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IS 28 (1985): Phosphor bronze ingots and castings [MTD 8: Copper and Copper Alloys]



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IS : 28 - 1985

Indian Standard

REAFFIRMED

SPECIFICATION FOR
PHOSPHOR BRONZE INGOTS AND CASTINGS

(*Fourth Revision*)

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

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August 1986

**AMENDMENT NO. 1 SEPTEMBER 1997
TO
IS 28 : 1985 SPECIFICATION FOR PHOSPHOR
BRONZE INGOTS AND CASTINGS**

(*Fourth Revision*)

(*Page 5, Table 1*) — Substitute the following for the existing table:

**Table 1 Chemical Composition
(Clause 4.1)**

Constituent	Percent				
	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5
Copper	Remainder	Remainder	Remainder	Remainder	Remainder
Total impurities and alloying elements	1.20 <i>Max</i>	0.60 <i>Max</i>	0.50 <i>Max</i>	0.80 <i>Max</i>	0.20 <i>Max</i>
Alloying Elements					
Tin	6.0-8.0	10.0 <i>Min</i>	6.5-8.5	9.0-11.0	11.0-13.1
Phosphorus	0.30-0.50	0.50 <i>Min</i>	0.30 <i>Min</i>	—	0.15 <i>Min</i>
Lead	0.25 <i>Max</i>	—	2.0-5.0	—	0.50 <i>Max</i>
Zinc	—	—	2.0 <i>Max</i>	—	0.30 <i>Max</i>
Nickel	—	—	1.0 <i>Max</i>	—	0.50 <i>Max</i>
Iron	—	—	—	—	0.15 <i>Max</i>
Aluminium	—	—	—	—	0.01 <i>Max</i>
Impurities					
Phosphorus	—	—	—	0.15 <i>Max</i>	—
Lead	—	0.25 <i>Max</i>	—	0.25 <i>Max</i>	—
Zinc	0.50 <i>Max</i>	0.05 <i>Max</i>	—	0.05 <i>Max</i>	—
Nickel	0.70 <i>Max</i>	0.10 <i>Max</i>	—	0.25 <i>Max</i>	—
Iron	0.30 <i>Max</i>	0.10 <i>Max</i>	—	—	—
Aluminium	0.01 <i>Max</i>	0.01 <i>Max</i>	—	—	—
Antimony	0.10 <i>Max</i>	—	—	—	—
Silicon	0.02 <i>Max</i>	0.02 <i>Max</i>	—	—	0.02 <i>Max</i>

(MTD 8)

Indian Standard
SPECIFICATION FOR
PHOSPHOR BRONZE INGOTS AND CASTINGS
(Fourth Revision)

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Indian Standard
SPECIFICATION FOR
PHOSPHOR BRONZE INGOTS AND CASTINGS
(*Fourth Revision*)

0. FOREWORD

0.1 This Indian Standard (Fourth Revision) was adopted by the Indian Standards Institution on 22 September 1985, 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 1950, and subsequently revised three times in 1958, 1969 and 1975. In this revision, the following modifications have been made:

- a) Grade 5 has been added;
- b) Clauses for chemical composition, size, shape and mass; and sampling and criteria for conformity have been modified;
- c) Clause on inspection and test certificate had been added; and
- d) An Appendix 'A' containing information to be given by the purchaser has been added.

0.3 This standard contains clauses **7.1, 9.1, 10.1, 11.0, 11.2, 12.1** and **14.1** where the purchaser is allowed to exercise his option and which calls for an agreement between the purchaser and the manufacturer.

0.4 In preparation of this standard, the sectional committee kept in view the manufacturing and trade practices being followed in the country in this field.

0.5 In preparation of this standard assistance has been derived from BS : 1400-1973 'Copper alloy ingots and copper and copper alloy castings', issued by the British Standards Institution.

0.6 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

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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 the requirements of 5 grades of phosphor bronze ingots and castings.

1.2 This standard, however, does not cover the requirements of material for use in railways. For this purpose, reference may be made to IS : 1458-1965†.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definition shall apply.

2.1 Ingot — A cast product in a form suitable for remelting primarily for the production of copper and copper alloys.

3. SUPPLY OF MATERIAL

3.1 General requirements relating to the supply of material shall be as laid down in IS : 1387-1967‡.

4. CHEMICAL COMPOSITION

4.1 The material shall have the chemical composition as given in Table I.

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

4.3 The manufacturer shall, when required, supply free of charge a copy of his work analysis of the material.

NOTE — The work analysis is defined as the routine analysis carried out by the manufacturer in order to control the quality of material.

