BRITISH STANDARD

BS 864-2: 1983

Incorporating Amendment Nos. 1, 2 & 3

Capillary and compression tube fittings of copper and copper alloy —

Part 2: Specification for capillary and compression fittings for copper tubes

UDC 621.643.2.06:669.3

Cooperating organizations

Associated Offices Technical Committee
Association of Consulting Engineers
Association of Hydraulic Equipment Manufacturers
Association of Mining Electrical and Mechanical Engineers
British Compressed Air Society
British Constructional Steelwork Association
British Electrical and Allied Manufacturers' Association (BEAMA)
British Gas Corporation*
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Society of Motor Manufacturers and Traders Limited
Telecommunication Engineering and Manufacturing Association (TEMA)
Water-tube Boilermakers' Association

The organizations marked with an asterisk in the above list, together with the following, were directly represented on the Technical Committee entrusted with the preparation of this British Standard:

British Non-ferrous Metals Federation
Copper Development Association
Copper Tube Fittings Manufacturers' Association
Hevac Association
National Brassfoundry Association
National Water Council
Thames Water Authority (Metropolitan Water Division)
Coopted member

This British Standard, having been prepared under the direction of the Mechanical Engineering Standards Committee, was published under the authority of the Board of BSI and comes into effect on 30 June 1983

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Amendments issued since publication

Amd. No.	Date of issue	Comments
5097	June 1986	
5651	April 1987	
7067	February 1992	Indicated by a sideline in the margin

Contents

Foreword

This Part of this British Standard has been prepared under the direction of the Mechanical Engineering Standards Committee and is a revision of BS 864-2:1971, which is withdrawn.

The size of fittings is in accordance with those sizes agreed internationally, and that are given in ISO 2016-1981 "Capillary solder fittings for copper tubes — Assembly dimensions and tests" published by the International Organization for Standardization (ISO). However, the tolerances on the socket diameters in ISO 2016 are greater than those acceptable to the UK and therefore they have not been included in this standard. This was because it was felt by the UK Technical Committee that the clearances that would occur when using the ISO tolerances would not enable a satisfactory joint to be achieved by capillary action.

This standard relates to the following three types of tube fittings of copper and copper alloy for use in conjunction with copper tubes complying with BS 2871-1:1971 and it should be noted that as BS 2871-1 is being revised the relevant tables have been included as Table 1 to Table 4 of this standard.

a) Capillary fittings, in which the joint is made by the flow of solder by capillary action along the annular space between the outside of the tube and the inside of the socket of the fitting, the size of this annular space being dimensionally controlled within close limits.

b) Compression fittings, type A, in which the joint is made by the compression of a loose ring or sleeve, on to the outside wall of the tube.

c) Compression fittings, type B, in which the joint is made by the compression of a manipulated portion of the tube at or near its end against the face of the body of the fitting or against a loose ring or sleeve within the fitting.

Where type A compression fittings are to be used with tubes in soft temper, reference should be made to the manufacturer to ensure that the design of fitting is suitable for this application. Regard should be paid to the provisions of appendix C in all cases where the joint is to be buried underground.

This standard does not attempt the complete dimensional standardization of any of the types of fittings, since the variety of the designs and methods of production already established by the various manufacturers makes any such attempt impracticable, and to do so would also restrict further development. It does however specify such dimensions and requirements as are essential to ensure satisfactory installation and performance.

NOTE All the figures in this standard are diagrammatic only. They do not purport to indicate standard forms or shapes, and are only for the purpose of indicating where the specified dimensions are to be measured.

Other British Standards dealing with copper and copper alloy pipe fittings are BS 66 & BS 99, BS 143 & BS 1256 and BS 2051.

Steel compression pipe couplings (metric dimensions) are covered in BS 4368-1 and for flange type fittings reference is made to BS 4504-2.

The major changes between this revision and the amended 1971 publication are as follows:

a) the maximum service temperature for compression fittings has been increased;

b) the thread requirements for the screwed ends of fittings have been clarified;

c) reference material specifications have been included;

d) minimum bore diameters are specified;

e) marking is now required on all fittings of 12 mm and larger;

f) minimum wall thicknesses of compression fittings and union ends are specified;

g) a clause on gauging of external threads and diameters of capillary sockets has been included.

NOTE It is unlikely that capillary and compression fittings complying with this standard will be available immediately because of the need for manufacturers to change marking procedures and obtain plug gauges.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 16, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This Part of this British Standard specifies requirements for capillary fittings and compression fittings for use with copper tubes complying with Table 1 to Table 4. It applies to the most commonly used types of fittings of nominal sizes ranging from 6 mm to 67 mm inclusive, including combined fitting and draining taps. Lightweight fittings for waste pipe systems are not covered by this standard, however, this does not preclude the use of fittings to this standard for waste pipe purposes where considered desirable.

The fittings when assembled with tubing complying with Table 1 to Table 4 and in accordance with the manufacturers' instructions, are suitable for the working service pressures and temperatures specified in Table 5.

Capillary fittings are only intended for use with solder not inferior to grades C and G of BS 219.

NOTE The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions

For the purposes of this Part of this standard the following definitions apply.

2.1
fitting

any device used in a tube system for the purpose of connecting the tubes either to each other or to a component part of a system

2.2
capillary fitting

a fitting in which the joint is made by the flow of solder by capillary action along the annular space between the outside of the tube and the inside of the socket of the fitting

2.3
compression fitting, type A

a fitting that requires no preparation of the ends of the tube other than that they are cut square and deburred, and in which the joint is made by the compression of a ring or sleeve on the outside wall of the tube

2.4
compression fitting, type B

a fitting that requires a manipulation of the tube at or near its end, and in which the joint is made by compressing the manipulated portion of the tube against the face of the body of the fitting or against a loose ring or sleeve within the fitting

2.5
combined fitting and draining tap

a fitting which incorporates a drain-off facility and in which the drain-off portion complies with the appropriate requirements of BS 2879

3 Designation of sizes and fittings

The size by which fittings are designated shall be the nominal outside diameter of the tube with which the fittings are to be used. The outside diameters of tubes shall be in accordance with Table 1 to Table 4.

NOTE The method of specifying the sizes of fittings is given in appendix A.

Table 1 — Annealed copper tubes for use in micro-bore or mini-bore heating systems

1	2	3	4	5
Size of tube	Outside diameter		Nominal thickness	Maximum working pressure
	Max.	Min.		
mm	mm	mm	mm	bar[a]
6	6.045	5.965	0.6	90
8	8.045	7.965	0.6	66
10	10.045	9.965		62

[a] 1 bar = 10^5 N/m^2 = 100 kPa.

