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भारतीय मानक

नलसाजी हेतु ताँबे के पाइप — विशिष्टि

Indian Standard

COPPER TUBES FOR PLUMBING — SPECIFICATION

ICS 77.150.30

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

May 2000

Price Group 2

Copper and Copper Alloys Sectional Committee, MTD 8

FOREWORD

This Indian Standard 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.

An informative Annex A has been given for the benefit of the purchaser giving particulars to be specified by the purchaser while placing the order for the copper tubes covered in this 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 value (*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

COPPER TUBES FOR PLUMBING — SPECIFICATION

1 SCOPE

This standard covers phosphorized (DHP) copper tubes suitable for general plumbing and similar applications for the conveyance of fluids including water and are commonly used with solder, flared or compression type fittings. The type of copper tube suitable for any particular application is determined by the internal or external fluid pressure in the installation and service condition, or any other local requirement.

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*
191 (Part 8) : 1980	Copper : Part 8 Phosphorized copper (DHP) (*third revision*)
440 : 1964	Methods for chemical analysis of copper (*revised*)
1387 : 1993	General requirements for the supply of metallurgical materials (*first revision*)
2335 : 1985	Method for drift expanding test for metallic tubes (*first revision*)
1608 : 1995	Mechanical testing of metals—Tensile testing (*second revision*)
3288 (Part 3) : 1986	Glossary of terms relating to copper and copper alloys : Part 3 Wrought forms
5493 : 1981	Dimensions for wrought copper and copper alloy tubes (*first revision*)
6243 : 1985	Method for hydrogen embrittlement test for copper (*first revision*)

3 TERMINOLOGY

3.1 For the purpose of this standard the definition of terms given in IS 3288 (Part 3) and the following definitions shall apply.

3.2 Mean Outside Diameter

The mean outside diameter is half the sum of two diameters at right angles of one cross-section of the tube.

3.3 Mean Wall Thickness

The mean wall thickness is half the sum of the two wall thicknesses measured at two points diametrically opposite to each other at any one cross-section of a tube.

3.4 Bunch

A coil in which the turns are bunched and held together such that the cross-section of the bunched turn is approximately circular.

3.5 Level or Transverse Wound

A coil in which the turns are wound into layer parallel to the axis of the coil, such that successive turns in a given layer are next to one another (also called helical coil).

3.6 Ovality

$$\text{Ovality} = \frac{OD_{Max} - OD_{Min}}{OD_{avg}}$$

NOTE — Before bending for a bent tube.

3.7 Out of Roundness

$$\text{Out of roundness} = OD_{Max} - OD_{Min}$$

3.8 Eccentricity

$$\text{Eccentricity} = \frac{WT_{Max} - WT_{Min}}{WT_{avg}}$$

WT = Wall thickness.

4 GENERAL REQUIREMENTS

The tubes shall comply with the general requirements set out in the following clauses and with the appropriate requirements stated in Tables W, X, Y, Z and Table 1.

5 SUPPLY OF MATERIAL

General requirements relating to the supply of material shall be as laid down in IS 1387.

6 FREEDOM FROM DEFECTS

The tubes shall be round, clean, smooth and free from harmful defects and from deleterious films in the bore.

7 CHEMICAL COMPOSITION

The copper tubes, when analyzed by the method

specified in IS 440 or any other established instrumental/chemical method shall conform to the requirements as given in IS 191 (Part 8). In case of dispute, the procedure given in IS 440 shall be the referee method. However when the method is not given in IS 440 the referee method shall be as agreed to between the purchaser and manufacturer.

8 MANUFACTURE

8.1 The tubes shall be solid drawn and supplied either in hard, half-hard or annealed condition.

8.2 The tubes shall be cut to size in coil or straight length, duly drafted and sealed at both ends.

9 CONDITIONS OF SUPPLY

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

O — Annealed (soft)
HB — Half-hard
HD — Hard

10 DIMENSIONS AND TOLERANCES

10.1 The tubes shall be designated by the outside diameter and the wall thickness, as given in Tables W, X, Y and Z. The relevant tolerances on mean outside diameter, wall thickness, straightness, length and roundness as specified in the standard shall be applicable for respective sizes.

