

Tolerances (Excerpts from API Specifications)

Pipe Specification		API 5L		API 5LU	
Outside Diameter	1.900 in. and smaller 2-3/8 in. through 18 in.	+ 0.016 in. + 0.75%	- 0.031 in. - 0.75%		
	20 in. through 36 in. Non-expanded Cold-expanded	+ 1.00% + 0.75%	- 1.00% - 0.25%	Less than 20 in. 20 in. and larger	+ 0.75% + 1.00% - 0.75% - 1.00%
Pipe Ends*1	Larger than 36 in. Non-expanded Cold-expanded*2	+ 1.00% + 1/4 in.	- 1.00% - 1/8 in.		
	10-3/4 in. and smaller	+ 1/15 in. (measured with ring gage)	- 1/64 in. (measured with ring gage)	10-3/4 in. and smaller	+ 1/16 in. (measured with ring gage)
Wall Thickness	12-3/4 in. through 20 in.	+ 3/32 in. (measured with ring gage)	- 1/32 in. (measured with ring gage)	12-3/4 in. through 20 in.	+ 3/32 in. (measured with ring gage)
	Larger than 20 in. (22 in. and larger)	+ 3/32 in. (measured with diameter tape)	- 1/32 in. (measured with diameter tape)	Larger than 20 in.	+ 3/32 in. (measured with diameter tape)
Weight	Welded Pipe: 2.875 in. OD and smaller 3-1/2 in. OD 4 in. through 18 in. OD 20 in. OD and larger	Grade A, B + 20.0% + 18.0% + 15.0% + 17.5%	- 12.5% - 12.5% - 12.5% - 10.0%	Welded Pipe: 18 in. OD and smaller 20 in. OD and larger	+ 15.0% + 19.5% - 12.5% - 8.0%
	Seamless Pipe: 2.875 in. OD and smaller 3-1/2 in. OD 4 in. through 18 in. OD 20 in. OD and larger	Grade A, B + 20.0% + 18.0% + 15.0% + 15.0%	- 12.5% - 12.5% - 12.5% - 12.5%	Seamless Pipe: 18 in. OD and smaller 20 in. OD and larger	+ 15.0% + 17.5% - 12.5% - 10.0%
Straightness	Standard weight Regular weight Extra strong weight Double extra strong weight Special plain end weight	+ 10.0%	- 3.5%	Regular weight	+ 10.0% - 3.5%
	Carload Lots		- 1.75%	Special light weight	+ 10.0% - 5.0%
Out of Roundness (for pipe larger than 20in. OD)	For pipe 4-1/2 in. OD and larger	Max. 0.2%			- 1.75% Max. 0.2%
Pipe End Preparation	Max. OD - specified OD \leq 1% x specified OD Specified OD - min. OD \leq 1% x specified OD			Max. OD - specified OD \leq 1% x specified OD Specified OD - min. OD \leq 1% x specified OD	
Note	For pipe 2/38 in. OD and larger Bevel angle 30° + 5° - 0° Root face 1/16 in. \pm 1/32 in. Squareness for 10-3/4 in. OD and larger max. 1/16 in.			Bevel angle 30° + 5° - 0° Root face 1/15 in. \pm 1/32 in. Squareness 10-3/4 in. OD and larger max. 1/16 in.	

Note * 1 Pipe and tolerances are applicable 4 in. from either end.
* 2 Not applicable to pipe hydrostatically tested to pressures in excess of standard test pressures.

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Tensile and Chemical Requirements (Excerpts from API Specifications, 1983 edition)

Application	Grade	Tensile Requirements						Elongation	
		Yield Strength			Tensile Strength			% min	min
		psi min	MPa min	kg/mm ² min	psi min	MPa min	kg/mm ² min		
Line Pipe	API 5L Grade A	30,000	207	21.1	48,000	331	33.7	$e = \frac{625,000}{U} \frac{A^{0.2}}{0.9}$	
	API 5L Grade B	35,000	241	24.6	60,000	413	42.2		
	API 5L Grade X42	42,000	289	29.5	60,000	413	42.2		
	API 5L Grade X46	46,000	317	32.3	63,000	434	44.3		
	API 5L Grade X52	52,000	358	36.6	(1) 66,000 * ¹ (2) 72,000	(1) 455 (2) 496	46.4 50.6		
	API 5L Grade X56 * ⁶	56,000	386	39.2	(1) 71,000 * ¹ (2) 75,000	(1) 489 (2) 517	49.9 52.7		
	API 5L Grade X60 * ³ * ⁶	60,000	413	42.2	(1) 75,000 * ¹ (2) 78,000	(1) 517 (2) 537	52.7 54.8		
	API 5L Grade X65 * ⁸ * ¹¹	65,000	448	45.7	(1) 77,000 * ¹ (2) 80,000	(1) 530 (2) 551	54.1 56.2		
	API 5L Grade X70 * ⁶ * ¹¹	70,000	482	49.2	82,000	565	57.6		
	API 5LU Grade X80	80,000	551	56.2	* ⁴ 95,000/125,000	655/862	66.8/87.8		
	API 5LU Grade X100	100,000	689	70.3	* ⁴ 110,000/135,000	758/931	77.3/94.9		

