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Wrought Copper Alloy Tubes
Seamless Drawn
Dimension Ranges and Coordination of Tolerances

DIN

1755

Sheet 1

Rohre aus Kupfer-Knetlegierungen, nahtlosgezogen;
Maßbereiche und Toleranzzuordnungen

Dimensions in mm

1. Scope

This Standard applies to seamless drawn tubes of 3 to 450 mm outside diameter and 0.3 to 10 mm wall thickness. It includes dimension ranges and coordination of tolerances and the corresponding permissible variations.

Tubes according to this Standard are manufactured from the materials of material groups I to IV quoted in Section 4; the restrictions mentioned should be observed.

Preferred dimensions for general use, see DIN 1755 Sheet 2

Preferred dimensions for pipelines, see DIN 1755 Sheet 3

This Standard does not apply to:

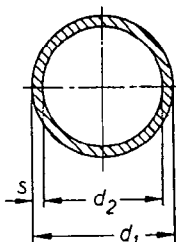
Copper tubes, see DIN 1754

2. Designation

Tubes are in principle designated by outside diameter times wall thickness.

Examples:

In accordance with the coordination of tolerances laid down in Section 3.1 the following must be distinguished:



Coordination of tolerance A (normal case)

Designation of a seamless tube of outside diameter $d_1 = 20$ mm and wall thickness $s = 2$ mm to coordination of tolerance A in the material with the symbol CuZn40 F42 (formerly Ms60 F41) or the material number 2.0360.26:

Tube 20 x 2 DIN 1755 - CuZn40 F42

or Tube 20 x 2 DIN 1755 - 2.0360.26

formerly Tube 20 x 2 DIN 1755 - Ms60 F41

Coordination of tolerance B

Designation of a seamless tube of outside diameter $d_1 = 20$ mm and wall thickness $s = 2$ mm to coordination of tolerance B (code letter B) in the material with the symbol CuZn40 F42 (formerly Ms60 F41) or the material number 2.0360.26:

Tube 20 x 2 B DIN 1755 - CuZn40 F42

or Tube 20 x 2 B DIN 1755 - 2.0360.26

formerly Tube 20 x 2 B DIN 1755 - Ms60 F41

Coordination of tolerance C

Designation of a seamless tube of outside diameter $d_1 = 20$ mm and wall thickness $s = 2$ mm to coordination of tolerance C (code letter C) in the material with the symbol CuZn40 F42 (formerly Ms60 F41) or the material number 2.0360.26:

Tube 20 x 2 C DIN 1755 - CuZn40 F42

or Tube 20 x 2 C DIN 1755 - 2.0360.26

formerly Tube 20 x 2 C DIN 1755 - Ms60 F41

If the code letters B or C are not quoted, in all cases tubes are supplied under coordination of tolerance A (normal case).

3. Dimensions and permissible variations

3.1. Coordination of tolerance*

Coordination of tolerance A (normal case)

Tubes to which only permissible variations on outside diameter and wall thickness are allotted.

Coordination of tolerance B

Tubes to which only permissible variations on inside diameter and wall thickness are allotted. The reference dimension for the permissible variation on wall thickness is the outside diameter.

Coordination of tolerance C

Tubes to which only permissible variations on outside diameter and inside diameter are allotted. The permissible thickness variation, the reference dimension of which is the outside diameter, also applies.

*) See "Coordination of tolerances for cross-section dimensions of non-ferrous metal tubes", DIN Mitteilungen, Vol. 45 (1966) No. 11, pp. 597-603.
Obtainable as special publication D-346 from Beuth Verlag GmbH, Berlin 30 and Köln 1.

