

# ASTM - A268/A268M

## Standard Specification for Seamless and Welded Ferritic and Martensitic Stainless Steel Tubing for General Service

This specification covers a number of grades of nominal-wall-thickness, stainless steel tubing for general corrosion-resisting and high-temperature service.

Most of these grades are commonly known as the “straight-chromium” types and are characterized by being ferromagnetic.

Two of these grades, TP410 and UNS S 41500 (Table 1), are amenable to hardening by heat treatment, and the high-chromium, ferritic alloys are sensitive to notchbrittleness on slow cooling to ordinary temperatures.

These features should be recognized in the use of these materials. Grade TP439 is used primarily for hot-water tank service and does not require post-weld heat treatment to prevent attack of the heat affected zone.

❖ **Manufacture :-**

1. The tubes shall be made by the seamless or welded process with no filler metal added.

❖ **Heat Treatment :-**

1. As a final heat treatment, tubes shall be reheated to a temperature of 1200 °F [650 °C] or higher and cooled (as appropriate for the grade) to meet the requirements of this specification.
2. The martensitic grade UNS S 41500 shall be reheated to a temperature of 950 °F [510 °C] or higher and cooled as appropriate to meet the requirements of this specification.

❖ **Chemical Composition :-**

The steel shall conform to the chemical requirements prescribed in Table 1.

**Table 1**

Grade	UNS Designation	C, max	Mn, max	P, max	S, max	Si, max	Ni	Cr	Al	Cu	N	Ti
TP405	S40500	0.08	1	0.04	0.03	1	0.50 max	11.5–14.5	0.10–0.30	...	...	...
TP410	S41000	0.15	1	0.04	0.03	1	...	11.5–13.5	...	...	...	...
TP429	S42900	0.12	1	0.04	0.03	1	...	14.0–16.0	...	...	...	...

TP430	S43000	0.12	1	0.04	0.03	1	...	16.0–18.0	...	...	...	...
TP443	S44300	0.2	1	0.04	0.03	1	0.75 max	18.0–23.0	...	0.90–1.25	...	...
TP446–1	S44600	0.2	1.5	0.04	0.03	1	0.75 max	23.0–27.0	...	...	0.25	...
TP446–2 <sup>A</sup>	S44600	0.12	1.5	0.04	0.03	1	0.50 max	23.0–27.0	...	...	0.25	...
...	S40800	0.08	1	0.045	0.045	1	0.80 max	11.5–13.0	...	...	...	12 × C min; 1.10 max
TP409	S40900	0.08	1	0.045	0.03	1	0.50 max	10.5–11.7	...	...	...	6 × C min; 0.75 max

Grade	UNS Designation	C, max	Mn, max	P, max	S, max	Si, max	Ni	Cr	Mo	Al, max	Cu, max	N, max	Ti	Cb
TP439	S43035	0.07	1	0.04	0.03	1	0.50 max	17.0–19.0	...	0.15	...	0.04	0.20 + 4 (C+N) min, 1.10 max	...
...	S43932	0.03	1	0.04	0.03	1	0.5	17.0–19.0	...	0.15	...	0.030 (Ti + Cb) {0.20 + 4 (C + N)} min.; 0.75 max		
...	S41500 <sup>B</sup>	0.05	0.5–1.0	0.03	0.03	0.6	3.5–5.5	11.5–14.0	0.5–1.0	...	...	...	...	...
TP430 Ti	S43036	0.1	1	0.04	0.03	1	0.75 max	16.0–19.5	...	...	...	...	5×C min, 0.75 max	...
TP XM-27	S44627	0.01 <sup>A</sup>	0.4	0.02	0.02	0.4	0.5 <sup>D</sup> max	25.0–27.5	0.75–1.50	...	0.2	0.015	...	0.05–0.20
TP XM-33 <sup>A</sup>	S44626	0.06	0.75	0.04	0.02	0.75	0.50 max	25.0–27.0	0.75–1.50	...	0.2	0.04	7×(C+N) but no less than 0.20 min; 1.00 max	...
18Cr2Mo	S44400	0.025	1	0.04	0.03	1	1.00 max	17.5–19.5	1.75–2.50	...	...	0.035	(Ti + Cb) = 0.20+4(C + N)min; 0.80 max	...
29-4	S44700	0.01	0.3	0.025	0.02	0.2	0.15 max	28.0–30.0	3.5–4.2	...	0.15	0.020 <sup>E</sup>	...	...
29-4-2	S44800	0.01	0.3	0.025	0.02	0.2	2.0–2.5	28.0–30.0	3.5–4.2	...	0.15	0.020 <sup>E</sup>	...	...