- *1 (1) Wall thickness > 0.375in., OD ≥ 20in.
Any wall thickness, OD < 20in.
(2) Wall thickness ≤ 0.375in., OD ≥ 20in.

- *2 The minimum elongation in 2 inches (60.8 mm) shall be determined by the following formula:

$$e = \frac{625,000}{U} \frac{A^{0.2}}{0.9}$$

where:

e = minimum elongation in 2 inches (50.80 mm) in per cent rounded to the nearest 1/2 per cent.

A = cross sectional area of the tensile test specimen in square inches, based on specified outside diameter or nominal specimen width and specified wall thickness rounded to the nearest 0.01 sq. in., or 0.75 sq. in., whichever is smaller.

U = specified tensile strength, psi.

- *3 The minimum tensile strength for grade X60 electric-resistance welded pipe in all sizes and wall thick-nesses shall be 75,000 psi (52.7 kg/mm²).

- *4 Tensile strength means min. value/max. value

- *5 Figures in parentheses are values for seamless pipe. Upper line value means non-expanded, Lowerline value means cold-expanded. In grades X42 through X65, for each reduction of 0.01 per cent below the maximum carbon content, an increase of 0.05 per cent manganese above the specified maximum is permissible, up to a maximum of 1.45 per cent for X52 and lower and up to a maximum of 1.60 per cent for grades higher than X52.

- *6 Other chemical analyses may be furnished by agreement between purchaser and manufacturer.

- *7 Either columbium, vanadium, titanium, or a combination thereof, shall be used at the discretion of the manufacturer.

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Chemical Requirements for Ladle Analyses, %							
C ^{*5}	Si	Mn ^{*5}	P	S	Cb	V	Ti
max	max	max	max	max	min	min	min
0.21 (0.22)		0.90	0.04	0.05			
0.26 (0.27)		1.15	0.04	0.05			
^{*13} 0.28 (0.29)		1.25	0.04	0.05			
0.30 (0.31) ^{*13} 0.28 (0.29)		1.35 1.25	0.04	0.05			
0.30 (0.31) ^{*13} 0.28 (0.29)		1.35 1.25	0.04	0.05			
0.26		1.35	0.04	0.05	0.005 ^{*7}	0.02 ^{*7}	0.03 ^{*7}
0.26		1.35	0.04	0.05	0.005 ^{*7}	0.02 ^{*7}	0.03 ^{*7}
0.26		1.40	0.04	0.05	0.005 ^{*9}	0.02 ^{*9}	
0.23 ^{*10}		1.60 ^{*10}	0.04	0.05			
0.26 ^{*12}	0.35	1.40 ^{*12}	0.04	0.05			
0.26 ^{*12}	0.35	1.40 ^{*12}	0.04	0.05			

*8 For grades X65 in sizes 16in. and larger with wall thickness 0.500 in. and less, the chemical composition shall be as shown or as agreed upon between the purchaser and manufacturer. For other sizes and wall thicknesses the chemical composition shall be as agreed upon between the purchaser and manufacturer. (Applicable to welded pipe only.)

*9 Either columbium or vanadium or a combination of both shall be used at the discretion of the manufacturer.

*10 For each reduction of 0.01 per cent below the specified maximum carbon content, an increase of 0.05 per cent manganese above the specified maximum is permissible.

*11 For seamless pipe of grades X65 and X70, the chemical composition shall be agreed upon between the purchaser and manufacturer.

*12 For each reduction of 0.01% below the specified maximum carbon content, an increase of 0.05% manganese above the specified maximum is permissible, up to a maximum of 1.50%.

*13 For cold expanded seamless pipe in size 20 in, and larger, the maximum carbon content shall be 0.28 percent.

