



TME 2011

PRODUCT STANDARD
TME DIVISION, BHOPAL**TM 20589****REV 00****PAGE: 01 OF 05****TECHNICAL SPECIFICATION FOR ZIRCONIUM COPPER BARS FOR ROTORS OF
THREE PHASE TRACTION MOTORS****1.0 SCOPE**

This specification covers the requirement of Zirconium Copper (C15000) rotor bars for rotors of the three phase traction motors.

2.0 GOVERNING SPECIFICATIONS

In the preparation of this specification, assistance has been taken from the following standards and specifications.

Table -1

ASTM : B747-07	- Specification for copper-zirconium alloys.
IS:1885 (pt.xxxiv):1993	- Electro technical Vocabulary :Rotating Machines.
IS:440 :1964	- Methods of chemical analysis of copper.
IS:2826 -1986	- Dimensions and Tolerances for Copper and Copper alloys Rods and Bars.
IS:14811:2000	- Copper plate, sheet and strip for industrial purposes
IS1608:1995	- Method of tensile testing of Cu alloys.
IS 1586:2000	- Method for Rockwell hardness test for metallic material.

2.1 In case of any conflict or disparity between the contents of the above specification and this specification, the latter shall prevail.

3.0 ENVIRONMENTAL CONDITIONS

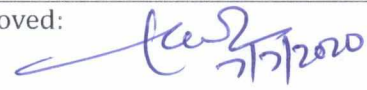
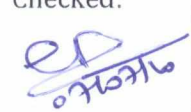
Rotors are designed to work at a maximum temperature of 230°C and so all the relevant properties shall remain intact over the complete operating range of temperature.

4.0 MATERIAL

The rotor bars shall be made from Zirconium Copper alloys conforming to UNS No. C15000-H04 Temper (Hard). The composition of the copper shall be as given in Table-2.

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Chemical composition of Zr Cu is given in Table 2 and supplier to provide test result of chemical composition test by spectrograph or any another suitable method to BHEL.

Table - 2**CHEMICAL COMPOSITION OF ZIRCONIUM COPPER**

Element	In percent / ppm
Cu + Ag	99.80% minimum
Zr	0.05 - 0.2 %

6.0 PHYSICAL, MECHANICAL AND ELECTRICAL PROPERTIES**Table - 3**

Properties	Zirconium Copper of C15000
Temper	H04 (Hard)
Composition	Cu + Ag 99.80% min and Zr 0.05-0.2 %
Electrical Conductivity	93% IACS min at 20°C
Resistivity	0.16481 Ω-g/m ² (Maximum)
Tensile Strength	400 MPa (Minimum)
Yield Strength	380 MPa (Minimum)
Elongation in 50 mm gauge length	11 % minimum
Hardness	90 HRF (minimum)
Sp gravity	8.89

7.0 SIZE, SHAPES, DIMENSIONS, WEIGHTS AND OTHER PROPERTIES OF ROTOR BARS

The size, shapes and dimensions of rotor bars shall be stated on order.

7.1 JOINTS

There shall be no joint in the rotor bar.

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	7.2 <u>FREEDOM FROM DEFECTS</u>	
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	7.2.1 The rotor bars shall be clean, smooth and free from all surface defects, such as scales, peelings, sharp edges and other defects. There shall be no die marks. 7.2.2 To check on this, suitable means shall be employed by the manufacturer by way of provision of a mirror or other suitable means and monitor the drawing out of the rotor bars.	
	8.0 <u>TESTS:</u> After purchase order is placed for supply of rotor bars, internal test results for all the tests mentioned in this specification shall be furnished by the successful tenderer to BHEL.	
	8.1 <u>TESTS ON ROTOR BAR</u> Supplier to provide test certificate and guarantee certificate (TC/GC) of following tests. 8.1.1 Visual Examination. 8.1.2 Measurements of dimensions. 8.1.3 Electrical Conductivity. 8.1.4 Tensile & yield strength/elongation test. 8.1.5 Hardness. 8.1.6 Chemical composition. 8.1.7 Ultrasonic/eddy current testing.	

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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 <u>METHOD OF TESTS</u>	
	9.1 <u>VISUAL EXAMINATION</u> The surface of rotor bar shall be fairly smooth, free, from inclusions or foreign particles, indentation, surface defects, scales, twists, entanglements etc. The rotor bars shall have not twists kinks or any mark of die.	
	9.2 <u>MEASUREMENT OF DIMENSIONS</u> Dimensions of rotor bar shall be measured with the help of duty calibrated calipers & micrometers.	
	9.3 <u>TENSILE & YIELD STRENGTH/ELONGATION TEST</u> When tested in accordance with IS:1608-1995, " Method for tensile testing of copper and alloy" for tensile strength and elongation, the material shall have a tensile strength of 400 MPa (min), Yield Strength of 380 MPa (min) and a minimum of 11 % elongation on a gauge length of 50 mm.	
	9.4 <u>CHEMICAL COMPOSITION</u> The material shall have the chemical composition as given in Table-2. The trace elements shall be determined in accordance with IS:440-2006. For oxygen content, certificate from the manufacturer of copper shall be furnished. At least one sample from finished material from each lot/batch of extrusion shall be tested for chemical analysis.	
	9.5 <u>ULTRASONIC TEST</u> Ultrasonic test should be carried out from NABL approved laboratory on number of samples as stipulated in the specification mentioned in the PO. If not specific in PO, the sample size shall be 10% of the quantity of a batch. In case the supplier of the finished product has in house ultrasonic testing facilities and government approved operator of ultrasonic equipment, in that case ultrasonic test can be witnessed by BHEL after confirming validity of calibration certificate of the ultrasonic test equipment, test certificate of the operator. The operator shall be valid level-II certification. Even, if supplier has in house ultrasonic test facility, one sample should be selected at random for ultrasonic test at NABL approved laboratory.	

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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	9.6 HARDNESS TEST Hardness of sample of rotor bars shall be determined on Rockwell hardness in F scale with 1.587 mm ball dia and 60 kg load in accordance with IS:1586:2000 9.7 ELECTRICAL CONDUCTIVITY TEST Conductivity of the bar shall be measured with help of calibrated conductivity meters. Calculated value of resistivity to be furnished. BHEL representative may check the accuracy and calibration of the measure equipment by resistance/conductivity of known value. 10.0 SUBMISSION OF SAMPLE FOR TESTING AT BHEL Supplier to submit sample for testing at BHEL, along with test certificate and guarantee certificate (TC/GC). 11.0 PACKING The finished product shall be suitably packed so as to ensure safe transportation of material without any damage. 12.0 MARKING OF ROTOR BAR The material shall be labeled securely and indelibly (i.e. with an adhesive label on an appendage) with the following information – a) Name of the manufacturer, purchase order reference and date. b) Name and trade mark of rolling agency. c) Item, size, quantity, batch no., date of manufacture of the material. d) Special precaution for storage, if applicable for the material.	
