

 Heat Exchanger Group BHEL Bhopal		STANDARD QUALITY ASSURANCE PLAN							QAP No.		CDE-15-3080	
									Revision No.		03	
		ITEM		SPHERICAL WAHSER					Date of Issue		10-09-2019	
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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
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1.0 MATERIAL INSPECTION												
1.1	Verification of <u>co-related Mill Test Certificates</u> of hot rolled / forged bar.	Chemical composition (Heat / Product Analysis) Properties.	Major	Visual	100%	BHEL Spec. AA10502 Rev.09 / as per BHEL Drg.	BHEL Spec. AA10502 Rev.09 / as per BHEL Drg.	MTC	R	R	-	See Note-1
		UT of Bar	Major	NDT + I	100%	BHEL Spec. AA0850118 Category-2 or equivalent.	BHEL Spec. AA0850118 Category-2 or equivalent.	MTC	R	R	-	- See Note-2 - Defects giving indication larger than that from 2mm dia or equivalent is not acceptable.
2.0 IN PROCESS												
2.1 In case made by forging												
2.1.1	Cut to length - For washer - For test sample	Co-relation with original bar to be ensured throughout the manufacturing cycle.	Major	Visual + I	100%	Mfg's established procedure.	Mfg's established procedure.	IR	P	-	-	Traceability to be ensured throughout the manufacturing cycle.
2.1.2	Forging of cut pieces and test sample.	Forging	Major	Visual + I	100%	Mfg's established procedure.	Mfg's established procedure.	IR	P	R	-	Forging reduction ratio of cut pieces and test sample should be same.
2.1.3	Normalizing of Cut Pieces & test sample	Heat Treatment	Major	Visual	100%	ASME Sec.VIII Div.1	ASME Sec.VIII Div.1	HT Data / Chart	P	R	-	
2.1.4	Rough machining of cut pieces.	Rough shaping	Major	Visual	Random	Mfg's established procedure.	Mfg's established procedure.	--	P	-	-	
2.1.5	Hardening & tempering of rough machined cut pieces & test sample	Hardening & tempering	Major	Visual	100%	Mfg's established procedure.	Mfg's established procedure.	IR	P	R	-	
2.1.6	Final machining of rough machined cut pieces	Final shaping	Major	Visual	100%	Mfg's established procedure.	BHEL drg.	IR	P	-	-	
2.1.7	Hard Punch on flat face of each washer along-with the test sample.	Unique identification	Major	Visual	100%	Mfg's established procedure.	Mfg's established procedure.	--	P	-	-	For co-relation with IR.
2.1.8	Gas Nitriding of spherical washers & test sample.	Surface hardening	Major	Visual	100%	Mfg's established procedure.	Mfg's established procedure.	--	P	-	-	
2.1.9	Cleaning of surface	Polishing of surface after nitriding	Minor	Visual	100%	Mfg's established procedure	Mfg's established procedure	IR	P	-	-	
2.1.10	Quality of surface	Surface hardness + Case Depth	Major	Visual + I	100%	BHEL drg.	BHEL drg.	IR	P	R	-	100% co-related hardness report required. - Case depth on sample washer (from each heat & heat batch) to be performed at any NABL approved lab.

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2.2	In case made from already forged and tempered bar											
2.2.1	Cut to length - For washer - For test sample	Co-relation with original bar to be ensured throughout the manufacturing cycle.	Major	Visual + I	100%	Mfg's established procedure.	Mfg's established procedure.	IR	P	-	-	Traceability to be ensured throughout the manufacturing cycle.
2.2.2	Final machining	Final shaping	Major	Visual	100%	Mfg's established procedure.	BHEL drg.	IR	P	-	-	
2.2.3	Hardening & tempering of cut pieces & test sample	Hardening & tempering	Major	Visual	100%	Mfg's established procedure.	Mfg's established procedure.	IR	P	R	-	
2.2.4	Hard Punch on flat face of each washer along-with the test sample.	Unique identification	Major	Visual	100%	Mfg's established procedure.	Mfg's established procedure.	--	P	-	-	For co-relation with IR.
2.2.5	Gas Nitriding of spherical washers & test sample.	Surface hardening	Major	Visual	100%	Mfg's established procedure.	Mfg's established procedure.	--	P	-	-	
2.2.6	Cleaning of surface	Polishing of surface after nitriding	Minor	Visual	100%	Mfg's established procedure	Mfg's established procedure	IR	P	-	-	
2.2.7	Quality of surface	Surface hardness + Case Depth	Major	Visual	100%	BHEL drg.	BHEL drg.	IR	P	R	-	100% co-related hardness report required. - Case depth on sample washer (from each heat & heat batch) to be performed at any NABL approved lab.
3.0	FINISHED PRODUCT INSPECTION											
3.1	Dimensional conformity of washer (for Item-01 & 02 both)	Dimensions	Major	Visual + I	100 %	BHEL Drg.	BHEL Drg.	IR	P	W (*)	-	(*) 5% out of the offered quantity (selected at random by BHEL-IA) to be witnessed BHEL-IA.
3.2	Quality of surface (for Item-01 & 02 both)	Surface Finish	Major	Visual + I	100 %	BHEL Drg.	BHEL Drg.	IR	P	W (**)		MPT to be performed by NDT Level-II person in MPT only.
3.3	Material / surface integrity	Magnetic Particle Test (MPT)	Major	Visual + I	10 %	Appendix-6 of ASME Sec.VIII Div.1	Appendix-6 of ASME Sec.VIII Div.1	IR	P	W (*)		(**) For total pairs of less than 1000 nos. : 03 nos. of pairs, For total pairs of equal or more than 1000 nos. : 05 nos. of pairs (selected at random by BHEL-IA) to be witnessed BHEL-IA.

