

ASTM - A250/A250M

Standard Specification for

Electric-Resistance-Welded Ferritic Alloy-Steel Boiler and Superheater Tubes

This specification covers several grades, designated T1, T1a, T1b, T2, T11, T12 and T22, of minimum-wallthickness, electric-resistance-welded, carbon-molybdenum and chromium molybdenum alloy-steel, boiler and superheater tubes.

The tubing sizes and thicknesses usually furnished to this specification are 1/2 to 5 in. [12.7 to 127 mm] in outside diameter and 0.035 to 0.320 in. [0.9 to 8.1 mm], inclusive, in minimum wall thickness.

Tubing having other dimensions may be furnished, provided such tubes comply with all other requirements of this specification.

Mechanical property requirements do not apply to tubing smaller than 1/8 in. [3.2 mm] in inside diameter or 0.015 in. [0.4 mm] in thickness.

A. Heat Treatment :-

1. After welding, or when cold finished, after the final cold-drawing pass, all tubes shall be heat treated and, except as provided in point A.2, furnished in the full annealed, isothermal annealed, normalized, or normalized and tempered condition at the option of the manufacturer.
2. If furnished in the normalized and tempered condition, the minimum tempering temperature shall be 1200 °F [650 °C], except T22 shall be tempered at 1250 °F [676 °C] minimum.
3. When grades T1, T1a, T1b, and T2 are cold finished, the tubes may, at the option of the manufacturer, be heat treated after the final cold-drawing pass at a temperature of 1200 °F or higher, provided one of the heat treatments specified in point A.1 was applied after welding.

B. Chemical Composition :-

The steel shall conform to the requirements given in Table 1.

Table 1

Element	Grade T1	Grade T1a	Grade T1b	Grade T2	GradeT11	GradeT12	Grade T22
Carbon	0.10–0.20	0.15–0.25	0.14 max	0.10–0.20	0.05–0.15	0.05–0.15	0.15 max
Manganese	0.30–0.80	0.30–0.80	0.30–0.80	0.30–0.61	0.30–0.60	0.30–0.61	0.30–0.60
Phosphorus, max	0.025	0.025	0.025	0.025	0.025	0.03	0.025
Sulfur, max	0.025	0.025	0.025	0.02	0.02	0.02	0.02
Silicon	0.10–0.50	0.10–0.50	0.10–0.50	0.10–0.30	0.50–1.00	0.5 max	0.5 max
Molybdenum	0.44–0.65	0.44–0.65	0.44–0.65	0.44–0.65	0.44–0.65	0.44–0.65	0.87–1.13
Chromium	0.50–0.81	1.00–1.50	0.80–1.25	1.90–2.60

C. Mechanical Requirements :-

1. Tensile Requirements :-

- i. The material shall conform to the requirements as to tensile properties given in Table 2.
- ii. Table 3 gives the computed minimum elongation values for each 1/32-in. [0.8-mm] decrease in wall thickness.
- iii. Where the wall thickness lies between two values given in Table 3, the minimum elongation value shall be determined by the following equation:

$$E = 48t + 115.00 \quad [E = 1.87t + 115.00]$$

where: E = elongation in 2 in. [50 mm] %, and
t = actual thickness of specimen, in.[mm].

Table 2

Grade	T1	T1a	T1b	T2	T11	T12	T22
Tensile strength, min, ksi [MPa]	55 [380]	60 [415]	53 [365]	60 [415]	60 [415]	60 [415]	60 [415]
Yield strength, min, ksi [MPa]	30 [205]	32 [220]	28 [195]	30 [205]	30 [205]	32 [220]	30 [205]
Elongation in 2 in. or 50 mm, min, %	30	30	30	30	30	30	30
For longitudinal strip tests a deduction shall be made for each 1/32-in. [0.8mm] decrease in wall thickness below 5/16 in. [8 mm] from the basic minimum elongation of the following percentage points	1.50 ^A	1.50 ^A	1.50 ^A	1.50 ^A	1.50 ^A	1.50 ^A	1.50 ^A

^A See Table 3 for the computed minimum values.

Table 3

Wall Thickness		Elongation in 2 in. or 50 mm, min, % ^A
in.	mm	Grades T1, T1a, T1b, T2, T11, T12, and T22
5/16 (0.312)	8	30
9/32 (0.281)	7.2	29
1/4 (0.250)	6.4	27
7/32 (0.219)	5.6	26
3/16 (0.188)	4.8	24
5/32 (0.156)	4	22
1/8 (0.125)	3.2	21
3/32 (0.094)	2.4	20
1/16 (0.062)	1.6	18

^A Calculated elongation requirements shall be rounded to the nearest whole number.

2. Hardness Requirements :-

The tubes shall have a hardness not exceeding the values given in Table 4.

Table 4

Grade	Brinell Hardness Number (Tubes 0.200 in. [5.1 mm] and over in wall thickness), HBW	Rockwell Hardness Number (Tubes less than 0.200 in. [5.1 mm] in wall thickness), HRB
T1	146	80
T1a	153	81

T1b	137	77
T2	163	85
T11	163	85
T12	163	85
T22	163	85

D. Mechanical Tests :- 1.

1. Tension Test.
2. Flattening Test.
3. Flange Test.
4. Reverse Flattening Test.
5. Hardness Test.
6. Hydrostatic or Non-destructive Electric Tests.

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