*Rules for rounding off numerical values (*revised*).

†Specification for railway bronze ingots and castings (*revised*).

‡General requirements for supply of metallurgical materials (*first revision*).

§Methods of chemical analysis of bronzes.

TABLE 1 CHEMICAL COMPOSITION

(Clause 4.1)

CONSTITUENT	PERCENT				
	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5
Tin	6·0-8·0	10·0 <i>Min</i>	6·5-8·5	9·0-11·0	11·0-13·1
Phosphorus	0·30-0·50	0·50 <i>Min</i>	0·30 <i>Min</i>	0·15 <i>Max</i>	0·15 <i>Min</i>
Lead	0·25 <i>Max</i>	0·25 <i>Max</i>	2·0-5·0	0·25 <i>Max</i>	0·50 <i>Max</i>
Zinc	0·50 <i>Max</i>	0·05 <i>Max</i>	2·0 <i>Max</i>	0·05 <i>Max</i>	0·30 <i>Max</i>
Nickel	0·70 <i>Max</i>	0·10 <i>Max</i>	1·0 <i>Max</i>	0·25 <i>Max</i>	0·50 <i>Max</i>
Iron	0·30 <i>Max</i>	0·10 <i>Max</i>	—	—	0·15 <i>Max</i>
Aluminium	0·01 <i>Max</i>	0·01 <i>Max</i>	—	—	0·01 <i>Max</i>
Antimony	0·10 <i>Max</i>	—	—	—	—
Silicon	0·02 <i>Max</i>	0·02 <i>Max</i>	—	—	0·02 <i>Max</i>
Total Impurities	1·20 <i>Max</i>	0·60 <i>Max</i>	0·50 <i>Max</i>	0·80 <i>Max</i>	0·20 <i>Max</i>
Copper	Remainder	Remainder	Remainder	Remainder	Remainder

5. MECHANICAL PROPERTIES

5.1 Tensile Test — The castings, when tested in accordance with IS : 2654-1977*, shall have the tensile properties as given in Table 2.

5.2 Forms of Test Bars — The test bars shall be according to one of the appropriate types as described in IS : 1408-1968†.

6. FRACTURE TEST

6.1 Casting — Casting sample shall be broken in the presence of purchaser in such a manner that the area of fracture is as large as practicable in determining the uniformity of the grain structure of the metal. If the fracture shows segregation or dross or dirt spots, or any other defects, all castings produced from the same cast shall be rejected.

*Method for tensile testing of copper and copper alloys (*first revision*).

†Recommended procedure for inspection of copper-base alloy sand castings (*first revision*).

TABLE 2 MECHANICAL PROPERTIES OF CASTINGS

(Clause 5.1)

DESCRIPTION	TENSILE STRENGTH	ELONGATION PERCENT ON GAUGE LENGTH OF
	<i>Min</i>	$5.65 \sqrt{A}$
	MP a	<i>Min</i>
Grade 1 Sand cast	190	3
	Chill cast	5
	Continuously cast	8
Grade 2 Sand cast	220	3
	Chill cast	2
	Continuously cast	7
Grade 3 Sand cast	190	3
	Chill cast	2
	Continuously cast	5
Grade 4 Sand cast	230	6
	Chill cast	5
	Continuously cast	9
Grade 5 Sand cast	220	5
	Chill cast	3
	Continuously cast	5

6.2 Ingots — The ingot samples selected as specified in 11 shall be broken at the notch to find the nature of fracture. The fracture shall not show segregation, dross, dirt spots or any other harmful defects.

7. PRESSURE TEST

7.1 If the purchaser required castings to be tested for pressure, this shall be stated with enquiry and order. The number of tests, the nature of the test, test pressure and the testing fluid shall be subject to agreement between the supplier and the purchaser.

8. FREEDOM FROM DEFECTS

8.1 Ingots — The ingots shall be of uniform quality and reasonably free from slag, dross and other harmful contaminations.

8.2 Castings — Castings shall be clean, and free from harmful defects, such as blow holes, gas cavities etc. Castings shall not be repaired unless

permission in writing has been obtained previously from the purchaser or his representative.