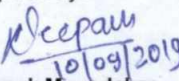
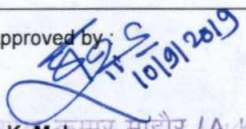
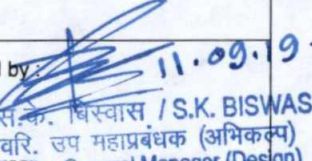
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3.4	Mechanical & chemical test of identified test sample (selected from each heat & heat treatment batch).	Mechanical analysis (Tensile, Yield, Elongation)	Critical	Visual + I	For each test sample	BHEL Spec. AA10502 Rev.09 / as per BHEL Drg.	BHEL Spec. AA10502 Rev.09 / as per BHEL Drg.	TC	P	W	-	- Testing to be done at NABL approved lab or using in-house test set up duly calibrated by NABL. - Preparation of test piece (to be taken in the longitudinal direction of the piece in accordance with IS-5517) to be done by Lab only.
3.5	Packing and dispatch	Verification of all T.C.s for completeness	---	Visual	100%	PO, Spen. Drg. & QAP	PO, Spen. Drg. & QAP	IR				See Note-6
		Protection and packing	---	Visual	100%	Mfg's established procedure.	Mfg's established procedure.	IR				- Ensure proper packing to avoid damage during transit & storage. - Proper care to be taken to avoid damage due to rubbing with each other during transport. Bubble sheet / suitable paper to be used for individual wrapping.

LEGEND : 1: Washer Supplier, 2: BHEL-IA, 3: Customer (NTPC/NPCIL/ other if any) / Customer's IA; **P**-Perform, **W**-Witness, **R**-Review, **MTC** : Mill test Certificates, **TC** : Test Certificate, **IR** : Inspection report, **IA** : Inspection Agency, **I** : Instrument to be used for check,

Note

- In case of unavailability original co-related MTC: Material to be tested at NABL approved lab for each heat and heat treatment batch.
- In case MTC does call for the UT (with acceptance norms as given), no separate UT is required. Else UT to be carried out by NDT Level-II meeting all specification requirement.
- No repair work is permitted without prior approval from BHEL.
- Important Note:** Spherical washer received at our end shall be subjected to random check to ensure its physical / mechanical / chemical properties including case depth. SRV shall only be cleared after successful test inside of BHEL.
- Four (04) copies of all Inspection reports (IR), MTC, HT Data, etc. as per this QAP (duly endorsed by IA) need to be submitted as part of final QA documents. **BHEL-IA to ensure that all reports shall be arranged in sequential manner as per this QAP with proper index sheet at top.**
- For conflict if any between this QAP and any other document, same need to be brought to the notice of BHEL for final acceptance.

Approval does not relieve supplier from meeting our requirements as per the drawing / specification.

Prepared by :  Deepak Maundekar Dy. Manager CDE		Approved by :  A.K. Mahor Dy. General Manager (D) CDE	Approved by :  S.K. Biswas Sr. Dy. General Manager (D) CDE
दीपक माण्डेकर / Sr. Engineer सी.डी.ई., मेल, भोपाल / CDE, BHEL, Bhopal		एस.के. बिस्वास / S.K. BISWAS वरिष्ठ महाप्रबंधक (अभिकल्प) सी.डी.ई., मेल, भोपाल / CDE, BHEL, Bhopal	