

ND 2154 30-11-1975

SPECIFICATION FOR COPPER AND COPPER ALLOYS

TUBES

Part 2. Tubes for general purposes

BS 2871 : Part 2 : 1972

HONG KONG TELEPHONE CO. LTD.	
24485	
Date	21 JUN 1972

Price 60p

BRITISH STANDARDS INSTITUTION

Incorporated by Royal Charter

2 PARK STREET, LONDON W1A 2BS

Telex: 266933

Telephone: 01-629 9000

THIS BRITISH STANDARD, having been approved by the Non-ferrous Metals Industry Standards Committee, was published under the authority of the Executive Board on 29 February, 1972.

© British Standards Institution, 1972.

First published (as BS 2871) July, 1957.

First revision February, 1972.

SBN: 580 06758 0

The Institution desires to call attention to the fact that this British Standard does not purport to include all the necessary provisions of a contract.

A complete list of British Standards, numbering over 5000, fully indexed and with a note of the contents of each, will be found in the British Standards Yearbook, which may be purchased from BSI Sales Department. It may also be consulted in many public libraries and similar institutions.

This standard makes reference to the following British Standards:

- BS 18. Methods for tensile testing of metals. Part 1. Non-ferrous metals
- BS 427. Method for Vickers hardness test.
- BS 1957. Presentation of numerical values (fineness of expression: rounding of numbers).
- BS 3889. Methods for non-destructive testing of pipes and tubes. Part 2B. Eddy current testing of non-ferrous tubes.

British Standards are revised, when necessary, by the issue either of amendment slips or of revised editions. It is important that users of British Standards should ascertain that they are in possession of the latest amendments or editions.

The following BSI references relate to the work on this standard:
Committee reference NFE 17 Draft for comment 70, 25753

Printed in England by WELBECON PRESS LIMITED, London, S.W.11.

CONTENTS

	Page
Co-operating organizations	5
Foreword	6

SPECIFICATION

1. Scope	7
2. General	8
3. Information to be supplied by the purchaser	8
4. Freedom from defects	8
5. Chemical composition	8
6. Manufacture	8
7. Condition	8
8. Dimensions and tolerances	9
9. Selection of test samples	10
10. Mechanical tests	10
11. Non-destructive tests	11
12. Mercurous nitrate test	11
13. Retests	12
14. Certificate of compliance	12
15. Inspection	12
16. Independent test	13
17. Facilities for testing	13
18. The rounding of numbers rule	13
19. Copper tubes for use in refrigeration plant	

TABLES

1. Tolerances on length	9
2. Chemical composition and mechanical properties of copper and copper alloys tubes	14
3. Preferred sizes of tubes for pipelines for shipbuilding and other engineering purposes	17
4. Preferred sizes of tubes for purposes other than pipelines	18
5. Copper tubes for steam services with plain ends (low pressure range)	19
6. Copper tubes for steam services with plain ends (high pressure range)	20
7. Copper tubes for steam services with screwed ends (low pressure range)	21
8. Copper tubes for steam services with screwed ends (high pressure range)	22

CONTENTS (continued)

	Page
9. Copper tubes for general purposes for pressures up to and including 12 bar (175 lb/in ²)	23
10. Copper tubes for general purposes for pressures over 12 bar (175 lb/in ²) up to and including 20 bar (300 lb/in ²)	24
11. Tolerances on diameter for tubes other than preferred sizes	25

FIGURES

1. Flattening test	16
2. Double-bend test	16
3. Drifting test	16

CO-OPERATING ORGANIZATIONS

The Non-ferrous Metals Industry Standards Committee, under whose supervision this British Standard was prepared, consists of representatives from the following Government departments, and scientific and industrial organizations:

Aluminium Federation
 Association of Bronze and Brass Founders
 British Bronze and Brass Ingot Manufacturers' Association
 *British Electrical and Allied Manufacturers' Association
 British Lead Manufacturers' Association
 *British Non-ferrous Metals Federation
 British Non-ferrous Metals Federation High Conductivity Copper Group
 *British Non-ferrous Metals Research Association
 *Copper Development Association
 Department of Trade and Industry (Marine Division)
 Electric Cable Makers' Confederation
 Institute of British Foundrymen
 Institute of Metals
 *Institution of Mechanical Engineers (Automobile Division)
 Institution of Mining and Metallurgy
 Institution of Production Engineers
 Institution of Structural Engineers
 Lead Development Association
 Light Metal Founders' Association
 London Metal Exchange
 Magnesium Industry Council
 *Ministry of Defence (Army Department)
 *Ministry of Defence (Navy Department)
 National Brassfoundry Association
 *Non-ferrous Metal Stockists
 Post Office
 *Royal Institute of British Architects
 Society of Motor Manufacturers and Traders Limited
 Tin Research Institute
 Zinc Development Association
 Individual manufacturers

