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ELECTROLYTIC TOUGH PITCH COPPER WIRE BARS / INGOTS / CONTINUOUSLY CAST WIRE RODS / EXTRUDED SECTIONS																				
1.0 GENERAL: This specification governs the quality requirements of electrolytic tough pitch copper wire bars, ingots, continuously cast wire rods (cleaned), and extruded sections for electrical purposes, with oxygen content of 400 ppm. max (Controlled oxygen). 2.0 APPLICATION: 2.1 Wire bars/rods / extruded sections are used for rolling / drawing into flats, strips, wires and bars etc for electrical application. 2.2 Ingots are used for Castings. 3.0 CONDITION OF DELIVERY: 3.1 Wire Bars / Ingots : As cast. 3.2 Wire Rods – Cleaned : Continuously cast, rolled annealed. Total thickness of the copper oxide film shall not exceed 400 Å⁰ (Angstrom) 3.3 Extruded Sections : As stated in BHEL order. Total thickness of the copper oxide film shall not exceed 400 Å⁰ (Angstrom). 4.0 COMPLIANCE WITH STANDARDS: The material shall comply with the requirements of the following national standard and also meet the requirements of this specification. 4.1 Wire Bars / Ingots : <table style="width: 100%; border: none;"> <tr> <td style="width: 40%;">ASTM B5 - 2011</td> <td style="width: 10%; text-align: center;">}</td> <td style="width: 50%;">Standard Specification for</td> </tr> <tr> <td>Gr : ETP-C11000</td> <td style="text-align: center;">}</td> <td>Electrolytic tough Pitch Copper</td> </tr> <tr> <td>Oxygen - 400 ppm, max</td> <td style="text-align: center;">}</td> <td>Refinery Shapes</td> </tr> </table> 4.2 Wire Rod-Continuously Cast: <table style="width: 100%; border: none;"> <tr> <td style="width: 40%;">ASTM B49 - 2010</td> <td style="width: 10%; text-align: center;">}</td> <td style="width: 50%;">Copper Redrawn Rod for Electrical</td> </tr> <tr> <td>Gr: ETP – C11040</td> <td style="text-align: center;">}</td> <td>Purposes</td> </tr> <tr> <td>Oxygen - 400 ppm, max.</td> <td style="text-align: center;">}</td> <td></td> </tr> </table>			ASTM B5 - 2011	}	Standard Specification for	Gr : ETP-C11000	}	Electrolytic tough Pitch Copper	Oxygen - 400 ppm, max	}	Refinery Shapes	ASTM B49 - 2010	}	Copper Redrawn Rod for Electrical	Gr: ETP – C11040	}	Purposes	Oxygen - 400 ppm, max.	}	
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Revisions : Cl: 24.1 of MOM of MRC-NFCW+HE		APPROVED : INTERPLANT MATERIAL RATIONALISATION COMMITTEE-MRC (NFCW+HE)																		
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4.2 Extruded Sections:

Assistance has been drawn from the following:

ASTM B49 - 2010	}	Copper Redrawn Rod for Electrical
Gr: ETP – C11040	}	Purposes
Oxygen - 400 ppm, max.	}	

5.0 DIMENSIONS AND TOLERANCES :

5.1 Sizes:

5.1.1 Wire Bars / Ingots:

The standard size and shape of wire bars/ingots shall be as per clause 7 of ASTM B5 and shall be as per Fig. 1 or 2 of the standard.

Any combination of the six standard sizes / shapes of wire bars/ingots as per Fig.1 or 2 of ASTM B5 is acceptable.

5.1.2 Wire Rods:

Wire rods shall be supplied in continuous length. The diameter of the bar to be supplied shall be as agreed to between BHEL and the manufacturer.

5.1.3 Extruded Sections:

Size of the extruded sections shall be as specified in BHEL order.

5.2 Tolerances:

5.2.1 Wire Bars/Ingots:

The permissible variation in dimensions and weights shall be as per ASTM B5.

5.2.2 Wire Rods:

The permissible tolerance on diameter shall be as per ASTM B49.

