

 Heat Exchanger Group BHEL - Bhopal		QUALITY ASSURANCE PLAN (QAP)							QAP No.		CDE-09-2702	
		Non Ferrous Straight W.W. Tubes for Hydro Coolers							Revision No.		01	
									Date of Issue		25.04.15	
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S.No.	Components & Operations	Characteristics	Class	Type of Check	Quantum of check	Reference Document	Acceptance Norms	Format of Records	Agency			Remarks
1	2	3	4	5	6	7	8	9	1	2	3	
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	- 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	- See Note-02 & 04 100% "W" by Tube Supplier & 10% (at random) "W" by BHEL-IA.
		Hydraulic test	Critical	I + Visual	100%	---do---	---do---	IR	W	W	R	- 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%	AA12130 Rev.06 (SB111 C70600)	AA12130 Rev.06 (SB111 C70600)	HT data / Chart	W	R	R	- 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					
		Dim check with respect to tolerance and straightness	Minor	I + Visual	100%	---do--- & BHEL drg.	---do--- & BHEL drg.	IR	W	W	R	100% "W" by Tube Supplier & 10% (at random) "W" by BHEL-IA. - See Note-15 & 16. - See Note-21 for marking on Base Tube.
		Surface finish										
Correlation of Material with TC & IR. Marking of tube.	Major	Visual	100%	--DO--	--DO--	IR	P	W	R			

LEGEND: 1: Base / Fin 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.

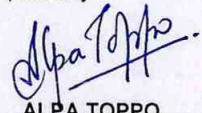
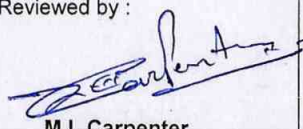
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1	2	3	4	5	6	7	8	9	10			11
1.2	Fin (Copper Wire)	Conductivity	Major	Visual	1 Sample (selected at random) per each lot.	IS-1897 / IS-191	97% (Min)	TC	W	W	R	See Note-1
		Purity	Major	Visual		As per spec.	As per spec.	TC	W	W	R	
		Wire Diameter	Major	Visual		BHEL Drg.	BHEL Drg.	IR	W	W	R	
1.3	Solder Wire	Chemical composition analysis	Major	Visual		As per spec.	As per spec.	TC	W	R	-	See Note-1
2.0	In Process Inspection : At Fin Tube Manufacturer's end.											
2.1	Finning of Tubes	Co-relation of Base Tube & Copper Wire with actual items received.	Major	Visual	100%	TC & IR as detailed at Para-1.1 & 1.2 above.	--	IR	P	W	--	- Hold Point for BHEL-IA - Marking on base tube need to be checked with TC & IR for co-relation.
		Finning	Major	Visual	100%	Mfr's std.	Mfr's std.	IR	P	-	-	Mfr's standard need to be approved from BHEL before start of manufacturing.
2.2	Surface Cleanliness	Cleaning of Tubes (Inside & Outside)	Minor	Visual	100%	Mfr's standard	Mfr's standard	IR	P	-	-	- Compressed air / Pressurized Potable water (max 30PPM Chloride content) to be used for cleaning followed by drying completely. - See Note-15 & 16
2.3	Leak Proofness	Hydraulic test	Critical	I + Visual	100%	BHEL Drg.	BHEL Drg.	IR	P	W	R	- Hold point for BHEL-IA. - See Note-5 - At 20.0 kg/cm²(g) for 10 sec (min). 20% at random "W" by BHEL IA
2.4	Cut straight end of tubes	Dimensional matching	Minor	Visual + I	100%	BHEL Drg.	BHEL Drg.	IR	P	-	-	See Note-16

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2.5	Dimensional check	TK at straight portion	Major	Visual + I	100%	BHEL Drg.	BHEL Drg.	IR	P	W	R	• $[= 1.016 / 0.914 \pm 0.11]$: As applicable. • 10% at random witnessed by BHEL IA.
		OD at straight portion	Minor	Visual + I	100%	BHEL Drg.	BHEL Drg.	IR	P	W	R	• $[= 12.7 / 9.5 \pm 0.064]$ • Use calibrated "go", "no go" ring gauge. • 10% at random witnessed by BHEL IA.
		Dimension – "A"	Major	Visual + I	100%	BHEL Drg.	BHEL Drg.	IR	P	W	R	• 10% at random witnessed by BHEL IA. • Tolerance = ± 1.0 mm
		Dimension – "B"	Major	Visual + I	100%	BHEL Drg.	BHEL Drg.	IR	P	W	R	
		Dimension – "C"	Major	Visual + I	100%	BHEL Drg.	BHEL Drg.	IR	P	W	R	
		Dimension – "D"	Major	Visual + I	100%	BHEL Drg.	BHEL Drg.	IR	P	W	R	
		Dimension – "E"	Major	Visual + I	100%	BHEL Drg.	BHEL Drg.	IR	P	W	R	
		Winding Formula (e.g. wire gauge, dia over loop, loops per inch, coils per ft run, etc.)	Major	Visual + I	100%	BHEL Drg.	BHEL Drg.	IR	P	W	R	• Tolerance : 0.25 mm (max). • 10% at random witnessed by BHEL IA.
		Squareness of cut	Major	Visual + I	100%	AA12130 Rev.06 (SB111 C70600)	AA12130 Rev.06 (SB111 C70600)	IR	P	W	R	
2.6	Checking of surface	See Note-15 & 16.	Minor	Visual	100%	BHEL Drg.	BHEL Drg.	IR	P	W	-	• 10% at random witnessed by BHEL IA.
2.7	Fin adhesion check	To ensure fin adhesion	Minor	Visual + I	1 No. per lot at random	BHEL Drg.	BHEL Drg.	IR	P	W	W	Randomly selected by BHEL-IA.
3.0	Final documentation.	Verification of all TCs & IRs for completeness	Major	Visual	100%	PO, Specn, drg & QAP	BHEL Spec., Drg	IR	P	R	R	See Note-09

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4.0	Preservation, Packing, Marking and dispatch.	Marking	Major	Visual	100%	Para-4.0 of BHEL Spec. AA-0490002	Para-4.0 of BHEL Spec. AA-0490002	IR	P	W	-	- 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: - 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 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.2.5 & 2.6 of QAP) to be done after hydro-testing only - Completeness of other requirements (left if any in BHEL's drawing) also needs to be ensured in totality. In case of any conflict between this QAP and other document, this QAP shall govern finally. - 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. - In case of local finned tube supplier and for NTPC project, TC review need to be done by NTPC-RIO at supplier's works only. - Reference BHEL drawing : As mentioned in Enq / PO. - 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.														
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