ASTM B552 / ASME SB 552

Standard Specification for Seamless and Welded Copper–Nickel Tubes for Water Desalting Plants

This specification establishes requirements for seamless and welded copper-nickel tubes from 0.625 to 1.25 in. (15.9 to 31.8 mm) in diameter for use in heat exchangers in water desalting plants. The following alloys are involved: Copper Alloy UNS Nos. C70600, C71500, C71640, and C72200.

A. Chemical Composition :-

The product shall conform to the chemical composition requirements specified in Table 1.

Table 1

Element	Copper Alloy UNS No.			
	C70600	**C71500**	**C71640**	**C72200**
Copper (incl silver)	remainder	remainder	remainder	remainder
Lead, max	0.05[A]	0.05[A]	0.05 [A]	0.05 [A]
Iron	1.0–1.8	0.40–1.0	1.7–2.3	0.5–1.0
Zinc, max	1.0 [A]	1.0 [A]	1.0 [A]	1.0 [A]
Nickel (incl cobalt)	9.0–11.0	29.0–33.0	29.0–32.0	15.0–18.0
Manganese	1.0 max	1.0 max	1.5–2.5	1.0
Chromium	...	...	...	0.30–0.70
Other named elements	[A]	[A]	[A]	[A]
Copper + elements with specific limits	...	...	...	99.5 min

[A] *When the product is for subsequent welding applications and so specified by the purchaser, zinc shall be 0.50 % max, lead 0.02 % max, phosphorus 0.02 % max, sulfur 0.02 max, and carbon 0.05 % max*.

B. Temper :-

1. Tempers within this specification are as defined in Practice B 601.

C. Mechanical Property Requirements :-

1. Tensile Strength:

The product shall conform with the tensile strength requirements prescribed in Table 2 for the temper, alloy and type specified in the ordering information when tested in accordance with Test Methods E 8.

Table 2

Copper Alloy UNS No.	Temper		Tensile Strength, min, ksi (MPa)
	Standard	**Former**	
C70600	O61	annealed	40 (275)
	W061	welded and annealed	40 (275)
	H55	light drawn, light cold worked	45 (310)
	WC55	welded and light cold worked	45 (310)
C71500	O61	annealed	52 (360)

	WO61	welded and annealed	52 (360)
	H55	light drawn, light cold worked	54 (370)
	WC55	welded and light cold worked	54 (370)
C71640	O61	annealed	63 (435)
	WO61	welded and annealed	63 (435)
	H55	light drawn, light cold worked	75 (515)
	WC55	welded and light cold worked	75 (515)
C72200	O61	annealed	45 (310)
	WO61	welded and annealed	45 (310)
	H55	light drawn, light cold worked	50 (345)
	WC55	welded and light cold worked	50 (345)

D. <u>Performance Requirements :-</u>

1. Expansion Test Requirements:
   Tube specimens selected for test shall withstand the expansion shown in Table 3 at one end when tested in accordance with Test Method B 153.
2. Flattening Test Requirements.
3. Weld Quality Test Requirements.

Table 3

Copper Alloy UNS No.	Temper		Expansion of Tube Outside Diameter, % of Original Outside Diameter
	Standard	Former	
C70600	O61	annealed	30
	WO61	welded and annealed	30
	H55	light drawn, light cold worked	15
	WC55	welded and light cold worked	15
C71500	O61	annealed	30
	WO61	welded and annealed	30
	H55	light drawn, light cold worked	15
	WC55	welded and light cold worked	15
C71640	O61	annealed	30
	WO61	welded and annealed	30
	H55	light drawn, light cold worked	15
	WC55	welded and light cold worked	15
C72200	O61	annealed	30
	WO61	welded and annealed	30
	H55	light drawn, light cold worked	15
	WC55	welded and light cold worked	15

E. <u>Nondestructive Test Requirements :-</u>

1. Electromagnetic (Eddy-Current) Test:
   i. Each tube shall be subjected to an eddy-current test. Testing shall follow the procedures of Practice E 243.
   ii. The provisions for the determination of "end-effect" in Practice E 243 shall not apply.

2. Hydrostatic Test:
    i. When specified in the contract or purchase order, each tube shall stand, without showing evidence of leakage, an internal hydrostatic pressure sufficient to produce a fiber stress of 7000 psi (48 MPa) as determined by the following equation for thin hollow cylinders under tension. The tube need not be subjected to a pressure gage reading over 1000 psi (7 MPa) unless specifically stipulated in the contract or purchase order.

$$P = 2St / (D - 0.8t)$$

where: P = hydrostatic pressure, psi (MPa);
t = wall thickness of the material, in. (mm);
D = outside diameter of the material, in. (mm); and
S = allowable stress of the material, psi (MPa).

3. Pneumatic Test:
    i. When specified in the contract or purchase order, each tube shall be subjected to a minimum internal air pressure of 60 psig (415 kPa) for 5 s without showing evidence of leakage.

F. Length :-

1. The lengths of the straight tubes shall not be less than that specified when measured at a temperature of 20°C but may exceed the specified value by the amounts given in Table 4.

Table 4

Specified Length		Tolerance, All Plus	
ft	**(m)**	**in.**	**(mm)**
Up to 15	(4.9) incl	3⁄32	(2.4)
Over 15 to 20, incl	(4.9–6.6) incl	1⁄8	(3.2)
Over 20 to 30, incl	(6.6–9.8) incl	5⁄32	(4)
Over 30 to 60, incl	(9.9–19.7) incl	3⁄8	(9.5)
Over 60 to 100, incl	(19.7–32.8) incl	1⁄2	(12.7)

G. Test Methods :-

1. Chemical Analysis:
Composition shall be determined, in case of disagreement, as follows:

Element	Test Method
Carbon	E 76
Chromium	E 118
Copper	E 478
Iron	E 478
Lead	E 478; atomic absorption
Manganese	E 62
Nickel	E 478; photometric
Phosphorus	E 62
Sulfur	E 76
Zinc	E 478; titrimetric

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