26-3-3	S44660	0.03	1	0.04	0.03	1	1.0– 3.50	25.0– 28.0	3.0– 4.0	...	...	0.04	(Ti + Cb) = 0.20-1.0 and 6×(C+N) min	...
25-4-4	S44635	0.025	1	0.04	0.03	0.75	3.5– 4.5	24.5– 26.0	3.5– 4.5	...	...	0.035	(Ti + Cb) = 0.20+4(C+N) min to 0.80 max	...
...	S44735	0.03	1	0.04	0.03	1	1.00 max	28.0- 30.0	3.6– 4.2	...	...	0.045	(Ti + Cb) = 0.20 +1 and 6×(C+N) min	...
...	S32803	0.015 <sup>C</sup>	0.5	0.02	0.005	0.5	3.0– 4.0	28.0- 29.0	1.8– 2.5	...	...	0.02	...	0.15–0.50 <sup>F</sup>
...	S40977	0.03	1.5	0.04	0.015	1	0.30– 1.00	10.5- 12.5	...	...	...	0.03	...	...
...	S43940	0.03	1	0.04	0.015	1	.	17.5- 18.5	...	...	...	...	0.10–0.60	(3 × %C + 0.30) min
...	S42035	0.08	1	0.045	0.03	1	1.0– 2.5	13.5– 15.5	0.2– 1.2	...	...	...	0.30–0.50	...
TP468	S46800	0.03	1	0.04	0.03	1	0.5	18.00– 20.00	...	...	...	0.03	0.07–0.30	0.10–0.60 and (Ti + Cb) = 0.20+4(C+N) min; 0.80 max

<sup>A</sup> For small diameter or thin walls, or both, tubing, where many drawing passes are required, a carbon maximum of 0.015 % is necessary. Small outside diameter tubes are defined as those less than 0.500 in. [12.7 mm] in outside diameter and light wall tubes as those less than 0.049 in. [1.2 mm] in average wall thickness (0.040 in. [1 mm] in minimum wall thickness). <sup>B</sup> Plate version of CA6NM.

<sup>C</sup> Carbon plus nitrogen = 0.30 max.

<sup>D</sup> Nickel plus copper.

<sup>E</sup> Carbon plus nitrogen = 0.025 % max.

<sup>F</sup> Cb / (C + N) = 12 min.

#### ❖ Tensile Requirements :-

The material shall conform to the tensile properties prescribed in Tables 2 and 3.

**Tables 2**

<b>Grade</b>	<b>UNS Designation</b>	<b>Tensile strength, min, ksi [MPa]</b>	<b>Yield strength, min, ksi [MPa]</b>	<b>Elongation<sup>A,B</sup> in 2 in. or 50 mm, min, %</b>
TP405	S40500	60 [415]	30 [205]	20
...	S40800	55 [380]	30 [205]	20
TP410	S41000	60 [415]	30 [205]	20
TP429, TP430, and TP430Ti	S429000, S43000, and S43036	60 [415]	35 [240]	20
TP443	S44300	70 [485]	40 [275]	20
TP446-1	S44600	70 [485]	40 [275]	18
TP446-2	S44600	65 [450]	40 [275]	20
TP409	S40900	55 [380]	25 [170]	20
TP439	S43035	60 [415]	30 [205]	20
	S43932	60 [415]	30 [205]	20
...	S41500	115 [795]	90 [620]	15
TPXM-27	S44627	65 [450]	40 [275]	20
TPXM-33	S44626	68 [470]	45 [310]	20
18Cr-2Mo	S44400	60 [415]	40 [275]	20
29-4 and 29-4-2	S44700 and S44800	80 [550]	60 [415]	20
26-3-3	S44660	85 [585]	65 [450]	20
25-4-4	S44635	90 [620]	75 [515]	20
...	S44735	75 [515]	60 [415]	18
28-2-3.5	S32803	87 [600]	72 [500]	16
	S40977	65 [450]	41 [280]	18
	S43940	62 [430]	36 [250]	18
	S42035	80 [550]	55 [380]	16
TP468	S46800	60 [415]	30 [205]	22

<sup>A</sup> For tubing smaller than 1/2 in. [12.7 mm] in outside diameter, the elongation values given for strip specimens in Table 2 shall apply. Mechanical property requirements do not apply to tubing smaller than 1/8 in. [3.2 mm] in outside diameter or with walls thinner than 0.015 in. [0.4 mm].

