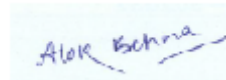
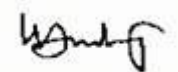

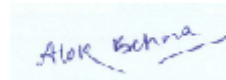
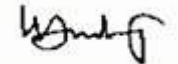

		BHEL HYDERABAD-32		STANDARD QUALITY PLAN					QP No. : HY/HE/010/U-TUBE Rev. No.: 03 DATE : 02.06.2016 PAGE : 1 OF 6				
ITEM: SEAMLESS SS 'U' TUBES FOR HP HEATERS & LP HEATERS													
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY			REMARKS
										S	M	C	
1.0	RAW MATERIAL INSPECTION												
1.1	MOTHER TUBES	A) IDENTIFICATION OF MOTHER TUBES MARKINGS W.R.TO TC	MAJOR	VISUAL	100%	TEST CERTIFICATE	BHEL SPECIFICATION	TC & INSPN. RECORD		P	V	W *	* VERIFY & RANDOM WITNESS NOTE-13
		B) VISUAL & DIMN. EXAM	-DO-	VISUAL & MEASURT	-DO-	-DO-	-DO-	-DO-		P	V	V	
1.2	VERIFICATION OF MOTHER TUBES TEST CERTIFICATE	A) CHEMICAL COMP.	-DO-	-DO-	-DO-	-DO-	-DO-	-DO-	✓		P	V	CARBON CONTENT LIMIT SHALL BE AS PER BHEL SPECIFICATION
		B) MECH. PROPERTIES	-DO-	-DO-	-DO-	-DO-	-DO-	-DO-	✓		P	V	
		C) UT	-DO-	INTERNAL FLAW	-DO-	-DO-	-DO-	-DO-	✓		P	V	NOTE-13
2.0	IN PROCESS INSPECTION												
2.1	PILGERING / INTERMEDIATE DRAWING	COLD PILGERING / COLD DRAWING	MAJOR	OD, THK, SURFACE	100%	-DO-	-DO-	-DO-			P	V	
2.2	TUBE WASHING	SURFACE CONDITION	MAJOR	VISUAL	100%	-DO-	-DO-	-DO-			P	V	
2.3	INTERMEDIATE HEAT TREATMENT	SOLUTION ANNEALING	MAJOR	TEMP, SOAKING TIME, SPEED	100%	-DO-	-DO-	-DO-	✓		P	V	

