

ASTM A213 T11 tube Specifications

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ASTM A213 T11 tube Specifications

ASTM A213 is the standard specification for seamless ferritic and austenitic alloy-steel boiler, superheater, and heat-exchanger tubes. Hebei Metals supplies Cr-Mo low alloy steel grades of T2, T5, T5b, T5c, T9, T11, T12, T17, T21, T22, T23, T24, T36, T91, T92, T122, and T911. The tubing sizes and thickness usually furnished to this specification are 1/8" (3.2 mm) in inside diameter to 5" (127 mm) in outside diameter and 0.015" to 0.500" (0.4-12.7 mm) in minimum or average wall thickness. ASTM A213 tubes of custom-diameter may be furnished, provided such tubes comply with all other requirements of the standard specification. The ASTM equivalent steel grades of A213 can be found in ASTM A335.



The heat-exchanger coil made of ASTM A213 T9 tubes.

1. Chemical Composition Requirements

**Chemical
Composition of
ASTM A213 Low
Alloy Steels, %**

Grade	UNS	C	Mn	P	S	Si	Cr	Mo	Others
T2	K11547	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	K41545	0.15	0.30-0.60	0.025	0.025	0.50	4.00-6.00	0.45-0.65	-
T5b	K51545	0.15	0.30-0.60	0.025	0.025	1.00-2.00	4.00-6.00	0.45-0.65	-
T5c	K41245	0.12	0.30-0.60	0.025	0.025	0.50	4.00-6.00	0.45-0.65	*A
T9	K90941	0.15	0.30-0.60	0.025	0.025	0.25-1.00	8.00-10.00	0.90-1.10	-
T11	K11597	0.05-0.15	0.30-0.60	0.025	0.025	0.50-1.00	1.00-1.50	0.44-0.65	-
T12	K11562	0.05-0.15	0.30-0.61	0.025	0.025	0.50	0.80-1.25	0.44-0.65	-
T17	K12047	0.15-0.25	0.30-0.61	0.025	0.025	0.15-0.35	0.80-1.25	-	-
T21	K31545	0.05-0.15	0.30-0.60	0.025	0.025	0.50-1.00	2.65-3.35	0.80-1.06	-
T22	K21590	0.05-0.15	0.30-0.60	0.025	0.025	0.50	1.90-2.60	0.87-1.13	-
T23	K40712	0.04-0.10	0.10-0.60	0.030	0.010	0.50	1.90-2.60	0.05-0.30	*B

T24	K30736	0.05-0.1 0	0.30-0.7 0	0.020	0.010	0.15-0.4 5	2.20-2.6 0	0.90-1.1 0	*C
T36	K21001	0.10-0.1 7	0.80-1.2 0	0.030	0.025	0.25-0.5 0	0.30	0.25-0.5 0	*D
T91	K90901	0.07-0.1 4	0.30-0.6 0	0.020	0.010	0.20-0.5 0	8.0-9.5	0.85-1.0 5	*E
T92	K92460	0.07-0.1 3	0.30-0.6 0	0.020	0.010	0.50	8.5-9.5	0.30-0.6 0	*F
T122	K91271	0.07-0.1 4	0.70	0.020	0.010	0.50	10.0-11. 5	0.25-0.6 0	*G
T911	K91061	0.09-0.1 3	0.30-0.6 0	0.020	0.010	0.10-0.5 0	8.5-9.5	0.90-1.1 0	*H

*All values are maximum unless a range is provided or otherwise specified.

*A - Ti:4xC-0.70;

*B - Ni:≤0.40,V:0.20-0.30,B:0.001-0.006,Nb:0.02-0.08,N:≤0.015,Al:≤0.030,W:1.45-1.75,Ti:0.005-0.06,Ti/N≥3.5;

*C - V:0.20-0.30,B:0.0015-0.007,N:≤0.012,Al:≤0.02,Ti:0.06-0.10;

*D - Ni:1.00-1.30,V:≤0.02,Nb:0.015-0.045,N:≤0.02,Al:≤0.050,Cu:0.50-0.80;

*E - Ni:≤0.40,V:0.18-0.25,Nb:0.06-0.10,N:0.03-0.07,Al:0.02,Ti:0.01,Zr:0.01;

