

	Heat Exchanger Group		QUALITY ASSURANCE PLAN (QAP)		QAP	CDE-17-3142
	BHEL - Bhopal				Revision No.	03
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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	

1	2	3	4	5	6	7						
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Notes:

- Drilling holes on the rubber bellow flange will be coated with self-vulcanizing rubber and also on the periphery of the flanges.
- Surface check on bellows after Curing to be free from any visual defects.
- During hydrostatic and vacuum tests, change in circumferential at top portion of the arch shall not to exceed 1.5% of the measured circumference at normal position. Test Certificate to include these dimensions also in addition to circumference.
- After 24 hours of test, permanent set will be measured and it should be within $\pm 0.5\%$. Initial measurement on circumferential and dimension overarch shall be taken when fitted on test bay.
- Two layers of inner cover with staggered lap joint and flange compactness internal records to be verified by BHEL during final inspection.
- In the event of combined forces for a pair of bellows exceeding 85% of the acceptance value, each bellow of that pair shall be tested for lateral deflection test individually at 0kg/cm^2 (g) pressure. The result obtained individually shall be extrapolated for design pressure in same ratio as for the combined pair and the acceptance of the bellow shall be determined accordingly.
- Before Vulcanizing Operation: Dimensional check, flange compactness before curing, Staggered Lap Joints (Circumferential & Longitudinal - meeting spec. IS-4682 Part-1).
- 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.
- Life cycle test shall be carried out on each size, design & type of bellows. In case it was already carried out for same type, size and design, then TC shall be reviewed by BHEL-IA & Customer for approval & acceptance during inspection which also needs to be a part of complete IR. Burst test is not required as the pressure required is about 10 times of test pressure and it is un-safe.
- In case of ambiguity (if any) found in the other specification/Document, this QAP may please be treated as final.

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		ITEM		Bare Rubber Bellow for R.E. Joint (Pr. Balance & Compensating Type)		Date of Issue		11.09.2019
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1	2	3	4	5	6	7	8	9	1 2 3	10 11
4.0	Preservation, Packing, Marking and dispatch.	Marking	Major	Visual	100%	Identification No. as mentioned in the Enq./PO documents.	Identification No. to be embossed on outer periphery of the bellows. Indelible ink can also be used for Identification.	IR	P W	Each bellow to be stickered (non-tempered type) by BHEL-IA after completion of all inspection stages and before box-up.
		Packing, Preservation & Dispatch	Major	Visual	100%	Mfg. Standard.	Suitable sturdy wooden box to be used to avoid damage during transit & storage.		P R	

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1	2	3	4	5	6	7	8	9	10	11
3.2	Functional Test on Rubber Bellows (Contd./-)	Deflection test (Lateral, Compression & Elongation) at 30 mm Hg. (abs) vacuum & at 0 to Design pressure (g) at an interval of 1 kg/cm2 (g) for deflection of 5, 10, 15, 20 & 25 mm (as applicable).	Critical	Visual + I	100%	As per BHEL approved drawing	As per BHEL approved drawing	IR	P W W*	• CHP • (*) 01 No. selected at random by customer out of total offered quantity. • Testing can also be done in pair.
3.3	Combined Movement Test at Design Pressure.	Compressed & Lateral Movement in each direction & then Elongation & Lateral Movement in each direction	Critical	Visual + I	100%	As per BHEL approved drawing	As per BHEL approved drawing	IR	P W W*	• Testing can also be done in pair.
3.4	Checking of surface	Surface smoothness	Major	Visual	100%	--	Absence of surface irregularities, cracks, dent mark, etc.	IR	P W	-
3.5	Final documentation	Verification of all TCs & IRs for completeness	Major	Visual	100%	PO, Specn, drg & QAP	PO, Specn, drg & QAP	IR	P R	R See Note-9

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								1	2	3	
1	2	3	4	5	6	7	8	9	10	11	
2.2	Manufacturing	Major	Visual	100%	Mfr. Std.	Min. 2 hrs. curing	--	P	R	Refer Note-5&7 below.	
		Major	Visual	100%	Mfr. Std.	No defects.	--	P	R	--	
3.0	Final Inspection										
3.1	Rubber Bellows	Dimensional conformity and compactness	Critical	Measurement + I	100%	As per BHEL approved drawing	As per BHEL approved drawing	IR	P	W	W*
		Vacuum test at 30mm Hg (abs) for 10 Minutes (Min.)	Critical	Visual + I	100%	As per BHEL approved drawing	No leakage & deformation	IR	P	W	W*
3.2	Functional Test on Rubber Bellows	Hydrostatic Test at 2 times the design Pressure for 30minutes (min)	Critical	Visual + I	100%	As per BHEL approved drawing	No leakage & deformation	IR	P	W	W*
(*) 01 No. selected at random by customer out of total offered quantity.											

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1.0	Raw Material Inspection (Contd./-)											
1.5	Reinforcement Fabric	Physical & Mechanical Properties	Major	Testing + T	One sample per entire supply	ASTM-D-5035 (Strip Method)	Minimum Breaking Load = 700 lbs./inch width	TC	P	R	R	Will be done at govt. approved Lab.
1.6	Reinforcement Ring	Mechanical test (Tensile Strength)	Major	Testing + T	One sample per entire supply	IS:1570 Part-1 Fe690/As per Drg.	690 MPa (Min)/ As per material Spec.	TC	P	R	R	-----do-----
1.7	MS Split Retainer Rings	Chemical & Mechanical test (T.S., Y.S. & EL)	Major	Testing + T	One sample / Heat & Heat Batch	As per BHEL Appd. Drg.	As per BHEL Appd. Drg.	MTC	P	R	R	
2.0	In Process Controls.											
2.1	MS Split Retainer Rings	a) Dimensional check	Major	Measurement + I	100%	As per BHEL approved drawing	As per BHEL approved drawing	IR	P	R	-	
		b) Galvanizing (Retainer Ring) If Applicable	Major	Measurement + I	100%	Coating thickness: 0.100mm - 0.130mm	Coating thickness: 0.100mm to 0.130mm & free from defects	IR	P	R	-	

