

**GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS**






**TECHNICAL SPECIFICATION
FOR
CONTINUOUS CAST COPPER WIRE RODS**

Issued by

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SPECIFICATION FOR CONTINUOUS CAST COPPER WIRE RODS

1.0. SCOPE

1.1 This Specification covers the requirement of Continuous Cast Copper (CCC) Wire Rods of size 19.1 To 26.5 mm diameter, manufactured by South Wire Process.

1.2 Old Specification no. ETI/OHE/65(8/87) is re-designated and updated to TI/SPC/OHE/CW/0971 in-line with TI document no. TI-WI-7.5.1- 1 ver 1.0.

1.3 The "Make in India" Policy of Government of India shall be applicable.

2.0. GOVERNING SPECIFICATIONS

In the preparation of this specification, following standards and specifications are referred.

1.	IS: 9713-1983 or latest for purpose of sampling
2.	IS: 440-1964 or latest for chemical analysis of copper
3.	IS: 613-2000 or latest for Electrical Resistivity Test
4.	RDSO specification TI/SPC/OHE/CW/0971 for HDGC Contact wire
5.	IS : 191-2007 or latest : Specification of copper
6.	IS: 12444:1988 or latest : Continuously cast and rolled electrolytic copper wire rods for electrical conductors.

Any deviation from this specification proposed by the manufacturer to improve upon the performance of Contact Wire shall be considered only on its merits provided full particulars with justification and financial implication are furnished by the manufacturer.

3.0. MATERIAL

3.1 The continuous cast copper wire rods, when analysed in accordance with clause 6.5, shall have the chemical composition as given in Table-2 of the specification no. TI/SPC/OHE/CW/0971 with latest amendments.

Diameter of the rod so obtained, shall be as given in Table-3 of the specification no. TI/SPC/OHE/CW/0971 with latest amendments.

Copper used, should be Electrolytic Grade Copper cathodes conforming to the requirement of LME Grade 'A' copper as listed in the London Metal Exchange. Grade 'A' copper conforming to the chemical composition of Cu-Cath-1 of IS 191: 2007 or latest.

4.0 FREEDOM FROM DEFECTS

- 4.1 The surface of continuous cast copper wire rod shall be fairly smooth, free from inclusion or foreign particles, indentation, surface defects, twists, entanglements etc.

5.0 TESTS

- 5.1 All the tests specified in this specification shall be carried out at the manufacturer works. The manufacturer shall arrange all the necessary machinery, apparatus, labour, assistance etc. required for conducting the tests without any extra cost. The tests for which the facilities are not available at the works of manufacturer, may be carried out at any other reputed or government laboratory with prior approval of the purchaser and the cost of such tests shall be borne by the manufacturer.

5.2 ACCEPTANCE TESTS

The following tests shall be carried out on the number of wire rods selected from the lot :

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|-------|----------------------------------|--------------|
| i) | Visual Examination | (Clause 6.1) |
| ii) | Measurement of dimensions | (Clause 6.2) |
| iii) | Compression Test | (Clause 6.3) |
| iv) | Tensile strength/elongation Test | (Clause 6.4) |
| v) | Chemical composition | (Clause 6.5) |
| vi) | Micro-structure examination | (Clause 6.6) |
| viii) | Electrical Resistivity Test | (Clause 6.7) |

5.3 SAMPLING AND CRITERIA FOR CONFORMITY :

- 5.3.1. Sampling and criteria for conformity shall be in accordance with Clause 9 of IS:9713-1983 or latest.

6.0. METHODS OF TESTS

6.1. VISUAL EXAMINATION

The Rods shall be visually examined for defects mentioned in Clause 4 of this Specification. The rods shall be free from defects.

6.2. MEASUREMENT OF DIMENSIONS

Discard approximately 2.5 meter length from the end of the coil. Three measurements at 60° angular displacement shall be made around the circumference at two places 4 meter apart. An average of six readings shall be considered as the diameter of the CCC wire rod. The diameter shall be as specified in table-3 of RDSO specification no.

TI/SPC/OHE/CW/0971 with latest amendment ,

6.3. COMPRESSION TEST

A sample from the coil of length twice the diameter of the wire rod shall be cut from the coil and then hammered till its length becomes half the original length. Curved surface, after test, shall not show any crack or defect on visual check.

6.4. TENSILE STRENGTH/ELONGATION TEST

When tested in accordance with IS: 1608-Part 1 ; 2018 or latest "Metallic Materials-Tensile Testing-Method of Test at Room Temperature" for tensile strength and elongation, the material shall have a tensile strength of 20.4 kgf/mm² (min.) and a minimum of 46% elongation on a gauge length of 250 mm.

6.5. CHEMICAL COMPOSITION

The material shall have the chemical composition as given in Table-2 of RDSO specification no. TI/SPC/OHE/CW/0971 with latest amendment. The trace elements shall be determined by Spectrometric method. The copper shall be determined in accordance with IS: 440-1964 or latest. Oxygen content, shall be determined by oxygen analyzer or Spectrometer.

6.6. MICRO-STRUCTURE EXAMINATION

The sample of wire Rod cut along transverse section polished and etched shall show equiaxed re-crystallised fine grains having grain size finer than ASTM-5. The presence of cast columnar grains in the micro-structure shall not be permitted.

6.7. ELECTRICAL RESISTIVITY TEST

Electrical Resistivity of CCC wire rod shall be determined in accordance with IS 613-2000 or latest. Resistivity shall not be greater than 0.01737 ohm mm²/m at 20°C.

7.0. PACKING

7.1. The material shall be supplied in coils strapped with loops or as required by the Purchaser.

8.0. MARKING

8.1. On the coil : Suitable tags with markings made on them shall be provided with each coil and shall carry the following information.

- i Name and trade mark of manufacturer
- ii Size of wire rod, weight and length of coil
- iii Lot number
- iv Date of manufacture
- v Purchase order number and name of consignee:
- vi Date of inspection and inspecting authority
- vii Any other information required by the purchaser.

- 8.2. On the rod : Suitable metal tag having information mentioned in Clause 8.1 shall be provided for identification.

- 9.0 All the provisions contained in RDSO's ISO procedure laid down in document no. QO-D-8.1-11 dated 01.07.2020 or latest (Title "Vendor-change in approved status") and subsequent versions/amendments thereof, shall be binding and applicable on the successful vendor/vendors in the contracts floated by Railways to maintain quality of the products supplied to Railways.

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