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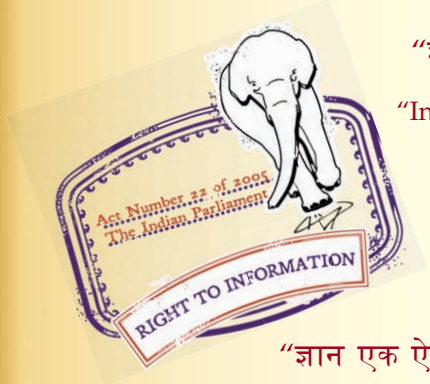
Jawaharlal Nehru
"Step Out From the Old to the New"

IS 7814 (2005): Phosphor bronze sheet, strip AND Foil - Specificat8ion [MTD 8: Copper and Copper Alloys]



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Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

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भारतीय मानक

फौस्फर कांस्य की चादर, पत्ती एवं पन्नी — विशिष्टि

(दूसरा पुनरीक्षण)

Indian Standard

PHOSPHOR BRONZE SHEET, STRIP AND FOIL — SPECIFICATION

(Second Revision)

ICS 77.120.30

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

September 2005

Price Group 3

FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Copper and Copper Alloys Sectional Committee had been approved by the Metallurgical Engineering Division Council.

This standard was first published in 1975 and subsequently revised in 1985.

The phosphor bronze are commonly used for deep drawing into bellows, stamping and forming into spring devices and into terminals and connectors for electrical apparatus, because they combine high strength with high elongation.

In this standard following modifications have been made:

a) One more grade has been added.

b) Relevant chemical composition and mechanical properties for the new grade have been incorporated.

c) Drawings for the bend test have been added.

d) Dimensions of tolerances have been incorporated in the standard.

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 accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

PHOSPHOR BRONZE SHEET, STRIP AND FOIL — SPECIFICATION

(Second Revision)

1 SCOPE

This standard covers the requirement for four grades of rolled phosphor bronze sheet, strip and foils.

2 REFERENCES

The following standards contain provisions which through reference in this text, constitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	*Title*
1387 : 1993	General requirements for the supply of metallurgical materials (*second revision*)
1501 : 2002	Methods for Vickers hardness test for metallic materials (*third revision*)
1599 : 1985	Methods for bend test (*second revision*)
1608 : 1995	Mechanical testing of metals — Tensile testing (*second revision*)
3288	Glossary of terms for copper and copper alloys
(Part 1) : 1986	Materials (*third revision*)
(Part 3) : 1986	Wrought forms
4027 : 1967	Method of chemical analysis of bronzes

3 TERMINOLOGY

For the purpose of this standard, the definition of terms as given in IS 3288 (Parts 1 and 3) shall apply.

4 SUPPLY OF MATERIAL

The general requirements relating to supply of material shall conform to IS 1387.

5 FREEDOM FROM DEFECTS

The finished sheet, strip and foil shall have clean, flat, bright and smooth surface, free from black oxide, discolouration, scratches, porosity, burrs or other harmful defects.

6 CONDITION OF DELIVERY

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

O : Annealed (soft)
HA : Quarter hard
HB : Half hard
HD : Hard
HE : Extra hard
HS : Spring hard
HES : Extra spring hard

7 CHEMICAL COMPOSITION

The material, when analyzed by the method specified in relevant parts of IS 4027 or any other established instrumental/chemical method shall conform to the requirements as given in Table 1. In case of dispute, the procedure given in IS 4027 and its relevant parts shall be the referee method. However, when the method is not given in IS 4027 or its relevant parts the referee method shall be as agreed to between the purchaser and the manufacturer.

8 MECHANICAL PROPERTIES

8.1 The material when tested for tensile test and hardness in accordance with IS 1608 and IS 1501 respectively shall have the properties as given in Table 2.

8.1.1 Both tensile test and hardness tests shall be carried out. Further, unless otherwise specified, the tensile test shall be applied and the hardness and bend test shall be taken to be mandatory.

8.2 Bend Test

The material is to be tested for bend test in accordance with IS 1599. The test piece shall not fracture or show any crack on the convex surface of the bend portion, when bent once through the angle as specified in the Table 3.

9 DIMENSIONS AND TOLERANCES

9.1 Preferred Inside Diameter of Strip and Foil (*see* Table 4)

Table 1 Chemical Composition of Phosphor Bronze Sheet, Strip and Foil

(*Clause* 7)

Grade	Percent					
	Tin	Phosphorous	Lead *Max*	Iron *Max*	Zinc *Max*	Cu+Sn+P *Min*
(1)	(2)	(3)	(4)	(5)	(6)	(7)
I	3.5-4.5	0.03-0.35	0.02	0.10	0.30	99.5
II	4.5-5.5	0.03-0.35	0.02	0.10	0.30	99.5
III	5.5-7.0	0.03-0.35	0.02	0.10	0.30	99.5
IV	7.0-9.0	0.03-0.35	0.02	0.10	0.20	99.5

NOTE — Copper may be taken as the difference between the sum of all the elements analyzed and 100 percent.

