9.3 Tensile properties

9.3.1 For PSL 1 pipe, the tensile properties shall be as given in Table 6.

9.3.2 For PSL 2 pipe, the tensile properties shall be as given in Table 7.

Table 6 — Requirements for the results of tensile tests for PSL 1 pipe

Pipe grade	Pipe body of seamless and welded pipes			Weld seam of EW, LW, SAW and COW pipes
	Yield strength [a] $R_{t0,5}$ MPa (psi) minimum	Tensile strength [a] R_m MPa (psi) Minimum	Elongation (on 50 mm or 2 in) A_f % minimum	Tensile strength [b] R_m MPa (psi) Minimum
L175 or A25	175 (25 400)	310 (45 000)	[c]	310 (45 000)
L175P or A25P	175 (25 400)	310 (45 000)	[c]	310 (45 000)
L210 or A	210 (30 500)	335 (48 600)	[c]	335 (48 600)
L245 or B	245 (35 500)	415 (60 200)	[c]	415 (60 200)
L290 or X42	290 (42 100)	415 (60 200)	[c]	415 (60 200)
L320 or X46	320 (46 400)	435 (63 100)	[c]	435 (63 100)
L360 or X52	360 (52 200)	460 (66 700)	[c]	460 (66 700)
L390 or X56	390 (56 600)	490 (71 100)	[c]	490 (71 100)
L415 or X60	415 (60 200)	520 (75 400)	[c]	520 (75 400)
L450 or X65	450 (65 300)	535 (77 600)	[c]	535 (77 600)
L485 or X70	485 (70 300)	570 (82 700)	[c]	570 (82 700)

[a] For intermediate grades, the difference between the specified minimum tensile strength and the specified minimum yield strength for the pipe body shall be as given in the table for the next higher grade.

[b] For intermediate grades, the specified minimum tensile strength for the weld seam shall be the same value as was determined for the pipe body using footnote a).

[c] The specified minimum elongation, A_f, expressed in percent and rounded to the nearest percent, shall be as determined using the following equation:

$$A_f = C\frac{A_{xc}^{0,2}}{U^{0,9}}$$

where

C is 1 940 for calculations using SI units and 625 000 for calculations using USC units;

A_{xc} is the applicable tensile test piece cross-sectional area, expressed in square millimetres (square inches), as follows:

- for circular cross-section test pieces, 130 mm^2 (0.20 in^2) for 12,7 mm (0.500 in) and 8,9 mm (0.350 in) diameter test pieces; and 65 mm^2 (0.10 in^2) for 6,4 mm (0.250 in) diameter test pieces;
- for full-section test pieces, the lesser of a) 485 mm^2 (0.75 in^2) and b) the cross-sectional area of the test piece, derived using the specified outside diameter and the specified wall thickness of the pipe, rounded to the nearest 10 mm^2 (0.01 in^2);
- for strip test pieces, the lesser of a) 485 mm^2 (0.75 in^2) and b) the cross-sectional area of the test piece, derived using the specified width of the test piece and the specified wall thickness of the pipe, rounded to the nearest 10 mm^2 (0.01 in^2);

U is the specified minimum tensile strength, expressed in megapascals (pounds per square inch).

Table 7 — Requirements for the results of tensile tests for PSL 2 pipe

Pipe grade	Pipe body of seamless and welded pipes						Weld seam of HFW, SAW and COW pipes
	Yield strength [a] $R_{t0,5}$ MPa (psi)		Tensile strength [a] R_m MPa (psi)		Ratio [a, c] $R_{t0,5}/R_m$	Elongation (on 50 mm or 2 in) A_f %	Tensile strength [d] R_m MPa (psi)
	minimum	maximum	minimum	Maximum	maximum	minimum	minimum
L245R or BR L245N or BN L245Q or BQ L245M or BM	245 (35 500)	450 [e] (65 300) [e]	415 (60 200)	655 (95 000)	0,93	[f]	415 (60 200)
L290R or X42R L290N or X42N L290Q or X42Q L290M or X42M	290 (42 100)	495 (71 800)	415 (60 200)	655 (95 000)	0,93	[f]	415 (60 200)
L320N or X46N L320Q or X46Q L320M or X46M	320 (46 400)	525 (76 100)	435 (63 100)	655 (95 000)	0,93	[f]	435 (63 100)
L360N or X52N L360Q or X52Q L360M or X52M	360 (52 200)	530 (76 900)	460 (66 700)	760 (110 200)	0,93	[f]	460 (66 700)
L390N or X56N L390Q or X56Q L390M or X56M	390 (56 600)	545 (79 000)	490 (71 100)	760 (110 200)	0,93	[f]	490 (71 100)
L415N or X60N L415Q or X60Q L415M or X60M	415 (60 200)	565 (81 900)	520 (75 400)	760 (110 200)	0,93	[f]	520 (75 400)
L450Q or X65Q L450M or X65M	450 (65 300)	600 (87 000)	535 (77 600)	760 (110 200)	0,93	[f]	535 (77 600)
L485Q or X70Q L485M or X70M	485 (70 300)	635 (92 100)	570 (82 700)	760 (110 200)	0,93	[f]	570 (82 700)
L555Q or X80Q L555M or X80M	555 (80 500)	705 (102 300)	625 (90 600)	825 (119 700)	0,93	[f]	625 (90 600)
L625M or X90M	625 (90 600)	775 (112 400)	695 (100 800)	915 (132 700)	0,95	[f]	695 (100 800)
L625Q or X90Q	625 (90 600)	775 (112 400)	695 (100 800)	915 (132 700)	0,97 [g]	[f]	—
L690M or X100M	690 [b] (100 100) [b]	840 [b] (121 800) [b]	760 (110 200)	990 (143 600)	0,97 [h]	[f]	760 (110 200)
L690Q or X100Q	690 [b] (100 100) [b]	840 [b] (121 800) [b]	760 (110 200)	990 (143 600)	0,97 [h]	[f]	—
L830M or X120M	830 [b] (120 400) [b]	1 050 [b] (152 300) [b]	915 (132 700)	1 145 (166 100)	0,99 [h]	[f]	915 (132 700)

