

Specification	Grade	Cb	Mnb	P	S	Si	Cr	Mo	Ni	V	Cb	Ti
API 5L 44th Ed (PSL 1) Seamless	A25	.21	.60	.030	.030	-	-	-	-	-	-	-
	A	.22	.90	.030	.030	-	-	-	-	-	-	-
	B	.28	1.20	.030	.030	-	-	-	-	c,d	c,d	d
	X42	.28	1.30	.030	.030	-	-	-	-	d	d	d
	X46	.28	1.40	.030	.030	-	-	-	-	d	d	d
	X52	.28	1.40	.030	.030	-	-	-	-	d	d	d
	X56	.28	1.40	.030	.030	-	-	-	-	d	d	d
	X60	.28 <sup>e</sup>	1.40 <sup>e</sup>	.030	.030	-	-	-	-	f	f	f
	X65	.28 <sup>e</sup>	1.40 <sup>e</sup>	.030	.030	-	-	-	-	f	f	f
	X70	.28 <sup>e</sup>	1.40 <sup>e</sup>	.030	.030	-	-	-	-	f	f	f
API 5L 44th Ed (PSL 1) Welded	A25	.21	.60	.030	.030	-	-	-	-	-	-	-
	A	.22	.90	.030	.030	-	-	-	-	-	-	-
	B	.26	1.20	.030	.030	-	-	-	-	c,d	c,d	d
	X42	.26	1.30	.030	.030	-	-	-	-	d	d	d
	X46	.26	1.40	.030	.030	-	-	-	-	d	d	d
	X52	.26	1.40	.030	.030	-	-	-	-	d	d	d
	X56	.26	1.40	.030	.030	-	-	-	-	d	d	d
	X60	.26 <sup>e</sup>	1.40 <sup>e</sup>	.030	.030	-	-	-	-	f	f	f
	X65	.26 <sup>c</sup>	1.40 <sup>c</sup>	.030	.030	-	-	-	-	f	f	f
	X70	.26 <sup>e</sup>	1.65 <sup>e</sup>	.030	.030	-	-	-	-	f	f	f

Specification	Grade	Cond	Cb	Mnb	P	S	Si	V	Cb	Ti	Other	IIW	Pcm
API 5L 44th Ed (PSL 2) (Seamless & Welded)	B	R or N	.24	1.20	.025	.015	.40	c	c	.04	e	.43	.25
	X42	R or N	.24	1.20	.025	.015	.40	.06	.05	.04	e	.43	.25
	X46	N	.24	1.40	.025	.015	.40	.07	.05	.04	d, e	.43	.25
	X52	N	.24	1.40	.025	.015	.45	.10	.05	.04	d, e	.43	.25
	X56	N	.24	1.40	.025	.015	.45	.10 <sup>f</sup>	.05	.04	d, e	.43	.25
	X60	N	.24 <sup>f</sup>	1.40 <sup>f</sup>	.025	.015	.45 <sup>f</sup>	.10 <sup>f</sup>	.05 <sup>f</sup>	.04 <sup>f</sup>	d, h	as agreed to	
API 5L 44th Ed (PSL 2) (Seamless & Welded)	B	Q	.18	1.40	.025	.015	.45	.05	.04	.04	e	.43	.25
	X42	Q	.18	1.40	.025	.015	.45	.06	.05	.04	e	.43	.25
	X46	Q	.18	1.40	.025	.015	.45	.07	.05	.04	e	.43	.25
	X52	Q	.18	1.50	.025	.015	.45	.10	.05	.04	e	.43	.25
	X56	Q	.18	1.50	.025	.015	.45	.10	.05	.04	d, e	.43	.25
	X60	Q	.18 <sup>f</sup>	1.70 <sup>f</sup>	.025	.015	.45 <sup>f</sup>	[V + Cb + Ti <= .15]			e	.4	.25
	X65	Q	.18 <sup>f</sup>	1.70 <sup>f</sup>	.025	.015	.45 <sup>f</sup>	[V + Cb + Ti <= .15]			h	.43	.25
	X70	Q	.18 <sup>f</sup>	1.80 <sup>f</sup>	.025	.015	.45 <sup>f</sup>	[V + Cb + Ti <= .15]			h	.43	.25
	X80	Q	.18 <sup>f</sup>	1.90 <sup>f</sup>	.025	.015	.45 <sup>f</sup>	[V + Cb + Ti <= .15]			i, j	as agreed to	
API 5L 44th Ed (PSL 2) (Welded Only)	B	M	.22	1.20	.025	.015	.45	.05	.05	.04	e	.43	.25
	X42	M	.22	1.30	.025	.015	.45	.05	.05	.04	e	.43	.25
	X46	M	.22	1.30	.025	.015	.45	.05	.05	.04	e	.43	.25
	X52	M	.22	1.40	.025	.015	.45	[V + Cb + Ti <= .15]			e	.43	.25
	X56	M	.22	1.40	.025	.015	.45	[V + Cb + Ti <= .15]			e	.43	.25
	X60	M	.12 <sup>f</sup>	1.60 <sup>f</sup>	.025	.015	.45 <sup>f</sup>	[V + Cb + Ti <= .15]			h	.43	.25
	X65	M	.12 <sup>f</sup>	1.60 <sup>f</sup>	.025	.015	.45 <sup>f</sup>	[V + Cb + Ti <= .15]			h	.43	.25
	X70	M	.12 <sup>f</sup>	1.70 <sup>f</sup>	.025	.015	.45 <sup>f</sup>	[V + Cb + Ti <= .15]			h	.43	.25
	X80	M	.12 <sup>f</sup>	1.85 <sup>f</sup>	.025	.015	.45 <sup>f</sup>	[V + Cb + Ti <= .15]			l	.43 <sup>f</sup>	.25
	X90	M	.12 <sup>f</sup>	1.85 <sup>f</sup>	.025	.015	.45 <sup>f</sup>	[V + Cb + Ti <= .15]			l	-	.25
	X100	M	.12 <sup>f</sup>	1.85 <sup>f</sup>	.025	.015	.45 <sup>f</sup>	[V + Cb + Ti <= .15]			i, j	-	.25
	X120	M	.12 <sup>f</sup>	1.85 <sup>f</sup>	.025	.015	.45 <sup>f</sup>	[V + Cb + Ti <= .15]			i, j	-	.25