Continued on pages 2 to 7
Explanations on page 7

Table 1. Dimension ranges and permissible variations on the diameter and wall thickness for tubes in straight lengths

When this Table is used, the coordination of tolerances A, B and C (see Section 3.1) should be observed

Measuring range	Outside diameter d_1 and/or Inside diameter d_2 Permissible \pm variation ¹⁾ Upper row: on mean diameter Lower row: on diameter including out-of-roundness						for material groups							
	for material groups I and II for a ratio $d_1:s$			for material group III for a ratio $d_1:s$			from 0,3 to 0,5		above 0,5 to 0,8		above 0,8 to 1,0		above 1,0 to 1,2	
	to 30	above 30 to 50	above 50	to 30	above 30 to 50	above 50	Ia. II	III	Ia. II	III	Ia. II	III	Ia. II	III
from 3 to 6	0,05 ³⁾ 0,07 ³⁾	—	—	—	—	—	0,03 10%	0,05	0,03 10%	0,05	0,03 9%	0,05	0,03 9%	0,05
above 6 to 10	0,06 0,09	0,06 0,12	—	0,10 0,15	0,10 0,20	—	0,03 10%	0,05	0,03 10%	0,05	0,03 10%	0,05	0,03 10%	0,05
above 10 to 14	0,08 0,12	0,08 0,16	—	0,15 0,20	0,15 0,30	—	0,03 10%	0,05	0,03 10%	0,05	0,03 10%	0,05	0,03 10%	0,05
above 14 to 18	0,08 0,12	0,08 0,16	0,08 b.a.	0,15 0,20	0,15 0,30	0,15 b.a.	0,04 10%	0,07	0,04 10%	0,07	0,04 10%	0,07	0,04 10%	0,07
above 18 to 30	0,12 0,18	0,12 0,24	0,12 b.a.	0,20 0,30	0,20 0,40	0,20 b.a.	0,04 10%	0,07	0,05 10%	0,09	0,05 10%	0,09	0,05 10%	0,09
above 30 to 50	0,15 0,24	0,15 0,30	0,15 b.a.	0,25 0,38	0,25 0,50	0,25 b.a.	—	0,06 10%	0,11	0,06 10%	0,11	0,06 10%	0,11	
above 50 to 80	0,20 0,30	0,20 0,40	0,20 b.a.	0,30 0,45	0,30 0,60	0,30 b.a.	—	—	0,08 10%	0,14	0,08 10%	0,14		
above 80 to 120	0,25 0,40	0,25 0,50	0,25 b.a.	0,40 0,60	0,40 0,80	0,40 b.a.	—	—	—	0,09 10%	0,16			
above 120 to 200	0,50 0,75	0,50 1,0	0,50 b.a.	0,75 1,2	0,75 1,5	0,75 b.a.	—	—	—	—	—	—		
above 200 to 315	0,75 1,2	0,75 1,5	0,75 b.a.	1,2 1,8	1,2 2,4	1,2 b.a.	—	—	—	—	—	—		
above 315 to 450	1,0 1,5	1,0 2,0	1,0 b.a.	2,0 3,0	2,0 4,0	2,0 b.a.	—	—	—	—	—	—		

¹⁾ see Section 3.3.1

²⁾ see Section 3.3.2

³⁾ These permissible variations apply only for the outside diameter

b.a. = by agreement

The permissible variations given in this Table apply only for material groups I to III, see Section 4.

