



# NATAL STAINLESS STEEL

## ASTM A 778 - 90a

### Welded, Unannealed Austenitic Stainless Steel Tubular Products

This specification covers straight seam and spiral butt seam welded unannealed austenitic stainless steel tubular products for low and moderate temperatures and corrosive service where heat treatment is not necessary for corrosion resistance. This specification has minimum mandatory testing and examination requirements.

### Dimensions and Tolerances

- **Tube sizes** normally furnished to this specification are as follows: - 3 in (75 mm) to 48 in (1200 mm) OD - 0.062 in (1.5 mm) to 0.5 in (12.5 mm) wall thickness
- **Length.** Normally furnished in 10 ft (3 m) lengths or over.
- **Length Tolerances.** No tube shall be shorter than specified. No tube shall be more than 0.25 in (6 mm) over that specified.
- **Straightness.** 0.25 in (6 mm) maximum deviation from 10 ft (3 m) straight edge.

### Cross-sectional tolerances

NPS	Outside Diameter (OD) <sup>1</sup>				Wall Thickness(t) <sup>2</sup>		Ovality <sup>3</sup> t < 3%OD
	Under		Over		Under	Over	
	in	mm	in	mm	%	%	%
1/2 to 1 1/2	0.031	0.8	0.015	0.4	12.5	12.5	1.5
>1 1/2 to 4	0.031	0.8	0.031	0.8	12.5	12.5	1.5
>4 to 8	0.031	0.8	0.062	1.6	12.5	12.5	1.5
>8 to 12	0.031	0.8	0.093	2.4	12.5	12.5	1.5
>12 to 18	0.031	0.8	0.093	2.4	12.5	12.5	1.5
>18 to 26	0.031	0.8	0.125	3.2	12.5	12.5	1.5
>26 to 34	0.031	0.8	0.156	4.0	12.5	12.5	1.5
>34 to 48	0.031	0.8	0.187	4.8	12.5	12.5	1.5

#### Notes

- 1 Includes ovality tolerance except for thin wall pipe (i.e. t>3% OD).
- 2 Min wall thickness = Nominal wall thickness (t) x 0.875. Not applicable if filler metal added.
- 3 Ovality = Difference between maximum and minimum OD. For t>3% OD, ovality is within OD tolerances.

### Manufacture

- **Material.** Refer to chemical composition table. Made from flat rolled sheet, coil or plate.
- **Manufacture.** Shielded arc-welding process (manual or automatic). Filler metal may be used. Tubes <14 in (350 mm) have single longitudinal weld or spiral butt weld. Tubes >14 in may have up to 3 longitudinal welds. Circumferential welds are permitted if agreed with purchaser.
- **Heat Treatment.** None.
- **Marking.** ASTM tube general requirements apply plus 'HT-O' to indicate no heat treatment.

### Finish and Repair

- **Weld Bead.** Reinforcement bead <1/16 in (1.6 mm) may be left on either surface of tube, or it may be removed.
- **Weld Defect Repair.** Defects may be removed to sound metal and rewelded.
- **Finish.** Tube will be clean and free of scale.



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## Ordering Information

Item	Notes
Specification number	ASTM A778 - 90a
Size	Outside diameter and wall thickness
Quantity	Random or specified lengths. Total length or number of lengths
Name of material	Welded, unannealed austenitic stainless steel tubes
Grade	Selected from chemical composition table
Weld seam	Straight seam or spiral butt seam welded
Test report	DIN 50049.3.1.B standard, or DIN 50049.3.1.C optional (3rd party witness test) at extra cost
Options and supplementary requirements	Refer to optional and supplementary requirements S1 to S5

### Note

- The above table is based on ASTM requirements except with regard to test reports, where standard practice options are added. See also page 10-2 for ISO based ordering and general delivery information.

## Mandatory Testing

- **Transverse Tension Test.** One test across weld per lot. Alternative test may be agreed for tube <8 in (200 mm) OD.
- **Transverse Guided-Bend Weld Test.** Two test specimens taken transversely from weld for each lot. Test is acceptable if no cracks or other defect exceed 1/8 in (3 mm) in length, in any direction. Cracks <1.4 in (6 mm) along edge of specimen are not considered. Alternative Flattening Test (S5) may be specified for tube <8 in OD.
- **Lot sizes** are: 400 for <3 in OD tube 300 for 3 to <8 in OD tube 200 for 8 to <14 in OD tube 100 for >14 in OD tube

## Optional and Supplementary Requirements

- **Alternative to transverse tension test** may be specified for <8 in OD tube.
- **S1 Etching Tests.** One end of one length from each 2500 ft (760 mm) tested. Test in accordance with Method E340 to show sound, homogeneous, reasonably uniform material, free of injurious laminations, cracks or objectionable defects.
- **S1 Intergranular Corrosion Bend Test.** One end of one length from each 2500 ft (760 m) tested. Test in accordance with Practice E.
- **S1 Packing Requirement.** Ends protected with wooden or plastic plugs.
- **S1 Hydrostatic Test.** Each length tested as per ASTM pipe general requirements in Section 3.
- **S1 Flattening Test.** One test per lot. A section of welded tube >4 in (100 mm) long is flattened with weld at 90° from direction of applied force. No cracks shall occur until distance between plates is <0.5 x OD.

## Tensile Requirements

Grade	UNS	Tensile Strength min		Yield Strength min		Elongation in 2 in (50 mm) min
		ksi	MPa	ksi	MPa	%
TP304L	S30403	70	485	25	170	40
TP316L	S31603	70	485	25	170	40
TP317L	S31703	75	515	30	205	35
TP321	S32100	75	515	30	205	40
TP347	S34700	75	515	30	205	40



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## Chemical Compositions

Grade	UNS	Composition Percentage, max or range								Note
		&DUERn C	0DQJDQHVe Mn	3KRVSkrUXs P	6XOSKXr S	6LOLFnrn Si	1LFNHI Ni	&KURPLXm Cr	0ROIEGHQXm Mo	
TP304L	S30403	0.030	2.00	0.045	0.030	1.00	8.00- 13.00	18.00-20.00	-	1,3
TP316L	S31603	0.030	2.00	0.045	0.030	1.00	10.00- 15.00	16.00-18.00	2.00-3.00	1,3
TP317L	S31703	0.030	2.00	0.045	0.030	1.00	11.00- 14.00	18.00-20.00	3.00-4.00	1,3
TP321	S32100	0.08	2.00	0.045	0.030	1.00	9.00- 12.00	17.00-19.00	-	2,4
TP347	S34700	0.08	2.00	0.045	0.030	1.00	9.00- 13.00	17.00-19.00	-	2,5

## Composition Notes

- 1 Carbon analysis reporting to the nearest 0.001% is required.
- 2 Carbon analysis reporting to the nearest 0.01% is required.
- 3 Nitrogen 0.10% max.
- 4 Titanium >5 x Carbon, 0.70% max
- 5 Niobium + Tantalum: >10 x Carbon, and 1.10% max

### Note

- Niobium is sometimes referred to as Columbium.