

Not For Production Use (For Reference Only)

ASTM A249/A249M-04a and UI

Specification for Welded Austenitic Steel Boiler, Superheater, Heat Exchanger, and Condenser Tubes

Note - Identical to ASME SA249

ASTM Chemical Requirements

Elements	304	304L	309S	316	316L	321	Heat Treatment
	S30400	S30403	S30908	S31600	S31603	S33200	
(C) Carbon, max	0.080	0.030	0.08	0.080	0.030	0.080	-The material will be heat treated to a minimum of 1900 degrees F and quenched.
(Mn) Manganese, max	2.000	2.000	2.000	2.000	2.000	2.000	
(P) Phosphorus, max	0.045	0.045	0.045	0.045	0.045	0.045	Surface Condition
(S) Sulfur, max	0.030	0.030	0.030	0.030	0.030	0.030	
(Si) Silicon	1.000	1.000	1.000	1.000	1.000	1.000	-The tubes, after heat treatment, shall be chemically descaled or pickled free of scale. Pickling or chemical descaling is not needed if bright annealing is used.
(Ni) Nickel	8.0-11.0	8.0-12.0	12.0-15.0	10.0-14.0	10.0-14.0	9.0-12.0	
(Cr) Chromium	18.0-20.0	18.0-20.0	22.0-24.0	16.0-18.0	16.0-18.0	17.0-19.0	Product Marking
(Mo) Molybdenum	N/A	N/A	N/A	2.0-3.0	2.0-3.0	N/A	
(Ti) Titanium	N/A	N/A	N/A	N/A	N/A	5xC-0.70	

Mechanical Testing Test

Test	ASTM	United
Flare	Not Required	Required
Flatten	Required	Required
Flange	Required	Required
Reverse Bend	Required	Required
Tension Test	Required	Required
Eddy Current	Required*	Required
Hydrostatic	Required*	Not Required
Pressure	Not Required	Required *

*Air pressure test 30 psi tubes over 20' for HBA / 180 grit / ID Polish tubes

* ASTM required either an Eddy Current or a Hydrostatic test be performed.

** Subsequent to welding and prior to final heat treatment, tubes shall be cold worked either in both weld and base metal or in weld metal only.

Mechanical Properties

Type	Tensile	Yield	Elong. At 2"	Hardness
	min, ksi (Mpa)	min, ksi (Mpa)	min, %	Rockwell B, max.
304	75 (515)	30 (205)	35	90
304L	70 (484)	25 (170)	35	90
309S	75 (515)	30 (205)	35	90
316	75 (515)	30 (205)	35	90
316L	70 (485)	25 (170)	35	90
321	75 (515)	30 (205)	35	90

Dimensional Requirements

Size	Outside Diameter		Squareness		Length**		Straightness		Weld Height		Wall***	
	ASTM	United	ASTM	United	ASTM	United	ASTM	United	ASTM	United	ASTM	United
1/2"	+/- .004	+/- .004	N/A	.015	-0 +1/8	-0 +1/8	.030/36"	.030/36"	.006	+0.004	+/- 10%	+/- 10%
3/4"	+/- .004	+/- .004	N/A	.015	-0 +1/8	-0 +1/8	.030/36"	.030/36"	.006	+0.004	+/- 10%	+/- 10%
1"	+/- .006	-.006/+0.002	N/A	.015	-0 +1/8	-0 +1/8	.030/36"	.030/36"	.006	+0.004	+/- 10%	+/- 10%
1-1/2"	+/- .006	-.006/+0.002	N/A	.025	-0 +1/8	-0 +1/8	.030/36"	.030/36"	.006	+0.006	+/- 10%	+/- 10%
2"	+/- .010	-.006/+0.002	N/A	.035	-0 +3/16	-0 +3/16	.030/36"	.030/36"	.006	+0.006	+/- 10%	+/- 10%
2-1/2"	+/- .012	-.008/+0.002	N/A	.040	-0 +3/16	-0 +3/16	.030/36"	.030/36"	.010	+0.010	+/- 10%	+/- 10%
3"	+/- .015	-.008/+0.003	N/A	.045	-0 +3/16	-0 +3/16	.030/36"	.030/36"	.010	+0.010	+/- 10%	+/- 10%
3-1/2"	+/- .015	-.008/+0.003	N/A	.045	-0 +3/16	-0 +3/16	.030/36"	.030/36"	.010	+0.010	+/- 10%	+/- 10%
4"	+0.015 / -.025	-.008/+0.003	N/A	.045	-0 +3/16	-0 +3/16	.030/36"	.030/36"	.010	+0.010	+/- 10%	+/- 10%
6"	+0.015 / -.025	+0.015 / -.025	N/A	.045	-0 +3/16	-0 +3/16	.030/36"	.030/36"	.010	+0.010	+/- 10%	+/- 10%

** These tolerances apply to 24 ft. lengths or less. For lengths over 24 ft. add a tolerance of 1/8 in. for each 10 ft., or fraction thereof, up to a max of 1/2 in.

*** Applicable only when nominal wall is specified. When minimum wall is specified, the tolerance is -0 +18%.