# ASTM A53 Grade A & B Steel Pipe

## Chemical Composition and Mechanical Properties



Chemical Composition									
Grade	Max, %								
	Carbon	Manganese	Phosphorus	Sulfur	Copper	Nickel	Chromium	Molybdenum	Vanadium
Type S (seamless pipe)									
Grade A	0.25	0.95	0.05	0.045	0.4	0.4	0.4	0.15	0.08
Grade B	0.3	1.2	0.05	0.045	0.4	0.4	0.4	0.15	0.08
Type E (electric-resistance-welded)									
Grade A	0.25	0.95	0.05	0.045	0.4	0.4	0.4	0.15	0.08
Grade B	0.3	1.2	0.05	0.045	0.4	0.4	0.4	0.15	0.08
Type F (furnace-welded pipe)									
Grade A	0.3	1.2	0.05	0.045	0.4	0.4	0.4	0.15	0.08

Mechanical Properties		
Strength	Grade A	Grade B
Tensile strength, min, psi [MPa]	48 000 [330]	60 000 [415]
Yield strength, min, psi [MPa]	30 000 [205]	35 000 [240]
Elongation in 2 in. or 50 mm	$e = 625\,000 [1940] A^{0.2}/U^{0.9}$	



TABLE 1 Chemical Requirements

Grade	UNS Designation <sup>A</sup>	Composition, % <sup>B</sup>																
		Carbon	Manganese	Phosphorus	Sulfur	Silicon	Chromium	Nickel	Molybdenum	Titanium	Columbium	Tantalum, max	Nitrogen <sup>C</sup>	Vanadium	Copper	Cerium	Boron	Aluminum
TP304	S30400	0.08	2.00	0.045	0.030	1.00	18.0-20.0	8.0-11.0	...	...	...	...	...	...	...	...	...	...
TP304L	S30403	0.035 <sup>D</sup>	2.00	0.045	0.030	1.00	18.0-20.0	8.0-13.0	...	...	...	...	...	...	...	...	...	...
TP309S	S30908	0.08	2.00	0.045	0.030	1.00	22.0-24.0	12.0-15.0	0.75	...	...	...	...	...	...	...	...	...
TP310S	S31008	0.08	2.00	0.045	0.030	1.00	24.0-26.0	19.0-22.0	0.75	...	...	...	...	...	...	...	...	...
TP316	S31600	0.08	2.00	0.045	0.030	1.00	16.0-18.0	11.0-14.0 <sup>E</sup>	2.00-3.00	...	...	...	...	...	...	...	...	...
TP316L	S31603	0.035 <sup>D</sup>	2.00	0.045	0.030	1.00	16.0-18.0	10.0-14.0	2.00-3.00	...	...	...	...	...	...	...	...	...
TP317	S31700	0.08	2.00	0.045	0.030	1.00	18.0-20.0	11.0-14.0	3.0-4.0	...	...	...	...	...	...	...	...	...
TP317L	S31703	0.035	2.00	0.045	0.030	1.00	18.0-20.0	11.0-15.0	3.0-4.0	...	...	...	...	...	...	...	...	...
TP321	S32100	0.08	2.00	0.045	0.030	1.00	17.0-19.0	9.0-12.0	...	<sup>G</sup>	...	...	0.10	...	...	...	...	...
TP347	S34700	0.08	2.00	0.045	0.030	1.00	17.0-19.0	9.0-13.0	...	...	...	...	...	...	...	...	...	...
TP347H	S34709	0.04-0.10	2.00	0.045	0.030	1.00	17.0-19.0	9.0-13.0	...	...	<sup>J</sup>	...	...	...	...	...	...	...
TP348	S34800	0.08	2.00	0.045	0.030	1.00	17.0-19.0	9.0-13.0	...	...	<sup>I</sup>	0.10	...	...	...	...	...	...
TP348H	S34809	0.04-0.10	2.00	0.045	0.030	1.00	17.0-19.0	9.0-13.0	...	...	<sup>J</sup>	0.10	...	...	...	...	...	...