Tolerances (Excerpts from API Specifications)

Mechanical Values					Chemical Analysis							
Material	Tensile Strength N/mm2	Yield Strength (Min)	Elongation % min.	C %	Si %	Mn %	P % max.	S % max.	Mo %	Cr %	Ni %	Div %
A53-Grade A	min. 330	205	variable	max. 0.25	-	max. 0.95	0.050	0.80				
A53-Grade B	min. 415	240	variable	max. 0.30	-	max. 1.20	0.050	0.60				
A106-Grade A	min. 330	205	35	max. 0.25	min. 0.10	0.27-0.93	0.048	0.058				
A106-Grade B	min. 415	240	30	max. 0.30	min. 0.10	0.29-1.06	0.048	0.058				
A179	Hardness Rb. max. 72			0.06-0.18	-	0.27-0.63	0.048	0.058				
A333-Grade 1	min. 379	207	35	max. 0.30	-	0.40-1.06	0.050	0.60				
A333-Grade 6	min. 414	241	30	max. 0.30	min. 0.10	0.29-1.06	0.048	0.058				
A333-Grade 3	min. 448	241	30	max. 0.19	0.18-0.37	0.31-0.64	0.050	0.050			3.18-3.82	
A335-Grade P1	min. 379	207	30	0.10-0.20	0.10-0.50	0.30-0.80	0.045	0.045	0.44-0.65			
A335-Grade P5	min. 414	207	30	max. 0.15	max. 0.50	0.30-0.60	0.030	0.030	0.44-0.55	4.00-6.00		
A335-Grade P11	min. 414	207	30	max. 0.15	0.50-1.00	0.30-0.60	0.030	0.030	0.44-0.65	1.00-1.50		
A335-Grade P12	min. 414	207	30	max. 0.15	max. 0.50	0.30-0.60	0.045	0.045	0.44-0.65	0.80-1.25		
A335-Grade P22	min. 414	207	30	max. 0.15	max. 0.50	0.30-0.60	0.030	0.030	0.87-1.13	1.90-2.60		
API-5L-Grade A	min. 331	207	variable	max. 0.22	-	max. 0.90	0.040	0.050				
API-5L-Grade B	min. 413	241	variable	max. 0.27	-	max. 1.15	0.040	0.050				
API-5L-Grade X42	min. 413	289	variable	max. 0.29	-	max. 1.25	0.040	0.050				
API-5L-Grade X46	min. 434	317	variable	max. 0.29	-	max. 1.35	0.040	0.050				
API-5L-Grade X52	min. 455	358	variable	max. 0.31	-	max. 1.35	0.040	0.050				
API-5L-Grade X56	min. 489	386	variable	max. 0.26	-	max. 1.35	0.040	0.050				
API-5L-Grade X60	min. 517	413	variable	max. 0.26	-	max. 1.35	0.040	0.050				
BS3059/1-320	320-480	195	25	max. 0.16	-	min. 0.30	0.050	0.050				
BS3059/2-360	360-500	215	24	max. 0.17	max. 0.35	0.40-0.80	0.045	0.045				
BS3601-ERW320	320-440	195	25	max. 0.16	-	0.30-0.70	0.050	0.050				
BS3601-ERW360	360-480	215	24	max. 0.17	max. 0.35	0.40-0.80	0.045	0.045				
BS3602-ERW/SAW410	410-530	235	22	max. 0.21	max. 0.35	0.40-1.20	0.050	0.050				
BS3601-S360	360-480	215	24	max. 0.17	max. 0.35	0.40-0.80	0.050	0.050				
BS3601-S410	410-530	235	22	max. 0.21	max. 0.35	0.40-1.20	0.050	0.050				
BS3602/1-360	360-500	215	24	max. 0.17	max. 0.35	0.40-0.80	0.045	0.045				
BS3602/1-410	410-550	245	22	max. 0.21	max. 0.35	0.40-1.20	0.045	0.045				
BS3602/1-490Nb	490-630	340	20	max. 0.23	max. 0.35	0.80-1.50	0.045	0.045				Nb 0.01-0.10
BS3602/2-410	410-550	245	24	max. 0.20	max. 0.35	0.50-1.30	0.040	0.040				
BS3603-410	410-530	235	22	max. 0.20	max. 0.35	0.60-1.20	0.045	0.045				
BS3603-503	440-590	245	16	max. 0.15	0.15-0.35	0.30-0.80	0.025	0.020			3.25-3.75	
BS3604-620	440-590	290	22	0.10-0.18	0.10-0.35	0.40-0.70	0.050	0.050	0.45-0.65	0.70-1.10		
BS3604-622	440-640	275	20	0.08-0.15	max. 0.50	0.40-0.70	0.040	0.040	0.90-1.20	2.00-2.50		
BS3604-625	450-600	170	20	max. 0.15	max. 0.50	0.30-0.60	0.040	0.040	0.45-0.65	4.00-6.00		
BS4360-50D	490-640	355	20	max. 0.20	max. 0.40	max. 1.40	0.040	0.040				Nb 0.003-0.10 V 0.0003-0.1