The Government departments and scientific and industrial organizations marked with an asterisk in the above list, together with the following, were directly represented on the committee entrusted with the preparation of this British Standard:

British Waterworks Association
 Copper Tube Fittings Manufacturers' Association
 Department of the Environment
 Department of Trade and Industry
 Electricity Council, The Central Electricity Generating Board and the Area Boards for England and Wales
 Engineering Industries Association
 Gas Council
 Institute of Plumbing
 Institution of Gas Engineers
 Institution of Heating and Ventilating Engineers
 Institution of Mechanical Engineers
 Metropolitan Water Board
 National Federation of Plumbers and Domestic Heating Engineers
 National Physical Laboratory (Department of Trade and Industry)
 Oil Companies' Materials Association

BRITISH STANDARD SPECIFICATION FOR COPPER AND COPPER ALLOYS

TUBES

Part 2: Tubes for general purposes

FOREWORD

This British Standard is the first revision in metric terms of one of a series for copper and copper alloys in various wrought forms, the preparation of which was authorized by the Non-ferrous Metals Industry Standards Committee. Others in the series are:

- BS 2870. Rolled copper and copper alloys. Sheet, strip and foil.
- BS 2872. Copper and copper alloys. Forging stock and forgings.
- BS 2873. Copper and copper alloys. Wire
- BS 2874. Copper and copper alloys. Rods and sections.
- BS 2875. Copper and copper alloys. Plate.

In preparing this metric revision of BS 2871 it was decided to produce it in three parts thereby eliminating the large section of particular applications which forms Part 3 of the 1957 edition.

This Part of this Part specifies requirements for tubes for general purposes expressed in metric units based on those previously expressed in imperial units in the standards.

- following standards, which have now been withdrawn:
- BS 61. Copper tubes (heavy gauge) for general purposes. Part 1. Copper tubes (heavy gauge).
 - BS 885. Brass tubes for general purposes. 70/30 arsenical brass, aluminium brass.
 - BS 1306. Non-ferrous pipes and tubes for steam services. Part 2. Seamless copper tubes for steam services.
 - BS 2017. Copper tubes for general purposes.

In addition the opportunity has been taken to include a table of pipeline sizes of tubes used specifically in the shipbuilding industry but also suitable for many other purposes. This table of sizes is in accordance with the sizes agreed by ISO and will be included in the revision of ISO Recommendation R 274. They will also meet the requirements of surveying authorities. The outside diameter of these tubes accord with some steel tube diameters and ensure correct mating of flanges, etc. In addition they are similar to those supplied to many European countries for shipbuilding purposes for many years.

Further rationalization of sizes has been effected in the various tables of copper tubes suitable for screwing, and for steam services, e.g. similar to existing BS 61 : Part 1 and BS 1306 : Part 2. The outside diameters of tubes suitable

for screwing are a direct conversion of the existing dimensions but the thicknesses have been re-calculated using the design stress values currently accepted and specified which has in many instances enabled reductions to be effected. As a result it is suggested that the six tables given in BS 1306 : Part 2 are usefully, and reduced to four by eliminating the medium pressure table and extending the requirement higher pressure table to cover these requirements. The two tables of screwed BS 61 tables tubes are the same as the previously existing BS 61 tables and one table of Part 1 of the plain tubes is the same as Table Y of Part 1 : 1971 of this standard.

The tolerances on the outside diameters specified in Part 1 and also the pipeline sizes specified in Table 2 of Part 2 are tighter than those covered in the revision of R 274; in all these cases the maximum diameters are in agreement in order to avoid difficulties in assembling flanges, fittings etc., due to interference fit. This course of action has been taken because the tighter tolerances have been adhered to in this country for many years without undue difficulty and it is universally accepted that where joints using the capillary principle are produced using soft solder or silver brazing as appropriate to the service conditions then more satisfactory joints result. Consequently whilst the maximum outside diameters are in accordance with the ISO draft recommendation and the minimum outside diameters are in some cases above the ISO sizes, they do completely meet the ISO requirements.

NOTE. Attention is drawn to certification facilities offered by BSI; see the back cover of this standard.

SPECIFICATION

1. SCOPE

This Part of this British Standard specifies requirements for copper and copper alloy tubes for general purposes from 2 mm up to and including 508 mm outside diameter and from 0.4 mm up to and including 8.0 mm thickness.

A list of preferred sizes is given in the following tables:

- Table 3. Preferred sizes of tubes for pipelines for shipbuilding and other engineering purposes.
- Table 4. Preferred sizes of tubes for purposes other than pipelines.
- Table 5. Copper tubes for steam services with plain ends (low pressure range). (Corresponding to BS 1306 : Part 2, Table 1.)
- Table 6. Copper tubes for steam services with plain ends (high pressure range). (Corresponding to BS 1306 : Part 2, Table 3.)
- Table 7. Copper tubes for steam services with screwed ends (low pressure range). (Corresponding to BS 1306 : Part 2, Table 4.)
- Table 8. Copper tubes for steam services for screwed ends (high pressure range). (Corresponding to BS 1306 : Part 2, Table 6.)

