

 Heat Exchanger Group BHEL - Bhopal		QUALITY ASSURANCE PLAN (QAP)							QAP No.		CDE-09-2708		
									Revision No.		04		
		ITEM	ALUMINIUM L-FINNED ADMIRALTY BRASS TUBE							Date of Issue		19.10.15	
										Page		01 of 03	
S.No.	Components & Operations		Characteristics	Class	Type of Check	Quantum of check	Reference Document	Acceptance Norms	Format of Records	Agency			Remarks
										1	2	3	
1	2		3	4	5	6	7	8	9	10			11

1	MATERIAL											
1.1	BASE TUBE (Ad. Brass)	Chemical composition analysis.	Major	T	1 No. at random per mfg. lot	AA12128 Rev.05 (SB111 C44300)	AA12128 Rev.05 (SB111 C44300)	TC	W	W	R	- Material to be tested at NABL approved lab / BHEL-TSD. BHEL-IA to ensure the same. - Hardness : 85 – 105 HV-5 - See Note-18. - Random selection to be done by BHEL-IA only.
		Mechanical properties including elongation, hardness, expansion, flattening & drifting.		T	2 Nos. at random per mfg. lot.			TC	W	W	R	
		Hydraulic test at a pressure of 70 kg/cm ² (g) (See Note-12 & 13)	Critical	I + Visual	100%	--DO--	--DO--	TC	P	W	W	100% "W" by "L-Fin Tube supplier & 20% (randomly selected by BHEL-IA) shall be "W" by BHEL-IA.
		Eddy current test (See Note-11 & 12)	Critical	I + Visual	100%	--DO--	--DO--	TC	P	W	W	
		Mercurous Nitrate test / 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	
		Microscopic Examination	Major	T		AA12128 REV 05	AA12128 REV 05	TC	W	W	R	
		Heat Treatment	Critical	Visual	100%	AA12128 Rev.05 (SB111 C44300)	AA12128 Rev.05 (SB111 C44300)	HT data / Chart	W	R	R	- Annealed (O61) temper - See Note-10
		- Dim. check (OD, TK & Length) with respect to tolerance. - Surface finish (See Note-3&4).	Major	I + Visual	100%	--DO--	--DO--	IR	P	W	W	100% "W" by "L-Fin Tube supplier & 20% (randomly selected by BHEL-IA) shall be "W" by BHEL-IA. - Thickness to be ensured - Use calibrated Go / No-Go Ring Gauge for OD check.
		- Correlation of Material with TC & IR. - Marking of tube.	Major	Visual	100%	--DO--	--DO--	IR	P	W	R	See Note-6 for marking on Base Tube.
1.2	Al. Fin	Chemical	Major	T	Sample	SB 209 ALLOY 1100 In O condition	SB 209 ALLOY 1100 In O condition	TC	W	W	R	Material to be tested at NABL / BHEL-TSD. BHEL-IA to ensure the same.
		Conductivity 59% Min. IACS	Major	T	One sample per type/lot			TC	W	W	R	

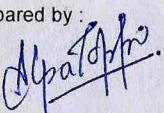
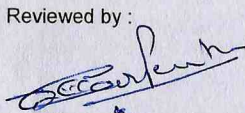
LEGEND: 1: Base / L-Fin Tube Supplier, 2: BHEL IA, 3: Customer (If any - See note : 7&8); P-Perform, W-Witness, R-Review of record, MTC : Manufacturer test Certificates, TC : Test Certificate Report, IR : Inspection report, IA : Inspection Agency, I : Instrument to be used for check, T : Testing (Lab.) to be done for check.