5.2.3 Extruded Sections:

As specified in BHEL order.

6.0 MANUFACTURE:

6.1 Wire Bars/Ingots :

Wire bars/Ingots shall be cast from ETP grade copper having oxygen content of 400 ppm, max.



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6.2 Wire Rods:

Wire rods shall be manufactured from continuously cast rods and annealed, from ETP grade copper having oxygen content of 400 ppm, max.

6.3 Extruded Sections:

Extruded sections shall be manufactured from ETP grade copper having oxygen content of 400 ppm, max

7.0 FREEDOM FROM DEFECTS:

7.1 Wire Bars/Ingots:

Wire bars/Ingots shall be substantially free of shrinks, holes, cold sets, pits, sloppy edges, concave tops, etc.

7.2 Wire Rods (Cleaned) & Extruded Sections:

The wire rods/Extruded sections shall have a smooth untarnished surface.

Surface shall be clean, smooth and free from pipes, laps, scale, flakes, cracks, kinks, twists, seams, damaged ends, excessive oil & grease and other injurious defects.

Total thickness of the copper oxide film shall not exceed 400 Å (Angstrom), when tested in accordance with ASTM B 49.

8.0 TEST SAMPLES:

One sample per melt shall be taken for chemical, mechanical and physical properties.

9.0 CHEMICAL COMPOSITION:

The chemical composition of copper shall be as follows:

Copper including silver – 99.90, minimum.

Oxygen content – 400 ppm, maximum.

10.0 PHYSICAL PROPERTIES:

Electrical resistivity when tested in accordance with ASTM E 1004 – Eddy Current probe Method, shall meet the following values.

10.1 Wire Bars/Rods/Extruded Sections:

The maximum mass resistivity for wire rods/bars shall be 0.15328 Ohm g/m² (conductivity 100% minimum IACS) at 20°C, annealed.

**CORPORATE PURCHASING
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The maximum mass resistivity for ingots and ingot bars shall be 0.15694 Ohm g/m² (Conductivity 97.66% minimum IACS) at 20 °C annealed.

*Note: Refer IS 613 for temperature correction factor.

11.0 MECHANICAL PROPERTIES**11.1 Elongation (Wire Rods-Continuously Cast & Extruded Sections).**

When tested in accordance with IS: 1608 / ASTM B49, the elongation on 250 mm gauge length shall not be less than 30 percent.

11.2 Spiral Elongation Number (SEN) (Wire Rods – Continuously Cast):

The spiral elongation number (SEN) as per ASTM B49 shall be reported for information in the test certificate.

12.0 TEST CERTIFICATES:

Unless otherwise specified in the order five copies of test certificates shall be supplied along with each consignment, giving the following information.

In addition, the supplier shall ensure to enclose 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:

AA 12024, Rev. No.06: Electrolytic Tough Pitch Copper Wire Bars/ Ingots/Continuously Cast Wire

BHEL Order No.

Supplier's Reference and Name

Heat No. /Charge No.

Results of Chemical composition, Physical & Mechanical properties and Dimensional measurements.

The spiral elongation number (SEN) as per ASTM B 49 shall be reported for information. Consignment/Identification, No.



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13.0 PACKING AND MARKING:

13.1 Packing:

13.1 Wire Bars / Ingots:

The wire bars/ingots shall be supplied in bundles.

13.1.2 Wire Rods (Continuously Cast) / Extruded Sections:

Wire rods / Extruded sections shall be supplied with wax coating, packed on strong wooden pellets with polyethylene and strapped with steel strips.

13.2 Marking :

Each bundle/package shall be marked with the following information :

AA 12024 : Electrolytic Tough Pitch Copper Wire Bars/ Ingots/Continuously Cast Wire Rods/Extruded Sections..

BHEL Order No

Consignment Identification No.

Size & Weight

Cast No.

Supplier's Name.

14.0 REFERRED STANDARDS (LATEST PUBLICATION INCLUDING AMENDMENTS):

1) ASTM: B5

2) ASTM: B49

3) ASTM: E 1004

4) IS: 613

5) IS: 1608