Table 2 — Half-hard copper tubes

1	2	3	4	5
Size of tube	Outside diameter		Nominal thickness	Maximum working pressures[a]
	Max.	Min.		
mm	mm	mm	mm	bar
6	6.045	5.965	0.6	133
8	8.045	7.965	0.6	97
10	10.045	9.965	0.6	77
12	12.045	11.965	0.6	63
15	15.045	14.965	0.7	58
18	18.045	17.965	0.8	56
22	22.055	21.975	0.9	51
28	28.055	27.975	0.9	40
35	35.07	34.99	1.2	42
42	42.07	41.99	1.2	35
54	54.07	53.99	1.2	27
67	66.75	66.60	1.2	20

[a] Based on material in ½ H (half-hard) condition.

Table 3 — Half-hard and annealed copper tubes

1	2	3	4	5	6
Size of tube	Outside diameter		Nominal thickness	Maximum working pressure ½ H condition[a]	Maximum working pressure 0 condition[b]
	Max.	Min.			
mm	mm	mm	mm	bar	bar
6	6.045	5.965	0.8	188	144
8	8.045	7.965	0.8	136	105
10	10.045	9.965	0.8	106	82
12	12.045	11.965	0.8	87	67
15	15.045	14.965	1.0	87	67
18	18.045	17.965	1.0	72	55
22	22.055	21.975	1.2	69	55
28	28.055	27.975	1.2	55	42
35	35.07	34.99	1.5	54	41
42	42.07	41.99	1.5	47	36
54	54.07	53.99	2.0	45	34
67	66.75	66.60	2.0	37	28

[a] Based on material in ½ H (half-hard) condition.
[b] Based on material in 0 (annealed) condition.

Table 4 — Hard drawn copper tubes

1	2	3	4	5
Size of tube	Outside diameter		Nominal thickness	Maximum working pressures[a]
	Max.	Min.		
mm	mm	mm	mm	bar
6	6.045	5.965	0.5	113
8	8.045	7.965	0.5	98
10	10.045	9.965	0.5	78
12	12.045	11.965	0.5	64
15	15.045	14.965	0.5	50
18	18.045	17.965	0.6	50
22	22.055	21.975	0.6	41
28	28.055	27.975	0.6	32
35	35.07	34.99	0.7	30
42	42.07	41.99	0.8	28
54	54.07	53.99	0.9	25
67	66.75	66.60	1.0	20

[a] Based on material in H (as drawn) condition.

4 Threads for screwed ends of fittings (other than for copper connector ends)

The screwed ends of fittings shall be screwed with one of the appropriate forms of screw thread as follows.

a) Parallel external threads as shown in Figure 1, in accordance with Table 3M, class B of BS 2779:1973 and Table 6 of this standard.

b) Taper external threads, as shown in Figure 2, in accordance with BS 21 with the exception of thread length and gauge position (see **9.1**). The thread lengths shall be in accordance with column 8 of Table 6.

c) Parallel internal threads, as shown in Figures 3(a) and 3(b), screwed in accordance with Table 4M of BS 2779:1973 and Table 6.

d) Screw threads in accordance with BS 21.

e) Screw threads for copper tubes in accordance with BS 61.

f) Special screw threads, provided that the minimum wall thickness is not less than that specified in columns 2 and 3 of Table 15.

Unless specifically ordered (see appendix B), screw threads shall be in accordance with a), b) or c) above.

In fittings with parallel threads the faces designated A and B in Figure 1 and Figure 3 respectively shall be smoothly machined at right angles to the axis of the threads.

Internal threads shall be chamfered at the face of the fitting to an included angle of approximately 90°, not more than one thread deep.

5 Material

5.1 General. Materials used in the manufacture of fittings shall comply with the British Standards listed in Table 7.

NOTE For flange type fittings, loose flanges and bolts may be of ferrous material unless otherwise specified. Ferrous flanges and bolts should be adequately protected against corrosion.

5.2 Solder

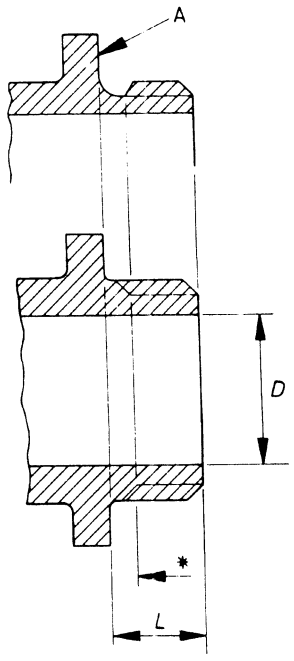
5.2.1 *General applications.* For general applications the solder used for making capillary joints shall be one of the tin-lead solders, grades A, AP, K, KP, F, R or G specified in BS 219 or one of the lead free grades specified in Table 17 of this standard (i.e. BS 864-2).

5.2.2 *Potable water applications.* For potable water applications the solder used for making capillary joints shall be one of the lead free grades of soft solder specified in Table 17.

Table 5 — Maximum working temperatures and pressures

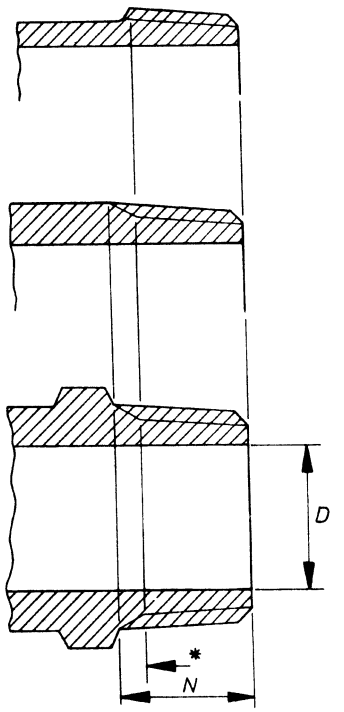
Service temperatures	Hydraulic pressure			
	Capillary fittings (see **5.2**)		Compression fittings	
	Size 6 mm to 54 mm	Size 67 mm	Size 6 mm to 54 mm	Size 67 mm
°C	bar	bar	bar	bar
30	16	10	16	10
65	10	6	10	6
110	6	4	6	4
120	—	—	5	3

NOTE Capillary fittings assembled with high melting point solders, and certain designs and sizes of compression fittings, are suitable for use at higher temperatures and pressures than are given in the above table and also for low pressure steam services. For such applications the manufacturer of the fittings should be consulted.



*Thread undercuts or thread run-out if provided should not exceed 1 1/2 pitches.

