

Indian Standard

(Reaffirmed 1998)

SPECIFICATION FOR CONTINUOUSLY CAST AND ROLLED ELECTROLYTIC COPPER WIRE RODS FOR ELECTRICAL CONDUCTORS

1. Scope—This standard covers the requirements of EC grade copper rod up to 18 mm in nominal diameter, produced by continuous casting and rolling for the manufacture of electrical round and rectangular conductors.

2. Terminology—For the purpose of this standard, the following definition as given in IS : 3288 (Part 3)-1986 'Glossary of terms relating to copper and copper alloys: Part 3 Wrought form', shall apply.

2.1 Wire Rod—Rod like product of uniform cross section exceeding 6 mm used as intermediate product for further working, supplied in coil form.

3. Supply of Material—General requirements relating to the supply of material shall conform to IS : 1387-1967 'General requirements for the supply of metallurgical materials (first revision)'.

4. Chemical Composition

4.1 The material shall have chemical composition of ETP Copper as given in Table 1, reproduced from IS : 191 (Part 5)-1980 'Specification for copper: Part 5 Electrolytic tough pitch copper (ETP) (third revision)'.

TABLE 1 CHEMICAL COMPOSITION

Element	Percent
Copper + Silver, <i>Min</i>	99.90
Bismuth, <i>Max</i>	0.001
Lead, <i>Max</i>	0.005
Total of all impurities excluding silver and oxygen, <i>Max</i>	0.03

Note—Oxygen should be limited to 0.06 percent subject to agreement between the supplier and the purchaser.

4.2 The chemical composition shall be determined by the methods specified in IS : 440-1964 'Methods of chemical analysis of copper (revised)' or any other established instrumental/chemical method. In case of dispute, the procedure specified in IS : 440-1964 shall be the referee method.

4.3 The method for determination of oxygen shall be as agreed to between the supplier and the purchaser.

5. Dimension and Tolerances

5.1 Dimension—The wire rods shall be supplied in diameter as required by the purchaser, between 6 mm and 18 mm both inclusive. The diameter shall be determined by the method as given in 5.1.1.

5.1.1 Discard approximately 2.5 m length from the end of the coil. Measurement shall be made with accuracy better than 0.01 mm with a micrometer. The measurement shall be made with a pressure of 1 to 3 MPa.

5.2 Tolerances

5.2.1 The wire rod shall be continuously cast and rolled up to nominal diameter of 18.0 mm within the permissible variation as given in Table 2. Three measurements at 60° angular displacement shall be made around circumference at two places 4 metres apart. An average of six readings shall be considered as the diameter of the wire rod. No individual reading should exceed the tolerance limit. Any special tolerance on diameter shall be as agreed between the purchaser and the supplier.

Adopted 25 June 1988

© March 1989, BIS

Gr 2

TABLE 2 TOLERANCE ON DIAMETER

(Clause 5.2.1)

(All values in mm)

Diameter		Tolerance
Over	Up to and including	
6	9	± 0.5
9	12	± 0.7
12	18	± 0.9

5.2.2 Ovality of the wire rod—The measurement shall be carried out in accordance with 5.1.1. Ovality shall be not more than 100 percent of the tolerance. Measurement shall be done at two places 4 metres apart, and at each point, 4 readings at 45° to each other shall be taken. Ovality shall be measured by obtaining the difference in a pair of readings taken at 90° to each other. The maximum difference obtained at each point shall be termed as the maximum ovality.

6. Freedom from Defects—The surface of the pickled wire rod shall be fairly smooth, untarnished, free from oxide, inclusions or foreign particles, indentation, twists, entanglements, etc.

7. Mechanical Properties

7.1 Tensile Test—When tested in accordance with IS : 2654-1977 'Method for tensile testing of copper and copper alloys (first revision)' for tensile strength and elongation, the material shall meet the requirements as given in Table 3.

TABLE 3 TENSILE PROPERTIES

Diameter		Tensile Strength, Min MPa	Elongation on Gauge Length of 250 mm, Min Percent
Over mm	Up to and including mm		
6	9	210	32
9	12	205	40
12	18	200	46

Note — 1MPa = 1 MN/m² = 1 N/mm² = 0.102 kgf/mm².

7.2 Surface Test (Compression Test)—A sample of wire rod, from a rolled coil, of length twice the diameter of the wire rod is to be cut and then hammered till its length becomes half of the original length. The curved surface, for example, periphery after test, shall not show any crack or defect on the surface when viewed with normal vision.

8. Sampling and Criteria for Conformity

8.1 Unless otherwise agreed to between the purchaser and the supplier, the following sampling procedure and criteria for conformity shall hold good.

8.2 In any consignment, all the coils of wire rod of same size, manufactured from same raw material under similar condition of production at the same place, shall be grouped together to constitute a lot.

8.3 Each coil of wire rod shall be examined for freedom from defects and for tolerance on diameter. Any coil found defective shall be rejected.

8.4 One sample shall be tested from each coil for chemical analysis, tensile test, surface test from the coils which have been found satisfactory in 8.3. From each sample, three test specimens, one for chemical analysis, second for tensile test and the third for surface test, shall be prepared and tested.

8.4.1 If the test result of chemical analysis as obtained for each of the elements satisfy the corresponding requirements, the coil shall be considered as conforming to the chemical composition requirements of this specification.

8.4.2 The coil shall be considered as conforming to the requirements of tensile properties and compression properties if the test results of samples satisfy the corresponding requirements.

8.5 Retest — If the test result of chemical analysis fails to satisfy the requirement for any element, two more tests for that element, shall be done on the same sample in order to confirm that the analysis has been done properly. If both the test results satisfy the relevant requirements, the coil shall be considered as conforming to the chemical composition requirements of this specification, otherwise not.

8.5.1 If the test result on any sample for tensile test and surface test (compression test) fail to satisfy the requirements for any of the mechanical properties and compression properties, two more tests shall be done on samples taken from the same coil. If both the test results satisfy the relevant requirements, the coil shall be considered as conforming to the corresponding requirements of this specification, otherwise not.

9. Packing

9.1 The material shall be packed in coils, the mass of each coil shall be not more than 2 500 kg.

9.2 The coils shall be wrapped with polythene sheet. The quality and application of the wrapping material shall be adequate to protect the wire rod coils from damage, rain, incidental to normal handling and shipment.

10. Marking

10.1 Suitable tags with marking made on them to show the name of the manufacturer, size of the wire rod, lot number, coil number, date of manufacture, mass and any such information required by the purchaser, shall be attached with each coil of the material.

10.2 Standard Marking — The material may also be marked with the Standard Mark. The details of standard marking scheme is available with the Bureau of Indian Standards.

11. Test Certificate — The manufacturer/supplier shall provide test certificate for each consignment giving information like lot number, coil number, corresponding chemical composition, tensile test and compression test results.

EXPLANATORY NOTE

The continuously cast and rolled copper wire rods are used in copper wire drawing industry as draw stock, for electrical conductors. The quality of copper wire depends upon the quality of the hot rolled copper wire rods.

AMENDMENT NO. 1 DECEMBER 1992

TO

**IS 12444 : 1988 SPECIFICATION FOR CONTINUOUSLY
CAST AND ROLLED ELECTROLYTIC COPPER WIRE
RODS FOR ELECTRICAL CONDUCTORS**

(Page 1, clause 1, line 1) — Substitute the words 'wire rods' for the word
'rod'.

(MTD 8)

Reprography Unit, BIS, New Delhi, India