Table 9. Copper tubes for general purposes for pressures up to and including 12 bar* (175 lb/in²) (Corresponding to BS 61 : Part 1, Table 1.)

Table 10. Copper tubes for general purposes for pressures over 12 bar (175 lb/in²) and up to and including 20 bar (300 lb/in²) (Corresponding to BS 61 : Part 1, Table 2.)

These requirements apply to round tubes except where reference is made to square or rectangular tubes.

NOTE. The titles of the British Standards referred to in this standard are listed on page 2.

2. GENERAL

The tubes shall comply with the general requirements set out in the following clauses, and with the appropriate requirements of Tables 1 to 11.

3. INFORMATION TO BE SUPPLIED BY THE PURCHASER

The purchaser shall state on his enquiry and order the following information:

- (1) The designation of the material required (see Table 2).
- (2) The condition of the material (see Table 2 and 7).
- (3) Whether mechanical and/or non-destructive tests are required (see 10 and 11).
- (4) Whether a certificate of compliance is required (see 14).
- (5) Whether it is the purchaser's intention to inspect the material at the supplier's works (see 15).
- (6) Whether the tubes are required in refrigeration quality (see 19).

4. FREEDOM FROM DEFECTS

The tubes shall be clean, smooth and free from harmful defects.

5. CHEMICAL COMPOSITION

The chemical composition of the tubes shall comply with the requirements of Table 2.

6. MANUFACTURE

The tubes shall be solid drawn, and in no case shall they be redrawn from used tubes. Unless otherwise ordered they shall be supplied in straight lengths and the ends shall be cut clean and square with the axis of the tubes.

7. CONDITION

The tubes shall be supplied in one of the following conditions as specified in Table 2:

M condition. Tubes in the 'as drawn' condition. An 'as drawn' tube is defined as one supplied in the condition of the tube on the completion of the

* 1 bar = 0.1 N/mm² = 10⁵ N/m².

necessary operations to produce the specified diameter and wall thickness. These operations are not necessarily directed toward producing any particular temper, and the temper of 'as drawn' tubes may vary with the diameter and thickness. Such tubes may be subjected to stress relieving treatment after the final draw at the option of the supplier. 'As drawn' tubes would normally be unsuitable for bending or expanding, without local annealing. Although the tensile strength figures quoted may be regarded as normal minima, they may not always be capable of attainment in exceptional sizes, whereas for many diameters and thicknesses, figures in excess of those quoted may be regularly obtainable. When there is doubt that these properties will be obtainable the supplier should inform the purchaser.

TA condition. Tubes in the temper annealed condition. These tubes will have been heat treated over their full length to an intermediate temper.

O condition. Tubes in the annealed condition.

1/2H condition. Tubes in the half hard temper produced by cold drawing.

If ordered in coil the tubes shall be annealed. Copper tubes in straight lengths, unless otherwise specified, will be supplied in the M condition.

8. DIMENSIONS AND TOLERANCES

8.1 Round tubes

8.1.1 Diameter. The mean outside diameter of the tube shall not vary from the specified outside diameter by more than the amount of the tolerances specified in Tables 3 to 11 inclusive. The mean outside diameter is half the sum of the two diameters at right angles on one cross section of the tube.

TABLE 1. TOLERANCES ON LENGTH

Diameter		Tolerance for specified length in metres					
Over	Up to and including	Up to and including 1 m		Over 1 m up to and including 3 m		Over 3 m up to and including 6 m	
mm	mm	mm	mm	mm	mm	mm	mm
—	80	+2	—0	+3	—0	+6	—0
80	300	+4	—0	+5	—0	+8	—0
300	—	+6	—0	+7	—0	+10	—0

By agreement

8.1.2 Thickness. The thickness of the tube at any point shall not vary from that specified by more than $\pm 10\%$ for diameters up to and including 108 mm and by not more than $\pm 12.5\%$ for diameters greater than 108 mm.

8.1.3 Length. The length of the tube shall not vary from that specified by more than the amount of the tolerances given in Table 1 when measured at a temperature of 15°C.

8.2 Square or rectangular tubes. The tolerances on square and rectangular tubes shall be agreed between the purchaser and the supplier.

9. SELECTION OF TEST SAMPLES

9.1 Mechanical tests. When tests other than those specified in 11 are called for by the purchaser, tubes of any one composition, size, thickness and temper shall be grouped in batches of 300 tubes or 1300 kg whichever is the greater weight, and the purchaser or his representative shall take at random one tube from each and any remaining part of a batch for testing. When the size of the order does not permit of batching in the above quantities, one tube of each composition, size, thickness and temper shall be selected for testing.

9.2 Mercurous nitrate test. This test is required for brass and copper nickel tubes, on samples selected in accordance with 9.1.