Table 2 Mechanical Properties of Phosphor Bronze Sheet, Strip and Foil

(*Clause* 8.1)

Grade	Condition	Thickness Up to and Including	Tensile Strength, MPa		Elongation Percent on 50 mm G.L.	Hardness, HV			
			Up to and Including 450 mm Wide	Over 450 mm Wide		Up to and Including 450 mm Wide		Over 450 mm Wide	
			Min	*Min*	*Min*	*Min*	*Max*	*Min*	*Max*
I	O	10	295	295	40	—	80	—	80
	HA	10	340	340	30	100	—	100	—
	HB	10	460	400	8	150	—	130	—
	HD	6	540	495	4	180	—	150	—
	HE	6	620	—	—	190	—	—	—
II	O	10	310	310	45	—	85	—	85
	HA	10	350	350	35	110	—	110	—
	HB	10	495	460	10	160	—	140	—
	HD	6	570	525	4	180	—	160	—
	HE	6	645	—	—	200	—	—	—
	HS	0.9	—	—	—	215	—	—	—
III	O	10	315	315	50	—	90	—	90
	HA	10	385	385	40	115	—	115	—
	HB	10	490	460	12	170	—	150	—
	HD	6	590	540	6	200	—	165	—
	HE	6	650	—	—	215	—	—	—
	HS	0.9	—	—	—	220	—	—	—
	HES	0.6	—	—	—	240	—	—	—
IV	O	10	345	345	50	—	95	—	95
	HA	10	390	390	40	100	—	100	—
	HB	10	490	460	30	170	—	150	—
	HD	6	590	550	8	200	—	170	—
	HE	6	690	—	5	220	—	—	—
	HS	0.9	—	—	—	230	—	—	—
	HES	0.6	—	—	—	240	—	—	—

NOTES

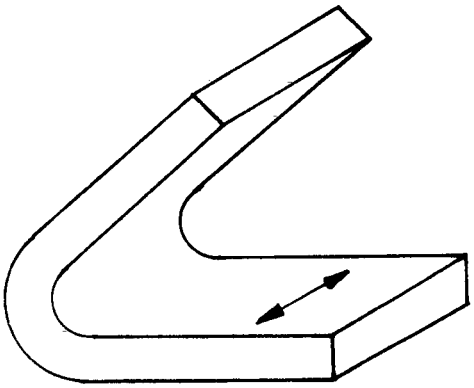
1 The mechanical properties exceeding the range of the specified value shall be agreed upon between the parties concerned with acceptance.

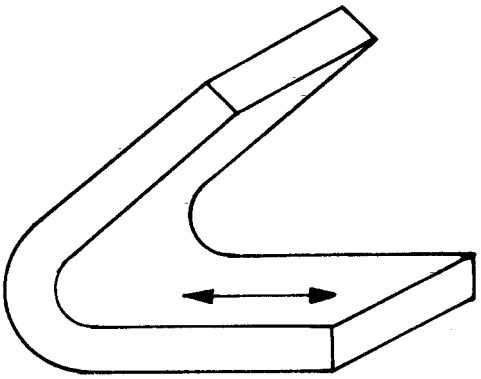
2 For 0.5 mm and below strip thickness, special load range to be applied for indentation.

3 The tensile test shall be applied to material having thickness up to and including 0.20 mm.

Table 3 Bend Test

(*Clause* 8.2)





Thickness Upto and Including	Condition	Transverse Bend Test		Longitudinal Bend Test	
		Angle	Radius	Angle	Radius
10 mm	O	180°	t	180°	t
"	HA	180°	t	180°	t
"	HB	180°	t	180°	t
"	HC	90°	t	120°	t
"	HD	90°	t	90°	t
"	HE	—	—	90°	t

t = thickness of the sheet. strip.

Table 4 Preferred Inside Diameter of Strip and Foil in Coil

(*Clause* 9.1)

All dimensions in millimetres.

Thickness		Preferred Inside Diameter				
Over	Up to and Including					
(1)	(2)	(3)	(4)	(5)	(6)	(7)
—	0.16	100	150	—	—	—
0.16	0.5	100	150	200	300	—
0.5	1.0	—	150	200	300	400
1.0	3.0	—	—	—	300	400

9.2 Thickness Tolerances

The thickness tolerances for sheet, strip and foil shall be as given in Table 5.

9.3 Width Tolerance

The width tolerances for sheet, strip and foil shall be as given in Table 6.

9.4 Length Tolerance for Sheet

The length tolerances for sheet shall be as given in Table 7.

9.5 Permissible Maximum Value on Camber for Strip

The permissible maximum value on camber for strip shall be as given in Table 8.

10 SAMPLING AND CRITERIA FOR CONFORMITY

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

10.1 Lot

In a consignment the sheets, strip and foil of the same width and thickness, and of the same temper shall be grouped together to form a lot not exceeding 1 000 kg. One or more lots may be formed from the material submitted for inspection depending on the mass of each lot shall be separately sampled for acceptance purposes.

