

Tubos sin costura de acero ferrítico y de aleación para calderas, recalentadores e Intercambiadores de Calor de acuerdo al estándar ASME/ASTM A 213/T11

Suministramos tubos con diámetro interior de 1/8 pulgada [3,2 mm] a 5 pulgadas [127 mm] de diámetro exterior y con espesor mínimo de la pared de 0,015 a 0,500 pulgadas [0,4 a 12,7 mm].

Composición química acero A213

Grado	C	Ma	P	S	Si	Cr	Mo
T22	0.05 - 0.15	0.30 - 0.60	0.025	0.025	0.50	1.90 - 2.60	0.87 - 1.13

Propiedades mecánicas acero A213

Grado T22	Resistencia a la tracción (Mpa)	Punto de fluencia (Mpa)
T22	205	415

Standard Specification for Seamless Ferritic and Austenitic Alloy-Steel Boiler, Superheater, and Heat-Exchanger Tubes(1)

This standard is issued under the fixed designation A 2 J3/A 2 J3M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval.

A superscript epsilon (e) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope*

1.1 This specification (2) covers minimum-wall-thickness seamless ferritic and austenitic steel boiler, superheater, and heat-exchanger tubes, designated Grades T5, TP304, etc. These steels are listed in Tables 1 and 2.

1.2 Grades containing the letter, H, in their designation have requirements different from those of similar grades not containing the letter, H. These different requirements provide higher creep-rupture strength than normally achievable in similar grades without these different requirements.

1.3 The tubing sizes and thicknesses usually furnished to this specification are 1/8 in. [3.2 mm] in inside diameter to 5 in. [127 mm] in outside diameter and 0.015 to 0.500 in. [0.4 to 12.7 mm], inclusive, in minimum wall thickness. Tubing having other dimensions may be furnished, provided such tubes comply with all other requirements of this specification.

1.4 The values stated in either inch-pound units or SI units are to be regarded separately as standard. Within the text, the SI units are shown in brackets. The values stated in each system are not exact equivalents; therefore, each system must be used independently of the other. Combining values from the two systems may result in nonconformance with the specification. The inch-pound units shall apply unless the "M" designation of this specification is specified in the order.

2. Referenced Documents

2.1 ASTM Standards : (3)

A 262 Practices for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels

A 450/A 450M Specification for General Requirements for Carbon, Ferritic Alloy, and Austenitic Alloy Steel Tubes

A 941 Terminology Relating to Steel, Stainless Steel, Related Alloys and Ferroalloys

E 112 Test Methods for Determining Average Grain Size

E 527 Practice for Numbering Metals and Alloys (UNS)

2.2 Other Standard:

SAE J 1086 Practice for Numbering Metals and Alloys (UNS)⁴

3. Terminology

3.1 *Definitions*-For definitions of terms used in this specification, refer to Terminology A 941.

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4. Ordering Information

4.1 It shall be the responsibility of the purchaser to specify all requirements that are necessary for products under this specification, Such requirements to be considered include, but are not limited to, the following: .

4.1.1 Quantity (feet, metres, or number of lengths),

4.1.2 Name of material (seamless tubes),

4.1.3 Grade (Tables 1 and 2),

4.1.4 Condition (hot finished or cold finished),

4.1.5 Controlled structural characteristics (see 6.3),

4.1.6 Size (outside diameter and minimum wall thickness),

4.1.7 Length (specific or random),

4.1.8 Hydrostatic Test or Nondestructive Electric Test (see 1'0.1),

4.1.9 Specification designation and year of issue,

4.1.10 Increased sulfur (for machinability, see Note A, Table 1, and 14.3), and

4.1.11 Special requirements and any supplementary requirements selected.

5. General Requirements

5.1 Material furnished to this specification shall conform to the requirements of Specification A 450/A 450M, including any supplementary requirements that are indicated in the purchase order, Failure to comply with the general requirements of Specification A 450/A 450M constitutes nonconformance with this specification. In case of conflict between the requirements of this specification and Specification A 450/A 450M, this specification shall prevail.

