



**BHARAT HEAVY
ELECTRICALS LIMITED**
PIPING CENTRE, MADRAS - 17
QUALITY ASSURANCE & CONTROL DEPT.

STANDARD QUALITY ASSURANCE PLAN FOR BUTT WELDED FITTINGS CONFORMING TO ASME SA 234

QP NO : QPG: 46

REV.NO : 01

DATE : 13-10-2015

REF: BHEL TDC No. : TDG:102 (latest revision)

SL . NO.	COMPONENT OR OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE STANDARD	TYPE OF RECORD		AGENCY		REMARKS
									D*	M	B	
1	2	3	4	5	6	7	8	9	10	11	12	15
1.0	Raw material sources for P91 shall be as per QCP:19(Latest Revision); Any other source proposed by the vendor shall be subjected to BHEL approval.. The Test Certificate for all material specifications received from RM manufacturer shall meet IBR requirements.											
1.1	Seamless Pipe	Chemical Composition, Mechanical Properties & HT/UT	Major	Verification of MTC & Ladle Analysis Report	100%	As per Required Material (ASME) Specification	MTC	X	P	V/R	Refer Note:1 MTC - Mill Test Certificate	
1.2		Surface defect	Major	Visual	100%	As per Required Material (ASME) Specification	Report	X	P	V		
1.3		Dimensions Outer Dia.,Thk.etc	Major	Measurement	100%	As per Spec	Report	X	P	V		
1.4		Pipe Check (chemical)	Major	PMI	100%	As per Required Material (ASME) Specification	Report	X	P	R/W*	*For 1st off trial at random	
1.5		Hardness Test for P91 material	Major	Measurement	100%	As per Spec	Report	X	P	R/W*		
1.6	Plates	Co-relation & verification of Mill TCs for										
1.7		a) Chemical Composition & b) Mechanical Properties	Major	Verify	100%	BHEL Drawing , Material Spec.	Mill TCs	X	P	V		
1.8		c) Soundness	Major	UT	100%	SA578						
1.9		d) Dimension & Surface finish	Major	Measurement & Visual	100%	BHEL Drawing , Material Spec.						

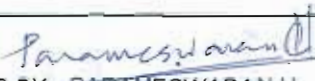
LEGEND: M:- Manufacturer; B:- BHEL/ BHEL Nominated Agency;
D* - Documents required if marked "X"

P - Perform; V - Verification; R-Review; W - Witness; H - Hold.

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APPROVED BY: PARAMESWARAN.H

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 BHARAT HEAVY ELECTRICALS LIMITED PIPING CENTRE, MADRAS - 17 QUALITY ASSURANCE & CONTROL DEPT.		STANDARD QUALITY ASSURANCE PLAN FOR BUTT WELDED FITTINGS CONFORMING TO ASME SA 234							QP NO : QPG: 46 REV.NO : 01 DATE : 13-10-2015				
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2.0	IN PROCESS INSPECTION												
2.1	Fitting Forming Procedure	procedure qualification	Major	Review	100%	ASME SA 234 & BHEL TDG:102 Refer Note : 5	Appd. Procedure	X	P	V	Forming Procedure shall be approved by BHEL.		
2.2	MT Procedure	Procedure Review	Major	Review	100%	ASME SA 234 & BHEL TDG:102	Appd. Procedure	X	P	V	MT - Magnetic Particle Test		
2.3	UT Procedure	Procedure Review	Major	Review	100%	ASME SA 234 & BHEL TDG:102	Appd. Procedure	X	P	V	UT - Ultrasonic Test		
2.4	RT Procedure	Procedure Review	Major	Review	100%	ASME SA 234 & BHEL TDG:102	Appd. Procedure	X	P	V	RT - Radiography Test		
2.5	Forming of pipe fittings	Process parameters	Major	Temperature, Measurement & Visual	100%	ASME SA 234 & Appd.Procedure	Internal report	X	P	---			
2.6	Heat Treatment	Rate of Heating, Rate of Cooling & Soaking time	Critical	Temp & Time graph	100%	ASME SA 234 & BHEL TDG:102 Refer Note : 2	HT Chart	X	P	V/ W*	W* : For 1st off trial at random		
2.7	Test Piece Marking (TPM)	Selection of Test coupons	Major	Measurement & Marking	One Sample / Heat / Size / HT Batch	As per ASTM A370	Internal report	X	P	V/ W*			
3.0	TESTS												
3.1	Finished product	YS, UTS, % Elongation (Mandatory)	Major	Tensile Strength,	One Sample / Heat / Size / HT Batch	ASME SA 234 & BHEL TDG:102	Test Report	X	P	V			
3.2		Hardness	Major	Hardness test	100% / 10%	ASME SA 234 & BHEL TDG:102	Test Report	X	P	W	100% for WP91 ; 10% for others		
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1	2	3	4	5	6	7	8	9	10	11	12	15
3.3		Volumetric Defect	Major	NDE - UT	100% / 10%	ASTM E213 - longitudinal notch of 5% - For Pipe Fittings		Test Report	X	P	W	100% for WP91 ; 10% for others
3.4		Sub-surface Defect	Critical	NDE - MT	100% / 10%	ASTM E709	ASME B31.1 Cl. 136.4.3	Test Report	X	P	W	100% for WP91 ; 10% for others
3.5		Volumetric Defect - Welded Fittings	Major	NDE - RT	100%	ASME SEC-V & ASME SecVIII Div-1, UW-51		Test Report	X	P	W	
3.6		Microstructure (Applicable for WP 91 Fittings)	Major	Metallographic test	One Sample / Heat / Size/ HT Batch	No micro fissures. Microstructure shall show tempered martensite. Grain growth if any has to be examined further.		Test Report (Magnification at 500x) Refer Note :9	X	P	W	Actual magnification shall be indicated in the photomicrograph. Photomicrographs shall be provided as records for review & acceptance and future in-service reference.
3.7	Supplementary tests as per TDC on Finished Product	Product Analysis	Major	Chemical Composition	One Sample / Heat / Size	ASME SA 234 & BHEL TDG:102		Test Report	X	P	V/ W*	
		YS, UTS, % Elongation	Major	Tensile Strength,	One Sample / Heat / Size/ HT Batch	ASME SA 234 & BHEL TDG:102		Test Report	X	P	V/ W*	
3.8	PMI for AS fittings	Chemical	Major	PMI	100%	ASME SA 234 & BHEL TDG:102		Test Report	X	P	W	