Tolerances (Excerpts from API Specifications)

Technical Standards			Comparable Qualities					
Material	Specification Standard	Dimensional Standard	ASTM	API	BS	DIN	Euro Standard EU 25-72	DIV
A53	A53	ANSI-B36.10		API-5L-Gr.A	3601-320/360	St. 37.0	FE 310	
A53	A53	ANSI-B36.10		API-5L-Gr.B	3601-410	St. 44.0	Fe 360B/430B	BS4360-43B/C
A106/A530	A106/A530	ANSI-B 36.10		API-5L-Gr.A	3602-S360	St. 35.8		
A106/A530	A106/A530	ANSI-B 36.10		API-5L-Gr.B	3602-S410	St. 45.8		
A179/A450	A179/A450	ANSI-B 36.10			3059-320/360	St. 35.8		
A333/A530	A333/A530	ANSI-B 36.10			360 1HFS27LT50	TT St.35N		
A333/A530	A333/A530	ANSI-B 36.10			3603HFS503LT100	TT St.35V		
A333/A530	A333/A530					10 Ni 14		
A335/A530	A335/A530	ANSI-B 36.10				15 Mo 3/16 Mo 5		
A335/A530	A335/A530	ANSI-B 36.10			3604-625	12 Cr Mo 19.5		
A335/A530	A335/A530	ANSI-B 36.10			3604-620-440-460	13 Cr Mo 44		
A335/A530	A335/A530	ANSI-B 36.10			3604-620-440-460	13 Cr Mo 44		
A335/A530	A335/A530	ANSI-B 36.10			3604-620-440	10 Cr Mo 910		
API-5L	API-5L	API-5L	A53 Gr.A		3601-320/360	St. 37.0	Fe 310	St.E 210.7
API-5L	API-5L	API-5L	A53 Gr.B		3601-410-4360-43B/C	St. 44.0	Fe 360B/430B	St E 240.7
API-5L	API-5L	API-5L			4360-43 B/C	St. E 290.7	Fe 430B	
API-5L	API-5L	API-5L				St. E 320.7		
API-5L	API-5L	API-5L			4360-50 B/C/D	St. E 360.7	Fe510B/C/D	St. E 355
API-5L	API-5L	API-5L				St. E 385.7		
API-5L	API-5L	API-5L				St. E 415.7		
BS3059 part1	BS3059 part1	BS3059 part1	A179			St.35.8/St.37.8		
BS3059 part2	BS3059 part2	BS3059 part2	A179			St.35.8/St.37.8		
BS3601	BS3601	BS1600/BS3600	A53 Gr.A	5L-Gr.A		St. 33	Fe 310	
BS3601	BS3601	BS1600/BS3600	A53 Gr.B	5L-Gr.B		St.37.0/St.37.2	Fe 360B	A672-B60
BS3601	BS3601	BS1600/BS3600	A53 Gr.B	5L-Gr.B	4360-43B/C	St.44.0/St.44.3	Fe430B/C	A672-B65/C65
BS3601	BS3601	BS1600/BS3600	A106 Gr.B	5L-Gr.B		St.37.0/St.37.2	Fe 360B	
BS3601	BS3601	BS1600/BS3600	A106 Gr.B	5L-Gr.B		St.44.0/St.44.3		
BS3602 part1	BS3602 part1	BS1600/BS3600	A106 Gr.B	5L-Gr.B		St.35.8/St.37.8		
BS3602 part1	BS3602 part1	BS1600/BS3600	A106 Gr.B	5L-Gr.B		St.45.8		
BS3602 part1	BS3602 part1	BS1600/BS3600		5L-Gr.X52	4360-50 B/C/D	St.52/St52.3	Fe510 B/C/D	
BS3602 part2	BS3602 part2	BS1600/BS3600	A672 B65/C65	5L-Gr.B	4360-43 B/C	St. E240.7	Fe 430 B/C	
BS3603	BS3603	BS1600/BS3600	A333 Gr.6			TT St. 35V		
BS3603	BS3603	BS1600/BS3600	A333 Gr.3			10 Ni 14		
BS3604	BS3604	BS1600/BS3600	A335 P12			13 Cr Mo 44		
BS3604	BS3604	BS1600/BS3600	A335 P22			10 Cr Mo 910		
BS3604	BS3604	BS1600/BS3600	A335 P5			12 Cr Mo 195		
BS4360	BS4360	BS1600	A671 CC70	5L-X52		St. 52-3	Fe 510D	St. E 555