IS 2768 (1982): Copper alloy strip for bullet envelope [MTD 8: Copper and Copper Alloys]

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Indian Standard

SPECIFICATION FOR COPPER ALLOY STRIP FOR BULLET ENVELOPE

(First Revision)

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

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Indian Standard

SPECIFICATION FOR COPPER ALLOY STRIP FOR BULLET ENVELOPE

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Indian Standard

SPECIFICATION FOR COPPER ALLOY STRIP FOR BULLET ENVELOPE

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 30 June 1982, after the draft finalized by the Copper and Copper Alloys Sectional Committee had been approved by the Structural and Metals Division Council.

0.2 Copper alloy strip is used for bullet envelope. This standard was earlier published in 1964. In this revision, requirements for hardness, reverse bend test and grain size requirement have been revised. The material is generally being used by Defence.

0.3 While preparing the revised standard, necessary assistance has been derived from DEF STAN 95-11/1, Bullet Envelope Materials, dated 22 Feb 1980 issued by Ministry of Defence, Directorate of Standardization, London.

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 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.

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1. SCOPE

1.1 This standard covers the requirements for cold rolled copper alloy (90/10) strips for bullet envelope.

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

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definition as given in IS : 3288 (Part I)-1981* shall apply.

2.1 Strip — Flat product, over 0·15 mm thick and up to and including 10 mm thick, of any width, and generally not cut to length; usually in coil, but may be flat or folded.

3. SUPPLY OF MATERIAL

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

4. MANUFACTURE AND QUALITY

4.1 The strip shall be finished by cold rolling with subsequent annealing and be available in the hardness range given in **6.1**.

4.2 Use of Scrap — Clean process scrap and electrical scrap may be used in the charge. Clean process scrap consists of ingot discards, webbing, large clippings, and partly, or completely formed components from guilding metal to this standard. It may include small clippings, swarf turnings and millings of guilding metal to this standard, if these are free from contamination to the satisfaction to the purchaser. It may also include guilding metal rejected for being slightly outside the limits of composition, with the agreement of the purchaser.

When continuous or semi-continuous casting with an underpouring technique is employed, ingot discards and clean process scrap other than guilding metal to this standard (as detailed in the following note) may be used so long as the chemical composition of the cast complies with Table 1.

NOTE — Clean process scrap is scrap arising from the production of strip or sheet or its subsequent fabrication into components and is free from contamination.

5. CHEMICAL COMPOSITION

5.1 When tested, the material shall have the chemical composition as given in Table 1.

5.2 The chemical composition shall be determined either by the method specified in IS : 440-1964‡ or any other established instrumental/chemical method. In case of dispute, the procedure specified in the latest edition of IS : 440-1964‡ for chemical analysis, shall be the Referee Method.

*Glossary of terms for copper and copper alloys: Part I Cast form and wrought form (main types) (*second revision*).

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

‡Methods of chemical analysis of copper (*revised*).

TABLE 1 CHEMICAL COMPOSITION

(*Clauses* **4.2** *and* 5.1)

CONSTITUENT	PERCENT
Copper	89 to 91
Nickel, *Max*	0·1
Arsenic, *Max*	0·02
Antimony, *Max*	0·01
Bismuth, *Max*	0·002
Tin, *Max*	0·03
Lead, *Max*	0·02
Iron, *Max*	0·05
Phosphorus, *Max*	0·01
*Other elements (each), *Max*	0·005
Zinc	Remainder

*Sulphur is not determined normally but may be in excess of 0·005 percent provided the properties and suitability of material are not adversely affected.

6. PHYSICAL PROPERTIES

6.1 Hardness, when tested in accordance with IS : 2866-1965*, shall be 55 to 75 HV.

6.2 Bend Test — Bend tests shall be made on test pieces cut with their major axes either parallel to the direction of rolling (longitudinal bend test) or at right angles to the direction of rolling (transverse bend test) (*see* **6.2.3** and **6.2.4**).

6.2.1 The longer edges shall be carefully rounded and smoothened longitudinally so that for material up to 3·15 mm thick the cross-section has approximately semi-circular edges; for material over 3·15 mm thick the edges shall be rounded to a radius of 1·6 mm.

