



# CORPORATE PURCHASING SPECIFICATION

AA19801

Rev No. 04

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## HIGH CODUCTIVITY (98% IACS) FORGINGS-ANNEALED

### 1.0 GENERAL

This specification governs the quality requirements of High Conductivity (98% IACS) Copper Forgings, for sizes 6 mm and above and with oxygen content of 400 ppm max. (controlled oxygen).

### 2.0 APPLICATION

For short circuiting rings of squirrel cage induction machines.

### 3.0 CONDITION OF DELIVERY

Forged and Annealed.

### 4.0 COMPLIANCE WITH NATIONAL STANDARDS

The material shall comply with the requirements of the following national standard with additional requirement of oxygen content of 400 ppm max. and also meet the requirements of this specification.

IS: 6912 – 2005: Copper and Copper Alloys Forging Stock and Forging - Specification

Gr. ETP Condition: O

Oxygen Content – 400 ppm max.

### 5.0 DIMENSIONS AND TOLERANCES

#### 5.1 Dimensions

The dimensions of the forgings shall be in accordance with the drawings supplied with BHEL order.

#### 5.2 Tolerances

##### 5.2.1 Rough Forged

Thickness and outside diameter +3%, -0%

Internal diameter -3%, +0%

##### 5.2.2 Rough Machined

As stated in BHEL order/drawing.

##### 5.2.3 Rolled and Punched

Thickness ± 0.254 mm

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Revisions:  
Clause 26.5.4 of MOM of MRC-NFM+HE

**APPROVED:**  
INTERPLANT MATERIAL RATIONALISATION  
COMMITTEE – MRC(NFM+HE)

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## 5.2.4 Inside and Outside Diameter

Over, mm	Up to and including, mm	Tolerance, ± mm
--	305	± 0.13
305	610	± 0.25
610	--	± 0.38

## 6.0 FREEDOM FROM DEFECTS

The forgings shall be free from defects such as inclusions, hard spots, cracks etc., which may adversely affect the machining, electrical conductivity and utility of forgings.

## 7.0 MANUFACTURE

High conductivity copper rings shall be forged or rolled and punched to shape without any welding or joining.

## 8.0 HEAT TREATMENT

The forgings shall be supplied in annealed condition and the test bars, representative of these forgings, shall also undergo the same heat treatment.

## 9.0 CHEMICAL COMPOSITION

The chemical composition of the material when analyzed in accordance with IS: 440 or any other conventional/instrumental methods shall be as follows:

Element	Percent	
	Min	Max
Copper	99.90	--
*Bismuth	--	0.0010
*Lead	--	0.005
*Total all impurities (excluding silver)	--	0.03
Oxygen	--	0.04

\*Note: These elements need not be determined when the material supplied conforms with mechanical and electrical properties specified in this specification. However, the supplier shall ensure that the composition of the material lies within the limits specified above.



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## 10.0 TEST SAMPLES

10.1 One sample per heat per consignment shall be taken for chemical, mechanical and electrical tests.

10.2 Test samples shall be provided from each batch of forgings, or from the forging stock from which the forging has been made. They shall be of sufficient length to provide the tensile test piece. It may be forged to a cross-section approximately 2/3 of the original cross-section and shall be heat treated, simultaneously with and similar to the forging it represents.

10.3 Electrical resistivity measurement and tensile testing shall be performed on each sample.

## 11.0 PROPERTIES

### 11.1 Mechanical properties

#### 11.1.1 Tensile

The material when tested in accordance with IS: 1608 shall have the following properties, for sizes 6 mm and above.

Tensile strength : 210 N/mm<sup>2</sup>, minimum.

#### 11.1.2 Hardness – Brinell

The material, when tested in accordance with IS: 1500 shall show a hardness of 40 HB minimum.

NOTE: Hardness test shall be conducted only when tensile test cannot be performed.

### 11.2 Electrical Properties

#### 11.2.1 Electrical Conductivity

The electrical conductivity of the forging shall not be less than 98% IACS, at 20°C, when tested by Eddy current probe method as per ASTM E1004

Note: Refer IS: 613, for temperature correction factor.

### 11.3 ADDITIONAL TESTS

If specified in the order/drawing, the forgings shall be subjected to the following tests.

- 1) Radiographic test.
- 2) Ultrasonic test.

## 12.0 REPAIR OF FORGINGS

The forgings shall not be repaired unless permission in writing has been obtained previously from the BHEL.

**13.0 TEST CERTIFICATES**

Unless otherwise stated, five copies of test certificates shall be supplied along with each consignment.

In addition, the supplier shall ensure to send one copy of the test certificate along with the dispatch documents to facilitate quick clearance of the material.

The test certificate shall bear the following information:

AA19801, Rev-04: HIGH CODUCTIVITY (98% IACS) FORGINGS-ANNEALED

BHEL Order No.

Manufacturer's/Supplier's Name:

Lot/Batch No.

Drawing No.

Quantity supplied

Test results for clause 5.0, 9.0, and 11.0.

**14.0 PACKING AND MARKING**

Forgings shall be suitably packed to prevent corrosion and damage during transit. Machined surface shall be properly protected with anti-corrosive compounds.

Each forging shall be legibly marked with the following information:

AA19801, Rev-04: HIGH CODUCTIVITY (98% IACS) FORGINGS-ANNEALED

BHEL Order No.

Manufacturer's/Supplier's Name:

Lot/Batch No.

Drawing No.

Quantity supplied

**15.0 REFERRED STADARDS (Latest Publications including Amendments)**

- 1) IS: 440
- 2) IS: 1608
- 3) IS: 1500
- 4) IS: 613
- 5) ASTM E1004