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रेडिएटर कोर के लिए तांबा एवं पीतल की पत्ती/पन्नी— विशिष्टि

(*आईएस 3331 का तीसरा पुनरीक्षण*)

Draft Indian Standard

Copper and Brass Strips/Foils for Radiator Cores — Specification

(*Third Revision of IS 3331*)

ICS 77.150.01

Ores and Feed Stock for Copper Industry, its Metals/ Alloys and Products Sectional Committee, MTD 08	Last date of comment: 09/11/2023

FOREWORD

(*Formal clauses will be added later*)

This standard was first published in 1965 and subsequently revised in 1977 and 2007. While reviewing this standard in the light of experience gained during these years, the Committee decided to revise it in line with present practice being followed by Indian industry. In the present revision, following modifications has been made:

a) An updated reference clause has been incorporated.
b) Marking clause has been updated.
c) Chemical composition of copper foil has been revised.
d) Mechanical property of copper foil for fin application and brass foils for tubes and brass strips for tank and header has been shown in Table 3.
e) Thickness tolerances of brass and copper foils and strips has been revised as Table 4A, 4B.
f) I value has been introduced as flatness measurement value.

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 : 2022 'Rules for rounding off numerical-values (*second revision*)'. 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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October 2023

Draft *Indian Standard*

Copper and Brass Strips/Foils for Radiator Cores — Specifications

(*Third Revision*)

1 SCOPE

This standard covers the requirements for copper and brass strips/foils for fabrication of radiators for motor cars, trucks, tractors, earth moving equipments, diesel locomotives and stationary internal combustion engines.

2 REFERENCES

The following standards contain provisions, which through reference in this text, constitute provisions 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*
IS 1387 : 1993	General requirements for the supply of metallurgical materials (*second revision*)
IS 3288 : 1986 (All parts)	Glossary of terms relating to copper and copper alloys
IS 3685 : 1966	Method of chemical analysis of brasses
ISO 2624 : 1990	Copper and copper alloys — Estimation of average grain size

3 TERMINOLOGY

For the purpose of this standard following definitions reproduced from IS 3288 (All parts) shall apply.

3.1 Strip — Flat product over 0.15 mm thick and up to and including 10 mm, of any width and generally not cut to length; usually in coils but may be flat or folded.

3.2 Foil — A flat product of thickness up to and including 0.15 mm, of any width generally not cut to length usually in coil form but may also be in flat or folded form.

4 SUPPLY OF MATERIAL

The general requirements relating to supply of material are laid down in IS 1387.

5 MANUFACTURE

The material manufactured by cold-rolling shall be supplied in annealed (O), half hard (HB) or hard (HD) temper condition.

6 FREEDOM FROM DEFECTS

6.1 Surface of the material shall be clean and free from oxides, pin holes, blisters, flakes, scratches and other harmful defects. The edges slitted/unslitted of strips/foils should be free from edges burrs and cracks.

6.2 The surface of the material shall be free from contaminants which would prevent satisfactory wetting and boding of soldier joints under normal production condition.

7 CHEMICAL COMPOSITION

The material shall have the composition as given in Tables 1 and 2.

8 PHYSICAL/MECHANICAL PROPERTIES

8.1 The average grain size and the limits of variation for annealed temper shall be as agreed to between the purchaser and the supplier.

