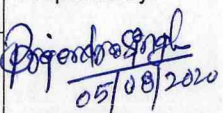

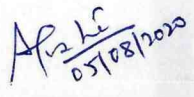
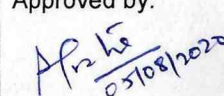

	Heat Exchanger Group BHEL BHOPAL		STANDARD QUALITY PLAN - SQP					QA PLAN No. : CDE-20-3479 Revision No. : 00 Date of issue : 05.08.2020 PAGE : 1 of 3					
			Item : INTERGAL LOW FIN SEAM LESS CARBON STEEL 'U' BEND TUBES FOR BLEED STEAM TUBENST ASSEMBLY										
S.No.	Operations	Characteristics	Class	Type of Check	Quantum of Check	Reference Document	Acceptance Norms	Format of Record	* D	Agency for action			Remarks
										S	M	C	

1.0	Raw Material Inspection												
1.1	Mother Tubes	- Identification of markings w.r.t MTC	Major	Visual	100%	Test Certificate	DIN 17175 St 35.8 / HE-54030	TC & IR	-	P	V	V	
		- Visual, Dimension & Surface finish check.	Major	Visual & Measurt.	100%	Test Certificate	DIN 17175 St 35.8 / HE-54030	TC & IR	-	P	V	V	
1.2	Verification of Mill Test Certificates	- Chemical composition	Major	Visual	100%	Test Certificate	DIN 17175 St 35.8 / HE-54030	TC & IR	✓	-	P	V	CHP
		- Mechanical Properties	Major	Visual	100%	Test Certificate	DIN 17175 St 35.8 / HE-54030	TC & IR	✓	-	P	V	CHP
2.0	In-Process Inspection												
2.1	Tube Forming	-Surface condition	Major	Visual	Periodic checking	Mfgrers. Std.	Mfgrers. Std.	IR	-	-	P	-	See note - 1
		-Dimensions	Major	Visual	Periodic checking	Mfgrers. Std.	Mfgrers. Std.	IR	-	-	P	-	
2.2	Intermediate / Final Drawing	Annealing after Drawing operation	Major	Heat treatment	100%	Mfgrers. Std	Mfgrers. Std.	IR	-	-	P	-	
2.3	Tube Washing	Surface Condition	Major	Visual	100%	Mfgrers. Std	Mfgrers. Std.	IR	-	-	P	-	
2.4	Heat Treatment of Tubes : Normalising	-Temperature, soaking time, heating rate etc.	Major	Recorder	Random	DIN 17175 St 35.8 / HE-54030	DIN 17175 St 35.8 / HE-54030	HT Chart	✓	-	P	V	
2.5	Test on Tubes	a. Chemical composition	Major	Chemical	As per Spec.	DIN 17175 / HE-54030 Drawing	DIN 17175 / HE-54030 Drawing	Supplier TC	✓	-	P	V	See note - 8
		b. Tensile testing	-do-	Mech.	-do-	-do-	-do-	-do-	✓	-	P	W	CHP
		c. Notch Impact test	-do-	Mech.	-do-	-do-	-do-	-do-	✓	-	P	W	
		d. Ring expanding test	-do-	Mech.	-do-	-do-	-do-	-do-	✓	-	P	W	

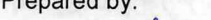

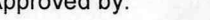
BHEL Drg No. : As mentioned in P.O.		BHEL Spec. No.: HE-54030 / As mentioned in P.O.		Prepared by:  Brajendra Yadav Dy. Manager - CDE	Reviewed by:  Lalit Asnani DGM(Design) - CDE	Approved by:  S P Vatsa AGM - CDE
Legend: *D- Documents marked (✓) to be included by Supplier in Doc. Package. S - Sub-Supplier P - Perform IR : Inspection Record M - Supplier / Manufacturer W - Witness Mfgrers. : Manufacturer C - BHEL/ Inspn. Agency V - Verify Measurt. : Measurement CHP - Customer hold point						

