



BHARAT HEAVY ELECTRICALS LIMITED
TIRUCHIRAPPALLI - 620 014, INDIA

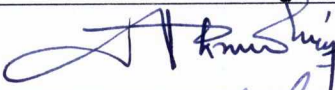
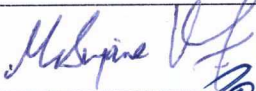
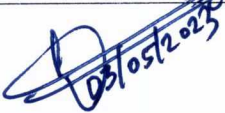

QUALITY ASSURANCE

CREEP TESTING (STRESS-RUPTURE TEST) REQUIREMENTS AS PER IBR

Prepared by

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03/05/2023

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Reviewed by	Signature
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Quality Assurance (V Deepesh, SM/QA)	 03/05/2023
Approved by	Signature
AGM/QA & BE (JVV Aruna Kumar)	 16/05/2023

RECORD OF REVISIONS

Rev. No.	DATE	Clause No.	Details of Revision
00	20/11/2017	---	Fresh issue
01	03/09/2018	1.0	Scope modified to bring more clarity
		2.0	Cl. 2 modified to bring creep requirements for all suppliers, additional labs are listed and Table 2 modified in line with the changes proposed in the new IBR draft.
02	01/03/2021	2.0	i. Table 1 Creep Stress rupture testing Requirements modified in line with the creep data values as per latest ASME BPVC 2019 Section IID ii. d) Modified the sample requirement
03	16/05/2023	2.0	i. Table 1 Creep Stress rupture testing Requirements modified in line with service temperature. ii. Creep rupture stress for Forgings included

1.0 SCOPE

- Creep testing is required as per IBR for all alloy & stainless steels materials which are to be used in furnace or in super heater zone of boilers being erected in India.
Hence, for our current boiler design, creep testing is required for tubes & forged finned elbows only.
- If the creep properties are established either by the mill on the starting raw material or by supplier on the finished product, then creep test reports shall meet the requirements of Clause 2.
- If the starting material is sourced from any mill which has not established creep properties, then creep testing shall be done as per Clause 2 on the product. If the Test results are meeting the requirements, then it can be treated as an approval of the creep values for the Mill which has supplied the starting material.

2.0 CREEP TESTING REQUIREMENTS

Creep testing shall be done in line with the following:

For the starting raw material (Ingot, billet, bloom, etc.), supplier/s shall produce the Creep (stress rupture) test report for each material grade being supplied by them as per the Table 1 given below:

Table 1. Creep Stress rupture testing Requirements

Sl. no	Grade	Testing temperature(°C)	Min Rupture Stress, S_{Rmin} (in MPa)
A	Tubes		
1	SA213 T11	540	115
2	SA213 T12	585	84
3	SA213 T22	610	66
4	SA213 T23	600	128
5	SA213 T91	665	60
6	SA213 T92	665	93
7	SA213 TP347H	695	81
8	SA213 S30432	705	105
B	Forgings		
1	SA182 F22 Cl.3	550	127
2	SA336 F22 Cl.3	550	127
3	SA182 F91	550	160
4	SA336 F91	550	160
5	SA182 F92	550	164
6	SA336 F92	550	164
7	SA182 F304	550	120
8	SA182 F316	550	129

- For steels produced indigenously, creep testing shall be carried out at National Metallurgical Laboratory, Jamshedpur, Corporate Research & Development Laboratory of Bharat Heavy Electricals Limited, Hyderabad, Well Known Steel Makers or any other Material Testing Laboratory recognized by the Central Boilers Board.

- b) For steels produced outside India, creep testing shall be carried out at Well Known Steel Makers, nationally recognized / accredited testing laboratory in the country of manufacture. Alternatively, the testing can also be done in any other laboratory if the tests are witnessed by a Competent Person working with IBR Authorized Inspection Agencies.
- c) Creep testing shall be done as per ASTM E139 (latest) or BS EN ISO 204 (latest).
- d) Two Test specimens each shall be prepared from the test bar preferably M10 round sample. Test bars for sampling shall be stamped by BHEL or BHEL authorised TPIA, as necessary.
- e) **Acceptance Criteria:** Both the samples tested shall not rupture and shall meet the creep requirements at 1,000 hours of testing at indicated temperatures & stress values as per Table 1.
- f) Reporting: As per Table 2.

Table 2. Suggested/Recommended Format for Reporting the Creep Testing Data:

SI No	Description	Details/Results
1	Report No. Date:	
2	Name and Address of the Tube/ Forged Finned Elbow/ forgings Manufacturer	
3	Name and Address of the Raw Material Supplier	
4	Material Specification & Grade (Code Case, if applicable)	
5	Heat/Melt No, SI No (if applicable)	
6	Heat treatment details (Type & Temperature)	
7	Name and Address of Testing Laboratory	
8	Testing method/ Standard (ASTM E139 or BS EN ISO 204) & Revision/Edition	
9	Test Sample Size	
10	No. of test samples	
11	Temperature at which test is conducted (°C)	
12	Stress value observed (MPa)	
13	Test Start Date & Time	
14	Test End/Reporting Date & Time	
15	Test duration (hours of creep testing)	
16	Test witnessed by (Name of Inspector & Agency)	
17	Test Result (Accepted/Not Accepted)	