10. MECHANICAL TESTS

10.1 Tensile test. Tensile tests shall be made on test samples of tube selected in accordance with 9.1, tested in full section or on longitudinal strips cut from any part of the tube. The tests shall be made in accordance with BS 18 Part 1 and the values obtained shall comply with the appropriate requirements of Table 2.

10.2 Hardness test. Hardness tests shall be made on test pieces in accordance with BS 427 and the values obtained shall comply with the appropriate requirements of Table 2.

10.3 Flattening test. This test applies to tubes not exceeding 108 mm outside diameter. The test pieces shall be annealed before flattening unless the tubes are supplied in the annealed condition.

The test pieces shall be flattened down until the interior surface meets as shown in Fig. 1. When subjected to this test the tube shall show no crack or flaw.

10.4 Double-bend test. This test applies to round tubes of over 108 mm outside diameter. The test pieces shall be annealed before flattening unless the tubes are supplied in the annealed condition.

A test piece 50 mm long shall be cut longitudinally from the tube. The longer edges shall be rounded and smoothed longitudinally so that a

cross section has approximately semicircular ends. The test piece shall be flattened and shall have its ends bent through 180° in opposite directions and doubled up close, as shown in Fig. 2. When subjected to this test the tube shall show no crack or flaw.

10.5 Drifting test. This test applies to round tubes not exceeding 108 mm outside diameter. The test piece shall be annealed before testing unless the tubes are supplied in the annealed condition.

The test piece shall be expanded, as shown in Fig. 3, 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 2. When subjected to this test the tube shall show no crack or flaw.

11. NON-DESTRUCTIVE TESTS

When specifically called for by the purchaser the manufacturer shall satisfy himself by means of one of the following tests that each tube will withstand the minimum test pressure specified.

11.1 Hydrostatic test. When this test is required, each tube shall be hydrostatically tested to an internal test pressure of the value given by the following formula. No tube shall, however, be tested to a hydrostatic pressure greater than 70 bar* unless otherwise agreed.

$$P = \frac{Kt}{D}$$

where P = internal pressure (bar)*,

t = wall thickness of the tube (mm),

D = outside diameter of the tube (mm),

K = a constant as specified in Table 2.

11.2 Pneumatic test. Alternatively, by agreement between the supplier and the purchaser, tubes in coil shall be tested to an air pressure of 4 bar*.

11.3 Eddy current test. At the option of the manufacturer, an eddy current test in accordance with the requirements of BS 3859 : Part 2B may be substituted for the hydrostatic or pneumatic test.

NOTE: These tests are intended to test the soundness of the tube wall, and are not to be regarded as an indication of strength or safe working pressure.

12. MERCUROS NITRATE TEST

This test is applicable to copper alloy tubes only.

A 150 mm length of tube, in the condition as offered for inspection, shall be first degreased and then dipped in a solution of 50% distilled water and 50% concentrated nitric acid (relative density 1.42) for a period not exceeding

*1 bar = 0.1 N/mm² = 10⁵ N/m².

30 s to remove all traces of carbonaceous matter and oxide films. It shall then be well rinsed in cold water and immediately immersed completely in a 1% w/w solution of mercurous nitrate in distilled water to which 1 ml of concentrated nitric acid (relative density 1.42) has been added for each 100 ml of solution. The test specimen shall remain in the solution for 30 min and then be removed, rinsed well in cold water and carefully wiped and examined immediately. The test specimen shall show no evidence of cracking. Specimens of CN 107 alloy shall be examined 24 h after removal from the solution. The test piece shall not be marked for identification by indenting.

Should any specimen fail to meet the requirements of this test, all the tubes submitted for inspection at the same time shall be withdrawn but may be resubmitted for inspection after stress relieving treatment.

13. RETESTS

Should any one of the test 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 from the tube from which the original test sample was taken, unless that tube has been withdrawn by the supplier.

Should the test pieces from both these additional samples pass, the batch represented by the test samples shall be deemed to comply with this standard. Should the test pieces from either of these additional samples fail, the batch represented by the test samples shall be deemed not to comply with this standard. The requirements of this clause shall not apply to 12.

if required and stated on the order

14. CERTIFICATE OF COMPLIANCE

The supplier shall, if required, certify that the tube complies with the requirements of this standard.

15. INSPECTION

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 afford the purchaser all reasonable facilities to satisfy himself that the material is in accordance with the standard. For this purpose the purchaser or his representative may, by prior arrangement, attend to inspect the material, to select and identify the samples for testing and to witness the tests being made.

The purchaser shall be at liberty to take samples from the material selected in accordance with 8 and have them analysed. The cost of such analysis shall be borne by the purchaser and the results shall be communicated to the supplier if they are not in accordance with the appropriate requirements of Table 2.

16. INDEPENDENT TEST

Should there be a dispute about the compliance of the material with either the composition or the test requirements of this standard, the purchaser and the supplier shall have the right to have tests made by a mutually acceptable testing authority.