		Heat Exchanger Group BHEL BHOPAL		STANDARD QUALITY PLAN - SQP Item : INTERGAL LOW FIN SEAM LESS CARBON STEEL 'U' BEND TUBES FOR BLED STEAM TUBENST ASSEMBLY				QA PLAN No. : CDE-20-3479 Revision No. : 00 Date of issue : 05.08.2020 PAGE : 2 of 3						
S.No.	Operations	Characteristics	Class	Type of Check	Quantum of Check	Reference Document	Acceptance Norms	Format of Record	*	Agency for action			Remarks	
									D	S	M	C		
2.6	Final sizing	- Outside Diameter - Surface condition	Major	Measurt.	100%	DIN 17175 St 35.8 / HE-54030/Drawing	DIN 17175 St 35.8 / HE-54030/Drawing	IR	-	-	P	-		
2.7	Straightening	- Straightness	Major	Visual	100%	DIN 17175 St 35.8 / HE-54030/Drawing	DIN 17175 St 35.8 / HE-54030/Drawing	IR	-	-	P	-		
2.8	Non-destructive examination of finished tubes	-Detection of surface, Sub-Surface & internal flaws / defects	Major	Supplier to specify	100%	As per approved procedure	As per approved procedure	IR	✓	-	P	W*	*100%	
2.9	Cut on length with allowances	Cut to length with allowances	Major	Measurt	100%	HE-54030 / Drawing	HE-54030 / Drawing	IR	-	-	P	-	See note - 2	
2.10	Inspection of Straight tubes	OD, Thickness, Length, Straightness, Edge burrs, surface condition	Major	Visual & Measurt	100%	DIN 17175 St 35.8 / HE-54030/Drawing	DIN 17175 St 35.8 / HE-54030/Drawing	IR	-	-	P	-		
2.11	Fin Profile/ Parameters	Major dia., minor/root dia., Fin height, No. of fins/meter, concentricity	Major	Visual & Measurt	100%	HE-54030/ Drawing	HE-54030/ Drawing	IR	-	-	P	-		
2.12	U-bending of tubes	Centre line bend radius (CLR), Wall thinning	Major	Visual & Measurt.	100%	HE-54030/ Drawing	HE-54030/ Drawing	IR	-	-	P	V	See note - 3	
2.13	Heat Treatment of U-bend portion including 150 mm along straight leg.	Annealing -Visual -Heat Treatment parameters	Major	-Visual -Temp.	Random	DIN 17175 St 35.8 / HE-54030	DIN 17175 St 35.8 / HE-54030	IR	✓	-	P	V	See note - 4	
3.0	Final Inspection													
3.1	Hydrostatic Testing of U-Bend Tubes	Pressure, Time, Leakage	Major	Visual	100%	DIN 17175 St 35.8 / Drawing	DIN 17175 St 35.8 / Drawing	Test report	✓	-	P	W	CHP, See note - 5	
3.3	Cut to length & Deburr	Length, edge condition	Major	Measurt	100%	DIN 17175 / HE-54030/ Drawing	DIN 17175 / HE-54030/ Drawing	IR	-	-	P	V		
BHEL Drg No. : As mentioned in P.O.			BHEL Spec. No.: HE-54030 / As mentioned in P.O.			Prepared by:  05/08/2020 Brajendra Yadav Dy.Manager - CDE		Reviewed by:  05/08/2020 Lalit Asnani DGM(Design) - CDE		Approved by:  05/08/2020 S P Vatsa AGM - CDE				
Legend: *D- Documents marked (✓) to be included by Supplier in Doc. Package. S - Sub-Supplier P - Perform IR : Inspection Record M -Supplier / Manufacturer W - Witness Mfg rs. : Manufacturer C - BHEL/ Inspn. Agency V - Verify Measurt. : Measurement CHP - Customer hold point														

		<i>Heat Exchanger Group</i> BHEL BHOPAL		STANDARD QUALITY PLAN - SQP				QA PLAN No. : CDE-20-3479 Revision No. : 00 Date of issue : 05.08.2020 PAGE : 3 of 3					
				Item : INTERGAL LOW FIN SEAM LESS CARBON STEEL ‘U’ BEND TUBES FOR BLED STEAM TUBENST ASSEMBLY									
S.No.	Operations	Characteristics	Class	Type of Check	Quantum of Check	Reference Document	Acceptance Norms	Format of Record	* D	Agency for action			Remarks
										S	M	C	
3.4	Dimension conformity & Visual Examination	OD, CLR, Wall thickness, wall thinning, Length, Ovality, Leg spacing, Plane of bend, Bend Radius, Curvature & Edge burrs.	Major	Measurt.	-do	DIN 17175 / HE-54030/ Drawing	DIN 17175 / HE-54030/ Drawing	IR	✓	-	P	W*	* Verify & Random witness, See note - 6
4.0	Packing & Despatch	Verification of all T.Cs. for completion.	Major	Visual	100%	DIN 17175, Drawing & SQP	DIN 17175., Drawing & SQP	-do-		-	P	V	
		Identification, Preservation & Packing	Major	Visual	100%	BHEL spec. AA-0490003	BHEL spec. AA-0490003	IR	✓	-	P	V	See note - 7

Notes:

- Lubricants used in tube drawing / pilgering operation shall be suitable to tube material. Each cleaning operation shall be followed by a rinse(s) with water. The final rinse shall be with clean water with chloride not exceeding **10 ppm**.
- Un-tested tubes ends to be cut and discarded. Defective tubes/area to be identified by permanent marking and shall be segregated out from the finished tube lot.
- Hot bending to form 'U' tubes shall not be permitted.**
- U-bend area plus approximately 150mm of each leg beyond tangent point of the U-bend shall be heat treated.
- 'Hydrostatic testing' shall be carried out with clean water. Chloride content in the water shall not exceed 10 ppm max.
- For assessment of tube thinning in bending / forming process, check one tube from each of minimum radius & maximum radius rows.
- Tubes shall be packed in sea worthy packing & shall be capable of with standing mechanical damages during transit, handling & shipment.
- Any tube picked at random, will be subjected to testing (chemical analysis, mechanical test etc.) & will also be inspected for other requirements as per specification & tube drawing, **after receipt of tubes at BHEL-Bhopal.**
- Plain tubes also shall be subjected to inspection by the same inspection agency as per the QA Plan duly approved by BHEL.
- All testing shall be carried out at NABL/BHEL approved laboratories only.
- A Certificate of Compliance(COC) listing applicable specifications, drawing, QA Plan etc., duly signed by inspection agency, shall be submitted along with the final documents/TCs.
- Supplier to submit QA plan in line with this QAP for BHEL/NPCIL approval

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