10.2 Visual and Dimensional Requirements

All the coils shall be individually examined for manufacturing defects, surface defects and dimensional tolerances. No failure shall occur, if the lot is to be accepted under this clause.

10.3 Chemical Composition and Mechanical Properties Requirements

From each lot, one sample per 1 000 kg or part thereof for chemical test and one sample per 250 kg or part thereof shall be tested for all mechanical tests. The samples shall be cut off cold and shall receive no further treatment (except that they may be machined to shape of the test pieces) before being tested. The lot shall be accepted under this clause, if the samples tested meet all the chemical composition and mechanical properties requirements of the specification.

11 RETESTS

11.1 If a test result of chemical analysis fails to satisfy the requirement for any of the constituents/ elements, two more tests to be conducted for the same element/constituents 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.

11.2 If any of the pieces first selected fails to pass any of the mechanical tests, two further samples from the same batch shall be selected for testing, one of which shall be from the sheet or strip from which the original test sample was taken, unless that sheet, strip or foil has been withdrawn by the supplier.

11.3 If the test pieces from both these additional samples pass the test, the batch represented by the test samples shall be deemed to comply with the requirements of this standard. If the test pieces from either of these additional samples fail, the batch represented by the test samples shall be deemed not to comply with the requirements of this standard.

12 PACKING

The material shall be suitably packed to prevent from all damages during transit or as required by the purchaser.

13 MARKING

13.1 Sheet, strip and foil shall be marked with the following items on each package on each coil or on each sheet by suitable means:

a) Grade, Temper grade or its symbol;

b) Dimensions;

c) Batch number;

d) Name of manufacturer or its identifying brand; or

e) Any such information required by the purchaser.

13.2 BIS Certification Marking

The material may also be marked with the Standard Mark.

13.2.1 The use of Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. The details of the conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

Table 5 Tolerance on Thickness for Sheet, Strip and Foil

(*Clause* 9.2)

All dimensions in millimetres.

Thickness		Tolerance on Thickness		
Over	Up to and Including	Width Up to and Including 160	Width Over 160 Up to and Including 300	Width Over 300 Up to and Including 450
(1)	(2)	(3)	(4)	(5)
0.04	0.10	10 percent of specified thickness	10 percent of specified thickness	—
0.10	0.16	±0.012	±0.015	±0.020
0.16	0.28	±0.015	±0.020	±0.025
0.28	0.63	±0.020	±0.025	±0.030
0.63	0.50	±0.025	±0.030	±0.040
0.90	1.20	±0.030	±0.040	±0.050
1.20	2.00	±0.040	±0.050	±0.060
2.00	2.80	±0.050	±0.060	±0.070
2.80	3.50	±0.060	±0.070	±0.090
3.50	5.00	±0.100	±0.130	±0.170
5.00	7.00	±0.120	—	—

NOTES

1 When the tolerance is specified either only plus or only minus side, the value in the above table shall be doubled.

2 The thickness tolerance on exceeding the range of specified dimensions shall be agreed upon between the parties concerned with acceptance.

Table 6 Width Tolerances for Sheet, Strip and Foil

(*Clause* 9.3)

All dimensions in millimetres.

Width		Tolerance on Width				
		Thickness (Up to and Including)				
Over	Up to and Including	0.25	0.55	1.00	2.00	4.00
(1)	(2)	(3)	(4)	(5)	(6)	(7)
10	50	±0.10	±0.15	±0.20	±0.30	—
50	100	±0.15	±0.20	±0.30	±0.50	±0.60
100	200	±0.20	±0.30	±0.50	±0.60	±0.80
200	400	±0.30	±0.50	±0.60	±0.80	±1.00

NOTES

1 When the tolerance is specified either only plus or only minus side, the value in the above table shall be doubled.

2 The width tolerance exceeding the range of specified dimensions shall be as agreed upon between the parties concerned with acceptance.

Table 7 Tolerance on Length for Sheet

(*Clause* 9.4)

All dimensions in millimetres.

Sl No.	Thickness		Tolerance on Length Up to and Including 1 220 mm
	Over	Up to and Including	
(1)	(2)	(3)	(4)
i)	—	0.4	+ 5 − 0
ii)	0.4	0.8	+ 5 − 0
iii)	0.8	5	+ 10 − 0

NOTE — The length tolerances on exceeding the range of specified dimensions shall be as agreed upon between the supplier and the purchaser.

Table 8 Permissible Maximum Value on Camber for Strip

(*Clause* 9.5)

All dimensions in millimetres.

Sl No.	Width		Permissible Maximum Value in Any 1 000 mm Length
	Over	Up to and Including	
(1)	(2)	(3)	(4)
i)	0	7	—
ii)	7	9	7
iii)	9	13	6
iv)	13	25	5
v)	25	50	4
vi)	50	100	3
vii)	100	450	2

NOTES

1 The term camber means the depth of the arc for the specified length.

2 The permissible maximum value in exceeding the range of the specified dimensions shall be as agreed between the supplier and the purchaser.

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act,* 1986 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards : Monthly Additions'.

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Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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