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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.		<u>TECHNICAL SPECIFICATION FOR ROUGH MACHINED DUPLEX SS SHAFT FORGINGS FOR C.W. PUMPS</u> 1.0 GENERAL: This standard specifies the quality requirements for the duplex stainless steel shaft forgings used for Cooling Water Pumps. 2.0 CONDITIONS OF DELIVERY : 2.1 Forging shall be rough machined as per the dimensions indicated against the relevant variant number shown in the accompanying Table-I. 2.2 If excessive deformation due to material manufacturing is found during final machining, the manufacturer shall supply substitute without payment in specified period. 3.0 COMPLIANCE WITH NATIONAL STANDARDS: Nearest equivalent international standards for this standard are: ASTM A276, ASTM A479 4.0 DIMENSIONS AND TOLERANCES: 4.1 The forging shall be supplied in rough machined condition (Ra 6.3) as per dimensions indicated against relevant Variant Number shown in the accompanying Table - I. When the forging are made out of ingots the minimum reduction ratio shall be 4:1. 4.2 No scratch, bruise shall be found on machined surface Tolerances on diameter shall be + 1.0 mm and on length is +5mm: 4.3 Maximum permissible run out shall be 2.0 mm (TIR). If it is not possible, the manufacturer shall produce the material whose diameter has extra shaft machining allowance considering feasible shaft run-out. 4.4 Strain during machining shall be paid much attention.			
Ref. Doc	Revisions : Refer to record of revisions :	Prepared : SUDHEER	Approved : MSRAM	Date : 03.01.19	



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5.0 HEAT TREATMENT:

Heat treatment of forgings shall be confirmed to requirements in ASTM A479/A276 as per condition mentioned based on variant number. The heat treatment temperature shall be as per manufacturer's standard.

Test pieces shall also be heat treated along with the forgings they represent.

6.0 FREEDOM FROM DEFECTS:

Forging shall be free from defects such as cracks, flakes, seams, segregation, harmful non-metallic inclusions and other defects which may affect the utility of the forging. Bars shall be free from internal and surface defects.

7.0 CHEMICAL COMPOSITION:

7.1 Chemical composition for UNS S31803

Carbon % max.	Silicon % max.	Manganese % max.	Phosphorus % max.	Sulphur % max.	Chromium %	Nickel %	Nitrogen %	Molybdenum %	Other elements
0.03	1.00	2.00	0.03	0.02	21.00 to 23.00	4.5 to 6.5	0.08 to 2.00	2.5 to 3.5	--

8.0 MECHANICAL PROPERTIES:

8.1 Mechanical properties for UNS S31803

Type	Condition	Tensile strength MPa min.	Yield stress MPa min.	Elongation in 50mm or 4D, min., %	Reduction in area min. %	Brinells Hardness Max.
--	Annealed	620	450	25	--	290

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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED. It must not be used directly or indirectly in any way detrimental to the interest of the company.	9.0 TESTING & INSPECTION: 9.1 ULTRASONIC EXAMINATION <u>Test Procedure:</u> As per ASME Sec.V Art. 23 SA388 <u>Acceptance criteria:</u> The following conditions are not acceptable: a) Signal-Noise (SN) ratio; (Defect echo)/(Noise echo) = 3 or above is found. b) When the reflected wave from the bottom is attenuated to be 20% or less than that from an area free from indications. The record shall be as per ASME Sec. VIII Div. 2.3.3.4.2. 9.2 CHEMICAL ANALYSIS Ladle analysis and check analysis shall be implemented for every batch to confirm to 7.0, for which result shall be submitted. 9.3 MECHANICAL TEST The mechanical properties of the included test piece shall confirm to 8.0. The tensile test shall be carried out at 20 deg. C according to ASTM A370. 9.4 CORROSION TEST Corrosion test as per ASTM G 48-A. 9.5 MICROGRAPHIC EXAMINATION <u>Test Procedure:</u> As per ASTM A923 METHOD A <u>Acceptance criteria:</u> ASTM A923 TABLE 1 9.6 Forgings shall be supplied with inspection and certification by BHEL or BHEL nominated Third Party Inspection Agency.		
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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.	11.0 DOCUMENTS TO BE SUBMITTED: The following documents shall be submitted for approval: a) Forging procedure b) Heat treatment procedure c) Dimensional inspection procedure d) UT procedure e) Chemical analysis & Mechanical test procedure f) Corrosion test procedure g) Micrographic examination procedure The following reports shall be submitted: a) Heat treatment record b) Dimensional inspection report c) UT report d) Material test report (Chemical analysis & Mechanical test) e) Corrosion test record f) Micrographic examination report 12.0 MARKINGS: The following details shall be engraved on each forging for easy identification. Drawing No: Eg. FP50696, VAR. No.xx Melt No:/Heat No: 13.0 PRESERVATION AND PACKING: At the time of packing or forwarding, adequate attention shall be paid to not to cause bends or damages to the material while loading, transportation and unloading. The forging shall be properly protected from damaged and corrosion during transport. Machined surfaces shall be protected with non-greasy anti-corrosive coating. Painting is not permitted. 14.0 REJECTION AND REPLACEMENT: If it is found that forging is not as per the specification requirement at any time during further operation at BHEL works, the forging is liable for rejection and the vendor shall replace the rejected forging at free of cost.		
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	Rev. No.	Date	Revision Details	Revised By	Approved By
	Ref. Doc.				