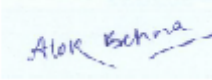
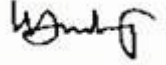
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				ITEM: SEAMLESS SS 'U' TUBES FOR HP HEATERS & LP HEATERS									
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY			REMARKS
										S	M	C	
2.4	FINAL DRAWING & SIZING	COLD DRAWN	MAJOR	OD, WALL THK & SURFACE	100%	-DO-	-DO-	-DO-			P	W *	* VERIFY & RANDOM WITNESS
2.5	FINAL HEAT TREATMENT	BRIGHT ANNEALING IN INERT ATMOSPHERE	MAJOR	TEMP, HOLDING TIME, RATE OF COOLING	100%	BHEL SPECIFICATION	BHEL SPECIFICATION	H T CHART	✓		P	V	NOTE 3
2.6	STRAIGHTENING	STRAIGHTNESS	MAJOR	OD, SURFACE	100%	-DO-	-DO-	-DO-			P		
2.7	CUT TO LENGTH WITH ALLOWANCE	LENGTH	MAJOR	MEASURT	100%	BHEL SPECIFICATION N & PO	BHEL SPECIFICATION & PO	INSPN. RECORD			P		
2.8	SAMPLING FOR TESTING		MAJOR	MEASURT	100%	BHEL SPECIFICATION N & PO	BHEL SPECIFICATION & PO	INSPN. RECORD			P	W	
2.9	TEST ON TUBES	a) PRODUCT ANALYSIS	MAJOR	CHEMICAL	AS PER SPEC.	SA213, SA1016 & PO	SA213, SA1016 & PO	SUPPLIERS TC	✓		P	V	CARBON CONTENT LIMIT SHALL BE AS PER BHEL SPECIFICATION
		b) TENSILE TESTING	-DO-	MECH.	AS PER SPEC.	-DO-	-DO-	-DO-	✓		P	W	
		c) HARDNESS TESTING	-DO-	MECH.	-DO	-DO-	-DO-	-DO-	✓		P	W	
		d) FLATTENING TEST	-DO-	MECH.	-DO	-DO-	-DO-	-DO-	✓		P	W	
		e) FLARING TEST	-DO-	MECH.	-DO	-DO-	-DO-	-DO-	✓		P	W	
		f) INTER GRANULAR CORROSION TESTING	-DO-	MET.	-DO	-DO-	-DO-	-DO-	✓		P	V	
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				ITEM: SEAMLESS SS 'U' TUBES FOR HP HEATERS & LP HEATERS				Rev. No.: 03 DATE : 02.06.2016 PAGE : 3 OF 6					
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY			REMARKS
										S	M	C	
		g) RESIDUAL CHLORIDE	-DO-	CHEM.	-DO	-DO-	-DO-	INSPN. RECORD	✓		P	V	
		h) MICROSTRUCTURE, GRAIN PROPERTIES	MAJOR	METALLO GRAPHY	ONE PER HEAT	BHEL SPEC.	BHEL SPEC. & P.O	TC	✓		P	V	
2.10	EDDY CURRENT TEST	INTERNAL FLAWS	-DO-	NDE	100%	ASTM E426	ASME SA1016 & NOTE 8	SUPPLIER TC	✓		P	W *	*100% ONLINE OR 100% OFFLINE. NOTE 11
2.11	ULTRASONIC TEST	INTERNAL FLAWS	-DO-	NDE	100 % BY MFR , 10 % BY BHEL	ASTM E213	ASME SA1016	SUPPLIER TC	✓		P	W	
2.12	INSPECTION OF STRAIGHT TUBES	OD, THICKNESS, LENGTH, STRAIGHTNESS, EDGE BURRS, SURFACE CONDITION	MAJOR	VISUAL & MEASURT	-DO	MFR. STD.	MFR. STD., BHEL SPEC	-DO-			P	V	
2.13	U-BENDING OF TUBES	CENTRE LINE BEND RADIUS (CLR)	MAJOR	VISUAL	100%	MFR. STD.	MFR. STD.	INSPN. RECORD			P	V	NOTE 4
		WALL THINNING	MAJOR	MEASURT	1 SAMPLE OF MIN BEND RADIUS FOR EACH THK	BHEL SPECIFICATIO N & DRG.	BHEL SPECIFICATION & DRG.	INSPN. RECORD			P	V	

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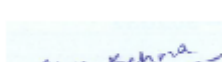
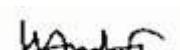
		BHEL HYDERABAD-32	STANDARD QUALITY PLAN						QP No. : HY/HE/010/U-TUBE				
			ITEM: SEAMLESS SS 'U' TUBES FOR HP HEATERS & LP HEATERS						Rev. No.: 03 DATE : 02.06.2016 PAGE : 4 OF 6				
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY			REMARKS
										S	M	C	
2.14	STRESS RELIEVING OF U- BEND PORTION	SOLUTION ANNEALING	MAJOR	TEMP, SOAKING TIME	100%	BHEL SPECIFICATIO N & DRG.	BHEL SPECIFICATION & DRG.	INSPN. RECORD	✓		P	V	NOTE 5
		RESIDUAL CIRCUMFERENTIAL STRESS	-DO-	MEASURT	ONE SPECIME N PER LOT	PO & DRG.	PO & DRG.	INSPN. RECORD	✓		P	W	PROCEDURE FOR RESIDUAL STRESS MEASUREME NT AS APPROVED BY BHEL TO BE FOLLOWED
3.0	FINAL INSPECTION												
3.1	HYDROSTATIC TESTING	PRESSURE, TIME, LEAKAGE	-DO-	LEAKAGE	-DO-	ASTM A1016	ASTM A1016	SUPPLIER TC	✓		P	W	CHP, NOTE 6 NOTE 12
3.2	CUT TO LENGTH & DEBURR	LENGTH, EDGE CONDITION	MAJOR	MEASURT	100%	BHEL SPECIFICATIO N & PO	BHEL SPECIFICATION & PO	INSPN. RECORD			P	V	
3.3	DIMN. CONFORMITY & VISUAL EXAM.	OD, CLR, THICKNESS, LENGTH, OVALITY, LEG SPACING, PLANE OF BEND, CURVATURE, EDGE BURRS.	MAJOR	MEASURT	-DO	DRG. / PO & SPEC	DRG. / PO & SPEC	-DO-	✓		P	W *	* VERIFY & RANDOM WITNESS
3.4	CLEANLINESS OF INSIDE SURFACE OF TUBES	NITROGEN PURGING	MAJOR	MEASURT	-DO	DRG. / PO & SPEC	DRG. / PO & SPEC	-DO-	✓		P	W *	* VERIFY & RANDOM WITNESS