10.2 Minimum length of straight or coiled tube shall be as agreed to between the purchaser and the manufacturer. The outside diameter, wall thickness and length shall be as ordered by the purchaser from the rationalized sizes of tubes as specified in the IS 5493.

Table W Dimensions for Annealed Copper Tubes Used in Micro Bore

(*Clauses* 4 *and* 10.1)

Size of Tubes	Outside Diameter		Preferred Thickness	Other Recommended Thickness	Maximum Working Pressure	
	Max	*Min*			For Preferred Thickness	For Other Recommended Thickness
mm	mm	mm	mm	mm	MPa	MPa
(1)	(2)	(3)	(4)	(5)	(6)	(7)
6	6.045	5.965	0.6	0.8	9.0	14.4
8	8.045	7.965	0.6	0.8	6.6	10.5
10	10.045	9.965	0.7	0.8	6.2	8.2

Table X Dimensions for Half-Hard Copper Tubes

(*Clauses* 4 *and* 10.1)

Size of Tube	Outside Diameter		Normal Thickness	Maximum Working Pressure
	Max	*Min*		
mm	mm	mm	mm	MPa
(1)	(2)	(3)	(4)	(5)
6	6.045	5.965	0.6	13.3
8	8.045	7.965	0.6	9.7
10	10.045	9.965	0.6	7.7
12	12.045	11.965	0.6	6.3
15	15.045	14.965	0.7	5.8
18	18.045	17.965	0.8	5.6
22	22.045	21.975	0.9	5.1
28	28.055	27.975	0.9	4.0
35	35.070	34.990	1.2	4.2
42	42.070	41.990	1.2	3.5
54	54.070	53.990	1.2	2.7
67	66.750	66.600	1.2	2.0
76	76.300	76.150	1.5	2.4
108	108.250	108.000	1.5	1.7
133	133.500	133.250	1.5	1.4
159	159.500	159.250	2.0	1.5

Table Y Dimensions for Half-Hard and Annealed Copper Tubes

(*Clauses* 4 *and* 10.1)

Size of Tube	Outside Diameter		Normal Thickness	Maximum Working Pressure	
	Max	*Min*			
mm	mm	mm	mm	HB Condtion	O Condtion
(1)	(2)	(3)	(4)	(5)	(6)
6	6.045	5.965	0.8	18.8	14.4
8	8.045	7.965	0.8	13.6	10.5
10	10.045	9.965	0.8	10.6	8.2
12	12.045	11.965	0.8	8.7	6.7
15	15.045	14.965	1.0	8.7	6.7
18	18.045	17.965	1.0	7.2	5.5
22	22.055	21.975	1.2	6.9	5.7
28	28.055	27.975	1.2	5.5	4.2
35	35.070	34.990	1.5	5.4	4.1
42	42.070	41.990	1.5	4.5	3.4
54	54.070	53.990	2.0	4.7	3.6
67	66.750	66.600	2.0	3.7	2.8
76	76.300	76.150	2.0	3.3	2.5
108	108.250	108.000	2.5	2.9	2.3

Table Z Dimensions for Hard Drawn Copper Tubes

(*Clauses* 4 *and* 10.1)

Size of Tube	Outside Diameter		Normal Thickness	Maximum Working Pressure
	Max	*Min*		
mm	mm	mm	mm	MPa
(1)	(2)	(3)	(4)	(5)
6	6.045	5.965	0.5	11.3
8	8.045	7.965	0.5	9.8
10	10.045	9.965	0.5	7.8
12	12.045	11.965	0.5	6.4
15	15.045	14.965	0.5	5.0
18	18.045	17.965	0.5	5.0
22	22.055	21.975	0.6	4.1
28	28.055	27.975	0.6	3.2
35	35.070	34.990	0.7	3.0
42	42.070	41.990	0.8	2.8
54	66.750	66.600	1.0	2.5
67	66.750	66.600	1.0	2.0
76.1	76.300	76.150	1.2	1.9
108	108.250	108.000	1.2	1.7
133	133.500	133.250	1.5	1.6
159	159.500	159.250	1.5	1.5