8.1.1 The average grain size may be estimated by comparing photo-micrographs shown in ISO 2624.

8.2 The mechanical properties of copper and brass strip/foil shall be as specified in Table 3.

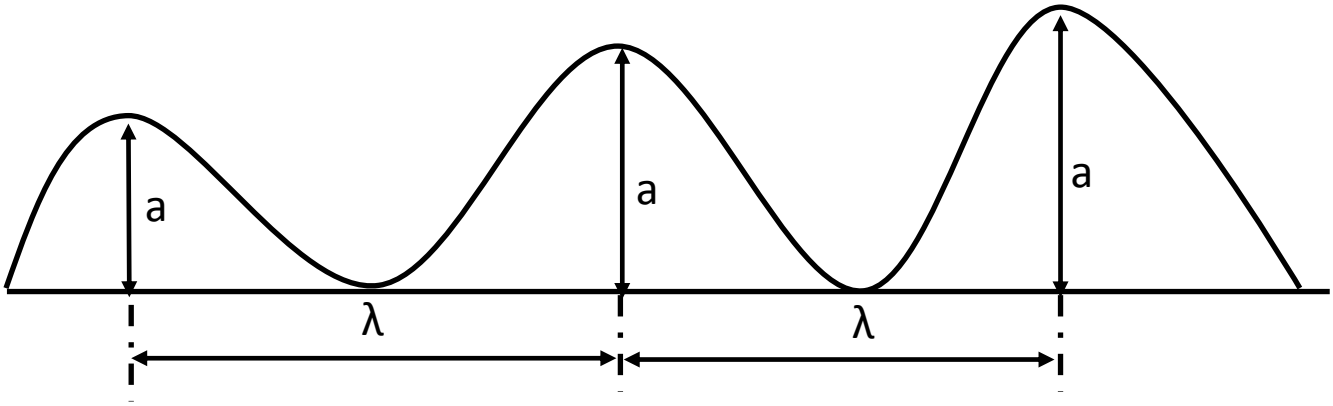
9 DIMENSIONS AND TOLERANCES

The copper and brass strip/foil shall be supplied in the thickness and widths specified by the purchaser subject to tolerances given in Table 4A and Table 4B respectively.

10 FLATNESS

The strip shall be free from waves and buckles.

I-Value is an exacting quantitative flatness measurement. It is a dimensionless number that incorporates both the height (a) and peak to peak length (λ) in the diagram below of a repeating wave.



$$I = \left(\frac{\pi}{2} X \frac{a}{\lambda}\right)^2 X\ 10^5$$

where, a = Mean height
λ = mean length

I-value for Brass and Copper foils should not be more than 30i.

11 STRAIGHTNESS

11.1 The strip and foil shall be supplied with straight parallel edges.

11.2 The slit edge shall be free from burrs and frilling.

Table 1 Chemical Composition of Copper Foils
(*Clause* 7)

Sl No.	Material	Percent			
		Sn	P	Other Impurities	Cu (including Sn)
(1)	(2)	(3)	(4)	(5)	(6)
i)	Tin Bearing Copper (TBC)	0.05-0.2	0.02 *Max*	0.10 *Max*	99.8 *Min*
NOTE — Keep phosphorous at lower limit when tin is towards higher limit.					

Table 2 Chemical Composition of Brass Strips/Foils
(*Clause* 7)

Sl no.	Material	Percent					
		Cu	Pb	Fe	Sn	Total other Impurities	Zn
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(i)	CuZn30	68.5-71.5	0.02 *Max*	0.05 *Max*	0.03 *Max*	0.2 *Max*	Remainder
(ii)	CuZn35	64.5-67.0	0.03 *Max*	0.05 *Max*	0.05 *Max*	0.3 *Max*	Remainder
(iii)	CuZn37	61.5-64.5	0.05 *Max*	0.075 *Max*	0.075 *Max*	0.6 *Max*	Remainder

Table 3 Mechanical properties of Copper and Brass foils/strips
(*Clause* 8.2)

Sl. No.	Application	Material	Temper	Hardness (HV)	Tensile Strength (N/mm^2)	Elongation on gauge length of 50 mm in percent	Grain Size, mm
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	Radiator fins	Copper	HD	110-140	400 *Min*	3 *Min*	-
ii)	Radiator tubes	Brass	HB	100-130	380 *Min*	15 *Min*	-

iii)	Radiator tanks and header plates	Brass	O	60-75	280-350	40 *Min*	0.05 *Max*

Table 4A Tolerance for Copper and Brass Foils
(Clause 9)

Sl No.	Thickness	Thickness Tolerance		Width	Width Tolerance	
		Normal	Close		Normal	Close
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	Up to and including 0.15 mm	± 7 percent of the thickness	±0.003 mm	Up to 100 mm	±0.1mm	±0.075 mm

Table 4B Thickness Tolerance for Brass Strips
(Clause 9)

Sl No.	Thickness	Tolerance mm			
		Up to and including 160 wide	Over 160 up to and including 300 wide	Over 300 up to and including 450 wide	Over 450 up to and including 630 wide
(1)	(2)	(3)	(4)	(5)	(6)
i)	0.15-0.24	0.015	0.02	0.025	0.03
ii)	0.25-0.62	0.02	0.025	0.03	0.04
iii)	0.63-0.89	0.025	0.03	0.04	0.05
iv)	0.9-1.19	0.03	0.04	0.05	0.06
v)	1.2-2.0	0.04	0.05	0.06	0.07

NOTE — Width Tolerance for Brass strips shall be considered as per mutual agreement between purchaser and supplier.