Table 1 Chemical requirements for ferretic steel

Grade	Composition, %									Other elements
	Carbon	Manganese	Phosphorus, max	Sulfur, max	Silicon	Chromium	Molybdenum	Titanium	Vanadium, min	
T2*	0.10-0.20	0.30-0.61	0.025	0.025	0.10-0.30	0.50-0.81	0.44-0.65	...	...
T5	0.15 max	0.30-0.60	0.025	0.025	0.50 max	4.00-6.00	0.45-0.65	...	...
T5b	0.15 max	0.30-0.60	0.025	0.025	1.00-2.00	4.00-6.00	0.45-0.65	...	...
T5c	0.12 max	0.30-0.60	0.025	0.025	0.50 max	4.00-6.00	0.45-0.65	B	...	
T9	0.15 max	0.30-0.60	0.025	0.025	0.25-1.00	8.00-10.00	0.90-1.10	...	...
T11	0.05 min-0.15 max	0.30-0.60	0.025	0.025	0.50-1.00	1.00-1.50	0.44-0.65	...	...
T12*	0.05 min-0.15 max	0.30-0.61	0.025	0.025	0.50 max	0.80-1.25	0.44-0.65	...	...
T17	0.15-0.25	0.30-0.61	0.025	0.025	0.15-0.35	0.80-1.25	...	...	0.15	
T21	0.05 min-0.15 max	0.30-0.60	0.025	0.025	0.50 max	2.65-3.35	0.80-1.06	...	...
T22	0.05 min-0.15 max	0.30-0.60	0.025	0.025	0.50 max	1.90-2.60	0.87-1.13	...	...
T23	0.04-0.10	0.10-0.60	0.030	0.010	0.50 max	1.90-2.60	0.05-0.30	...	0.20-0.30	W 1.45-1.75 B 0.0005-0.006 Al 0.030 max Cb 0.02-0.08 N 0.030 max
T24	0.05-0.10	0.30-0.70	0.020	0.010	0.15-0.45	2.20-2.60	0.70-1.10	0.06-0.10	0.20-0.30	B 0.0015-0.0020 N 0.012 max Al 0.020 max
T91	0.08-0.12	0.30-0.60	0.020	0.010	0.20-0.50	8.00-9.50	0.85-1.05	...	0.18-0.25	Cb 0.06-0.1 Ni 0.40 max Al 0.04 max N 0.030-0.070
T92	0.07-0.13	0.30-0.60	0.020	0.010	0.50 max	8.50-9.50	0.30-0.60	...	0.15-0.25	W 1.5-2.00 B 0.001-0.006 N 0.03-0.07 Al 0.04 max Cb 0.04-0.09 Ni 0.40 max
T122	0.07-0.14	0.70 max	0.020	0.010	0.50 max	10.00-12.50	0.25-0.60	...	0.15-0.30	W 1.50-2.50 B 0.0005-0.005 Cu 0.30-1.70 N 0.040-0.100 Al 0.040 max Cb 0.04-0.10 Ni 0.50 max
T911	0.09-0.13	0.30-0.60	0.020	0.010	0.10-0.50	8.50-10.50	0.90-1.10	...	0.18-0.25	Ni 0.40 max N 0.04-0.09 Cb 0.060-0.10 W 0.90-1.10 B 0.0003-0.006 Al 0.04 max
S44400	0.025 max	1.00 max	0.040	0.030	1.00 max	17.5-19.5	1.75-2.50	e	...	N max 0.035 Ni + Cu max 1.00

(A) It is permissible to order T2 and T12 with 0.045 max Sulfur.

(B) Grade T5c shall have a titanium content 01 not less than four times the carbon content and not more than 0.70 %.

(e) S44400 shall have $Ti + Cb = 0.20 + 4(C + N)$ min, 0.80 max.

6. Materials and Manufacture

6.1 *Manufacture and Condition*- Tubes shall be made by the seamless process and shall be either hot finished or cold finished, as specified. Grade TP347HFG shall be cold finished.

6.2 *Heat Treatment*:

6.2.1 *Ferritic Alloy and Ferritic Stainless Steels*- The ferritic alloy and ferritic stainless steels shall be reheated for heat treatment in accordance with the requirements of Table 3. Heat treatment shall be carried out separately and in addition to heating for hot forming.