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										S	M	C	
4.0	PACKING & DESPATCH	VERIFICATION OF ALL TCS FOR COMPLETION.	MAJOR	VISUAL	100%	PO, SPEC., DRG. & QP	-DO-	-DO-			P	V	
		PMI	-DO-	NDE	10 % BY MFR	BHEL SPECIFICATIO N & PO.	BHEL SPECIFICATION & PO.	INSPN. RECORD	✓		P	W	RANDOM WITNESS BY BHEL TPIA
		REVIEW OF REJECTION REPORT	MAJOR	VISUAL	100 %	PO, SPEC., DRG. & QP	-DO-	INSPN. RECORD	✓		P	V	*CHP NOTE 12
		PACKING & DISPATCH	MAJOR	VISUAL	100 %	PO, SPEC., DRG. & QP	-DO-	INSPN. RECORD			P	V	NOTE - 7

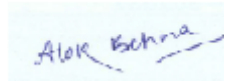
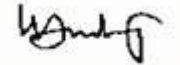
Notes:

- 1) Lubricants used in tube drawing operation shall be non-chlorinated (50 ppm chlorides or less). All cleaning compounds shall be chloride and caustic free. Each cleaning operation shall be followed by a rinse or rinses with water, the final rinse shall be with demineralised water containing not more than 10 ppm chlorides.
- 2) Intermediate solution annealing shall also be done in Bright Annealing furnace only.
- 3) Straight tubes shall be cleaned and bright annealed at a temperature of 1040°C min. Followed by quenching to below 370° c. BHEL TPIA shall check parameter settings and same shall be mentioned in Report.
- 4) Hot bending to form 'U' tubes shall not be permitted.
- 5) U bend area plus approximately 150mm of each leg beyond tangent point of the U bend shall be heat treated.
- 6) Hydrostatic testing of tubes shall be carried out with demineralised water. Chloride content of D.M. water shall not exceed 10 ppm.

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		ITEM: SEAMLESS SS 'U' TUBES FOR HP HEATERS & LP HEATERS											
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										S	M	C	

- 7) Tubes shall be packed in sea worthy packing & shall be capable of withstanding mechanical damages during transit.
- 8) Eddy current test shall be carried out with a transverse tangential notch as per SA1016
- 9) Project specific requirements, if any, as per PO shall also be complied with. Vendor holds the responsibility of supplying tubes to the specification and relevant standards.
- 10) The required certification for HP Heater U-tubes from IBR in IBR form III B format shall be furnished to BHEL.
- 11) All tubes passed in eddy current test shall be marked by electro-stencilling by BHEL/BHEL TPIA. All rejected tubes shall be removed from work area in presence of BHEL/BHEL TPIA
- 12) Vendor to perform root cause analysis and submit report to BHEL, in case of any rejection of tubes during Hydrotest failure.
- 13) BHEL TPIA shall check random 5 samples from each lot and verify co-relation with TCs during raw material induction & verification of balance TCs. Raw materials shall be procured from BHEL approved Sources:
- 14) In case of new Vendor (executing BHEL Order for first time), in addition to BHEL TPIA, BHEL QC shall also inspect/witness stage/final inspection at random as a surveillance check.

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