12 EDGE-WISE CURVATURE (DEPTH OF ARC)

In any length or width of one meter of the material, the depth of arc shall not exceed 2 mm.

13 SAMPLING AND RETEST

13.1 Samples of copper and brass strips/foils of the same composition, width, thickness and temper shall be batched together. For each batch, the number of samples taken shall be as given in Table 5.

13.2 Retests

Should any one of the pieces first selected by the purchaser or his representative fail to pass any of the prescribed tests, two further samples from the same batch shall be selected for testing, one of which shall be free from the strip or foil from which the original test sample was taken, unless that strip or foil has been withdrawn by the supplier. Should the test piece from both these additional samples pass, the batch represented by the test samples shall be deemed to have complied with this standard. Should the test piece from either of these additional samples fail, the batch represented by the test samples shall be deemed not to comply with this standard.

14 DELIVERY

14.1 Each coil shall not contain more than two lengths of strip.

14.2 The internal and external diameter of the coil and the minimum mass of each coil shall be mutually agreed to between the supplier and the purchaser.

15 PACKING

15.1 Coils shall be packed in such a way as to protect them against;

a) ingress of moisture and other elements which are likely to cause surface tarnishing and damage,
b) damage of slit edges,
c) collapse of the inner diameter, and
d) unwinding of the strips from the coil while taking out the box and during handling.

15.2 Where coils have to be transported, they shall be securely packed in strong wooden cases to resist breakage of packing during handling and transit.

16 MARKING

16.1 Each coil shall be marked with the grade of the material, size, temper, name of the manufacturer, net and gross mass.

16.2 BIS Certification Marking

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and the products may be marked with the Standard Mark.

17 TEST CERTIFICATE

The manufacturer/supplier shall provide test certificate for each consignment giving information like lot number, coil number, corresponding chemical composition, tensile test, compression test, etc.

Table 5 Sampling and Retest

(*Clause* 13.1)

Sl No.	**Number of coils of foil or strip in the lot**	**Number of coils of foil or strip to be selected**
(1)	(2)	(3)
i)	Up to 15	5
ii)	16-25	8
iii)	26-50	13
iv)	51-100	20
v)	101-150	32
vi)	151-300	50
vii)	301-500	80
viii)	501 and above	125

NOTE — The samples shall be cut off cold and shall receive no further treatment except that they may be machined to the shape of the test piece before being tested.

ANNEX A

(*Table* 3)

CORRELATION BETWEEN VICKERS HARDNESS AND LOAD FOR VARIOUS THICKNESSES OF COPPER AND BRASS STRIPS/FOILS

Thickness mm	**Vickers Harness** (HV)	**Load** g
(1)	(2)	(3)
0.05	50-80	25
	81-150	50
	151-300	100
0.06	50-110	50
	111-120	100
0.07	50-80	50
	81-160	100
	161-230	200
0.08	40-60	50
	61-120	100
	121-180	200
0.09	50-95	100
	96-140	200
	141-260	300
0.10	40-75	100
	76-110	200
	111-190	300
0.11	40-65	100
	66-95	200
	96-160	300
	161-300	500
0.12	40-55	100
	56-80	200
	81-130	300
	131-260	500
0.13	50-70	200
	71-115	300
	116-230	500
0.14	40-60	200
	61-100	300
	101-200	500

Thickness mm	**Vickers Harness** (HV)	**Load** g
(1)	(2)	(3)
0.15	40-55	200
	56-85	300
	86-170	500
	171-350	1000
0.16	45-75	300
	76-150	500
	151-350	1000
0.17	40-65	300
	66-130	500
	131-260	1000
0.18	40-60	300
	61-120	500
	121-240	1000
0.19	35-55	300
	56-105	500
	106-210	1000
0.20	50-95	500
	96-190	1 000
0.21	50-80	500
	81-190	1000
0.22	45-75	500
	76-170	1000
0.23	40-70	500
	71-140	1000
	141-300	2000
0.24	40-65	500
	66-130	1000
	131-300	2000
0.25	40-65	500
	66-130	1000
	131-300	2000