



Record of Revision: Rev 00: 21/07/17 – Fresh Issue

1. SCOPE: -

Specification: ASTM A234M WP92 (Latest on date of PO)

The fittings shall meet Indian Boiler Regulations (IBR), unless otherwise specified, and the following requirements in addition to the standards specified in the Purchase Order (PO).

2. RAW MATERIALS: -

- All fittings shall be of seamless construction. Pipes used for manufacturing shall be seamless pipes or forgings.
- The raw material for fittings shall meet the respective specification. The test certificate shall be furnished with Traceability.
- The raw material shall be procured from the Mills listed in document ref.QCP:19 (latest revision). For raw material sources not listed in QCP, credentials shall also be submitted by the vendor along with offer for BHEL review and approval.
- Raw material for IBR items to be inspected at Mill & test certificate countersigned by IBR approved Authority, if the mill is not approved under IBR as well-known steel maker.

3. MANUFACTURING & TESTING REQUIREMENTS:

Seamless Formed Fittings – Ells, Tees, Reducers

Starting material:					
1) Tube & Pipe (Rolled/forged)	NDE – Hydro or UT	Hydro test shall be done as per ASTM A530. UT shall be done as per - ASTM E 213 with longitudinal notch of 5% wall thickness with max. 1.5mm and min. 0.3mm. Actual measured notch depth to be specified in Test Certificate. <i>Note: If UT is not done on the starting material, the same shall be done by the fitting manufactures before forming.</i>			
Finished fitting (hot forming)	Heat treatment after forming	Heat Treatment Temp, °C		Soaking time, hr/in	
		Normalising	Tempering	Normalising	Tempering
		1040-1080	760-780	1/2	1
	NDE	Wet MPI (100%) - ASTM E709. No linear indications are acceptable.			
	NDE – UT (For OD $\geq$ 200mm or W.T $\geq$ 6mm)	Shall be done as per - ASTM E 213 with longitudinal notch of 5% wall thickness with max. 1.5mm and min. 0.3mm. Actual measured notch depth to be specified in Test Certificate.			
	Hardness	196-250 BHN – 100% to be checked			
	Dimension	As per Engineering drawing indicated in Purchase Order. If not, as per ASME B16.9. The ends of reducers shall have a straight portion of Minimum 13mm.			

4. GENERAL REQUIREMENTS:

- Mechanical Testing** – Test samples shall be tested in the Heat treatment of fitting delivered condition
 - Tension Test:** - One fitting of each specification, heat, heat treatment lot and size as per applicable standard.
 - Product analysis** – one / heat / size.
- Photomicrograph test for WP92:** - Photomicrograph test shall be carried out on one per heat, per size. 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 Photomicrograph report to be provided. The actual magnification shall be indicated.

5. 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.

6. 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.

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7. PAINTING, COLOUR CODING & MARKING

7.1 **Painting:** All fittings shall be **painted** on the external surface as given below (unless otherwise specified): -

Surface preparation :	Blast cleaning SSPC - SP-10
Primer coat :	One coat of 60 microns of In-Organic Ethyl Zinc Silicate primer.
Finish coat :	Two coats of 20 microns each of Heat Resistance Aluminium paint to IS13183 Gr-1.
Total DFT :	100 microns minimum.
Shade :	Aluminium -- for all fittings.

The internal surface shall be protected with rust preventive coating or rust inhibitor.

7.2 **Colour Coding:** All fittings shall be colour coded circumferentially at all ends: **BROWN and BLUE**

7.3 **Marking** (In English only):

7.3.1 The fittings dispatched to **BHEL Stores** shall be hard punched / etched with i) Vendor code & Name ii) Material code/ Work order & DU details, iii) Heat number, iv) Material specification, v) Maker's emblem, vi) Inspectors seal, vii) Running Serial number (Example: 1/25,2/25,3/25..... & 25/25) viii) Qty & Weight and ix) Statutory authorities seal.

In addition, the above details along with size shall be paint stencilled on the fittings. If the thickness of the fitting is less than 6 mm, punching is not permitted and the above details shall be paint stencilled

7.3.2 The fittings dispatched directly to project site as **DTS** shall be hard punched and paint stencilled with **DU code** (14-digit work order du detail) instead of material code as given by Purchase, PC in addition to marking done as per Para 7.3.1.

8. 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 as per the Packaging procedure PC: PKG: 01 to avoid transit & other damages.

