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SPECIFICATION FOR
PHOSPHOR BRONZE WIRES FOR
GENERAL ENGINEERING PURPOSES
(First Revision)

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Deputy Director

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NEW DELHI 110002

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Indian Standard
**SPECIFICATION FOR
 PHOSPHOR BRONZE WIRES FOR
 GENERAL ENGINEERING PURPOSES**
(First Revision)

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Indian Standard

SPECIFICATION FOR
PHOSPHOR BRONZE WIRES FOR
GENERAL ENGINEERING PURPOSES

(*First Revision*)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards on 25 June 1987, after the draft finalized by the Copper and Copper Alloys Sectional Committee had been approved by the Structural and Metals Division Council.

0.2 This standard was first published in 1975. In this revision, the following modifications have been made:

- a) Definition of wire has been brought in line with IS : 3288- (Part 3)-1986* to which reference has also been made in this standard;
- b) Clauses for method for chemical analysis, and dimensions and tolerances have been revised and latest reference have been made;
- c) Tables on chemical composition and physical properties have been modified; and
- d) Sampling and criteria for conformity have been modified.

0.3 Phosphor bronze wires are used for many applications specially for springs, in different conditions of tension depending on the applicability. The chemical composition and mechanical properties embrace various applications of wire for general engineering purposes including filler metal.

0.3.1 Requirements for phosphor bronze wires used for fourdrinier cloth are covered in IS : 10710-1983†.

0.4 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in

*Glossary of terms relating to copper and copper alloys: Part 3 Wrought forms.
†Specification for phosphor bronze wires for fourdrinier cloth.

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accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard covers requirements for two grades of phosphor bronze wires used for general engineering purposes.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definition as given in IS : 3288 (Part 3)-1986† shall apply.

2.1 Wire — A solid section of uniform cross-section along its whole length and the distance between two parallel faces not exceeding 6 mm may be supplied in straight length or in coil or in spools.

3. SUPPLY OF MATERIAL

3.1 General requirements relating to the supply of material shall conform to IS : 1387-1967‡.

4. FREEDOM FROM DEFECTS

4.1 The material shall be clean, smooth and free from harmful defects. There shall be no joints in the wire except those made in the rod or wire before final drawing.

5. CONDITION

5.1 The material shall be supplied in one of the following conditions as specified by the purchaser:

- a) Annealed (soft) (O),
- b) Half hard (HB),
- c) Hard (HD), and
- d) Extra hard (HE).

*Rules for rounding off numerical values (revised).

†Glossary of terms relating to copper and copper alloys: Part 3 Wrought forms.

‡General requirement for the supply of metallurgical materials (first revision).

6. CHEMICAL COMPOSITION

6.1 The material shall have the chemical composition as given in Table 1.

TABLE 1 CHEMICAL COMPOSITION OF PHOSPHOR BRONZE WIRES

| GRADE | PERCENT | | | | Copper |
|-------|---------|-------------|-------------|------------------|-----------|
| | Tin | Phosphorous | Lead | Total Impurities | |
| I | 4.2-5.5 | 0.02-0.40 | Max 0.05 | Max 0.20 | Remainder |
| II | 5.5-7.5 | 0.02-0.40 | 0.05 | 0.20 | Remainder |

6.2 The chemical composition shall be determined either by the methods specified in IS : 4027-1967* or its relevant parts or any other established instrumental/chemical method. In case of dispute, the procedure specified in IS : 4027-1967* or its relevant parts shall be the referee method.

7. MECHANICAL PROPERTIES

7.1 Tensile Test — The material, when tested in accordance with IS : 2656-1964†, shall have the properties as given in Table 2.

TABLE 2 MECHANICAL PROPERTIES OF PHOSPHOR BRONZE WIRES

| GRADE | CONDITION | DIAMETER | | TENSILE STRENGTH MPa | | ELONGATION PERCENT ON GAUGE LENGTH OF 100 mm, |
|-------|-----------|----------|---------------------|----------------------|-----|---|
| | | Over | Up to and Including | Min | Max | Min |
| | | mm | mm | | | |
| I | O | 0.45 | 6.0 | 340 | — | 40 |
| | | 0.45 | 6.0 | 540 | 700 | — |
| | HD | 0.45 | 6.0 | 700 | 850 | — |
| | | 0.45 | 2.5 | 850 | — | — |
| HE | 2.5 | 6.0 | 800 | — | — | |
| | — | — | — | — | 50 | |
| II | O | 0.45 | 6.0 | 370 | — | — |
| | | 0.45 | 6.0 | 590 | 740 | — |
| | HD | 0.45 | 6.0 | 740 | 900 | — |
| | | 0.45 | 2.5 | 900* | — | — |
| HE | 2.5 | 6.0 | 850 | — | — | |
| | — | — | — | — | — | |

*For special requirements, the purchaser may specify a minimum of 925 MPa for wires of 0.45 to 0.50 mm diameter.