The results obtained by the independent testing authority shall be accepted as final.

17. FACILITIES FOR TESTING

For making tests on samples selected in accordance with 9 the supplier shall provide and prepare the necessary test pieces, and supply labour and appliances for such testing as may be carried out on his premises in accordance with this standard. Unless otherwise agreed, material for testing shall remain the property of the supplier. Failing facilities at his own works for making the prescribed tests, the supplier shall make the necessary arrangements for making the test elsewhere.

18. THE ROUNDING OF NUMBERS RULE

Values between the limits of composition and mechanical properties shown (NOT dimensional tolerances) are subject to the application of the 'rounding' rule in accordance with BS 1957. Under this rule the determined values are rounded to the last place of figures stated as limits.

The following examples illustrate the application of the rounding rules:

Specification limits		Extreme values which round to specification limits	
Min.	Max.	Min.	Max.
—	0.050	—	0.0505
0.2	0.6	0.15	0.65
6	9	5.5	9.4
6.0	9.0	5.95	9.05
7	10	6.6	10.5
7.5	10.5	7.46	10.54

19. COPPER TUBES FOR USE IN REFRIGERATION PLANT

The tubes shall be manufactured from material designated C106.

The inside of the tubes shall be clean and free from grease and loose material and material which may become loose.

When so specified, the tubes shall be dry internally and the ends of the tubes shall be hermetically sealed.

TABLE 2. CHEMICAL COMPOSITION AND MECHANICAL

For essential alloying elements, limits are in heavy type. Unless otherwise stated, figures in total impurities

Designation	Material	Copper	Tin	Lead	Iron	Nickel	Zinc	Arsenic	Antimony	Aluminium	Manganese	Sulphur
C 101	Electrolytic tough pitch high conductivity copper	99.90 min. (incl. silver)	—	0.005	—	—	—	—	—	—	—	—
C 102	Fire refined tough pitch high conductivity copper	99.90 min. (incl. silver)	—	0.005	—	—	—	—	—	—	—	—
C 103	Oxygen-free high conductivity copper	99.95 min. (incl. silver)	—	0.005	—	—	—	—	—	—	—	—
C 106	Phosphorus deoxidized non-arsenical copper	99.85 min. (incl. silver)	0.01	0.010	0.030	0.10*	—	0.05	0.005	—	—	—
C 107	Phosphorus deoxidized arsenical	99.20 min. (incl. silver)	0.01	0.010	0.030	0.15*	—	0.30 0.50	0.01	—	—	—
CZ 108	Brass 63% copper	62.0/ 65.0	—	0.30	—	REM	—	—	—	—	—	—
110	brass	76.0/ 78.0	—	0.07	0.06	—	—	0.06	—	—	2.30	—
CZ 119	Leaded brass 62% copper, 2% lead	61.0 64.0	—	1.0 2.5	—	REM	—	—	—	—	—	—
CZ 126	Special 70/30 Arsenical	69.0	—	0.07	0.06	—	REM	0.02	—	—	—	—
CZ 127	Aluminium-nickel-silicon**	81.0/ 86.0	0.10	0.05	0.25	0.80/ 1.40	REM	—	0.70/ 1.20	0.10	—	—
102	nickel-iron	—	—	—	2.00	11.0	—	—	—	—	1.00	—
CN 107	70/30 Copper-nickel	REM	—	0.01	0.40 1.00	30.0 32.0	—	—	—	—	0.50/ 1.50	0.08

* Impurity or optional addition.

† Should the copper be required to undergo severe fabrication in the temperature range 400–700 °C this fact shall be indicated by the purchaser, and in such cases the bismuth content shall not exceed 0.0015%.

** Silicon content is 0.80–1.30 %

PROPERTIES OF COPPER AND COPPER ALLOYS TUBES

column include those in lighter type. Unless otherwise indicated all limits are maximum.