Figure 1 — Parallel threads (external)



*Thread undercuts or thread run-out if provided should not exceed 1 1/2 pitches.

Figure 2 — Taper threads (external)

6 Components made from castings, hot pressings, rod or drawn tube

6.1 Castings. Castings shall be in all respects sound, free from laps, blow holes and pitting, and both the external and internal surfaces shall be clean, smooth and free from sand.

They shall be neatly dressed and no casting shall be burned, plugged, stopped or patched.

6.2 Hot pressings. Hot-pressed components shall be sound and solid, free from laminations, and shall be smooth and well finished.

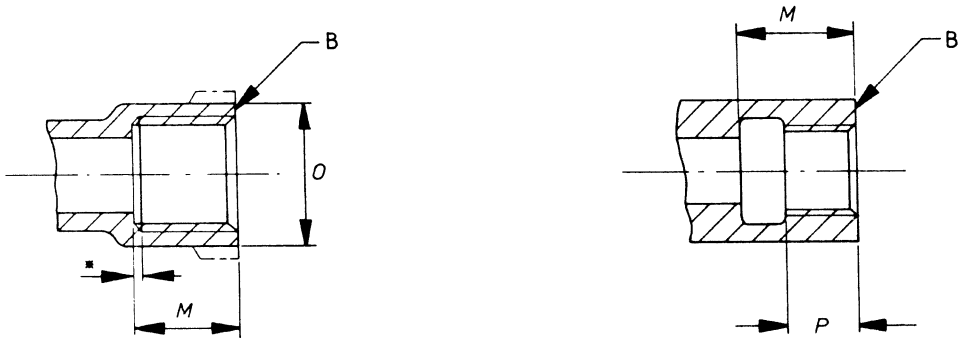
6.3 Drawn tube or cold forged copper. Drawn tube or cold forged copper components shall be seamless, sound, free from laminations, and shall be smooth and well finished.

6.4 Rod. Rod components shall be sound, free from laminations and/or inclusions, and shall be smooth and well finished.

7 Dimensions

The dimensions of the fittings shall be as specified in Table 9, Table 10, Table 11, Table 14 and Table 15.

Threads other than those specified in Table 6 shall, when assembled hand-tight, have the minimum length of engagement shown in Table 8 a) for compression joints and Table 8 b) for tail pipe ends.



*Thread undercuts or thread run-out if provided should not exceed 1 1/2 pitches.

Figure 3 — Parallel threads (internal)

Table 6 — Detail of screwed ends of fittings (other than for copper connector ends)
(see Figure 1, Figure 2 and Figure 3)

1	2	3	4	5	6	7	8	9	10	11
Thread size	*D* **max.**		*D*	*L*[a]		*M*	*N*	*O* **min.**		*P*
	Pressings	**Castings**	**min.**	**Max.**	**Min.**	**min.**	**min.**	**Pressings**	**Castings**	**min.**
in	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
1/8	5.2	4.5	2.9	8.0	6.4	9.5	6.0	11.6	12.3	4.5
¼	8.1	7.3	5.8	9.5	8.0	11.0	9.0	15.2	16.0	7.0
3/8	10.8	10.0	9.0	11.0	9.5	12.7	9.0	19.2	20.0	7.0
½	14.5	13.7	12.5	11.0	9.5	15.0	11.0	24.0	24.7	9.0
¾	20.0	19.2	17.6	12.7	11.0	17.0	12.2	30.2	31.0	10.0
1	25.4	23.7	22.7	14.3	12.7	19.0	14.3	37.2	37.9	11.5
1¼	32.4	31.6	30.8	16.0	14.3	21.0	16.0	46.2	47.0	13.5
1½	38.2	37.4	36.7	17.5	16.0	23.0	16.8	52.7	53.4	13.5
2	50.8	47.7	46.9	19.0	17.5	25.0	19.0	65.0	65.7	17.0
2½	64.0	63.3	62.4	20.7	19.0	28.0	20.7	81.8	82.6	18.5

[a] The length of the thread dimension *L* may exceed these figures for special applications.

Table 7 — Metals and alloys used in the manufacture of fittings

Metal or alloy	BS number	Designation
Copper	BS 2871	C101[a]
		C106[a]
Brass rod for forging	BS 2872	CZ122
		CZ132[a]
Brass rod for machining	BS 2874	CZ121/3Pb
		CZ121/4Pb
		CZ132[a]
Gunmetal castings	BS 1400	LG1[a]
		LG2[a]
Brass castings	BS 1400	SCB1
		SCB3
Brass die castings	BS 1400	DCB3
Brass pressure die castings	BS 1400	PCB1

[a] These metals and alloys are dezincification immune or resistant (see appendix C).

The minimum dimensions of plain tails for lead shall be as specified in Table 9. The dimensions of tail pipe ends for swivel fittings shall be as specified in Table 10.

NOTE Swivel fittings are not intended to swivel in use, but to provide swivel adjustment only during the assembly of the pipeline system.

8 Bore of fitting(s)

8.1 Equal fittings. Except where stated otherwise in this standard the area of the bore through each equal fitting shall be not less than the area of a circle of diameter equal to the minimum bore diameter given in Table 11 for the relevant size of fitting.

8.2 Transition and unequal fittings. Except where stated otherwise in this standard the area of the bore through each end of each branch of transition and unequal fittings shall be not less than the area of a circle of diameter equal to the minimum bore diameter given in Table 6 for the relevant thread size or Table 11 for the relevant size of fitting.

9 Gauging

9.1 Gauging of tapered external threads complying with clause 4(b). Tapered external threads shall be gauged by using system B taper screw ring gauges in accordance with BS 21 : 1973, and by using additional plate gauges as appropriate for threads complying with column 8 of Table 6. The distance by which the top of the thread specified in column 8 of Table 6 stands below the negative (-ve) of the system B screw ring gauge shall not exceed the values given in Table 12.

9.2 Gauges. Capillary sockets shall be gauged by the GO and NOT GO plug gauges in Table 13. These plug gauges shall be profiled at the nose end for a length not exceeding 0.5 mm.

Plain tails shall be gauged by GO and NOT GO ring gauges (see appendix D).

Where thin wall copper fittings fabricated from tube are slightly oval they shall be considered satisfactory provided that they accept the GO gauges given in Table 13 or Table 18 (as appropriate) when reasonable hand pressure is exerted.