Wall thickness s																						
Upper row: Permissible + variation from the mean thickness in mm ²⁾																						
Lower row: Permissible + thickness variation in % of the nominal wall thickness ²⁾ for the dimension range of the wall thickness																						
above 1,2 to 1,4	above 1,4 to 1,6	above 1,6 to 1,8	above 1,8 to 2,0	above 2,0 to 2,5	above 2,5 to 3	above 3 to 4	above 4 to 5	above 5 to 6	above 6 to 8	above 8 to 10												
for material group																						
Ia.II	III	Ia.II	III	Ia.II	III	Ia.II	III	Ia.II	III	Ia.II	III	Ia.II	III	Ia.II	III	Ia.II	III	Ia.II	III			
0,03	0,05	0,04	0,07	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—			
9%	9%	9%	9%	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—			
0,03	0,05	0,04	0,07	0,04	0,07	0,04	0,07	—	—	—	—	—	—	—	—	—	—	—	—			
9%	9%	9%	9%	9%	9%	9%	9%	—	—	—	—	—	—	—	—	—	—	—	—			
0,03	0,05	0,04	0,07	0,05	0,09	0,05	0,09	0,06	0,11	0,08	0,14	—	—	—	—	—	—	—	—			
9%	9%	9%	9%	9%	9%	9%	9%	8%	8%	8%	8%	—	—	—	—	—	—	—	—			
0,04	0,07	0,05	0,07	0,06	0,11	0,06	0,11	0,07	0,13	0,08	0,14	0,09	0,16	0,10	0,18	—	—	—	—			
9%	9%	9%	9%	9%	9%	9%	9%	8%	8%	8%	8%	8%	8%	8%	8%	—	—	—	—			
0,05	0,09	0,06	0,11	0,07	0,13	0,08	0,14	0,08	0,14	0,10	0,18	0,10	0,18	0,12	0,22	0,12	0,22	0,13	0,23	—		
10%	10%	10%	10%	10%	9%	9%	9%	9%	9%	9%	9%	9%	9%	8%	8%	8%	8%	8%	8%	8%		
0,07	0,13	0,08	0,14	0,08	0,14	0,10	0,18	0,10	0,18	0,12	0,22	0,12	0,22	0,14	0,25	0,14	0,25	0,15	0,27	0,15	0,27	
10%	10%	10%	10%	10%	9%	9%	9%	9%	9%	9%	9%	9%	9%	8%	8%	8%	8%	8%	8%	8%	8%	
0,09	0,16	0,10	0,18	0,10	0,18	0,12	0,22	0,12	0,22	0,14	0,25	0,15	0,27	0,16	0,29	0,16	0,29	0,17	0,31	0,18	0,32	
10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	9%	9%	9%	9%	9%	9%	9%	9%	9%	9%	9%	8%	
0,10	0,18	0,12	0,22	0,12	0,22	0,14	0,25	0,15	0,27	0,16	0,29	0,17	0,31	0,18	0,32	0,18	0,32	0,20	0,36	0,22	0,40	
10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	9%	9%	9%	9%	9%	9%	9%	9%	9%	9%	9%	8%	
—	0,14	0,25	0,15	0,27	0,16	0,29	0,18	0,32	0,20	0,36	0,22	0,40	0,24	0,43	0,24	0,43	0,24	0,43	0,26	0,47	0,26	0,47
—	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	9%	9%	9%	9%	9%	9%	9%	9%	9%	
—	—	—	—	—	—	—	0,22	0,40	0,24	0,43	0,26	0,47	0,28	0,50	0,30	0,54	0,32	0,58	0,35	0,63	0,35	0,63
—	—	—	—	—	—	—	12%	12%	12%	12%	12%	12%	12%	12%	12%	12%	12%	12%	12%	12%	12%	
—	—	—	—	—	—	—	—	—	0,30	0,54	0,32	0,58	0,35	0,63	0,38	0,68	0,40	0,72	0,45	0,81	0,45	0,81
—	—	—	—	—	—	—	—	—	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%	

3.2. Preferred dimensions

Preferred dimensions of tubes to coordination of tolerance A are stipulated in DIN 1755 Sheet 2 for general application and in DIN 1755 Sheet 3 for pipelines.

Preferred dimensions of tubes to coordination of tolerances B and C are not stipulated.

3.3. Permissible variations

The permissible variations are arranged according to dimension ranges.

3.3.1. Permissible variations on diameter (outside and/or inside diameter) see Table 1

The mean diameter \bar{d} is the arithmetic mean of the maximum diameter d_{max} and the minimum diameter d_{min} , measured in the same plane perpendicular to the axis of the tube:

$$\bar{d} = \frac{d_{max} + d_{min}}{2}$$

The calculated value \bar{d} must lie within the permissible variations.

Where permissible variations are given for the diameter including out-of-roundness, this means that every diameter measured must lie within these permissible variations.

When the diameter is measured, a distance of a minimum of d_1 and a maximum of 100 mm from either end of the tube must be ignored.

For tubes in the soft condition of the material concerned, designated by the appended number .10 after the material number (see DIN 17671 Sheet 1) only the permissible variations for the mean diameter from Table 1 apply since the permissible variations on the diameter including out-of-roundness cannot be guaranteed for these tubes.