*F - Ni:≤0.40,V:0.15-0.25,B:0.001-0.006,Nb:0.04-0.09,N:0.030-0.070,Al:≤0.02,W:1.5-2.00,Ti:0.01,Zr:0.01;

*G - Ni:≤0.50,V:0.15-0.30,B:0.0005-0.005,Nb:0.04-0.10,N:0.040-0.100,Al:≤0.02,W:1.50-2.50,Cu:0.30-1.70,Ti:0.01,Zr:0.01;

*H - Ni:≤0.40,V:0.18-0.25,B:0.0009-0.006,Nb:0.06-0.10,N:0.040-0.090,Al:≤0.02,W:0.90-1.10,Ti:0.01,Zr:0.01;

2. Mechanical Properties

Mechanical Properties of ASTM A213 Low Alloy Steel Tubes

Grade	Tensile Strength		Yield Strength		Elongation , %	Hardness	
	ksi	MPa	ksi	MPa		Brinell/Vickers	Rockwell
T5b	60	415	30	205	30	179 HBW/190 HV	89 HRB
T9	60	415	30	205	30	179 HBW/190 HV	89 HRB
T12	60	415	32	220	30	163 HBW/170 HV	85 HRB
T23	74	510	58	400	20	220 HBW/230 HV	97 HRB
T24	85	585	60	415	20	250 HBW/265 HV	25 HRC
T36 Class 1	90	620	64	440	15	250 HBW/265 HV	25 HRC
T36 Class 2	95.5	660	66.5	460	15	250 HBW/ 265 HV	25 HRC
T91	85	585	60	415	20	190 to 250 HBW/ 196 to 265 HV	90 HRB to 25 HRC
T92	90	620	64	440	20	250 HBW/ 265 HV	25 HRC
T122	90	620	58	400	20	250 HBW/ 265 HV	25 HRC
T911	90	620	64	440	20	250 HBW/ 265 HV	25 HRC
Others ^{*A}	60	415	30	205	30	163 HB/170 HV	85 HRB

*A - All other low alloy steel grades of ASTM A213.

3. Heat Treatment

Heat Treatment Process for ASTM A213 Low Alloy Steel Tubes

Grade	Heat Treatment Type	Austenitizing/Solutioning Temperature, min. or range ° F[° C]	Cooling Media	Subcritical Annealing or Tempering Temperature, min. or range ° F[° C]
T2	full or isothermal anneal	-	-	-
	normalize and temper	-	-	-
	subcritical anneal	-	-	1200-1350[650-730]
T5	full or isothermal anneal	-	-	-
	normalize and temper	-	-	1250[675]
T5b	full or isothermal anneal	-	-	-
	normalize and temper	-	-	1250[675]
T5c	subcritical anneal	-	air or furnace	1350[730]
T9	full or isothermal anneal	-	-	-
	normalize and temper	-	-	1250[675]
T11	full or isothermal anneal	-	-	-
	normalize and temper	-	-	1200[650]
T12	full or isothermal anneal	-	-	-
	normalize and temper	-	-	-
	subcritical anneal	-	-	1200-1350[650-730]
T17	full or isothermal anneal	-	-	-
	normalize and temper	-	-	1200[650]
T21	full or isothermal anneal	-	-	-
	normalize and temper	-	-	1250[675]
T22	full or isothermal anneal	-	-	-
	normalize and temper	-	-	1250[675]
T23	normalize and temper	1900-1975[1040-1080]	-	1350-1470[730-800]
T24	normalize and temper	1800-1870[980-1020]	-	1350-1420[730-770]

T36	normalize and temper	1650[900]	-	1100[595]
T91	normalize and temper	1900-1975[1040-1080]	-	1350-1470[730-800]
T92	normalize and temper	1900-1975[1040-1080]	-	1350-1470[730-800]
T122	normalize and temper	1900-1975[1040-1080]	-	1350-1470[730-800]
T911	normalize and temper	1900-1975[1040-1080]	-	1365-1435[740-780]

4. Inspection and Tests

Tests or inspection the ASTM A213 tube shall take include: tension test, hardness test, flattening test, flaring test, hydrostatic or any alternative nondestructive(NDT) test, dimension inspection and visual examination.

来自 <<http://www.metalspiping.com/astm-a213-low-alloy-steel-tubes-for-boiler-superheater-heat-exchanger.html>>

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