10 Capillary fittings (see Table 14 and Figure 7, Figure 10 and Figure 11)

10.1 Capillary fittings shall comply with **10.2** to **10.9**.

10.2 The dimensions of capillary fittings shall be as specified in Table 14.

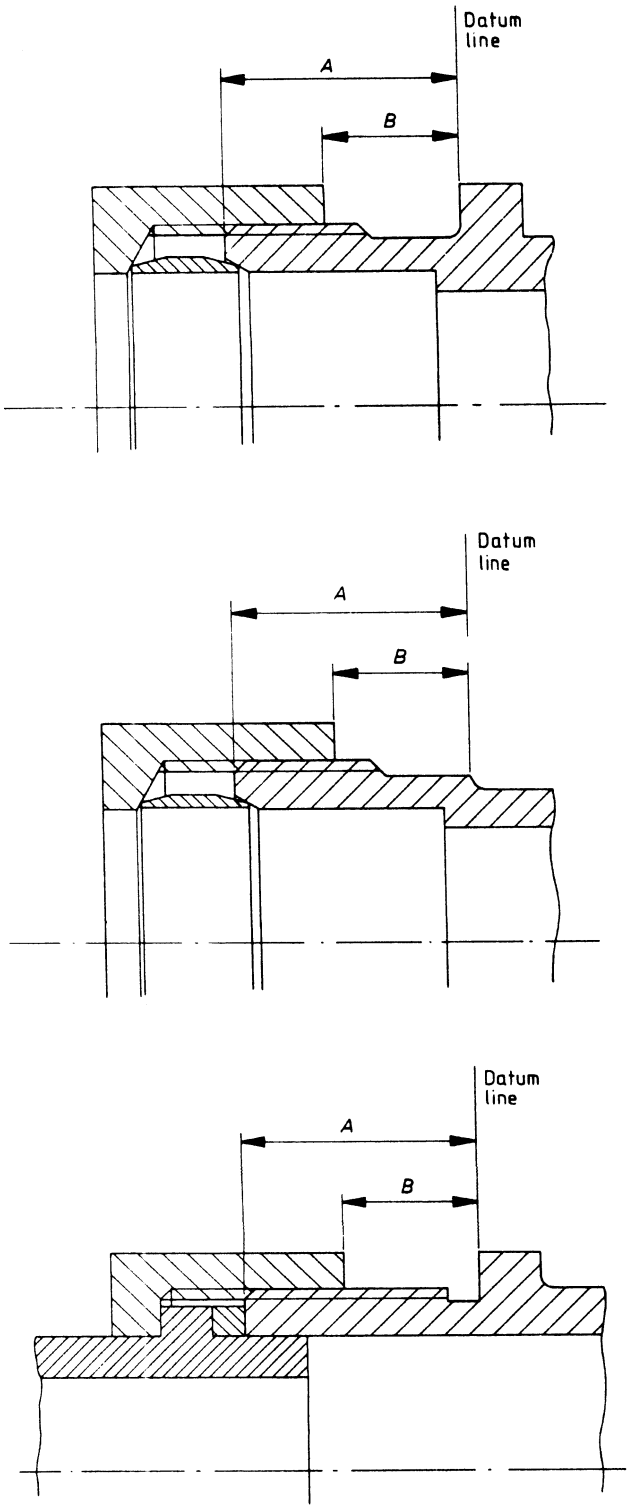
The socket bore dimensions shall comply with columns 2, 3 and 4 of Table 14.

For flange type fittings the dimensions of flanges shall comply with BS 4504-2.

10.3 The fittings shall be free from internal fins or other irregularities which might restrict the free flow of fluid, and shall be so designed that the resistance to the flow of fluid through the fittings is minimized.

10.4 Union nuts shall be either hexagonal or octagonal, or shall have ribs for tightening.

10.5 Provision for tightening shall be made on all straight fittings with screwed ends.



NOTE. Dimension *A* is measured from the datum line to the commencement of the thread on the body of the fitting.

Figure 4 — Method of determination of thread engagement in hand tight condition (*A* minus *B*) (see Table 8 for values)

Table 8 — Minimum length of thread engagement when assembled hand-tight

a) Compression joints

Tube size	Minimum length of thread engagement
mm	mm
6 8 10 12	4.0
15 18 22	4.5
28 35 42 54	5.5
67	6.5

b) Tail pipe ends

Nut thread size BSP	Minimum length of thread engagement	
	All types except tapered spigot copper tube tails	Tapered spigot copper tube tails [a]
	mm	mm
½ ¾	6.0	4.5
1 1¼ 1½ 2	8.0	5.5
2½	8.0	6.5

[a] See notes to Table 10.

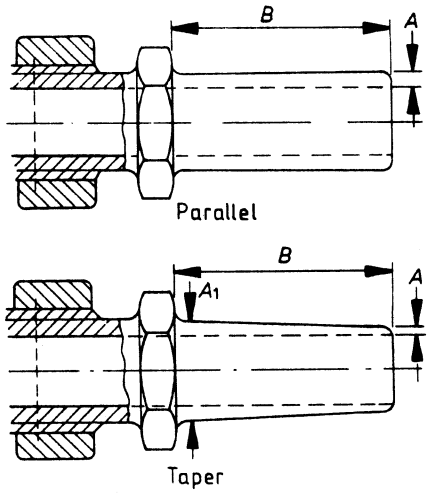
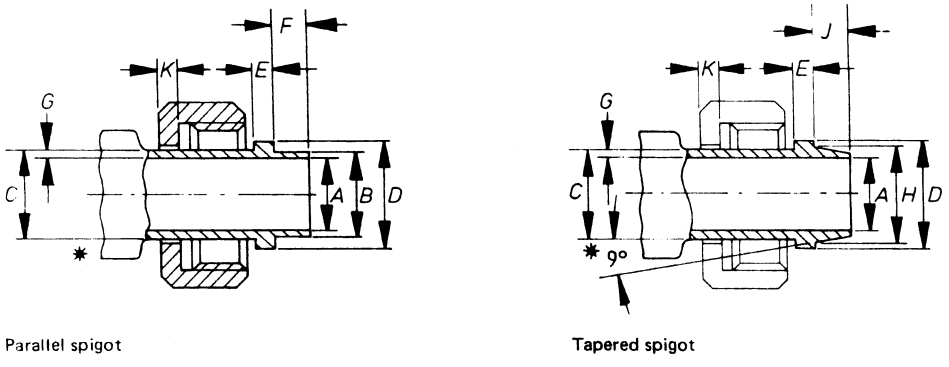


Figure 5 — Plain tails for lead (see Table 9)

Table 9 — Dimensions of plain tails for lead

1	2	3	4	5	6	7	8	9
Size of copper connectors	Associated lead pipe size	Thickness of wall						Length *B* (min.)
		Parallel		Taper				
		A (min.)		*A* (min.)		A_1 (min.)		
		Hot pressings	Castings	Hot pressings	Castings	Hot pressings	Castings	
mm	mm	mm	mm	mm	mm	mm	mm	mm
15	12	1.6	2.0	1.2	1.6	2.0	2.4	44.0
22	20	1.6	2.0	1.2	1.6	2.0	2.4	44.0
28	25	2.0	2.4	1.6	1.6	2.4	2.4	44.0
35	32	2.0	2.4	1.6	2.0	2.4	2.8	51.0
42	40	2.3	2.5	1.8	2.3	2.5	3.2	51.0
54	50	2.3	2.5	1.8	2.3	2.5	3.2	51.0



Parallel spigot

Tapered spigot

* This end of fitting to suit the manufacturer's individual design provided it comes within the specified tolerances.