NOTE — 1 N/mm² = 0.102 kgf/mm² = 1 MPa.

*Method of chemical analysis of bronzes.

†Method for tensile testing of copper and copper alloy wires.

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7.2 Wrapping Test — The wire in the hard and extra hard condition shall be wrapped around a wire of its own diameter to form a close helix of eight turns. This shall then be unwrapped for six turns. The wire shall not break or show any cracks when subjected to this test. For details, see also IS : 1755-1983*.

8. DIMENSIONS AND TOLERANCES

8.1 Dimension — The diameter of the wire shall be as required by the purchaser and stated in the order.

8.2 Tolerances — The tolerance on the diameter shall be in accordance with IS : 9861-1981†.

8.2.1 Where tolerances other than these are required, these shall be subject to agreement between the purchaser and the supplier.

8.3 Measurement — The diameter of round wire shall be determined by means of a suitable micrometer and by taking the mean of the two measurements at right angles made at the same cross-section of the sample.

9. SAMPLING AND CRITERIA FOR CONFORMITY

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

9.1 Lot — In any consignment, all the coils of wire of the same size, grade and temper manufactured under similar conditions of production shall be grouped together to constitute a lot. However, a lot shall not exceed 1 000 kg in mass. If necessary, two or more lots shall be formed on the basis of the mass of the consignment.

9.2 Each coil of wire shall be examined from the lot for freedom from defects and for tolerance on diameters. Any coil found defective shall be rejected.

9.3 For chemical composition, one test shall be conducted for each 200 kg of wire or part thereof in the lot. For this purpose, necessary number of coil shall be selected at random in accordance with IS : 1817-1961‡.

*Method for wrapping test of metallic wire (*first revision*).

†Dimensions for wrought copper and copper alloy wires for general engineering purposes.

‡Methods of sampling non-ferrous metals for chemical analysis.

9.3.1 If the results of chemical analysis as obtained for each of the constituent satisfy the corresponding requirements, the lot shall be considered as conforming to the chemical requirements of the specification.

9.4 The number of samples for mechanical tests (tensile test, wrapping test) shall be at the rate of one per every 100 kg of wire or part thereof in the lot.

9.4.1 The lot shall be considered as conforming to the requirements of the mechanical tests, if all the test results on different samples satisfy the corresponding requirements.

10. RETESTS

10.1 If a test result of chemical analysis fails to satisfy the requirements for any of the constituents, two more tests for that constituent 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 lot shall be considered as conforming to the specification, otherwise not.

10.2 If any one of the test pieces first selected fails to pass the tensile test and wrapping test, two further samples from the same lot shall be selected for testing, one of which shall be from the coil from which the original test sample was taken, unless that coil has been withdrawn by the supplier.

10.2.1 If the test pieces from both these additional samples pass, the lot represented by the test sample shall be deemed to comply with this standard. If the test pieces from either of these additional samples fail, the lot represented by the test samples shall be rejected.

11. PACKING

11.1 The wires shall be coiled carefully and each length of wire shall be made up into a separate coil weighing up to 50 kg.

11.2 The inner diameter of coil depending on size of the wire shall be subject to agreement between the purchaser and the supplier.

11.3 The coils shall be suitably packed to avoid damage during transit.

12. MARKING

12.1 Suitable tags with marking made on them to show the size, grade, temper, lot number, data of manufacture, mass of the material, in addition to name of the manufacturer and any such information required by the purchaser, shall be attached to each coil of the material.

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12.1.1 The coils of wire may also be marked with the Standard Mark.

NOTE — The use of the Standard Mark is governed by the provisions of the Bureau of Indian Standards Act 1986 and the Rules and Regulations made thereunder. The Standard Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well defined system of inspection, testing and quality control which is devised and supervised by BIS and operated by the producer. Standard marked products are also continuously checked by BIS for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

13. TEST CERTIFICATE

13.1 The supplier shall provide test certificate for each consignment giving information like lot number, corresponding chemical composition and mechanical test results.