


TD-106-1 Rev.5 Form No.		PRODUCT STANDARD PULVERIZERS HYDERABAD		SPEC.No. BA55023		
				Rev. No. 04		
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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>SPECIFICATION FOR WORM GEAR SET</u>				
		<p>I. INTRODUCTION</p> <p>WORM GEAR SETS ARE USED IN THE GEARBOX ASSEMBLY OF BOWL MILLS FOR TRANSMISSION OF TORQUE AND CHANGE OF DIRECTION FROM HORIZONTAL TO VERTICAL. THE BOWL MILLS ARE USED IN THERMAL POWER STATIONS FOR PULVERISATION OF COAL.</p> <p>II. FOR MATERIAL CODES AND DRAWINGS REF PAGE 4 OF 5.</p> <p>III. DUTY CONDITION</p> <p>THE WORK DUTY IS CONTINUOUS 24 HOURS A DAY AND 365 DAYS A YEAR. SEMI SUBMERGED LUBRICATION HAS BEEN PROVIDED FOR THE GEAR SET. MAXIMUM PEAK TORQUE IS 3 TIMES THE NORMAL TORQUE. PRIME MOVER: ELECTRIC MOTOR (WORKING CONDITION <math>\pm 10\%</math> VOLTAGE FLUCTUATION). COUPLING: DIRECT COUPLING BY FLEXIBLE GEAR/ SPRING COUPLING.</p> <p>IV. SCOPE OF SUPPLY ( REF.TABLE-3)</p> <p>WORM SHAFT - 1 NO. WORM GEAR- 1 NO. KEYS - 2 NOS. LOCK NUT/LOCK WASHER</p> <p>V. TECHNICAL CONDITION:</p> <p>A) WORM SHAFT:</p> <p>THE CHEMICAL AND MECHANICAL PROPERTIES WILL BE AS AGREED BETWEEN BHEL AND SUPPLIER. TYPICAL MATERIALS ARE SAE 8650, 20MnCr5, SAE 8620, AISI 4150. FOR ANY OTHER MATERIAL, MATERIAL PROPERTIES AND DESIGN CALCULATIONS TO BE PROVIDED AND PRIOR APPROVAL TO BE TAKEN FROM BHEL. MINIMUM FORGING REDUCTION FROM INGOT TO FINISH SHAFT IS 4:1. HARDENING AND TEMPERING SHALL BE CARRIED OUT AT SUITABLE TEMP. TO ACHIEVE DESIRED PROPERTIES. THESE CAN BE PROVED ON SEPARATELY FORGED TEST COUPONS.</p> <p>ULTRASONIC TESTING TO BE CARRIED OUT AS PER BHEL STANDARD AA0850118. ACCEPTANCE LEVEL IS CATEGORY-2.</p> <p>MPI TO BE CARRIED OUT AFTER FINISH MACHINING TO ASTM E 709. NO CRACKS OR LINEAR INDICATIONS ARE ALLOWED.</p> <p>FOR CASE CARBURISED STEELS, THE MECHANICAL PROPERTIES SHALL BE TESTED ON BLANK CARBURISED TEST PIECE. THE SHAFT SHALL BE CASE CARBURISED TO A DEPTH OF 1.50 MM MINIMUM AND TO A HARDNESS OF 56- 60 HRC.</p> <p>FOR FLAME HARDENED MATERIAL THE TOOTH HARDNESS SHALL BE 56-60 HRC. 0.4 MICRON FINISH SHALL BE MAINTAINED ON ALL THE TOOTH SURFACES.</p>				
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<p>           B) WORM GEAR:              THE WORM GEAR SHALL BE CENTRIFUGALLY CHILLED CAST TO AVOID POROSITY, BLOW HOLES, SAND INCLUSIONS ETC.              THE CHEMICAL AND MECHANICAL PROPERTIES WILL BE AS AGREED BETWEEN BHEL AND SUPPLIER. TYPICAL MATERIALS ARE Gz-CuSn12Ni, Z1102-4(AGMA GRADE). FOR ANY OTHER MATERIAL, MATERIAL PROPERTIES AND DESIGN CALCULATIONS TO BE PROVIDED AND PRIOR APPROVAL TO BE TAKEN FROM BHEL.            LPI TO BE CARRIED OUT AFTER FINISH MACHINING BHEL STD AA0850131, ACCEPTANCE LEVEL 2 OF AA0850132.         </p> <p>           VI. DELIVERY CONDITION            A) THE GEAR SETS SHALL BE SUPPLIED IN FULLY MACHINIED CONDITION            B) THE GEARS AND WORMS SHALL BE INTERCHANGEABLE.            C) WORM GEAR SET SHALL BE GUARANTEED FOR 1,00,000 HOURS WORKING LIFE.         </p> <p>           VII. DOCUMENTATION            A) GUARANTEE AND INTERCHANGEABLITY CERTIFICATES SHALL BE GIVEN WITH THE QUOTATION.            B) QUALITY PLAN SHALL BE SUBMITTED FOR APPROVAL AND THE SAME SHALL BE FOLLOWED FOR MANUFACTURING.            C) CHEMICAL AND MECHANICAL TEST CERTIFICATES, UT, LPI, MPI TEST RESULTS AND HEAT TREATMENT DETAILS SHALL BE SENT 10 DAYS PRIOR TO DESPATCH OF THE COMPONENTS. AFTER CLEARANCE FROM BHEL THE MATERIAL SHALL BE DESPATCHED.            D) ASSEMBLY, OPERATION AND MAINTENANCE PROCEDURES SHALL BE SENT WITHIN 4 MONTHS FROM RECEIPT OF BHEL PURCHASE ORDER.         </p> <p>           VIII. PACKING            GEAR, SHAFT, KEY AND LOCKNUT/LOCK WASHER SHALL BE PACKED SEPARATELY IN SEA WORTHY PACKING TO AVOID DAMAGE IN TRANSIT AND IN HANDLING.         </p>			