Carbon	Bismuth	Phosphorus	Selenium	Tellurium	Total Impurities	Condition	Tensile strength ‡	Elongation on 5.65 % S ₀ min.	Hardness HV 5	Minimum expansion (see 10.5)	Constant A (see 11.1)
—	0.0010	—	—	—	0.03 (excluding oxygen and silver)	—	N/mm ²	%	—	—	bar *
—	0.0025	—	—	—	0.04 (excluding oxygen and silver)	O	200–250	40	60 max.	40	800
—	0.0010	—	—	—	0.03 (ex. oxygen and silver)	M	270 min.	—	100 min.	—	1100
—	0.0030†	0.013 0.050	—	0.010	0.060 (ex. silver, nickel, arsenic, phosphorus)	O	200–250	40	60 max.	40	800
—	—	—	Se + Te 0.020	—	—	M	250 min.	30	75–100	—	800
—	0.0030†	0.013 0.050	—	0.010	0.070 (ex. silver, nickel, arsenic)	M	280 min.	—	100 min.	40	1100
—	—	—	Se + Te 0.020	—	—	—	—	—	—	—	—
—	—	—	—	—	0.60	O	300–380	40	80 max.	40	1250
—	—	—	—	—	—	TA	350 min.	35	85–110	35	1250
—	—	—	—	—	—	M	450 min.	—	130 min.	—	1600
—	—	—	—	—	0.30	O	380 approx.	—	75 max.	—	—
—	—	—	—	—	—	M	380 approx.	—	130 min.	—	—
—	—	—	—	—	—	O	280–350	40	75 max.	30	1100
—	—	—	—	—	—	M	—	—	on 10% S ₀	—	1100
—	—	—	—	—	0.50 (ex. tin, lead, iron, manganese)	O	430–500	40	140 max.	40	1550
—	—	—	—	—	—	M	550 min.	—	150 min.	—	1750
0.06	—	—	—	—	0.30	O	370–450	30	110 max.	30	1600
—	—	—	—	—	—	M	500 min.	—	140 min.	—	1800

‡ For information only.

§ Only one of these tests will be carried out to ensure compliance with the requirements of this standard unless otherwise specified by the purchaser.

Samples annealed before testing.

* 1 bar = 0.1 N/mm² = 10⁵ N/m².

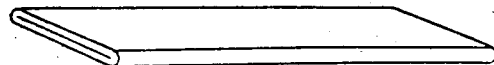


Fig. 1. Flattening test

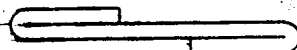


Fig. 2. Double-bend test

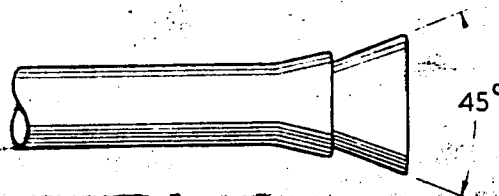


Fig. 3. Drifting test

TABLE 3. PREFERRED SIZES OF TUBES FOR PIPELINES FOR SHIPBUILDING AND OTHER ENGINEERING PURPOSES

Tube size	O.D. max.	O.D. min.	Preferred standard thickness	Other standard thickness	Other* standard thickness
mm	mm	mm	mm	mm	mm
5	5.045	4.965	0.8	—	—
8	8.045	7.965	0.8	1.0	0.6
10	10.045	9.965	0.8	1.0	0.6
12	12.045	11.965	0.8	1.0	0.6
16	16.045	15.965	1.0	1.5	—
20	20.055	19.975	1.0	2.0	—
25	25.055	24.975	1.5	2.0	—
30	30.055	29.975	1.5	2.0	—
38	38.07	37.99	1.5	2.0	—
44.5	44.57	44.49	1.5	2.0	—
57	57.20	57.12	1.5	2.0	—
76.1	76.30	76.15	2.0	2.5	—
88.9	89.15	89.00	2.5	3.0	—
108	108.25	108.00	2.5	3.0	—
133	133.50	133.25	2.5	3.0	—
159	159.50	159.25	2.5	3.0	—
193.7	194.50	194.25	3.0	3.5	—
219.1	219.90	218.30	3.0	4.0	—
267	268.00	266.40	3.0	4.0	—
323.9	324.90	323.30	4.0	4.5	—
368	369.00	367.40	4.0	4.5	—
419	420.00	418.40	4.0	4.5	—
457.2	458.20	455.20	4.0	4.5	—
508	509.00	506.00	4.5	5.0	—

NOTE. Tubes for pipelines are usually required suitable for cold bending or other fabrication processes and unless otherwise specified, are supplied in either the TA, 1/4H or O condition appropriate to material and size at the manufacturer's discretion.

*Aligns with BS 2871 : Part 1.

TABLE 4. PREFERRED SIZES OF TUBES FOR PURPOSES OTHER THAN PIPELINES

Outside diameter	Tolerance	Standard thicknesses		
mm	mm	mm	mm	mm
5	0.08	0.5	0.6	0.8
6		0.5	0.6	0.8
8		0.6	0.8	1.0
10		0.6	0.8	1.0
12		0.6	0.8	1.0
12	0.10	0.8	1.0	1.2
16		0.8	1.0	1.2
20	0.12	1.0	1.2	1.5
25		1.0	1.2	1.5
30		1.2	1.5	2.0
38	0.15	1.2	1.5	2.0
44.5		1.5	2.0	2.5
50		1.5	2.0	2.5

TABLE 5. COPPER TUBES FOR STEAM SERVICES WITH PLAIN ENDS
(LOW PRESSURE RANGE)

(Corresponding to BS 1306 : Part 2 : Table 4)

