

TD-106 Rev No. 00	Form No.  HYDERABAD	PRODUCT STANDARD PUMPS HYDERABAD		FP 50137 Rev No. 12 Page 1 of 4	
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>FORGED BARD, ROUGH MACHINED FOR PUMP SHAFTS</u> 1.0 GENERAL: This standard specifies the quality requirements of forged bars used for Boiler Feed Pumps and Booster pump shafts of 500mw & 600mw power plants. 2.0 CONDITION OF DELIVERY: 2.1 Forged bars shall be supplied in rough machined condition with surface finish of 6.3 microns or better. 2.2 Forged bars shall be hardened and tempered before rough machining. 2.3 Forged bars shall be stress relieved after rough machining. 3.0 EQUIVALENT INTERNATIONAL STANDARD (for reference only): Nearest equivalent international standard: DIN 17440-1996, Gr-X20Cr13 (1.4021) Nearest equivalent BHEL material specification : AA19321. 4.0 DIMENSIONS, TOLERANCES AND HEAT TREATMENT: 4.1 <u>DIMENSIONS:</u> The forged bars shall be supplied in rough machined condition as per the dimensions indicated in the Variant table. The minimum reduction ratio when forgings are made of ingots shall be 4:1. 4.2 <u>TOLERANCES :</u> Tolerances on diameter shall be ± 1.0 mm and on length ± 5.0 mm. Maximum permissible run out shall be 0.50 mm. 4.3 <u>HEAT TREATMENT:</u> Forged bars shall be hardened and tempered to give the mechanical properties specified. Test pieces shall also be heat treated along with the forgings they represent. Stress relieving shall be done to remove machining stresses and this temperature shall be less than the tempering temperature.			
		Ref. Doc	Revisions : Refer to record of revisions :	Prepared : T.S.R.	Approved : J.G.C.



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5.0 FREEDOM FROM DEFECTS:

Forged bars 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 forgings.

5.1 Inclusion rating per each melt and per heat treatment batch as per ASTM : E45,2 thin series for all types. (For BFP shafts only).

6.0 CHEMICAL COMPOSITION:

Carbon %	Silicon % max.	Manganese % max.	Nickel % max.	Chromium %	Phosphorus* % max.	Sulphur* % max.
0.16 0.25	1.00	1.50	1.00	12.0 14.0	0.04	0.03

SPECIAL REMARK :- * Phosphorous and sulphur shall be limited to 0.03% each.

7.0 MECHANICAL PROPERTIES:

TENSILE STRENGTH N/mm ² , min.	YIELD STRENGTH N/mm ² , min.	Elongation % min.	Hardness HB	Charpy Impact Value (2 mm V-notch) Joules, min.
750-950	550	12	217-241	15

7.1 Percentage reduction test to be done.

8.0 NON-DESTRUCTURE TESTS:

8.1 100% Ultrasonic examination shall be carried out after heat treatment and rough machining as per AA0850118 and acceptance as per AA0850102 Category-2. Frequency shall be minimum 2 MHz and back wall echo shall be minimum 80%.

8.2 100% Magnetic particle examination shall be carried out after heat treatment and rough machining as per AA0850102. Acceptance as per AA0850102 Category-2.

9.0 INSPECTION:

Forged bars shall be supplied with inspection and certification by Third Party authorized by BHEL.

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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. Ref. Doc 10.0 TEST CERTIFICATES: The supplier shall furnish 5 copies of test certificates, duly certified by Inspection agency (in English) containing the following information. a) Dimensional report b) Chemical analysis c) Mechanical properties including percentage reduction test results for cl.7.1. d) Heat treatment chart e) NDT results (Ultrasonic and magnetic particle) f) BHEL order No, supplier's name, Specn No., & description of item. 11.0 MARKING : The following details shall be engraved on each forged bar for easy identification. Material code, Specn and Var no. Melt No / Heat No: 12.0 PRESERVATION & PACKING: The forged bars shall be properly protected from damage and corrosion during transport. For carbon steel/Alloy steel forging the entire surface of the forging shall be applied with suitable non-greasy anti corrosive coating painting is not permitted on any surface. 13.0 REJECTION AND REPLACEMENT: The final decision regarding acceptance or rejection rests with BHEL, if the forging is not found as per specification or drawing at any time during further operation on the forging. The supplier shall replace the rejected forging at his own cost. 14.0 VARIANT TABLE: <table border="1" data-bbox="389 1570 1435 1818"> <thead> <tr> <th>VAR. NO.</th> <th>DIA x L (mm x mm)</th> <th>APPRX. WT. (kg)</th> <th>PUMP TYPE</th> <th>MATL CODE</th> </tr> </thead> <tbody> <tr> <td>01</td> <td>Ø150 x 2800</td> <td>388</td> <td>FK4E36</td> <td>FP9512153076</td> </tr> <tr> <td>02</td> <td>Ø110 x 1850</td> <td>138</td> <td>FA1E63</td> <td>FP9512153084</td> </tr> <tr> <td>03</td> <td>Ø110 x 1800</td> <td>134</td> <td>FA1B75</td> <td>FP9512153106</td> </tr> </tbody> </table>						VAR. NO.	DIA x L (mm x mm)	APPRX. WT. (kg)	PUMP TYPE	MATL CODE	01	Ø150 x 2800	388	FK4E36	FP9512153076	02	Ø110 x 1850	138	FA1E63	FP9512153084	03	Ø110 x 1800	134	FA1B75	FP9512153106
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	Rev. No.	Date	Revision Details	Revised By	Approved By
	01	31/10/84	NOTE AT 3.6 ON 100%UT REVISED	TSR	JGC
	02	04/12/85	BP SHAFT 31891233554 ADDED	TSR	JGC
	03	06/12/86	CLAUSE 3.4 MODIFIED	TSR	JGC
	04	02/02/93	UT REVISED TO AA0850118	TSR	JGC
	05	22/06/95	GENERALLY REVISED IN LINE WITH EMI-011	TSR	JGC
	06	04/05/96	PERCENTAGE REDUCTION TEST ADDIED AT 7-1, BP UT ACC. CAT. CHANGED. FREEDOM FROM DIFFECTS CL.NO. 5.1, & 5.2 ADDED.	TSR	JRR
	07	20/08/03	"FOR BFP SHAFTS ONLY" ADDED AGAINST CL.5.1 & CL. 5.2	MSR	BRK
	08	27/12/04	MAX PERMISSIBLE RUN OUT ADDED AT CL.NO. 4.2.	MSR	BRK
	09	25/04/08	AT CLAUSE NO. 7.0, MECHANICAL PROPERTIES, CHARPY IMPACT VALUE (2 mm V NOTCH) WAS "CHARPY IMPACT VALUE (2 mm U NOTCH)".		
	10	10/05/10	BS standards revised to BS EN standards at cl.no. 3.0 & cl.no.4.3	MSR	BRK
	11	18/02/2013	SPEC REVISED IN LINE WITH FP50443.	ASJK	BRK
	12	18/04/2017	Cl.no.2.0, 4.0 & 8.0 revised. Rough machined drawings deleted in view of CFFP supply of plain forged bars. Variant table added.	MSRAM	KHRK