<sup>A</sup> New designation established in accordance with Practice E 527 and SAE J1086.

<sup>B</sup> Maximum, unless otherwise indicated.

<sup>C</sup> The method of analysis for nitrogen shall be a matter of agreement between the purchaser and manufacturer.

<sup>D</sup> For small diameter or thin walls or both, where many drawing passes are required, a carbon maximum of 0.040 % is necessary in grades TP304L and TP316L. 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. [1.20 mm] in average wall thickness (0.044 in. [1.10 mm] in minimum wall thickness).

<sup>E</sup> For welded TP316, TP316N, TP316LN, and TP316H pipe, the nickel range shall be 10.0-14.0 %.

<sup>F</sup> For welded pipe, the phosphorus maximum shall be 0.045 %.

<sup>G</sup> The titanium content shall be not less than five times the carbon content and not more than 0.70 %.

<sup>H</sup> The titanium content shall be not less than four times the carbon content and not more than 0.60 %.

<sup>I</sup> The columbium content shall be not less than ten times the carbon content and not more than 1.00 %.

<sup>J</sup> The columbium content shall be not less than eight times the carbon content and not more than 1.0 %.

<sup>K</sup> Grade S34751 shall have a columbium (niobium) plus tantalum content of not less than 15 times the carbon content.



Nominal Diameter		Outside Diameter (mm)	OD Tolerances (mm)	Wall Thickness, mm ( $\pm 12.5\%$ )	
inch	mm			DIN 2440	DIN 2441
1/8	6	10.2	+0.4 ; -0.4	2.00	2.65
1/4	8	13.5	+0.5 ; -0.3	2.35	2.90
3/8	10	17.2	+0.5 ; -0.3	2.35	2.90
1/2	15	21.3	+0.5 ; -0.3	2.65	3.25
3/4	20	26.9	+0.4 ; -0.4	2.65	3.25
1	25	33.7	+0.5 ; -0.4	3.25	4.05
1-1/4	32	42.4	+0.5 ; -0.4	3.25	4.05
1-1/2	40	48.3	+0.5 ; -0.4	3.25	4.05
2	50	60.3	+0.5 ; -0.4	3.65	4.05
2-1/2	65	76.1	+0.5 ; -0.8	3.65	4.05
3	80	88.9	+0.6 ; -0.9	4.05	4.85
4	100	114.3	+0.7 ; -1.2	4.50	5.40
5	125	139.7	+1.1 ; -1.2	-	5.40

استاندارد DIN 2440, DIN 2441

ضخامت لوله های مانیسمان (میلی متر) بر اساس استاندارد ASME B36.10M

SCHEDULE

Nominal pipe size mm(inch)	OD		20	30	STD	40	60	XS	80	100	120	140	160	XXS
	in	mm												
15(1/2)	0.84	21.30	-	-	2.77	2.77	-	3.73	3.73	-	-	-	4.78	7.47
20(3/4)	1.05	26.70	-	-	2.87	2.87	-	3.91	3.91	-	-	-	5.56	7.82
25(1)	1.31	33.40	-	-	3.38	3.38	-	4.55	4.55	-	-	-	6.35	9.09
32(1.1/4)	1.66	42.20	-	-	3.56	3.56	-	4.85	4.85	-	-	-	6.35	9.70
40(1.1/2)	1.90	48.30	-	-	3.68	3.68	-	5.08	5.08	-	-	-	7.14	10.15
50(2)	2.37	60.30	-	-	3.91	3.91	-	5.54	5.54	-	-	-	8.74	11.07
65(2.1/2)	2.87	73.00	-	-	5.16	5.16	-	7.01	7.01	-	-	-	9.53	14.02
80(3)	3.50	88.90	-	-	5.49	5.49	-	7.62	7.62	-	-	-	11.13	15.24
90(3.1/2)	4.00	101.60	-	-	5.74	5.74	-	8.08	8.08	-	-	-	-	-
100(4)	4.50	114.30	-	-	6.02	6.02	-	8.56	8.56	-	11.13	-	13.49	17.12
125(5)	5.56	141.30	-	-	6.55	6.55	-	9.53	9.53	-	12.70	-	15.88	19.05
150(6)	6.62	168.30	-	-	7.11	7.11	-	10.97	10.97	-	14.27	-	18.26	21.95
200(8)	8.62	219.10	6.35	7.04	8.18	8.18	10.31	12.70	12.70	15.09	18.26	20.62	23.01	22.23
250(10)	10.75	273.10	6.35	7.80	9.27	9.27	12.70	12.70	15.09	18.26	21.44	25.40	28.58	25.40
300(12)	12.75	323.90	6.35	8.38	9.53	10.31	14.27	12.70	17.48	21.44	25.40	28.58	33.32	25.40
350(14)	14.00	355.60	6.35	9.53	9.53	11.13	15.09	12.70	19.05	28.83	27.79	31.75	35.71	-
400(16)	16.00	406.40	7.92	9.53	9.53	12.70	16.66	12.70	21.44	26.19	30.96	36.53	40.49	-