Figure 6 — Tail pipe ends for swivel fittings

Table 10 — Dimensions of tail pipe ends for swivel fittings

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Dimension	*A*		*B*	*C*	*D*		*E*	*F*		*G*		*H*	*J*	*K*
Nut thread size	Stamping min.	Casting min.	Max.	Max.	Max.	Min.	Min.	Max.	Min.	Stamping min.	Casting min.	Max.	Min.	Min.
in	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
½	11.0	10.2	14.6	15.1	18.5	18.0	2.4	6.4	4.7	1.2	1.4	17.0	7.9	2.5
¾	16.1	15.3	19.8	20.0	24.0	23.5	2.4	6.4	4.7	1.4	1.6	22.3	7.9	3.1
1	21.2	20.4	25.7	25.7	30.2	29.4	3.0	6.4	4.7	1.5	1.8	28.0	7.9	3.4
1¼	25.4	25.4	34.0	33.6	38.9	38.0	3.3	8.0	6.3	1.6	1.9	36.9	9.5	3.9
1½	31.7	31.7	39.6	39.2	44.8	43.9	3.8	9.6	7.9	1.8	2.2	42.6	9.5	4.7
2	44.4	43.7	50.8	50.7	56.6	55.4	4.0	9.6	7.9	2.0	2.3	54.3	12.7	4.7
2½	50.8	50.8	56.6	62.0	71.9	71.0	4.3	9.6	7.9	2.0	2.4	60.2	12.7	5.0

NOTE 1 The dimensions in this table correspond with those specified in Table 12 of BS 1010-2:1973, except those in columns 11 and 12 which accord with Table 14.

NOTE 2 Thread engagement is not less than that specified in clause **7**. The minimum wall thickness from root of thread to flat of, coupling is not less than as specified in Table 14 and Figure 11.

NOTE 3 Tail pipes may be made from copper tube, providing dimensions *B* and *F* or *H* and *J* are adhered to, and providing the thickness of the copper tube used is not less than the corresponding tube thickness for the same sizes in Table 2. In the case of tail pipes made from copper tube the minimum dimension *E* will be equivalent to twice the thickness of the tube used.

10.6 The internal diameter of the sockets of the fittings (dimension *D* in Figure 7) over the length which is designed to make close contact with the tube or external threaded end, shall be within the limits given in columns 2 and 3 of Table 14. In cases of dispute the gauges specified in clause **9** shall be used.

10.7 Capillary fittings shall be supplied either with an internal shoulder or stop against which an inserted tube, assumed cut square with its axis, shall abut for not less than 20 % of its periphery. If specifically ordered without an internal shoulder these shall be designated slip fittings. (See **14.2** for marking requirements.)

10.8 The length of that surface of the socket which is designed to make close contact with the tube shall be not less than the dimension given in column 4 of Table 14.

For plain sockets without grooves this dimension shall be the length from the face of the fitting to that point on the shoulder or stop against which the inserted tube abuts, [dimension *A* in Figure 7 a)].

For sockets having an internal groove or grooves, this length shall be exclusive of the widths of such grooves, and shall be the sum of the lengths of those surfaces which are designed to make close contact with the tube, [e.g. the sum of dimensions *B* and *C* in Figure 7 b)].

10.9 The outside diameter of plain tails shall be in accordance with the dimensions controlled by the ring gauges specified in appendix D and the length of plain tails shall be suitable for use with socket lengths as specified in column 4 of Table 14.

11 Compression fittings, type A
(see Table 15 and Figure 8 and Figure 11)

11.1 Type A compression fittings shall comply with the conditions specified in **11.2** to **11.7**.

11.2 The dimensions of type A compression fittings shall be as specified in Table 15.

11.3 The fittings shall be free from internal fins or other irregularities which might restrict the free flow of fluid, and shall be so designed that the resistance to the flow of fluid through the fittings is minimized.

11.4 Union nuts shall be either hexagonal or octagonal or shall have ribs for tightening.

11.5 Provision for tightening shall be made on all straight fittings with screwed ends.

11.6 Type A compression fittings shall be supplied either with an internal shoulder or stop against which an inserted tube, assumed cut square with its axis, shall abut for not less than 20 % of that periphery; or if specifically ordered (see appendix B) without an internal shoulder. In the latter case these shall be designated slip fittings.

11.7 The minimum wall thicknesses specified shall not apply to the thickness of the loose ring or sleeve where such a ring or sleeve has been deformed to form a seal.

NOTE Where these fittings are to be used with tubes in soft temper, reference should be made to the manufacturer to ensure that the design of fitting is suitable for this application.

Table 11 — Minimum bore diameter

Size of fittings	Minimum bore diameter
mm	mm
6	4.0
8	6.0
10	8.0
12	10.0
15	12.0
18	15.0
22	18.0
28	24.0
35	30.0
42	37.0
54	47.0
67	59.0

Table 12 — Thread gauges (to BS 21)

Thread size	Distance below -ve gauge face
in	mm
1/8	0.5
¼	0.7
3/8	1.1
½	2.2
¾	2.3
1	2.5
1¼	3.1
1½	2.3
2	4.4
2½	4.8

Table 13 — Plug gauge diameters for capillary sockets including wear allowance

Size of fittings	Go gauge	Not go gauge
mm	mm	mm
6	6.0725/6.065	6.1525/6.145
8	8.0725/8.065	8.1525/8.145
10	10.0725/10.065	10.1525/10.145
12	12.0725/12.065	12.1525/12.145
15	15.0725/15.065	15.1525/15.145
18	18.0725/18.065	18.1525/18.145
22	22.0825/22.075	22.1625/22.155
28	28.0825/28.075	28.1625/28.155
35	35.0975/35.090	35.1775/35.170
42	42.0975/42.090	42.1775/42.170
54	54.0975/54.090	54.1775/54.170
67	66.7875/66.780	66.8675/66.860