3.3.2. Permissible variations on wall thickness, see Table 1

The mean wall thickness \bar{s} is the arithmetic mean of the maximum wall thickness s_{max} and the minimum wall thickness s_{min} , measured in the same plane perpendicular to the axis of the tube:

$$\bar{s} = \frac{s_{max} + s_{min}}{2}$$

The calculated value \bar{s} must lie within the permissible variations.

The thickness variation is the variation \pm of the maximum or minimum wall thickness from the mean wall thickness:

$$U = s_{max} - \bar{s} = \bar{s} - s_{min}$$

The thickness variation can most conveniently be calculated as half the difference between the maximum and minimum wall thickness measured in the same plane perpendicular to the axis of the tube:

$$U = \frac{s_{max} - s_{min}}{2} \text{ in mm}$$

The relative thickness variation U_b referred to the nominal thickness is given in % in Table 1:

$$U_b = \frac{U}{\bar{s}} \cdot 100 = \frac{s_{max} - s_{min}}{s_{max} + s_{min}} \cdot 100 \text{ in \%}$$

Variations in millimetres calculated from the % figures quoted should be given to two decimal places (rounded according to DIN 1333).

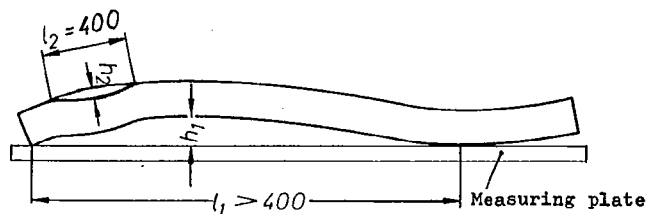
3.3.3. Permissible variation from straightness

For tubes of outside diameter d_1 over 10 mm in manufacturing, approximate and fixed lengths (except tubes in the soft condition) the permissible variations in Table 2 apply.

h_1 is the permissible variation per metre, increasing linearly for measured lengths l_1 over 400 mm. Over any length $l_2 = 400$ mm, however, the permissible variation must not exceed h_2 , see diagram.

Table 2

Ratio $d_1 : s$		Permissible variation	
above	to	for each metre h_1	for every 400 mm h_2
—	5	2	0,8
5	10	3	1,2
10	20	4	1,6
20	40	5	2,0
40	—	6	2,5



4. Materials and strength properties
(to be stated when ordering)

Wrought copper alloys according to DIN 17671 Sheet 1

Tubes to this Standard cannot be supplied in all dimensions in all the materials quoted. Where necessary therefore, agreement should be reached on the required material.

Material groups I, II, III and IV take account of the differing working characteristics of the alloys according to their composition (see symbols in Tables 3 to 6).

Table 3. Material group I

Denomination	Symbol		Material number	Density kg/dm ³	Conversion factor
	new	former			
Low alloy wrought copper alloys	CuSP	—	2.1498	8,9	1
	CuTeP	SF-CuTe	2.1546	8,9	1
Copper-zinc alloys (brass)	CuZn36Pb1	Ms63Pb	2.0330	8,5	0,955
	CuZn36Pb3	—	2.0375	8,5	0,955
	CuZn38Pb1	Ms60Pb	2.0370	8,4	0,944
	CuZn39Pb3	Ms58	2.0401	8,5	0,955
	CuZn40Pb2		2.0402	8,4	0,944