TABLE-1

## WORM SHAFT MATERIAL PROPERTIES (FOR REFERENCE)

VAR. NO.	C	Si	Mn	P	S	Cr	Mo	Ni	Cu	CORE HARDNESS BHN	UTS N/MM <sup>2</sup>	YS N/MM <sup>2</sup> MIN	IMPACT V NOTCH JOULES	%AGE ELONG. MIN
SAE 8650	0.48	0.15	0.75	—	—	0.40	0.15	0.40	—	280—315	900—1050	750	20	12
	0.53	0.35	1.00	0.035	0.040	0.60	0.25	0.70	0.35					
20MnCr5	0.17	—	1.10	—	—	1.00	—	—		290—320	950—1250	670	20	8
	0.22	0.40	1.40	0.035	0.035	1.30	—	—						
4150	0.48	0.15	0.75	—	—	0.80	0.15	—	—	241—285	800—950	550		13
	0.53	0.35	1.00	0.035	0.040	1.10	0.25	—	0.35					
SAE 8620	0.18	0.15	0.75	—	—	0.40	0.15	0.40	—	162—212	660—1010	470	30 KCU	11
	0.20	0.35	1.00	0.035	0.040	0.60	0.25	0.70	0.35					

TABLE-2

## WORM GEAR MATERIAL PROPERTIES (FOR REFERENCE)

VAR. NO.	Cu	Sn	Ni	P	Pb	Zn	S	Fe		HARDNESS BHN -TYP	UTS N/MM <sup>2</sup> MIN.	YS N/MM <sup>2</sup> MIN	%AGE ELONG. MIN
Gz-CuSn12Ni	84.0	11.0	1.50	—	—	—	—	—		100	300	180	8
	87.0	13.0	2.50	0.20	0.30	0.40	0.05	0.20					
Z1102-4	88.0	10.0	—	0.10	—	—	—	—	Al<0.005	100	300	180	8
	90.0	12.0	0.05	0.30	0.50	0.50	—	0.15					

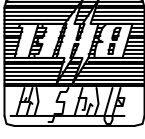
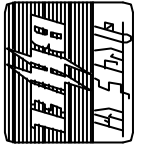


TABLE-3

VAR. NO.	CENTER DIST	MILL TYPE	WORM GEAR DRG NO.	WORM SHAFT DRG NO.	LOCK NUT	KEY DRG. NO.	DRIVE MOTOR	MATERIAL CODE
					LOCK WASHER			
01	27"	623 XRP	2-60-160-00003	2-60-160-00022	4-60-160-00050	4-60-160-00059	300 KW 1000 RPM	BA9755023011
02	36"	703 HP/XRP	2-61-170-00888	1-61-170-00413	SKF KM36/Torrington AN36 SKF MB36/Torrington W36	4-61-180-00870	260 KW 1000 RPM	BA9755023020
03	36"	803 HP	2-61-180-01068	1-61-180-00511	SKF KM36/Torrington AN36 SKF MB36/Torrington W36	4-61-180-00870	340 KW 600 RPM	BA9755023038
04	41"	803 XRP	2-61-176-90015	2-61-176-90018	4-61-180-90072	4-61-176-90033	340 KW 1000 RPM	BA9755023046
05	48"	883 XRP	2-61-188-02095	2-61-188-02096	3-61-188-02043	4-61-180-00870	425 KW 600 RPM	BA9755023054
06	54"	1003 XRP	1-61-100-00265	1-61-100-00272	3-61-100-00530	4-61-100-02242	600 KW 600 RPM	BA9755023062
07	30"	663 XRP	2-61-166-01346	2-61-166-02523	KLM 34 OF FAG- M170X3 OR EQUI. - 2 NOS	4-61-180-00870	220 KW 1000 RPM	BA9755023070
					MBL 34 OF FAG OR EQUI. - 2 NOS			
08	54"	1003 XRP	1-61-100-00265	1-61-100-01314	KM 38 - M190X3 - 1 NO. KM 34 - M170X3 - 1 NO.	4-61-100-02242	600 KW 600 RPM	BA9755023089
					MB 38 - 1 NO. MB 34 - 1 NO.			
09	48"	883 XRP	2-61-188-02095	2-61-188-02612	KM 38- M190X3- 1 NO. AND KM 34- M170 X3-1 NO.	4-61-180-00870	425 KW 600 RPM	BA9755023097



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