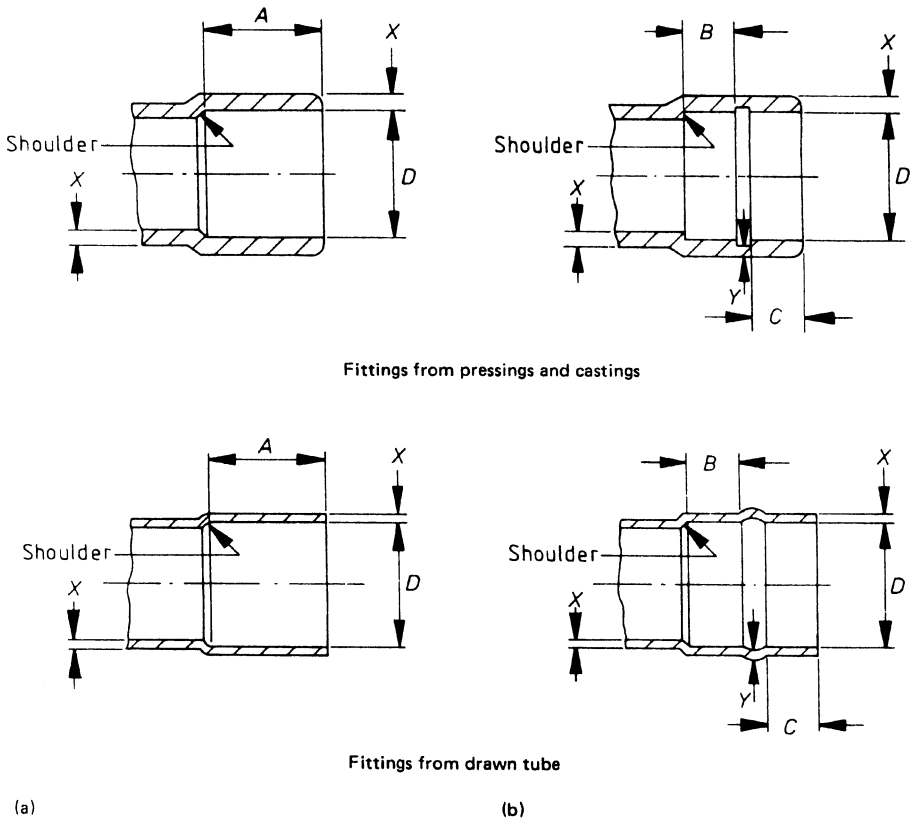


Figure 7 — Capillary fittings made from pressings, castings and drawn tube (see Table 14)

Table 14 — Dimensions of capillary fittings

1	2	3	4	5	6	7	8	9	10
Size of fitting	Internal diameter of socket		Minimum length of socket surface in close contact with tube (see 10.8)	Minimum wall thickness					
	D			Drawn tube and cold forged		Pressing and rod		Castings	
	Max.	Min.	*A* or *B* + *C*	*X*	*Y*	*X*	*Y*	*X*	*Y*
mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
6	6.145	6.065	5.8	0.6	0.54	1.0	0.6	1.0	0.7
8	8.145	8.065	6.8	0.6	0.54	1.0	0.6	1.0	0.7
10	10.145	10.065	7.8	0.6	0.54	1.1	0.6	1.1	0.8
12	12.145	12.065	8.6	0.6	0.54	1.1	0.6	1.2	0.8
15	15.145	15.065	10.6	0.7	0.63	1.2	0.7	1.4	0.9
18	18.145	18.065	12.6	0.8	0.72	1.4	0.8	1.5	1.0
22	22.155	22.075	15.4	0.9	0.81	1.4	0.9	1.6	1.2
28	28.155	28.075	18.4	0.9	0.81	1.5	0.9	1.8	1.2
35	35.17	35.09	23.0	1.0	0.90	1.6	1.2	1.9	1.4
42	42.17	42.09	27.0	1.1	0.99	1.8	1.2	2.2	1.5
54	54.17	54.09	32.0	1.2	1.08	2.0	1.2	2.3	1.6
67	66.86	66.78	33.3	1.2	1.08	2.0	1.2	2.4	1.7

NOTE Minimum wall thickness requirements shall not apply under indented marking on the socket end.

12 Compression fittings, type B

(see Table 15, and Figure 9 and Figure 11)

NOTE Appendix C gives guidance on fittings to be buried underground.

12.1 Type B compression fittings shall comply with **12.2** to **12.6**.

12.2 The dimensions of type B compression fittings shall be as specified in Table 15.

12.3 The fittings shall be free from internal fins or other irregularities which might restrict the free flow of fluid, and shall be so designed that the resistance to the flow of fluid through the fittings is minimized.

12.4 Union nuts shall be either hexagonal or octagonal or shall have ribs for tightening.

12.5 Provision for tightening shall be made on all straight fittings with screwed ends.

12.6 All cones and seatings against which the pipe abuts shall be accurately machined to ensure a good fit.

13 Test requirements

13.1 Hydraulic type test for assembled joints. The fittings and their component parts, when assembled with short lengths of copper tube complying with Table 1 to Table 4 shall be capable of withstanding an internal hydraulic pressure of 20 bar maintained for a period of 15 min when the tube is fixed at one end only. The assembled joint shall show no signs of leakage or other defect in the fittings or the joint.

13.2 Porosity test. After all machining and screwing operations have been completed the manufacturer shall test for porosity the body of every fitting made from a casting for a period of 3 s by a pressure test consisting of one of the following:

a) the application of an internal hydraulic pressure of not less than 20 bar; or

b) the application of an internal air pressure of not less than 5 bar, and not more than 7 bar while the fitting is completely immersed in water; or

c) the application of an internal air pressure of not less than 5 bar, and not more than 7 bar by means of a leak detection system no less suitable than the method specified in b) above (e.g. electronic test).

When so tested fittings shall show no signs of leakage.

14 Marking

14.1 Fittings of 12 mm and over. Fittings of 12 mm and larger shall be legibly and permanently marked with the maker's name or trade mark and with the relevant identification symbol as given in Table 16.

14.2 Slip fittings (see **10.7** and **11.6**). Slip fittings shall be stamped with the word "SLIP" in letters of a minimum size of 3 mm and in such a manner as not to deform the fitting.

14.3 *Integral solder ring fittings.* Integral solder ring fittings with solder suitable for use in potable water installations shall be legibly and permanently marked with the manufacturer's published identification symbol.