PMD 2154

Size of tube	Outside diameter max.	Outside diameter min.	Working pressure up to and including 7 bar* (100 lb/in ²) Maximum working temperature 205 °C (405 °F)
			Thickness
mm	mm	mm	mm
6	6.045	5.965	0.8
8	8.045	7.965	0.8
10	10.045	9.965	0.8
12	12.045	11.965	0.8
15	15.045	14.965	1.0
18	18.045	17.965	1.0
22	22.055	21.975	1.2
28	28.055	27.975	1.2
35	35.07	34.99	1.5
42	42.07	41.99	1.5
66.75	66.60	66.60	2.0
108	108.25	108.0	2.5
153	153.50	153.25	3.0
159	159.50	159.25	3.5
193.7	194.50	194.25	4.0
219.1	219.90	218.30	4.5

* 1 bar = 0.1 N/mm² = 10⁵ N/m²

NOTE: Up to and including 108 mm, the maximum and minimum outside diameters and the thickness align with BS 2871 : Part 1 : Table X.

PMD 2154

TABLE 6. COPPER TUBES FOR STEAM SERVICES WITH PLAIN ENDS
(HIGH PRESSURE RANGE)

(Corresponding to BS 1306 : Part 2 : Table 3)

PMD 2154

Size of tube	Outside diameter max.	Outside diameter min.	Working pressure up to and including 17 bar* (250 lb./in. ²) Maximum working temperature 205 °C (405 °F)
			Thickness
mm	mm	mm	mm
6	6.045	5.965	0.8
8	8.045	7.965	0.8
10	10.045	9.965	0.8
12	12.045	11.965	0.8
15	15.045	14.965	1.0
18	18.045	17.965	1.0
22	22.055	21.975	1.2
28	28.055	27.975	1.5
35	35.07	34.99	2.0
42	42.07	41.99	2.0
			3.0
67	66.75	66.60	4.0
			5.0
100			6.5
153	133.50	133.25	8.0
159	159.50	159.25	9.5
193.7	194.50	194.25	10.5
219.1	219.90	218.30	

* 1 bar = 0.1 N/mm² = 10⁵ N/m².

NOTE: Up to and including 108 mm, the maximum and minimum outside diameter and the thickness align with BS 2871 : Part 1 : Table 1.

TABLE 7. COPPER TUBES FOR STEAM SERVICES WITH SCREWED ENDS (LOW PRESSURE RANGE)

(Corresponding to BS 1306 : Part 2 : Table 4)

PMD 2154

Size of tube	Outside diameter max.	Outside diameter min.	Working pressure up to and including 7 bar* (100 lb./in. ²) Maximum working temperature 205 °C (405 °F)
			Thickness
in.	mm	mm	mm
1/8	6.65	6.50	1.0
1/4	10.24	10.08	1.2
3/8	13.41	13.26	1.2
1/2	16.59	16.43	1.2
5/8	19.84	19.63	1.3
3/4	23.01	22.81	1.4
1	29.77	29.57	1.5
1 1/4	36.12	35.92	1.7
1 1/2	42.47	42.26	1.8
2	55.85	55.60	2.3
2 1/2	68.55	68.30	2.6
3	81.86	81.61	2.9
3 1/2	95.25	94.95	3.2
4	108.56	108.25	3.5

* 1 bar = 0.1 N/mm² = 10⁵ N/m².

TABLE 8. COPPER TUBES FOR STEAM SERVICES WITH SCREWED ENDS (HIGH PRESSURE RANGE)

(Corresponding to BS 1306 : Part 2 : Table 6)

Size of tube	Outside diameter max.	Outside diameter min.	Working pressure over 7 bar* (100 lb in ²) up to and including 17 bar* (250 lb in ²) Maximum working temperature 205 °C (405 °F)
			Thickness
in.	mm	mm	mm
1/8	9.98	9.85	1.2
1/4	13.49	13.34	1.6
3/8	16.99	16.84	1.8
1/2	21.34	21.18	2.4
5/8	23.34	23.18	2.5
3/4	26.89	26.69	2.7
1	33.73	33.53	3.4
1 1/4	42.39	42.19	3.8
1 1/2	48.29	48.08	4.2
2	60.15	59.89	4.9
2 1/2	75.72	75.46	5.6
3	88.42	88.16	6.2
3 1/2	100.91	100.61	6.9
4	113.61	113.31	7.6

* 1 bar = 0.1 N/mm² = 10⁵ N/m².

TABLE 9. COPPER TUBES FOR GENERAL PURPOSES FOR PRESSURES UP TO AND INCLUDING 12 bar* (175 lb in²)

(Corresponding to BS 61 : Part 1 : Table 1)

Size of tube	Outside diameter max.	Outside diameter min.	Working pressure up to and including 12 bar* (175 lb in ²)
			Thickness
in.	mm	mm	mm
1/8	6.65	6.50	1.0
1/4	10.24	10.08	1.2
3/8	13.41	13.26	1.2
1/2	16.59	16.43	1.2
	19.84	19.63	1.3
			1.4
			1.5
			1.7
1 1/4	36.12	35.96	1.8
1 1/2	42.47	42.26	2.3
2	55.85	55.60	2.6
2 1/2	68.55	68.30	2.9
3	81.86	81.61	3.2
3 1/2	95.25	94.95	3.5
4	108.56	108.25	

* 1 bar = 0.1 N/mm² = 10⁵ N/m².