Table 4. Material group II

Denomination	Symbol		Material number	Density kg/dm ³	Conversion factor
	new	former			
Copper-zinc alloys (brass and special brass)	CuZn5	(Ms95)	2.0220	8,9	1
	CuZn10	Ms90	2.0230	8,8	0,989
	CuZn15	Ms85	2.0240	8,8	0,989
	CuZn20	Ms80	2.0250	8,7	0,977
	CuZn28	(Ms72)	2.0261	8,6	0,966
	CuZn30	Ms70	2.0265	8,5	0,955
	CuZn33	Ms67	2.0280	8,5	0,955
	CuZn36	Ms63	2.0335	8,4	0,944
	CuZn37		2.0321	8,4	0,944
	CuZn40	Ms60	2.0360	8,4	0,944
	CuZn30Al	—	2.0515	7,5	0,843
CuZn31Si	SoMs68	2.0490	8,4	0,944	
Copper-tin alloys (tin bronze)	CuSn2	SnBz2	2.1010	8,9	1
	CuSn6	SnBz6	2.1020	8,8	0,989
	CuSn8	SnBz8	2.1030	8,8	0,989
Copper-nickel alloys	CuNi5Fe		2.0862	8,9	1
	CuNi10Fe		2.0872	8,9	1
	CuNi30Fe		2.0882	8,9	1
Low alloy wrought copper alloys	CuAsP	SB-Cu	2.1491	8,9	1
	CuMn2		2.1363	8,8	0,989
	CuMn5		2.1366	8,6	0,966
	CuSi2Mn		2.1522	8,7	0,977
	CuSi3Mn		2.1525	8,5	0,955
	CuBe2		2.1247	8,3	0,932
	CuCr		2.1291	8,9	1
	CuNi1,5Si		2.0853	8,8	0,989
	CuNi2Si		2.0855	8,8	0,989
	CuNi3Si		2.0857	8,8	0,989

Table 5. Material group III

Denomination	Symbols		Material number	Density kg/dm ³	Conversion factor
	new	former			
Copper-zinc alloys (special brass)	CuZn20Al	SoMs76	2.0460	8,3	0,932
	CuZn35Ni	SoMs59	2.0540	8,3	0,932
	CuZn37Al	SoMs58Al1	2.0510	8,3	0,932
	CuZn40Al		2.0560	8,2	0,921
	CuZn40Ni	SoMs58	2.0571	8,3	0,932
	CuZn40Mn		2.0572	8,3	0,932
	CuZn40MnPb	SoMs58Pb	2.0580	8,2	0,921
Copper-aluminium alloys (aluminium bronze)	CuAl5	AlBz5	2.0916	8,2	0,921
	CuAl8	AlBz8	2.0920	7,7	0,865
Copper-nickel zinc alloys (nickel silver)	CuNi12Zn24	Ns6512	2.0730	8,7	0,977
	CuNi18Zn20	Ns6218	2.0740	8,7	0,977

Table 6. Material group IV: The permissible variations must be agreed.

Denomination	Symbols		Material number	Density kg/dm ³	Conversion factor
	new	former			
Copper-zinc alloys (special brass)	CuZn40Al2	SoMs58Al2	2.0550	8,1	0,910
Copper-aluminium alloys (aluminium bronze)	CuAl8Fe	AlBz8Fe	2.0932	7,7	0,865
	CuAl10Fe	AlBz10Fe	2.0936	7,5	0,843
	CuAl9Mn	AlBz9Mn	2.0960	7,5	0,843
	CuAl10Ni	AlBz10Ni	2.0966	7,5	0,843
	CuAl11Ni	AlBz11Ni	2.0978	7,4	0,831

5. Finish

According to technical conditions of delivery DIN 17671 Sheet 2

6. Weights and permissible variations

The weight is calculated from the nominal dimensions of the outside diameter and wall thickness of the tube concerned and the density of the material. For conversion factors see Tables 3 to 6.

The permissible variation on weight is obtained from the permissible variations on the nominal dimensions and the permissible variations on the composition of the alloy.

7. Mode of delivery

7.1. Tubes in manufacturing lengths: from 2000 to 8000 mm

Supply of short lengths of at least 1000 mm is permissible up to 10 % of the delivered weight.

7.2. Tubes in approximate lengths: up to 8000 mm

Approximate lengths must be specially agreed when ordering. For the purpose of marking, the word "approximate" should then be added after the length.

The permissible variation on the ordered length is ± 10 %.

For tubes of diameter up to 100 mm, short lengths of at least 1000 mm may be supplied up to 10 % of the delivered weight. For tubes of diameter over 100 mm, the permissible short lengths must be specially agreed.

7.3. Tubes in fixed lengths

Fixed lengths must be specially agreed when ordering. For the purpose of marking the word "fixed" should then be added after the length. For fixed lengths the permissible variations in Table 7 apply.