Table 15 — Dimensions of compression fittings and union ends
(see Figure 8, Figure 9, Figure 10 and Figure 11)

1	2	3
Size of fitting	**Minimum wall thickness at any point of body or nut**	
	Dimension *A, B, C* or *D*	
	Hot pressings and components made from rod	**Castings**
mm	mm	mm
6	1.0	1.0
8	1.0	1.0
10	1.1	1.1
12	1.1	1.1
15	1.2	1.3
18	1.4	1.5
22	1.4	1.5
28	1.5	1.8
35	1.6	1.8
42	1.8	2.0
54	1.9	2.3
67	2.0	2.4

Table 16 — Markings for fittings

1	2	3	4	5	6	7
Symbol	**Type of fitting**	**Class of tube for which fitting is suitable**				
		Tube complying with Table 1	**Tube complying with Table 2**	**Half-hard tube complying with Table 3**	**Annealed tube complying with Table 3**	**Tube complying with Table 4**
864	Capillary	*	*	*	*	*
864.1	Type B compression	*	*	*	*	—
864.2	Type A compression	*	*	*	—	*
864.3	Type B compression	*	—	*	*	—
864.4	Type B compression	*	*	—	—	—
NOTE *indicates the class or classes of tubes for which a fitting bearing the particular symbol is suitable.						

Table 17 — Chemical compositions of lead free soft solders for use with potable water

Grade	Tin Sn %	Antimony Sb max. %	Lead Pb max. %	Silver Ag		Cadmium Cd max. %	Bismuth Bi max. %	Arsenic As max. %	Iron Fe max. %	Copper Cu		Zinc Zn max. %	Aluminium Al max. %	Other total max. %
				min. %	max. %					min. %	max. %			
Tin/Copper														
99C	Remainder	0.05	0.10	—	0.05	0.002	0.10	0.03	0.02	0.45	0.85	0.001	0.001	0.08
Tin/Silver														
98S	Remainder	0.10	0.10	1.8	2.2	0.005	0.10	0.03	0.02	—	0.10	0.001	0.001	0.08
97S	Remainder	0.10	0.10	3.0	3.5	0.005	0.10	0.03	0.02	—	0.10	0.001	0.001	0.08
96S	Remainder	0.10	0.10	3.5	3.7	0.005	0.10	0.03	0.02	—	0.08	0.01	0.005	0.08

NOTE The grades specified in the table are to be included in BS 219 by amendment.

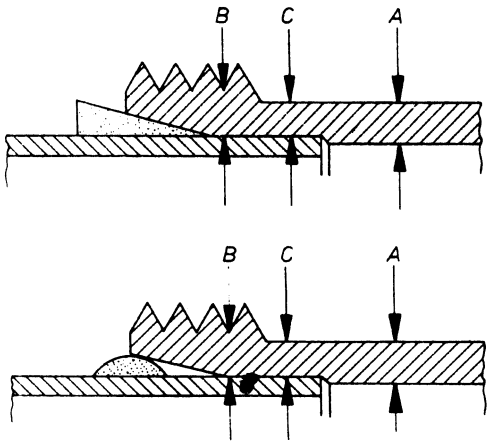


Figure 8 — Compression fittings, type A

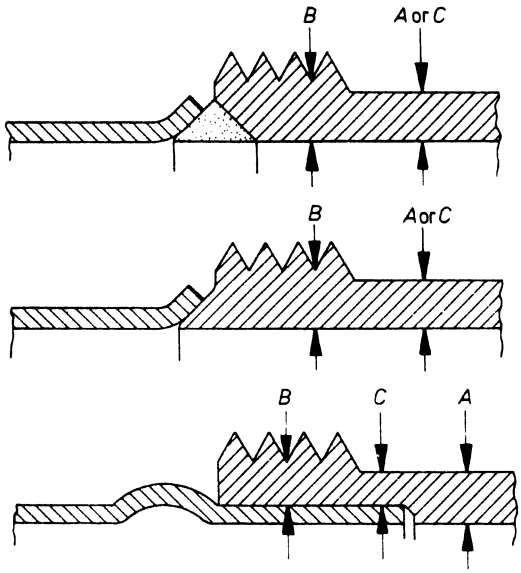


Figure 9 — Compression fittings, type B

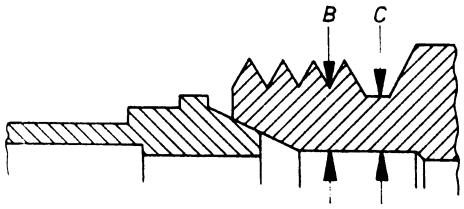


Figure 10 — Union end for capillary type fitting

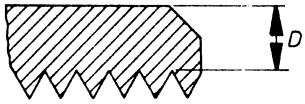


Figure 11 — Nuts

Appendix A Methods of specifying fittings

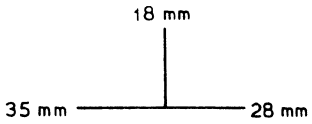
A.1 General. The methods of specifying fittings are as given in **A.2** to **A.8**.

A.2 Straight fittings. For fittings with two unequal ends, the larger end should be given first.

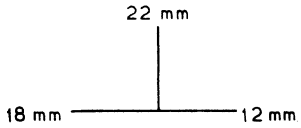
A.3 Right angle tees. Right angle fittings having three ends should be designated first by the ends on the run, i.e. two ends (the larger of the two ends being specified first) in the same straight line, and then by the remaining end.

Examples

35 mm × 35 mm × 18 mm tee



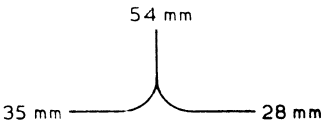
35 mm × 28 mm × 18 mm tee



18 mm × 12 mm × 22 mm tee

A.4 Double sweep tees. Double sweep tees should be designated as described in **A.3**.

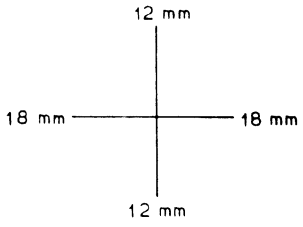
Example



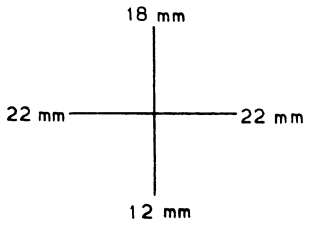
35 mm × 28 mm × 54 mm double sweep tee

A.5 Right angle crosses. Right angle fittings with four ends should be designated first by the larger end on the run and then by the second end on the run followed by the remaining ends (the larger of the two remaining ends being specified first).

