried out: "Fabricated Y piece / welded Tees are capable of withstanding

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K. Ganeshan, MPL

without failure, breakage or impairment of their serviceability a hydrostatic test pressure equal to that prescribed for the specified matching pipe of equivalent material".

- xiv. References to the NDT & other test reports covered in 11.2 below.

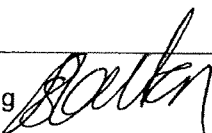
11.2 The following reports shall be **furnished separately** along with the Form III & MTC indicated in para 11.1 above.

- i. NDE reports for VT, MT, RT, UT (UT Reports in soft copy + hard copy)
- ii. Positive Material identification (PMI) report for Alloy steel.
- iii. Heat Treatment Chart.
- iv. Hardness Test report
- v. Metallography Report along with photomicrograph with minimum 500x magnification.
- vi. Dimensional report.

12.0 RECORDS OF REVISION.

- Rev 01 : a) Para 3.0, 4.2.1, 6.0, 10.0 are included
 b) Para 1.0, 4.2, 4.3, 8.2, 11.0 are revised
- Rev 02 : a) Para 2.10, 4.2.1, 8.1, 8.2, 9.0 are revised
- Rev 03 : a) Para 2.12, 8.0 and 11.0 (18) are revised
- Rev 04 : a) Para 8.1 modified as sea worthy painting.
 b) Para 11 modified. Works TC 'EN 10204 Type 3.2' specified. Individual reports are required.
- Rev 05 : a) Para 5.6 (Hardness test) included.
 b) Para 8.1 modified indicating colour shades.
 c) Para 11 modified for better clarity with respect to documentation

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S. Jayakumar, Engg		Approved by	K. Vedaprasad, QC
P. Elangovan, QA		K. Ganeshan, MPL	