ASTM A213 TP316Ti (S31635) Technical Datasheet

Prepared from ASTM A213/A213M-23

1. Basic designation

Standard	Grade	UNS	Family	Product form
ASTM A213/A213M-23	TP316Ti	S31635	Stainless	Seamless boiler / superheater / heat-exchanger tube

2. Chemical composition

C	Mn	P	S	Si	Cr	Ni	Mo	N	Nb	Ti	Other
≤0.08	≤2.00	≤0.045	≤0.030	0.75	16.0–18.0	10.0–14.0	2.00–3.00	0.10	—	5×(C+N)–0.70	—

3. Tensile and hardness requirements

Condition / size range	Tensile strength, min	Yield strength, min	Elongation in 2 in. / 50 mm, min %	Hardness
Standard	75 [515]	30 [205]	35	192 HBW / 200 HV / 90 HRB

4. Heat treatment and grain size requirements

Heat treat type	Austenitizing / solutioning / stabilizing temperature	Cooling media / note	Subcritical annealing or tempering temperature	ASTM grain size No.
solution treatment	1900 [1040]	water or other rapid cool	—	—

5. Required inspection and testing

Item	Requirement
Product analysis	One billet or one tube from each heat. If original test fails, retest two additional billets or tubes; both retests must conform.
Grain size	As required by Table 3; one end of one finished tube from each lot.
Tension test	One specimen from one tube for lots of not more than 50 tubes; from two tubes for lots of more than 50 tubes.
Hardness test	Brinell, Vickers, or Rockwell on specimens from two tubes from each lot.
Flattening test	One flattening test on specimens from each end of one finished tube per lot, not the one used for flaring test.
Flaring test	One flaring test on specimens from each end of one finished tube per lot, not the one used for flattening test.
Mechanical property exception	Mechanical property requirements do not apply to tubing smaller than 1/8 in. [3.2 mm] inside diameter or thinner than 0.015 in. [0.4 mm].
Hydrostatic or NDE electric test	Each tube shall be subjected to the nondestructive electric test or the hydrostatic test unless otherwise specified in the purchase order.
Forming operations	Tubes, when inserted in a boiler or tube sheet, shall stand expanding and beading without cracks or flaws.
Surface condition	Ferritic alloy cold-finished tubes shall be free of scale and suitable for inspection; stainless tubes shall be pickled free of scale unless bright annealed.

6. Permitted wall-thickness variations and lot size

Condition	Reference	Over	Under
Specified minimum wall thickness	Per ASTM A1016/A1016M	—	—
Specified average wall thickness, cold formed tubes	±10 % of specified average wall thickness	+10 %	-10 %
Specified average wall thickness, hot formed tubes; OD 0.405 to 2.875 in. [10.3 to 73.0 mm], all t/D	Per Table 6	+20 %	-12.5 %
Specified average wall thickness, hot formed tubes; OD above 2.875 in. [73.0 mm], t/D ≤ 5 %	Per Table 6	+22.5 %	-12.5 %
Specified average wall thickness, hot formed tubes; OD above 2.875 in. [73.0 mm], t/D > 5 %	Per Table 6	+15 %	-12.5 %

Tube size	Lot size when heat treated by continuous process or direct quench after hot forming
2 in. [50.8 mm] and over OD and 0.200 in. [5.1 mm] and over wall	Not more than 50 tubes
2 in. [50.8 mm] and over OD and under 0.200 in. [5.1 mm] wall	Not more than 75 tubes

Less than 2 in. [50.8 mm] but over 1 in. [25.4 mm] OD	Not more than 75 tubes
1 in. [25.4 mm] or less OD	Not more than 125 tubes

7. Welding filler requirement

ASTM A213/A213M is a seamless tube specification and does not provide a grade-by-grade filler-metal selection table. The standard only references AWS welding specifications in its referenced documents. Welding filler selection should therefore be established by project welding procedure / WPS, base-metal compatibility, service environment, and applicable construction code.

8. Purchase order description example

Example wording
ASTM A213/A213M-23, Grade TP316Ti, UNS S31635, seamless tube, hot finished or cold finished as ordered, outside diameter and minimum wall thickness as ordered, length as ordered, heat treatment in accordance with Table 3, hydrostatic test or nondestructive electric test, and supplementary requirements as specified.

9. Supplementary requirements and notes

• No grade-specific supplementary requirement is mandatory unless specified by the purchaser. General supplementary requirements in ASTM A213 are S1 Stress-Relieved Annealed Tubes, S2 Stabilizing Heat Treatment, S3 Unstraightened Tubes, S4 Intergranular Corrosion Test, and S5 Minimum Cooling Rate for Grade T91 Type 2.