Table 9 — Permissible specified outside diameter and specified wall thickness

Specified outside diameter D mm (in)	Specified wall thickness t mm (in)	
	Special light sizes[a]	Regular sizes
≥ 10,3 (0.405) to 13,7 (0.540)	—	≥ 1,7 (0.068) to 2,4 (0.094)
> 13,7 (0.540) to 17,1 (0.675)	—	≥ 2,2 (0.088) to 3,0 (0.118)
> 17,1 (0.675) to 21,3 (0.840)	—	≥ 2,3 (0.091) to 3,2 (0.125)
> 21,3 (0.840) to 26,7 (1.050)	—	≥ 2,1 (0.083) to 7,5 (0.294)
> 26,7 (1.050) to 33,4 (1.315)	—	≥ 2,1 (0.083) to 7,8 (0.308)
> 33,4 (1.315) to 48,3 (1.900)	—	≥ 2,1 (0.083) to 10,0 (0.394)
> 48,3 (1.900) to 60,3 (2.375)	—	≥ 2,1 (0.083) to 12,5 (0.492)
> 60,3 (2.375) to 73,0 (2.875)	≥ 2,1 (0.083) to 3,6 (0.141)	> 3,6 (0.141) to 14,2 (0.559)
> 73,0 (2.875) to 88,9 (3.500)	≥ 2,1 (0.083) to 3,6 (0.141)	> 3,6 (0.141) to 20,0 (0.787)
> 88,9 (3.500) to 101,6 (4.000)	≥ 2,1 (0.083) to 4,0 (0.156)	> 4,0 (0.156) to 22,0 (0.866)
> 101,6 (4.000) to 168,3 (6.625)	≥ 2,1 (0.083) to 4,0 (0.156)	> 4,0 (0.156) to 25,0 (0.984)
> 168,3 (6.625) to 219,1 (8.625)	≥ 2,1 (0.083) to 4,0 (0.156)	> 4,0 (0.156) to 40,0 (1.575)
> 219,1 (8.625) to 273,1 (10.750)	≥ 3,2 (0.125) to 4,0 (0.156)	> 4,0 (0.156) to 40,0 (1.575)
> 273,1 (10.750) to 323,9 (12.750)	≥ 3,6 (0.141) to 5,2 (0.203)	> 5,2 (0.203) to 45,0 (1.771)
> 323,9 (12.750) to 355,6 (14.000)	≥ 4,0 (0.156) to 5,6 (0.219)	> 5,6 (0.219) to 45,0 (1.771)
> 355,6 (14.000) to 457 (18.000)	≥ 4,5 (0.177) to 7,1 (0.281)	> 7,1 (0.281) to 45,0 (1.771)
> 457 (18.000) to 559 (22.000)	≥ 4,8 (0.188) to 7,1 (0.281)	> 7,1 (0.281) to 45,0 (1.771)
> 559 (22.000) to 711 (28.000)	≥ 5,6 (0.219) to 7,1 (0.281)	> 7,1 (0.281) to 45,0 (1.771)
> 711 (28.000) to 864 (34.000)	≥ 5,6 (0.219) to 7,1 (0.281)	> 7,1 (0.281) to 52,0 (2.050)
> 864 (34.000) to 965 (38.000)	—	≥ 5,6 (0.219) to 52,0 (2.050)
> 965 (38.000) to 1 422 (56.000)	—	≥ 6,4 (0.250) to 52,0 (2.050)
> 1 422 (56.000) to 1 829 (72.000)	—	≥ 9,5 (0.375) to 52,0 (2.050)
> 1 829 (72.000) to 2 134 (84.000)	—	≥ 10,3 (0.406) to 52,0 (2.050)

NOTE Standardized values for specified outside diameter and specified wall thickness of pipe are given in ISO 4200 [7] and ASME B36.10M [8].

[a] Pipe having the combination of specified outside diameter and specified wall thickness is defined as special light size pipe. Other combinations given in this table are defined as regular size pipe. Pipe that has a combination of specified outside diameter and specified wall thickness that is intermediate to the tabulated values is considered to be special light size if the next lower tabulated value is for special light size pipe; other intermediate combinations are considered to be regular size pipe.

9.11.2 Mass per unit length

The mass per unit length, ρ_l, expressed in kilograms per metre (pounds per foot), shall be calculated using Equation (4):

$$\rho_l = t(D - t) \times C$$

where

D is the specified outside diameter, expressed in millimetres (inches);

t is the specified wall thickness, expressed in millimetres (inches);

C is 0,024 66 for calculations in SI units and 10.69 for calculations in USC units.