11 MECHANICAL PROPERTIES

11.1 Tensile Test

Tensile test shall be conducted on test samples of tube selected in accordance with **13.1** and tested in full section or on longitudinal strips cut from any part of tube. The test shall be made in accordance with IS 1608, and the values obtained shall comply with the requirements given in Table 1.

11.2 Drift Expanding Test

Drift expanding test shall be conducted on tubes designated in Table X and Table Y, supplied without annealing. The test shall be made in accordance with IS 2335, by means of a taper drift having an included angle of 45°, until the outside diameter of the expanded end exceeds the original outside diameter by the amount specified in Table 1. The tubes shall not crack or flow, when subjected to this test.

12 HYDROSTATIC TEST

Each tube shall withstand the hydrostatic test pressure P for 5 s when calculated in accordance with the following formula:

$$P = \frac{20\,Ft}{D-t}$$

where

P = Pressure, MPa;

F = Stress, MPa;

t = Thickness, mm; and

D = Outside diameter, mm.

F for —

HD condition 72.5 MPa

HB condition 60.0 MPa

O condition 46.0 MPa

No leakage shall be permitted.

Table 1 Mechanical Properties and Test Requirements for Copper Tubes

(*Clauses* 4, 11.1 *and* 11.2)

Specified Size of Tube		Condition	Tensile Strength	Percentage Elongation on $5.85\sqrt{S_0}$	Percentage Expansion During Drift Test	
Over	Up to and Including		MPa			
mm	mm		*Min*	*Min*	*Min*	
(1)	(2)	(3)	(4)	(5)	(6)	
—	10	O	210	40	30	Refer Table W
—	54	HB	250	30	35	Refer Table X
54	108	HB	250	30	25	
108	159	HB	250	30	15	
—	35	O	210	40	30	Refer Table Y
35	108	O	210	40	30	
—	35	HB	250	30	30	
35	108	HB	250	30	30	
—	54	HD	280	—	—	Refer Table Z
54	108	HD	310	—	—	
108	159	HD	310	—	—	

13 SAMPLING AND CRITERIA FOR CONFORMITY

13.1 Unless otherwise agreed to between the purchaser and the manufacturer, the consignment of tubes of the same diameter, thickness and temper condition shall be grouped together to constitute a lot of 300 tubes or 1 000 kg whichever is greater in weight. One sample from each lot shall be separately assessed for conformity to the specification.

13.2 When the size of the order does not permit batching in above quantities, one tube of each size, thickness and diameter shall be selected for testing.

13.3 Should any one of the test samples, first selected, fail to comply the requirements specified, two further samples shall be selected from the lot represented by the sample which failed. Should both the test samples comply with the requirements, the lot shall be deemed to have passed. Should either of the retest samples fail, the lot represented shall be rejected.

14 MARKING

14.1 Unless otherwise agreed to between the purchaser and the manufacturer, each tube shall be clearly marked with the manufacturer's name or trade-mark and identification mark, if any.

14.1.1 The material may be marked with the Standard Mark.

14.1.2 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.

ANNEX A

(Foreword)

INFORMATION TO BE GIVEN BY THE PURCHASER

A-1 The purchaser should provide following information at the time of placing order:

a) The tubes required as per Tables W, X, Y or Z;

b) If tubes are required as per Table Y, the condition of the material;

c) If tubes are required as per Table W, the thickness of the tube;

d) Whether mechanical tests are required;

e) Whether it is the intention of purchaser to inspect the material at the manufacturer's works; and

f) Whether a test certificate of compliance is required.

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.

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Review of Indian Standards

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