TABLE 10. COPPER TUBES FOR GENERAL PURPOSES FOR PRESSURES OVER 12 bar* (175 lb/in²) UP TO AND INCLUDING 20 bar* (300 lb/in²)

(Corresponding to BS 61 : Part 1 : Table 2)

AMP 2154

Size of tube	Outside diameter max.	Outside diameter min.	Working pressure over 12 bar* (175 lb/in ²) up to and including 20 bar* (300 lb/in ²)
			Thickness
in.	mm	mm	mm
1/8	9.98	9.85	1.2
1/4	13.49	13.34	1.6
3/8	16.99	16.87	1.8
1/2	21.34	21.18	2.4
5/8	23.34	23.18	2.5
3/4	26.89	26.69	2.7
1	33.73	33.55	3.4
1 1/4	42.39	42.19	3.8
1 1/2	48.29	48.08	4.2
2	60.15	59.89	4.9
2 1/2	75.72	75.46	5.6
3	88.42	88.16	6.2
3 1/2	100.91	100.61	6.9
4	113.61	113.51	7.6

* 1 bar = 0.1 N/mm² = 10⁵ N/m².

TABLE 11. TOLERANCES ON DIAMETER FOR TUBES OTHER THAN PREFERRED SIZES

Outside diameter		Tolerance on mean diameter
Over	Up to and including	
mm	mm	mm
50	80	±0.20
80	130	±0.25
130	190	±0.50
190	260	±0.80
260	320	±1.00
320	450	±1.25
450	—	±1.50

BRITISH STANDARDS

The following are available on application:

YEARBOOK

Including subject index and numerical list of British Standards

SECTIONAL LISTS. Gratis

Acoustics (SL 10)
Aerospace materials and components (SL 25)
Automobile (SL 34)
British Standard Handbooks (SL 27)
Building (SL 16)
Chemical engineering (SL 5)
Chemicals, fats, glues, oils, soap, etc. (SL 4)
Cinematography and photography (SL 1)
Coal, coke and colliery requisites (SL 13)
Codes of Practice (SL 8)
Consumer goods (SL 3)
Documentation, including Universal Decimal Classification (SL 35)
Drawing practice (SL 37)
Electrical engineering (SL 26)
Farming, dairying and allied interests (SL 31)
Furniture, bedding and furnishings (SL 11)
Gardening, horticulture and landscape work (SL 41)
Gas and solid fuel and refractories (SL 2)
Glassware, excluding laboratory apparatus (SL 39)
Heating, ventilating and air conditioning (SL 42)
Hospital equipment (SL 18)
Illumination and lighting fittings (SL 14)
Industrial instruments, etc. (SL 17)
Iron and steel (SL 24)
Laboratory apparatus (SL 23)
Leather, plastics, rubber (SL 12)
Local authority purchasing officers' guide (SL 28)
Machine tools (SL 20)
Mechanical engineering (SL 6)
Nomenclature, symbols and abbreviations (SL 29)
Non-ferrous metals (SL 19)
Nuclear energy (SL 36)
Packaging and containers (SL 15)
Paints, varnishes, paint ingredients and colours for paints (SL 9)
Personal safety equipment (SL 30)
Petroleum industry (SL 38)
Printing and stationery, paper and board (SL 22)
Road engineering (SL 32)
Shipbuilding (SL 40)
Textiles and clothing (SL 33)
Welding (SL 7)

Applications should be addressed to:

BRITISH STANDARDS INSTITUTION

Sales Branch

Telephone: 01-837 8801

Newton House, 101 Pentonville Road, London N1 9ND

BRITISH STANDARDS INSTITUTION

The British Standards Institution was founded in 1901 and incorporated by Royal Charter in 1929.

The principal objects of the Institution as set out in the charter are to co-ordinate the efforts of producers and users for the improvement, standardization and simplification of engineering and industrial materials; to simplify production and distribution; to eliminate the waste of time and material involved in the production of an unnecessary variety of patterns and sizes of articles for one and the same purpose; to set up standards of quality and dimensions, and to promote the general adoption of British Standards.

In carrying out its work the Institution endeavours to ensure adequate representation of all viewpoints. Before embarking on any project it must be satisfied that there is a strong body of opinion in favour of proceeding and that there is a recognized need to be met.

The Institution is a non-profit-making concern. It is financed by subscriptions from firms, trade associations, professional institutions and other bodies interested in its work, by a Government grant and by the sale of its publications. The demands on the services of the Institution are steadily increasing and can only be met if continuing and increased financial support is provided.

Membership of the Institution is open to British subjects, companies, technical and trade associations, and local and public authorities.