6.2.2 Where possible, the material shall be subjected to a transverse bend test; where this is not possible it shall be subjected to a longitudinal bend test.

*Method for vickers hardness test for copper and copper alloys.

6.2.3 *Reverse Bend Test* — A test piece of 13 mm in width and of convenient length be cut from the material so that its major axis is at 90° to rolling direction. If the width of the material is less than 50 mm, a longitudinal test piece having its major axis parallel to the rolling direction may be used. The longer side of the test piece be rounded and smoothened longitudinally so that the cross section has approximately semi circular ends. Part of the test piece shall be gripped between two formers each having an inner edge radius equal to three times the thickness of the material. The free end of the test piece shall be bent through 90 over one former and bent back to its original position (1 bend), it shall then be bent through 90° over the other former and back to its original position (2 bends), the necessary constraint being applied to maintain contact between the test piece and the former. Repeating this procedure until cracking occurs and a kink appears in the test piece at the crack; failure is defined as the formation of a kink that prevents the test piece from following the curve of the former. The number of completed bends before failure shall not be less than 8 (*see* Table 2).

6.2.4 *Single Bend Test* — A test piece of approximate width as laid down in Table 2 and of convenient length shall be cut from the strip in any direction at the discretion of the inspecting authority and sharp edges be removed and side smoothened. The test piece shall not crack when bent through 180° over a former of radius equal to half the thickness of the material.

TABLE 2 BEND AND REVERSE BEND TEST REQUIREMENTS

Thickness of Strips (*t*)	Width of Test Piece	Type of Test	Radius of Former	Number of Bends
(mm)	(mm)			
Up to and including 2·54	13	Reverse	3t	8 Minimum
Over 2·54	25	Single	1/2t	1 of 180°

6.3 Grain Size — The average grain size of the material shall not be greater than 0·065 mm.

6.3.1 The average grain size may be determined if specified by the purchaser by etching the surface of the material to reveal its grain structure and then comparing this, at a magnification of 75, with the grain size standards given in IS : 4748-1968*.

*Methods for estimating average grain size of metals.

7. DIMENSIONS AND TOLERANCES

7.1 The dimensions and tolerances shall be as laid down in IS : 3052-1974* unless otherwise specified by the purchaser.

8. FREEDOM FROM DEFECTS

8.1 The strips shall be reasonably clean, sound and free from surface and other visible defects.

9. CALCULATION OF WEIGHT

9.1 The weight of the strips shall be calculated where necessary on the basis that its density is 8·8 g/cm^3.

10. PACKING

10.1 Strips shall be supplied in coils of continuous length or folded or as flats and the mass of each coil shall be as per agreement. Each package may weigh 125 kg.

11. MARKING

11.1 Each coil shall have attached to it a metallic tag which is stamped with suitable marks to indicate the material, name of the manufacturer, mass and such other information required by the purchaser.

11.1.1 Each coil and in the case of strips in flat form, each package 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.

12. SAMPLING AND CRITERIA FOR CONFORMITY

12.1 Lot — In any consignment, all the strips of the same width and thickness belonging to a particular cast of melt and manufactured by a single firm shall be grouped together to constitute a lot.

*Dimensions for wrought copper and copper alloys sheet, strip and foil (for general engineering purposes) (*first revision*).

12.1.1 Tests for determining the conformity of the lot to the requirements of this specification shall be carried out on each lot separately. Unless otherwise required (*see* Note), the number of strips to be selected for this purpose at random over the whole lot shall be in accordance with col 1 and 2 of Table 3.

NOTE — In view of the critical nature of the dimensions and the requirements specified under **7** and **8** for some of the ordnance stores, purchaser may ask for cent percent inspection in place of sampling inspection for checking the conformity of the lot to these requirements. In such cases, strips found not conforming to any of these requirements shall be rejected and the remaining shall be used for further testing as specified in **12.2.2**.

