



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

**STANDARD QUALITY PLAN FOR SEAMLESS BW FITTINGS CONFORMING
TO ASME SA 234WP91 WITH VENDOR MATERIAL (INDIGENOUS)**

QP NO : QPG: 82
REV.NO : 00
DATE : 10-10-2013

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	

1.0 Raw material sources shall be approved by BHEL. The Test Certificate received from RM manufacturer shall meet IBR requirements.

1.1		a) Chemical Composition, Mechanical Properties	Major	Verification of MTC	100%	ASME SA335P91		MTC	X	P	V	MTC - Mill Test Certificate Refer Note 01
		b) Hydro test (or) UT condition	Major	Verification of MTC	100%	ASME SA335P91 / ASTM E213						
		c) Hardness test	Major	Verification of MTC	100%	ASME SA335P91						
	Seamless Pipe	d) Photomicrographic test	Major	Verification of MTC	10%	ASME SA335P91 (Supplimentary reqmt-S5) / No micro fissures. Microstructure shall show tempered martensite.		Photo - micrographic Report with 500X magnification minimum	X	P	V	
		e) Surface defect	Major	Visual	100%	ASME SA335P91			X	P	V	
		f) Dimensions Outer Dia.,Thk.etc	Major	Measurement	100%	ASME SA335P91		Material inward inspection Report	X	P	V	
		g) Pipe material confirmation Test (Chemical)	Major	Spectro / X-ray fluorescence	100%	ASME SA335P91			X	P	W	

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D - Documents required if marked "X"

PREPARED & REVIEWED BY: 
VIVEKANANDA YELLU, SR.ENGR/QA

APPROVED BY: 
M.S.MURALIDHARAN, MGR/QA

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2.0 IN PROCESS INSPECTION												
2.1	Burst Test (Type test)	Design & Process Qualification	Critical	Hydro Test	One / Type	ASME B 16.9		Test Report	X	P	W	Refer Note 03
2.2	Material receiving inspection	Marking & transfer of identification	Major	Visual	100%			HC	X	P	V	HC : History card Refer Note 04
2.3	Fitting Forming Procedure	Procedure qualification	Major	Review	100%	ASME SA 234 WP91		\$Appd.Procedure	X	P	V	\$ Vendor's procedure to be approved by BHEL
2.4	Forming of pipe fittings	Process parameters	Critical	Temperature, Measurement & Visual	100%	Appd.Procedure		Internal report	X	P	W*/V	W* : 10% witness by BHEL
2.5	Post forming Heat Treatment	Rate of Heating, Rate of Cooling & Soaking time	Critical	Temp & Time graph	100%	ASME SA 234 & Refer Note 02		HT Chart	X	P	W	Refer Note 02
2.6	Test Piece Marking	Selection of Test coupons	Major	Measurement & Marking	One Sample / Heat / Size / HT Batch	As per ASTM A370		Internal report	X	P	W	Refer Note 04 & Refer Note 08
3.0 TESTS												
3.1	Chemical properties	Product Analysis	Major	Chemical Composition	One Sample / Heat / Size	ASME SA 234 WP91		Test Report	X	P	W	Refer Note 05
3.2	Mechanical properties	YS, UTS, % Elongation (Mandatory)	Major	Tensile Strength,	One Sample / Heat / Size / HT Batch	ASME SA 234 WP91		Test Report	X	P	W	

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3.3	Hardness test	Hardness	Major	Measurement	100%	ASME SA 234 WP91		Test Report	X	P	W	
3.4	NDE	(a) Volumetric Defect	Major	UT	100%	ASME SA388	ASME SecVIII Div-2, CI3.3.4	Test Report	X	P	W	
		(b) Sub-surface Defect	Critical	WET MPI	100%	ASTM E709	ASME B31.1 CI. 136.4.3	Test Report	X	P	W	
3.5	Photomicrographic test	Microstructure	Critical	Insitu Micro	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 & Photomicrograph (Magnification at 500x minimum)	X	P	W	Refer Note 09
4.0 FINAL INSPECTION												
4.1	Dimensional Inspection	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 10
4.2	Positive Material Identification	Chemical check	Critical	Spectro / X-ray fluorescence	100%	ASME SA 234 WP91		Test Report	X	P	W	Chemical properties shall meet the requirements of SI.No.1.1(g) above
4.3	Marking & Identification	Marking / Color coding	Major	Visual	100%	BHEL TDG:102 & P.O.		Report	X	P	W	

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4.4	Surface Protection & Painting	Appearance & DFT		Visual & Measurement	100%	Refer Note 11		Report	X	P	W	
4.5	Preservation & Packing	End Protection	Major	Visual	100%	BHEL TDG:102 & P.O.		Report	X	P	V	Refer Note 14
5.0	Inspection clearance	(a) IBR Certification	Major	all tests as per IBR	100%	IBR		FORM-IIIC	X	P	V	
		(b) Documentation	Major	Verification	100%	All reports as required in this QAP		Report	X	P	CHP	Refer Note 16

NOTES:

- 1.0 (a) If the raw materials are received directly from RM Manufacturer's work, 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
BHEL shall identify and witness the sample for check test
- 2.0 **POST FORMING HEAT TREATMENT :-**
Normalise at 1040 - 1060 deg.C & Temper at 750-770 deg.C
For Gr91, 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 0 to 100 deg.C after hot forming before normalizing and also after normalizing before tempering. Normalising and tempering of Gr91 shall be done encompassing the entire component.
Gr91 soaking shall be 2Hrs minimum for thickness upto 50mm and 4Hrs minimum for thickness 51-100mm

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- 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.
The fitting per type used for Burst test shall meet the requirements of SI.No.2.2 to 4.2 indicated in this QP.
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.
- 5.0 Chemical & Mechanical tests shall be performed at in-house or NABL approved laboratories.
- 6.0 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.
- 7.0 Items shall be visually checked. No hard scales shall be present on inside & outside surfaces.
- 8.0 Gas cutting & Plasma cutting are prohibited for Gr91 material.
- 9.0 Three replicas in one fitting. Actual magnification shall be indicated in the photomicrograph. Photomicrographs shall be provided as records for review & acceptance and future in-service reference.
- 10.0 Minimum thickness measured at any location on the finished fitting shall be \geq the thickness at corresponding locations of the fitting that was undergone successful burst test. But in any case not less than 0.875 of the specified nominal thickness.
- 11.0 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 I, after surface preparation by power tool cleaning (SSPC-SP3).
- 12.0 All items shall be inspected and cleared by BHEL / BHEL authorised Inspection agency & IBR authorities.
- 13.0 Necessary IBR Requirements shall be fulfilled and IBR documents to be submitted.
- 14.0 Machined ends shall be well protected using end caps and suitably packed to avoid transit & other damages. Tack welding is prohibited on P91 material.
- 15.0 Calibrated instruments shall be used during testing.
- 16.0 One set of full documentation (as indicated in this QP) in Hard copy (Paper format) and in soft form (CD form) shall be submitted to BHEL for future reference.

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