



TME 2011

**PRODUCT STANDARD  
TME DIVISION, BHOPAL****TM 20590**

REV 00

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**SPECIFICATION FOR ZIRCONIUM COPPER RESISTANCE RING FOR ROTORS OF THREE PHASE  
TRACTION MOTORS****1.0 SCOPE :**

This specification covers the requirement of Zirconium Copper (C15000) resistance ring for modified 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.


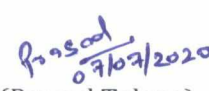

**Table -1**

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
IS:1608:1995	- Method of tensile Testing of Cu Alloys
IS:1586:2000	- Method for Rockwell Hardness Test for Metallic Materials

**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.

Revision: 00	Distribution	Qty	Approved:  (S P Singh)		
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**4.0 MATERIAL :**

The Resistance Ring shall be made from Zirconium Copper alloys conforming to UNS No - C15000- H03 Temper (Three quarter hard).The composition of the copper shall be as given in Table-2.

**5.0 CHEMICAL COMPOSITION :**

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

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

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

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

Properties	Zirconium Copper of C15000
Temper	H03 (three quarter 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 <sup>2</sup>
Tensile Strength	325 - 385 MPa
Elongation in 50 mm gauge length	11 %minimum
Hardness	90 HRF (Min)
Sp gravity	8.89

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**7.0 SIZE, SHAPES, DIMENSIONS, WEIGHTS AND OTHER PROPERTIES OF RESISTANCE RING:**

The size, shapes and dimensions of resistance ring shall be stated on order.

**7.1 JOINTS**

There shall be no joint in the resistance ring.

**7.3 FREEDOM FROM DEFECTS**

7.3.1 The resistance ring 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.

7.3.2 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 resistance ring.

**8.0 TESTS**

After purchase order is placed for supply of rotor bars, internal test results for all the mentioned in this specification shall be furnished by successful tenderer to BHEL.

**8.1 TESTS ON RESISTANCE RING**

Supplier to provide test certificate and guarantee certificate (TC/GC) of following tests.

- 8.1.1 Visual Examination
- 8.1.2 Measurement 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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**9.0 METHOD OF TESTS:**

**9.1 VISUAL EXAMINATION**

The surface of Resistance Ring shall be fairly smooth, free from inclusions or foreign particles, indentation, surface defects, scales, twists, entanglements etc.

**9.2 MEASUREMENT OF DIMENSIONS**

Dimensions of resistance ring shall be measured with the help of duty calibrated vernier calipers/micrometer.

**9.3 TENSILE & YIELD STRENGTH/ELONGATION TEST**

When tested in accordance with IS:1608:1995, "Method for tensile testing of copper and alloy" for tensile strength, yield strength and elongation, the material shall have a tensile strength and elongation as per Table 3 of this specification.

**9.4 CHEMICAL COMPOSITION**

The material shall have the chemical composition as given in Table-2. The copper shall be determined in accordance with IS:440-2006. For oxygen content, certificate from the manufacturer of copper shall be furnished.

**9.5 ULTRASONIC TEST**

Ultra sonic test should be carried out from NABL approved laboratory on number of samples as stipulated in the specification mentioned in the PO. In case the supplier of the finished product has in house ultrasonic testing facilities and govt. approved operator of ultrasonic equipment, in that case ultrasonic test can be witnessed by Railway Inspector on 10 % quantity after confirming validity of calibration certificates 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.

**9.6 HARDNESS TEST**

Hardness of sample of punched type resistance rings shall be determined on Rockwell hardness in F scale with 1.587mm ball dia and 60 kg load in accordance with IS:1586:2000 on two samples from lot as per clause 15.

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**9.7 ELECTRICAL CONDUCTIVITY TEST**

Conductivity of the Resistance Ring shall be measured with help of calibrated Conductivity meters. Calculated value of resistivity to be furnished.

**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 suitable packed so as to ensure safe transportation of material without any damage.

**12.0 MARKING OF PUNCHED TYPE RESISTANCE RING**

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 raw material supplier
- c) Item, size, quantity, batch no., date of manufacture of the material.
- d) Special precaution for storage, if applicable for the material.

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