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

Signature

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2.0	In Process Inspection : At Fin Tube Manufacturer's end.											
2.1	Finning of Tubes	Co-relation of Base Tube & Al-Fin TC with actual items received.	Major	Visual	100%	TC & IR as detailed at Para-1.1 & 1.2 above.	--	IR	P	W	-	HP for BHEL-IA
		Finning	Major	Visual	100%	Mfr's std.	Mfr's std.	IR	P	-	-	
2.2	Leak Proofness	Hydraulic test	Critical	Visual + I	100%	BHEL Drg.	BHEL Drg.	IR	P	W	R	- Hold point for BHEL-IA. - See Note-12 & 13 - At 20.0 kg/cm2(g) for 20 sec (min). 20% at random "W" by BHEL IA
2.3	Cut straight end of tubes	Dimensional matching	Minor	Visual + I	100%	BHEL Drg.	BHEL Drg.	IR	P	-	-	If applicable.
2.4	Dimensional check	- Dimensional check (Fins TK, Fin OD). - No of fins per meter. - Finned, Un-Finned Length & total length. - OD at both ends	Major	Visual + I	100%	BHEL Drg.	BHEL Drg.	IR	P	W	R	100% "W" by "L-Fin Tube supplier & 20% (randomly selected by BHEL-IA) shall be "W" by BHEL-IA. - See Note-1 to 4. - Use calibrated Go / No-Go Ring Gauge for OD check.
2.5	Checking of Surface	Cleaning of Tubes (Inside & Outside)	Minor	Visual	100%	Mfr's standard	Mfr's standard	IR	P	W	-	See Note-3 & 4
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
4.0	Preservation, Packing, Marking and dispatch.	Marking	Major	Visual	100%	See remarks	See remarks	IR	P	--	--	Each box shall be legibly marked with short description of item, BHEL PO no. and etc.
		Packing & preservation	Major	Visual	100%	BHEL Spec. AA-0490002	BHEL Spec. AA-0490002	IR	P	--	--	- Tubes should be packed in sturdy wooden box to avoid damage during transit, handling and shipment. - Plastic end caps to be provided on each tube.
		Dispatch	Major	Visual	100%	BHEL Spec. AA-0490002 Rev.02	BHEL Spec. AA-0490002 Rev.02	IR	P	--	--	

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NOTE :-													
(1) Tubes shall be completely free from oil from inside and outside. For removal of oil completely, <u>Finned Tubes are required to be dipped in suitable chemical solvent (solvent shall not be detrimental for the base tube & fin material) for certain duration followed by drying completely before packing finally.</u> TPI to ensure Oil Free Tubes by placing tubes on rough papers for minimum 1 hour and examine any traces of Oil on papers both in vertical and horizontal condition. Tubes to be selected randomly from lot (min. 10 nos. for a lot of 250 Tubes). (2) Fins shall not be loose wounded, this is to be ensured. (3) Inside & Outside surface of tubes shall be free from tool marks, dents, surface cracks, wrinkles, etc. (4) 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. (5) Base tube will be procured from B.H.E.L approved sources only, as mentioned in the enquiry checklist. (6) 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 & L-Fin Tube supplier's end before start of finning. (7) For customer intervention required if any, supplier to obtain all required details from BHEL well in advance (8) In case of customer intervention required, supplier to arrange the inspection at their end. (9) Four (04) copies of all inspection reports & test certificates (covering all the tests / stages as mentioned in the subject QAP) duly signed by BHEL-IA (as per this QAP) shall be furnished along-with the final dispatch documents. BHEL-IA to ensure that all reports shall be arranged in sequential manner as per this QAP with proper index sheet at top. (10) 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). (11) 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. (12) Defective tubes to be cut and discarded. Defective tubes area to be identified by permanent marking & segregated out from the area of finished tube lot. (13) 'Hydrostatic Testing' of tube shall be carried out using demineralized / drinking / clean potable water followed by drying completely using hot compressed air. (14) Final dimensional check and checking of surface (Cl.2.4 & 2.5 of QAP) to be done after hydro-testing only. (15) 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. (16) 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. (17) Reference BHEL drawing : As mentioned in Enq / PO. (18) Ladle analysis report of all applicable heats need to be reviewed by BHEL-IA along-with the product analysis report. These ladle analysis reports also need to be a part of dispatch documents. Ladle analysis to be done in NABL approved lab / BHEL-TSD only / supplier's own calibrated spectrometer.													
Approval does not relieve supplier from meeting our requirements as per the drawing / specification.													
NOTE : For this PI -241101070 which is NTPC project, Vendor to comply fully the NTPC RQP 0000-999-QVE-P-180 Rev.03 in addition to BHEL QAP CDE-09-2708 Rev.04.													
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