TABLE 3 SCALE OF SAMPLING AND PERMISSIBLE NUMBER OF DEFECTIVES

(*Clause* 12.1.1)

LOT SIZE	SAMPLE SIZE	PERMISSIBLE NO. OF DEFECTIVES*
(1)	(2)	(3)
Less than 15	All	†
16 to 40	15	1
41 to 65	25	2
66 to 110	35	3
111 to 180	50	4
181 to 300	75	6
301 and above	110	8

*This ensures that lots containing only four percent or less defectives shall be accepted most of the times.

†Defective strips shall be rejected and the remaining shall be used for further testing specified in **12.2.2**.

12.2 Number of Tests and Criteria for Conformity

12.2.1 The strips selected in accordance with Table 3 shall be inspected for manufacture and quality (*see* **4.1**), dimensions (*see* **7**) and freedom from defects (*see* **8**). Any strip failing to meet the requirements of one or more of these characteristics shall be considered as a defective. If the number of defectives found is less than or equal to the permissible number of defectives given in col 3 of Table 3, the lot shall be declared as conforming to the requirements of the above characteristics (*see* Note under **12.1.1**).

12.2.2 From each lot, the number of strips to be subjected to the determination of copper and zinc content (*see* Table 1), hardness test (*see* **6.1**) and bend test (*see* **6.2**) shall be one for lots weighing 200 kg or less

and shall be in proportion of one per 200 kg and part thereof for lots weighing more than 200 kg subject to a maximum of five samples. One determination of all other requirements of chemical composition (*see* Table 1) shall be done for each lot irrespective of the lot weight. The strips for these tests shall be selected out of those obtained in **12.1.1.**

NOTE 1 — In the case of strips in coil form weighing more than 200 kg, one example shall be taken for each coil to provide the necessary test pieces.

NOTE 2 — The material required for chemical analysis from each of the strips intended for testing shall be collected in accordance with IS : 1817-1961*.

NOTE 3 — The test pieces required for various tests shall be cut off from each of the selected strips when cold and shall receive no further treatment except that they may be machined to the required shape of the test pieces before being tested.

12.2.2.1 When only one chemical analysis or physical test is done on a lot, the lot shall be considered as conforming to the requirements of the specification if the result so obtained from each of the characteristics satisfies the corresponding requirement of the specification. If the result of the analysis or test fails to satisfy the requirements for any characteristics, two more tests for that characteristic shall be done in order to confirm that the analysis or test has been done properly. If both these analyses or test results satisfy the relevant requirements, the lot shall be deemed as conforming to the requirements of the specification, otherwise not.

12.2.2.2 In the case of the determination of copper content and hardness test, when more than one analysis or test result is available for a lot, the lot shall be considered as conforming to the requirements of this specification if the mean and the range calculated from the analysis or test results of each of the characteristics satisfy the conditions given below:

a) (Mean + 0·6 Range) shall be less than or equal to the maximum specification limit, and

b) (Mean — 0·6 Range) shall be greater than or equal to the minimum specification limit.

NOTE 1 — Mean is obtained by dividing the sum of the test (or analysis) results by the number of test (or analysis) results.

NOTE 2 — Range is defined as the difference between the maximum and the minimum value of test (or analysis) results.

NOTE 3 — The multiplier 0·6 of the range ensures that lots containing only 0·5 percent or less defective strips shall be accepted most of the times.

12.2.2.3 In the case of bend test, when more than one test result is available, the lot shall be declared as conforming to the requirement of this characteristic if each one of the test results is found to be satisfactory.

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

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	Unit	Symbol
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	Unit	Symbol
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	Unit	Symbol	Definition
Force	newton	N	$N = 1\ kg.m/s^2$
Energy	joule	J	$1\ J = 1\ N.m$
Power	watt	W	$1\ W = 1\ J/s$
Flux	weber	Wb	$1\ Wb = 1\ V.s$
Flux density	tesla	T	$1\ T = 1\ Wb/m^2$
Frequency	hertz	Hz	$1\ Hz = 1\ c/s\ (s^{-1})$
Electric conductance	siemens	S	$1\ S = 1\ A/V$
Electromotive force	volt	V	$1\ V = 1\ W/A$
Pressure, stress	pascal	Pa	$1\ Pa = 1\ N/m^2$

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