9. INSPECTION & CERTIFICATION (In English only): -

9.1 All fittings are to be Inspected at the manufacturer's works by the Inspection agencies / authorities as per IBR and as indicated in the P.O. Inspection certificate in IBR Form III C shall be submitted along with the Work Test Certificate countersigned by the above authorities and shall include the following (Three ink signed originals required).

1. Test Certificate Number & date,
2. BHEL P.O Number & Amendment Number, BHEL P.O. Serial Number, BHEL TDC Number
3. Size-wise Quantity, Specification, Grade & Year of code., Heat/Melt Number
4. Starting material details with traceability, Steel making process, Ladle Analysis of Raw Material and product analysis of fitting.
5. Product analysis, Tension test results.
6. Guarantee of HTP shall be given as follows: - "Fittings are capable of withstanding without failure, leakage or impairment of their serviceability a hydrostatic test pressure equal to that prescribed for the specified matching pipe of equivalent material". *

*Details furnished in the Tests certificate in lieu of chart/report is acceptable.

9.2 The following reports shall be **furnished separately** along with the Form III C & MTC indicated in para 9.1 above. NDE reports for VT, MT, UT (UT Reports in soft copy + hard copy). Actual measured UT-notch depth to be specified in Test Certificate.

1. Positive Material Identification (PMI) report for Alloy steel.
2. Heat Treatment Chart.
3. Hardness Test report.
4. Photomicrograph test report along with photomicrograph with minimum 500x magnifications.
5. Dimensional report (as built drawing with dimensions)
6. Thickness Measurement Report for Elbows & Tees as per Doc No: TDG120:001 & TDG120:002

10. AUDIT CHECKS AT BHEL

BHEL reserves the right to carry out audit checks for Chemistry, HT condition, Mechanical test and NDT on fittings. **Supplies found defective during check at BHEL are liable for rejection.**

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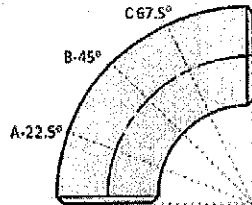


THICKNESS MEASUREMENT REPORT FOR ELBOW

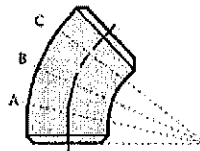
PO Number:
Work order/Du:
Description of Material:
Material Spec.:
Heat no:

Doc No: TDG120:001 Rev.00
Date: xx.xx.xxxx

Size:



90° Elbow



Less than 90°

Measurement (Extrados) points

Angle	A	B	C
90	22.50°	45.00°	67.50°
60	15.00°	30.00°	45.00°
45	11.25°	22.50°	33.75°
30	NA	15.00°	NA

Description of item :
Material Spec :
Material Code :

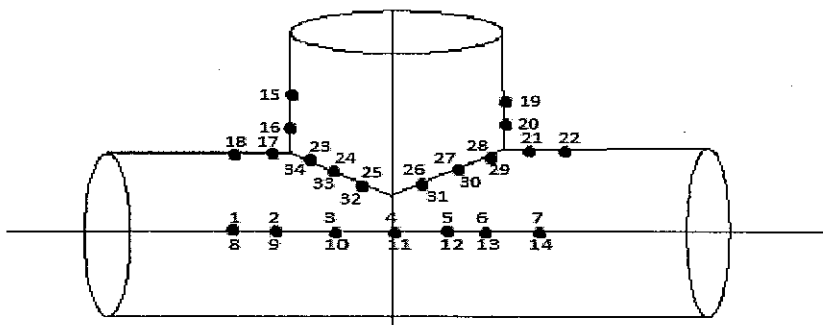
No	Wall thickness at ends		Wall Thickness at angle			Remarks
	End 1	End 2	A	B	C	
1.						
2.						
3.						
4.						
5.						
6.						

THICKNESS MEASUREMENT REPORT FOR TEE's

PO Number:
Work order/Du:
Description of Material:
Material Spec.:
Heat no:

Size:

Doc No: TDG120:002 Rev.00
Date: xx.xx.xxxx



Location	Thickness (mm)	Location	Thickness (mm)	Location	Thickness (mm)	Location	Thickness (mm)	Location	Thickness (mm)
1		8		15		22		29	
2		9		16		23		30	
3		10		17		24		31	
4		11		18		25		32	
5		12		19		26		33	
6		13		20		27		34	
7		14		21		28			

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