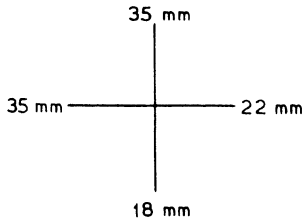
Examples



18 mm × 18 mm × 12 mm × 12 mm cross



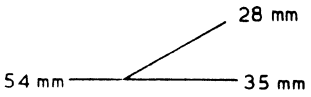
22 mm × 22 mm × 18 mm × 12 mm cross



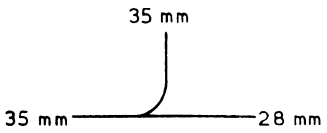
35 mm × 22 mm × 35 mm × 18 mm cross

A.6 Angle or sweep tees. Angle or sweep fittings having three ends should be designated first by the end to which the angle of sweep runs, irrespective of size; the branch should be specified last.

Examples



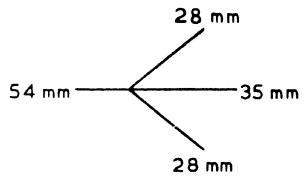
54 mm × 35 mm × 28 mm angle tee



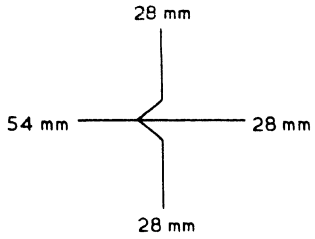
35 mm × 28 mm × 35 mm sweep tee

A.7 Angle or sweep crosses. Angle or sweep fittings having four ends should be designated first by the end to which the angle or sweep runs, irrespective of size; the branch sizes should be specified last.

Examples



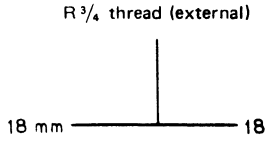
54 mm X 35 mm X 28 mm X 28 mm angle cross



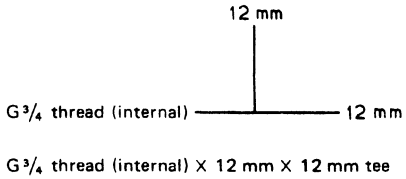
54 mm X 28 mm X 28 mm X 28 mm sweep cross

A.8 Screwed ends. Designations given without qualifications should be understood to relate to ends for joining copper tubes. When it is desired to designate a screwed end, the type of thread, and whether it is external or internal, should be stated after the size designation of that end. The words "external" and "internal" should relate to the thread of the fitting.

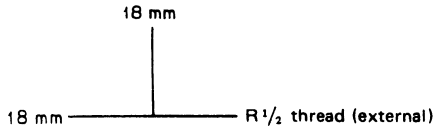
Examples



18 mm X 18 mm X R ¾ thread (external) tee



G ¾ thread (internal) X 12 mm X 12 mm tee



18 mm X R ½ thread (external) X 18 mm tee

Appendix B Information to be supplied by the purchaser

The following information should be supplied by the purchaser:

a) type of screw thread required (see clause **4**);

b) whether or not an internal shoulder or stop is required on capillary fittings (see **10.7**);

c) whether or not an internal shoulder or stop is required on type A compression fittings (see **11.6**).

Appendix C Fittings to be buried underground, for use with copper tubes complying with Table 3

It is essential to ensure that the method of jointing and the material used for the joint are suitable for use underground. Copper alloy fittings installed underground are required by Water Undertakings Byelaws to be dezincification immune or resistant (see Table 7).

The Water Undertakings Byelaws require that any compression fitting used on copper water pipes laid underground is of type B.

When capillary fittings are used with fully annealed copper tubes, it is essential that the ends of the tubes be sized to the outside diameter dimensions specified in Table 3 for length not less than the socket length of the fittings (see column 4 of Table 10).

Appendix D GO and NOT GO gauges for plain tails

GO and NOT GO ring gauges for measuring plain tails are given in Table 18 (see also **9.2**).

Table 18 — Ring gauge diameters for plain tails including wear allowance

Size of fittings	GO gauge	NOT GO gauge
mm	mm	mm
6	6.035 / 6.045	5.945 / 5.955
8	8.035 / 8.045	7.945 / 7.955
10	10.035 / 10.045	9.945 / 9.955
12	12.033 / 12.045	11.943 / 11.955
15	15.033 / 15.045	14.943 / 14.955
18	18.033 / 18.045	17.943 / 17.955
22	22.042 / 22.055	21.952 / 21.965
28	28.042 / 28.055	27.952 / 27.965
35	35.055 / 35.070	34.965 / 34.980
42	42.055 / 42.070	41.965 / 41.980
54	54.055 / 54.070	53.965 / 53.980
67	66.735 / 66.750	66.575 / 66.590

Publications referred to

BS 21, *Specification for pipe threads for tubes and fittings where pressure-tight joints are made on the threads (metric dimensions).*

BS 61, *Threads for light gauge copper tubes and fittings.*

BS 66 & BS 99, *Cast copper alloy pipe fittings for use with screwed copper tubes*[1)].

BS 143 & BS 1256, *Malleable cast iron and cast copper alloy screwed pipe fittings for steam, air, water, gas and oil*[1)].

BS 219, *Specification for soft solders.*

BS 1010, *Draw-off taps and stopvalves for water services (screwdown pattern).*

BS 1010-2, *Draw-off taps and above ground stopvalves.*

BS 1400, *Copper alloy ingots and copper and copper alloy castings.*

BS 2051, *Tube and pipe fittings for engineering purposes*[1)].

BS 2051-1, *Copper and copper alloy capillary and compression tube fittings for engineering purposes.*

BS 2779, *Pipe threads where pressure-tight joints are not made on the threads.*

BS 2871, *Copper and copper alloys. Tubes.*

BS 2871-1, *Copper tubes for water, gas and sanitation.*

BS 2872, *Copper and copper alloys. Forging stock and forgings.*

BS 2874, *Copper and copper alloys. Rods and sections (other than forging stock).*

BS 2879, *Specification for draining taps (screw-down pattern).*

BS 4368, *Carbon and stainless steel compression couplings for tubes*[1)].

BS 4368-1, *Heavy series.*

BS 4504, *Flanges and bolting for pipes, valves and fittings. Metric series.*

BS 4504-2, *Copper alloy and composite flanges.*

BS 6017, *Specification for copper refinery shapes.*

ISO 2016, *Capillary solder fittings for copper tubes — Assembly dimensions and tests.*

[1)] Referred to in the foreword only.

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