6.2.2 *Austenitic Stainless Steels*-All austenitic tubes shall be furnished in the heat-treated condition, and shall be heat treated in accordance with the requirements of Table 3. Alternatively, immediately after hot forming, while the temperature of the tubes is not less than the specified minimum solution treatment temperature, tubes may be individually quenched in water or rapidly cooled by other means.

6.3 If any controlled structural characteristics are required, these shall be so specified in the order as to be a guide as to the most suitable heat treatment.

TABLE 2 Chemical Requirements of Austenitic Steel

Grade	TP2 01	TP2 02	TP30 4	TP3 04H	...	TP3 04N	TP304L N	TP30 4L	TP30 9Cb	TP30 9H	TP30 9HCb	TP30 9S	...	TP31 0Cb	TP31 0H	TP31 0HCb	TP31 0HCb N	TP31 0s	...	TP31 6	TP31 6H
UNS Designation	S20100	S20200	S30400	S30409	S30432	S30451	S30453	S30403	S30940	S30909	S30941	S30908	S31002	S31040	S31009	S31041	S31042	S31008	S31272	S31600	S31609
Carbon	0.15 max	0.15 max	0.08 max	0.04-0.10	0.07-0.13	0.08 max	0.035 maxB	0.035 maxB	0.08 max	0.04-0.10 2.00	0.04-0.10 2.00	0.08 max	0.015 max	0.08 max	0.04-0.10	0.04-0.10	0.04-0.10	0.08 max	0.08-0.12	0.08 max	0.04-0.10
Manganese, max	5.50-7.50	7.50-10.0	2.00	2.00	0.50	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	1.5-2.0	2.00	2.00
Phosphorus, max	0.060	0.060	0.040	0.040	0.045	0.040	0.040	0.040	0.045	0.045	0.045	0.045	0.020	0.045	0.040	0.045	0.030	0.045	0.030	0.040	0.040
Sulfur, max	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.015	0.030	0.030	0.030	0.030	0.030	0.015	0.030	0.030
Silicon	1.00 max	1.00 max	0.75 max	0.75 max	0.030 max	0.75 max	0.75 max	0.75 max	0.75 max	0.75 max	0.75 max	0.75 max	0.15 max	0.75 max	0.75 max	0.75 max	0.75 max	0.75 max	0.3-0.7	0.75 max	0.75 max
Nickel	3.50-5.50	400-600	8.00-11.0	8.00-11.0	7.50-10.50	8.00-11.0	8.00-11.0	8.00-13.0	12.00-16.00	12.00-15.00	12.00-16.00	12.00-15.00	19.0-22.0	19.00-22.00	19.0-22.00	19.0-22.00	17.00-23.00	19.00-22.00	14.0-16.0	11.0-14.0	11.0-14.0
Chromium	16.0-18.0	17.0-19.0	18.0-20.0	18.0-20.0	17.00-19.00	18.0-20.0	18.0-20.0	18.0-20.0	22.00-24.00	22.00-24.00	22.00-24.00	22.00-24.00	24.0-26.0	24.00-26.00	24.00-26.00	24.00-26.00	24.00-26.00	24.00-26.00	14.0-16.0	16.0-18.0	16.0-18.0
Molybdenum	...	...	...	...	...	...	...	...	0.75 max	0.75 max	0.75 max	0.75 max	0.10 max	0.75 max	...	0.75 max	...	0.75 max	1.0-1.4	2.00-3.00	2.00-3.00
Titanium	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.3-0.6	...	...
Columbium + Tantalum	...	...	...	...	0.20-0.80	...	...	...	10x C min, 1.10 max	...	10x C min, 1.10 max	...	...	10x C min, 1.10 max	...	10x C min, 1.10 max	0.20-0.60	...	...	...	...
Tantalum, max	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Nitrogen	0.25 max	0.25 max	...	...	0.05-0.12	0.10-0.16	0.10-0.16	...	...	...	...	...	0.10 max	...	...	...	0.15-0.35	...	...	...	...
Cerium	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Others	...	...	...	...	B 0.001-0.010 Al 0.003-0.030 Cu 2.5- 3.5	...	...	...	...	...	...	...	...	...	...	...	...	...	B 0.001-0.004-0.010 0.008	...	...