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3.9	Burst Test	Performance & Design Proof	Critical	Hydro Test	One / Type (on similar Fitting ^s)	ASME B 16.9 & ASME SA 234 Refer Note : 3		Test Report	X	P	R /W#	\$ - As allowed in relevant standard # - WITNESS -If size is not qualified as per Burst Test Report available.	
4.0	FINAL INSPECTION												
4.1		Surface check, Bend angle, Radius, End-to-end dimn, Ovality, Thickness, Wrinkles, d1 at ends, Edge preparation & other dimensions as per Drg.	Major	Visual & Measurement	100%	ASME B16.9, BHEL Drg.. & P.O.		Report	X	P	W	Refer Note : 12	
4.2		IBR Certification	Major	all tests as per IBR	100%	IBR		FORM-IIIC	X	P	IBR		
4.3		Marking / Color coding	Critical	Visual	100%	BHEL TDG:102 & P.O.		Report	X	P	V	Refer Note : 17	
4.4		Surface Protection, Preservation & Packing	Critical	Visual	100%	BHEL TDG:102 & P.O.		Report	X	P	V	Refer Note : 13 & 16	
5.0	Inspection clearance	Documentation	Critical	Verification	100%	All reports as required in this QAP		Report	X	P	H		
NOTES :-													

NOTES :-

- 1.0 (a) If the raw materials are received directly from RM Manufacturer's works, the material shall be accepted based on (i) correlation of Heat number on material with TC and (ii) verification of TCs.
(b) If the materials are received through Dealers place, check test (Chemical and Mechanical tests on one sample per Heat/ size) shall be done in addition to the above for accepting the material

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2.0	POST FORMING HEAT TREATMENT :-												
	For P91 materials : Normalise at 1040 - 1060 deg.C & Temper at 750-770 deg.C; Soaking shall be 2Hrs minimum for thickness upto 50mm and 4Hrs minimum for thickness 51-100mm												
	Normalising and Tempering shall be carried out within 72 hours after completion of forming. The items shall be kept dry and stress free. The temperature shall be brought down to room temperature after hot forming before normalizing and also after normalizing before tempering. Normalising and tempering of Gr91 shall be done encompassing the entire component.												
	SA234 WPB : As per Specn; SA105 & SA234WPC : Normalised; SA234 WP11/WP12/WP22 : Normalised & Tempered.												
3.0	BURST TEST (Type test) : Burst test procedure shall be submitted by the vendor to BHEL for approval. Burst test will be witnessed by BHEL.												
	After successful completion of the burst test regular production may be permitted.												
4.0	Seal transfer on pieces to be cut shall be done by BHEL inspector & IBR for Gr-91 materials and IBR for other than Gr-91 materials.												
5.0	Welded Fittings shall be made from Two - Halves.												
6.0	Chemical & Mechanical tests shall be performed at in-house or NABL approved laboratories.												
7.0	Welding consumables shall be approved by BHEL.												
8.0	All NDE procedures shall be submitted to BHEL for review. NDE procedures shall have Level-III certified personnel approval incase of in-house. Incase of non-availability of inhouse facility NDE shall be performed by NABL approved laboratories.												
9.0	Items shall be visually checked. No hard scales shall be present on inside & outside surfaces.												
10.0	Gas cutting & Plasma cutting are prohibited for Gr91 material.												
11.0	3 replicas in one fitting. 1 replica for the size Nb 80 & below. Actual magnification shall be indicated in the photomicrograph. Photomicrographs shall be provided as records for review & acceptance and future in-service reference.												
12.0	Minimum thickness measured at any location on the finished fitting shall be not less than 0.875 of the specified nominal thickness.												
13.0	All fittings shall be Painted as below when not specified in the P.O./Drawing:- Three coats of 20 microns each of total DFT 60 microns minimum of Heat Resistance Aluminium Paint to IS 13183 Gr II, after surface preparation by Blast cleaning (SSPC-SP10).												
14.0	All items shall be inspected and cleared by BHEL / BHEL authorised inspection agency & IBR authorities.												
15.0	Necessary IBR Requirements shall be fulfilled and IBR documents to be submitted.												
16.0	Machined ends shall be well protected using end caps and suitably packed to avoid transit & other damages. Tack welding is prohibited on P91 material.												
17.0	Marking :- a) Items dispatched to Stores : The finished components shall be punched & paint stencilled with Material code, Heat number, material specification, maker's emblem, Inspectors seal and Statutory authorities seal (as applicable) b) DTS (Direct to Project Site) Items :- DTS shall be hard punched and paint stencilled with DU code (14 digit work order du detail) as given by purchase in addition to marking done as per 15 (a). Colour coding : Red for WPB ; Blue for WPC ; Blue & Red for WP22; Brown & Red for WP91.												
18.0	If the thickness of the fitting is less than 6 mm, punching is not permitted and the above details shall be paint stencilled. Fittings of size up to 2" (50mm) shall be tied together and the above details shall be punched / engraved in a separate tag and tied to it.												

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