9. SIZE, SHAPE AND MASS

9.1 Ingots — Size, shape and mass of ingots shall be as agreed to between the supplier and the purchaser.

9.2 Castings — The dimensions of the casting shall be in accordance with the drawing. All surfaces marked for machining shall have sufficient allowance for that purpose but this shall not be too excessive resulting in more machining, and unnecessary increase in the mass of the casting.

10. MARKING

10.1 The name or trade-mark of the manufacturer and the cast number and grade of the material shall be cast or otherwise legibly marked by stamping on each ingot or casting, by which the manufacturer and the grade of the material may be identified. In the case of small castings where it is difficult to cast on or stamp all the details, the marking shall be as agreed to between the purchaser and the supplier.

10.1.1 The material may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI 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 ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

11. SAMPLING AND CRITERIA FOR CONFORMITY

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

11.1 Lot — In any consignment, ingots/castings of the same grade and same shape (*see* Table 1) manufactured at the same place under similar condition shall be grouped together to constitute a lot.

11.2 Sampling for Chemical Analysis — One sample shall be taken and analysed from each cast of 1 000 kg or part thereof the ingots/castings. However, in case more frequent chemical analysis is required,

the same shall be agreed to between the supplier and the purchaser. The sampling for chemical analysis shall be taken by drilling or sawing in such a manner as to be representative of the entire cross section. Drillings and sawings from ingots/castings shall be obtained in accordance with the appropriate procedure specified in IS : 1817-1961*.

11.2.1 If the test results of chemical analysis as obtained for each of the constituents satisfy the corresponding requirements, the lot shall be considered as conforming to the chemical requirement of the specification.

11.3 Sampling for Mechanical Properties — Three test bars shall be separately cast along with the castings for tensile strength for every 1 000 kg or part thereof the casting. These test bars shall be cast to shape in accordance with 5.2 and Appendix B of IS : 1408-1968†. These test bars shall be of suitable size for turning them to the standard dimensions of the test piece as laid down in IS : 2654-1977‡.

11.3.1 Out of three test bars, one bar shall be tested for mechanical test for every 1 000 kg or part thereof ingots castings. If the test results satisfy the requirements of mechanical properties, the lot shall be considered as conforming to the mechanical properties.

11.4 Retest

11.4.1 If the sample drawn for chemical analysis fails to meet the requirements stipulated in the standard, two more tests shall be conducted 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 accepted; and if either of the retest fails, the lot represented shall be deemed as not complying with the standard.

11.4.2 If a test piece fail to meet tensile test requirements specified in the standard, two further test pieces which represent the same cast may be tested in the same manner. If one of the further test pieces meet the requirements of the tensile test, the ingots or castings represented thereby shall be deemed to comply with the standard, otherwise the lot shall be rejected.

12. INSPECTION

12.1 All inspection and testing of ingots/castings described in this standard shall be carried out by the supplier unless otherwise agreed

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

†Recommended procedure for inspection of copper base alloy sand castings (first revision).

‡Methods for tensile testing of copper and copper alloys (first revision).

between the purchaser and the supplier. The inspection requirement shall be stated in the enquiry, order and/or test schedule where applicable.

12.2 The purchaser shall notify the supplier when placing the order if it is his intention to inspect the material at the supplier's works. The supplier shall offer the purchaser all reasonable facilities to satisfy himself that the material is in accordance with this standard. For this purpose the purchaser or his representative may, by prior arrangement, attend to inspect the material, to select and identify that test samples for testing and to witness the test being made.

13. TEST CERTIFICATE

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

14. INFORMATION TO BE GIVEN BY THE PURCHASER

14.1 The standard contains a number of clauses in which the purchaser is allowed to exercise an option. The list of information to be given by the purchaser in respect to these clauses is given in Appendix A.

A P P E N D I X A

(*Clause 14.1*)

INFORMATION TO BE GIVEN BY THE PURCHASER

- A-1.** Whether the purchaser wish to inspect the material at the supplier works (*see 12 and IS: 1387-1967**).
- A-2.** The alloy grade required.
- A-3.** Whether information is required concerning the works analysis.
- A-4.** Detailed drawings of castings.
- A-5.** In case of ingots whether purchaser prefers any special size, shape and mass of the ingots.
- A-6.** Preparation of test piece for tensile testing.
- A-7.** Marking details.

*General requirements for the supply of metallurgical materials (*first revision*).

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(*Continued from page 2*)

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