

 Heat Exchanger Group BHEL - Bhopal		QUALITY ASSURANCE PLAN (QAP)							QAP No. Revision No.		CDE-15-3070 01	
		ITEM	Non Ferrous Straight Seamless Tubes for OFWF Cooler							Date of Issue Page		20.08.2015 01 of 03
S.No.	Components & Operations		Characteristics	Class	Type of Check	Quantum of check	Reference Document	Acceptance Norms	Format of Records	Agency		
		1								2	3	
1	2	3	4	5	6	7	8	9	10			11
1.0		Material										
1.1	Base Tube (90-10 Cu/Ni)	Chemical composition analysis	Major	T	1 No. at random per Heat Lot.	AA12130 Rev.06 (SB111 C70600)	AA12130 Rev.06 (SB111 C70600)	TC	W	W	R	See Note-1
		Mechanical test including Elongation, Hardness, Flattening, Expansion	Major	T	2 Nos. at random per mfg. Lot	---do---	---do---	TC	W	W	R	<ul style="list-style-type: none"> Hardness Vickers HV 5 : 110 (Max). See Note-1
		Eddy current test	Major	I + Visual	100%	CL. 13.1.1 of SB-111 (E243)	CL. 13.1.1 of SB-111 (E243)	IR	W	W	R	<ul style="list-style-type: none"> See Note-02 & 04 100% "W" by Tube Supplier & 10% (at random) "W" by BHEL-IA.
		Hydraulic test	Critical	I + Visual	100%	AA12130 Rev.06 (SB111 C70600)	AA12130 Rev.06 (SB111 C70600)	IR	W	W	R	<ul style="list-style-type: none"> At 70kg/cm2(g) See Note-05 100 % "W" by Tube Supplier & 20% (at random) "W" by BHEL-IA.
		Heat Treatment Bright Annealed	Critical	Visual	100%	---Do---	---Do---	HT data / Chart	W	R	R	<ul style="list-style-type: none"> Annealed (O61) temper See Note-3
		Mercurous nitrate or Ammonia Vapor cracking test	Major	T	1 No. at random per mfg. Lot	ASTM B-154 / B-858	ASTM B-154 / B-858	TC	W	W	R	See Note-1
		Microscopical examination				As specified in SB-111	As specified in SB-111					

LEGEND: 1: Tube Supplier, 2: BHEL-IA, 3: Customer (e.g. NTPC / NHPC/etc. if any); P-Perform, W-Witness, R-Record review, IR/TC: Inspection Report/Test Certificate, IA : Inspection Agency, T : Testing lab to be used for check, I : Instrument used to check.

Manufacturing Lot Size : 600 Tubes or 4500KG (total weight of tubes) from same heat lot – whichever constitute greater weight.

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1	2		3	4	5	6	7	8	9	10	1	2	3	
2.0		In process Inspection												
2.1	Dimensional check	TK at straight portion	Major	Visual + I	100%	AA12130 Rev.06 (SB111 C70600)	AA12130 Rev.06 (SB111 C70600)	IR	P	W	R	<ul style="list-style-type: none"> Tolerance = Table-12 of Spec. SB-111. 10% at random witnessed by BHEL IA. 		
		OD at straight portion	Minor	Visual + I	100%	---Do---	---Do---	IR	P	W	R	<ul style="list-style-type: none"> Tolerance = Table-10 of Spec. SB-111. Use calibrated "go", "no go" ring gauge. 10% at random witnessed by BHEL IA. 		
		Length of tubes	Minor	Visual + I	100%	---Do---	---Do---	IR	P	W	R	<ul style="list-style-type: none"> 10% at random witnessed by BHEL IA. Tolerance = (+)3.0/(-)0.0 		
		Straightness	Minor	Visual + I	100%	---Do---	---Do---	IR	P	W	R	<ul style="list-style-type: none"> 10% at random witnessed by BHEL IA. 0.5mm (max) in any length of 1000mm. 		
		Squareness of cut	Major	Visual + I	100%	---Do---	---Do---	IR	P	W	R	<ul style="list-style-type: none"> Tolerance : 0.25 mm (max). 10% at random witnessed by BHEL IA. 		
2.2	Checking of surface	Surface finish and cleanliness	Minor	Visual	100%	See Note-12 & 13.	See Note-12 & 13.	IR	P	W	-	<ul style="list-style-type: none"> 10% at random witnessed by BHEL IA. 		
2.3	Identification	Marking on tube	Major	Visual	100%	See Note-14	See Note-14	IR	P	W	R	<ul style="list-style-type: none"> 10% at random witnessed by BHEL IA. 		
		Correlation of Material with TC & IR.	Major	Visual	100%	----	----	IR	P	W	R			
3.0	Final documentation.	Verification of all TCs & IRs for completeness	Major	Visual	100%	PO, AA12130 Rev.06 (SB111 C70600) & QAP	PO, AA12130 Rev.06 (SB111 C70600) & QAP	IR	P	R	R	See Note-09		

