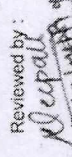


		Heat Exchanger Group		QUALITY ASSURANCE PLAN (QAP)				QAP		CDE-17-3142	
BHEL - Bhopal				Bare Rubber Bellow for R.E. Joint (Pr. Balance & Compensating Type)				Revision No. 03			
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S.No.	Components & Operations	Class	Type of Check	Quantum of check	Reference Document	Acceptance Norms	Format of Records			Remarks
							1	2	3	
1	2	3	4	5	6	7				
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.										

Prepared by:  Deepak Kumar Sr. Engineer / CDE, BHEL, BHOPAL	Reviewed by:  S. S. Mas Sr. General Manager (Quality) CDE, BHEL, BHOPAL	Approved by:  S. S. Mas Sr. General Manager (Quality) CDE, BHEL, BHOPAL
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 Heat Exchanger Group BHEL - Bhopal	QUALITY ASSURANCE PLAN (QAP)				QAP	CDE-17-3142	
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1	2	3	4	5	6	7	8	9	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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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		
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*		
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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Bare Rubber Bellow for R.E. Joint
(Pr. Balance & Compensating Type)

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									1	2	3	
1	2	3	4	5	6	7	8	9	10			11
2.2	Manufacturing	a) Vulcanizing	Major	Visual	100%	Mfr. Std.	Min. 2 hrs. curing	--	P	R	--	Refer Note-5&7 below.
		b) Surface after curing (02 Hrs. Min.)	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*	• CHP
3.2	Functional Test on Rubber Bellows	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*	• (*) 01 No. selected at random by customer out of total offered quantity.
		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*	

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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	10 11
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	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	----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	
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	

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1	2	3	4	5	6	7	8	9	10	11
1.0 Raw Material Inspection (Contd./-)										
1.4 Neoprene Rubber	a) Ozone resistance test	Major	Testing + T	One sample from each batch	ASTM D-1149-B or IS-3400 PART-20	No cracks for 72 hours in Ozone concentration @ 50 PPHM	TC	P	R	Will be done at govt./NABL approved Lab.
	b) Hydro-stability test	Major	Testing + T	One sample from each batch	ASTM-D-3137	±10% variation in tensile strength after 96 hours and ±5% change in volume.	TC	P	R	do----
	c) Blow Lamp Test	Major	Testing + T	One sample from each batch	IS-3181 Annex "H"	Able to extinguish itself within 4 seconds.	TC	P	R	do----
	d) Kerosene dip test on Neoprene after dipping for one hour	Major	Testing + T	One sample from each batch	Mfg. Standard	No visible defects or cracks & ±10% swelling in Volume is acceptable.	TC	P	R	do----

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S.No.	Components & Operations	Characteristics	Class	Type of Check	Quantum of check	Reference Document	Acceptance Norms	Format of Agency Records	Remarks	
1	2	3	4	5	6	7	8	9	10	
1.0 Raw Material Inspection										
1.1	Polymer Identification on Neoprene Rubber	Qualitative analysis	Major	Testing + T	One sample from each batch	IS 3400 Part-22	Presence of Chloroprene	TC	P R R	Will be done at govt./NABL approved Lab.
	a) Tensile Strength		Major	Testing + T	----do----	IS 3400 Part-1	Minimum 120 Kg./sq.cm (g)	TC	P R R	----do----
1.2	Neoprene Rubber	b) Elongation	Major	Testing + T	----do----	----do----	Minimum 350 %	TC	P R R	----do----
	c) Shore hardness		Major	Measurement +	----do----	ASTM D-2240	As per Drg. 60/65 ± 5° shore-A	TC	P R R	----do----
1.3	Natural Rubber	a) Adhesion of fabric to rubber	Major	Testing + T	----do----	IS 3400 Part-5	25 lbs/liner inch. width without stripping	TC	P R R	----do----
		b) Adhesion of rubber to metal	Major	Testing + T	----do----	IS 3400 Part-14 Method - A	60 lbs/liner inch. width without stripping	TC	P R R	----do----
LEGEND :										
1. Bare Bellow Supplier or his Sub vendor, 2. BHEL-IA, 3. Customer (NTPC / TANGENCO / APGENCO / etc.) – as mentioned in the Enquiry / PO.										
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 to be used to check										