With fixed lengths, saw cuts may vary from a right angle only by half the permissible variation given in Table 7.

Table 7

Outside diameter d_1		Permissible plus variations for fixed lengths above							by agreement
		—	100	250	500	1000	2000	4000	
above	to	to							
		100	250	500	1000	2000	4000	—	
—	10	by agreement							
10	50	1	1,5	2	3	4	5	by agreement	
50	120	1,5	2	3	4	5	6		
120	250	2	3	4	5	6	7		
250	450	3	4	5	6	7	8		

7.4. Example of order

As regards the code letters B and C, Section 2 should be observed. 2 t of seamless drawn tube of outside diameter $d_1 = 20$ mm and wall thickness $s = 2$ mm of coordination of tolerance A in manufacturing lengths in the material with the symbol CuZn40 F42 (formerly Ms60 F41) or the material number 2.0360.26

2 t Tubes 30 x 2 DIN 1755 - CuZn40 F42
 or 2 t Tubes 30 x 2 DIN 1755 - 2.0360.26
 formerly 2 t Tubes 30 x 2 DIN 1764 - Ms60 F41

Explanations

This issue of the standard takes account of the fact that only two of the cross-section dimensions of a tube should be subject to a tolerance, see coordination of tolerances A, B and C. With the introduction of this coordination of tolerances the previous redundancy of dimensioning, i.e. simultaneous stipulation of permissible variations on outside diameter, inside diameter and wall thickness, is avoided.

For further details reference should be made to the comments of F. Ballas⁴⁾ and those of H.J. Fischer and R.M. Zollinger⁵⁾. Here, the only point that need be made is that the permissible variations are influenced both by the tool and the manufacturing process. For this reason, a distinction is now made between dimension tolerances dependent on the tool, i.e. the permissible variations from the mean diameter or the mean wall thickness and variations in shape dependent on the manufacturing process, i.e. the permissible variations in the diameter including out-of-roundness or the permissible wall thickness variation (eccentricity).

With agreement having been reached on the new system of tolerances, it was then necessary to make the standards both more universal on the one hand and more specialized on the other, than previously, i.e. to provide tolerances to the standard for intermediate dimensions by quoting dimension ranges and also to stipulate preferred dimensions for particular applications e.g. for pipelines.

These aims were achieved by dividing up the previous standard DIN 1755 into a number of Sheets as follows:

Sheet 1: Dimension ranges and coordination of tolerances

The dimension ranges enable the permissible variation applicable in any particular case to be read off or calculated for any required dimension. This is particularly important for tubes to coordination of tolerances B and C for which it was not possible to stipulate any preferred dimensions.

Sheet 2: Preferred dimensions for general application

Since in general, tubes to coordination of tolerance A are used, this Standard stipulates preferred dimensions for outside diameter and wall thickness arranged according to preferred numbers and including dimensions corresponding to the international range of diameters for pipelines.

On the basis of the provisions of Sheet 1, for each dimension, the permissible variations on outside diameter and wall thickness are given. In addition, the minimum possible wall thickness for the given tube cross-section and the weight are calculated in order to provide the user of the standard with some essential design data.

Sheet 3: Preferred dimensions for pipelines

The preferred dimensions for the outside diameter were deliberately brought into line with the series which has been internationally adopted for pipelines. This harmonization was necessary since all joints e.g. unions and flanges, are matched to these outside diameters. For the rest of the contents of this Standard the same principles apply as for Sheet 2.

Because of this subdivision, it was decided to present each Sheet in such a manner as to enable it to be used independently of the other Sheets. It is thus possible, according to requirements, to alter, i.e. to delete and/or add to the preferred dimensions in Sheet 2 and/or Sheet 3.

In the course of revision, it was also necessary to provide for a division of the materials into several groups to take account of the working characteristics of the alloys.

⁴⁾ See DIN-Mitt. Vol. 41 (1962), No. 8/9, pp. 357-362

⁵⁾ See DIN-Mitt. Vol. 45 (1966), No. 11, pp. 597-603