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4.0	Preservation, Packing, Marking and dispatch.	Marking on packing case.	Major	Visual	100%	Para-4.0 of BHEL Spec. AA-0490002	Para-4.0 of BHEL Spec. AA-0490002	IR	P	W	-	<ul style="list-style-type: none"> Plastic end caps to be provided on each tube as per Para-2.1 of spec. AA-0490003. See Note-6. 10% at random witnessed by BHEL IA. 	
		Packing & preservation	Major	Visual	100%	BHEL Spec. AA-0490002	BHEL Spec. AA-0490002	IR	P	R	--		
		Dispatch	Major	Visual	100%	BHEL Spec. AA-0490002	BHEL Spec. AA-0490002	IR	P	R	--		
Notes:													
<ol style="list-style-type: none"> Testing (mechanical & chemical both) to be carried out at NABL approved lab / BHEL TSD only. NDT (ECT) to be carried out by own in-house ISNT / ASNT NDT Level-I person under the supervision by Level-II/III person only. Heat Treatment to be carried out by calibrated in-house bright annealing furnace / set up only. All associated thermocouples & temperature recorder need to be with valid calibration record (duly calibrated by NABL approved agency). Un-tested tube ends to be cut and discarded. Defective tubes area to be identified by permanent marking and shall be damaged & Segregated out from the finished tube lot. 'Hydrostatic Testing' of tube shall be carried out using demineralized / drinking water followed by drying completely using hot compressed air. Tubes shall be packed in sturdy packing as per BHEL Spec.AA-0490002 & shall be capable of withstanding mechanical damages during transit, handling & shipment. All requirements of BHEL drawing and material specification shall be complied fully. After receipt of items at BHEL-Bhopal, same can be checked at random to confirm all QAP requirements. Discrepancy found if any, shall be communicated to Tube Supplier for complete replacement. Four (04) copies of all test certificates (covering all the tests / steps as mentioned in the above QAP) duly signed by BHEL-IA (as per the approved QAP) shall be furnished along-with the final dispatch documents. Sequence of documents shall be as per the QAP only with proper index sheet at top. Final dimensional check and checking of surface (Cl.2.0 of QAP) to be done after hydro-testing only All instruments (used for dimension / thickness / hardness measurement) shall have proper co-related valid calibration record. Calibration shall be done by NABL approved agency only. Inside & Outside surface of tubes shall be free from tool marks, dents, surface cracks, wrinkles, etc. Inside of tubes to be cleaned to remove dirt, oil, carbon deposit, etc. Tube end edge to be smooth without burrs, to be protected by end caps before dispatch. Each tube shall be stenciled with BHEL Order No., BHEL Spec. No., Heat No., Size of Tube and Supplier's mark for proper co-relation with TC. BHEL-IA to ensure the same at both base tube & Fin Tube supplier's end. 													
						Prepared by :		Reviewed by :			Approved by :		
						ARUN SINGH Engineer (D) CDE		ALPA TOPPO Sr. Engineer (D) CDE			S.K.BISWAS Dy.Gen. Manager (D) CDE		