<sup>B</sup> For longitudinal strip tests a deduction of 0.90 % for TP446-1 and S44735 and 1.00 % for all other grades shall be made from the basic minimum elongation for each 1/32 in. [0.8 mm] decrease in wall thickness below 5/16 in. [8 mm]. The following table gives the computed minimum values:

**Tables 3**

Wall Thickness		Elongation <sup>A</sup> in 2 in. or 50 mm, min, %		
in.	mm	TP446-1 and S44735	S41500	All Other Grades
5/16 [0.312]	8	18	15	20
9/32 [0.281]	7.2	17	14	19
1/4 [0.250]	6.4	16	14	18
7/32 [0.219]	5.6	15	13	17
3/16 [0.188]	4.8	14	12	16
5/32 [0.156]	4	13	11	15
1/8 [0.125]	3.2	13	11	14
3/32 [0.094]	2.4	12	10	13
1/16 [0.062]	1.6	11	9	12
0.062–0.035, excl	1.6–0.9	10	8	12
0.035–0.022, excl	0.9–0.6	10	8	11
0.022–0.015, incl	0.6–0.4	10	8	11

<sup>A</sup> Calculated elongation requirements shall be rounded to the nearest whole number.

Note—The above table gives the computed minimum values for each 1/32 in. [0.8 mm] decrease in wall thickness.

Where the wall thickness lies between two values shown above, the minimum elongation value shall be determined by the following equation:

Grade	Equation
TP446-1 and S44735	$E = 28.8t + 9.00$ [ $E = 1.13t + 9.00$ ]
S41500	$E = 24t + 7.5$
All other grades	$E = 32t + 10.00$ [ $E = 1.25t + 10.00$ ] where:
$E = \text{elongation in 2 in. or 50 mm, \%}$	
$t = \text{actual thickness of specimen, in. [mm]}.$	

❖ **Hardness Requirements :-**

The tubes shall have a hardness number not to exceed those prescribed in Table 4.

**Table 4**

Grade	UNS Designation	Brinell Hardness, max	Rockwell Hardness, B Scale, max
TP405	S40500	207	95

...	S40800	207	95
TP410	S41000	207	95
TP429, TP430, and TP430 TI	S42900, S43000, and S43036	190	90
TP443	S44300	207	95
TP446-1 and TP446-2	S44600	207	95
TP409	S40900	207	95
TP439	S43035 <sup>A</sup>	190	90
	S43932	190	90
...	S41500	295 <sup>B</sup>	32
TPXM-33 and TPXM-27	S44626 and S44627	241	100
18CR-2Mo	S44400	217	95
29-4 and 29-4-2	S44700 and S44800	207	100
26-3-3	S44660	265	25 <sup>B</sup>
25-4-4	S44635	270	27 <sup>B</sup>
...	S44735	...	100
28-2-3.5	S32803	240	100
...	S40977	180	88
...	S43940	180	88
...	S42035	180	88

<sup>A</sup> Editorially corrected October 2000.

<sup>B</sup> Rockwell hardness, C scale.

❖ **Mechanical Tests Required :-** 1. Tension Tests.

2. Flaring Test (for Seamless Tubes).
3. Flange Test (for Welded Tubes).
4. Hardness Test.
5. Reverse Flattening Test.
6. Intergranular Corrosion Test :- If intergranular corrosion testing is specified in the purchase order, the test shall be made in accordance with Practices A763, using samples prepared as agreed upon between the seller and the purchaser.

7. Hydrostatic or Non-destructive Electric Test :- Each tube, seamless or welded, shall be subjected to the non-destructive electric test or the hydrostatic test. The type of test to be used shall be at the option of the manufacturer, unless otherwise specified in the purchase order.

❖ **SUPPLEMENTARY REQUIREMENTS :-**

A. Pneumatic Test.

B. Additional Testing of Welded Tubing for 100 % Joint Efficiency in Certain ASME Applications :-

Where this supplement is specified in the purchase order, in certain ASME applications it is permissible to use 100 % joint efficiency for the longitudinal weld, provided the following additional requirements are met:

- i. Each tube shall be subjected to an ultrasonic inspection employing Practices E273 or E213 with the rejection criteria referenced in Specification A1016/A1016M.
- ii. If Practice E273 is employed, a 100 % volumetric inspection of the entire length of each tube shall also be performed using one of the non-destructive electric tests permitted by Specification A1016/A1016M.
- iii. The test methods described in the supplement may not be capable of inspecting the end portions of tubes.
- iv. This condition is referred to as end effect. This portion, as determined by the manufacturer, shall be removed and discarded.

❖ **Keyword**

- [astm a268 specification](#)
- [sa-268 xm27](#)
- [astm a268 pdf download](#)
- [astm a268 pdf](#)
- [sa 268 tp 410](#)
- [astm a268 free pdf download](#)
- [a268 material](#)