# API 5L Pipe Specification (PSL1, PSL2, SOUR SERVICE)

For more info please visit https://www.octalsteel.com/api-5l-pipe-specification

## Chemical Composition for API 5L PSL1 pipe Wall thickness ≤ 25.0 mm (0.984 in)

| Chemical composition for API 5L PSL1 Pipe | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Steel Grade (Steel Name) | Wall Thickness ≤ 25.0 mm (0.984 in) | | | | | | | |
| | Mass fraction, based upon heat and product analyses | | | | | | | |
| | % | | | | | | | |
| | C | Mn | P | | S | V | Nb | Ti |
| | max | max | min. | max | max | max | max | max |
| Seamless pipe | | | | | | | | |
| L175 or A25 | 0.21 | 0.60 | — | 0.030 | 0.030 | — | — | — |
| L175P or A25P | 0.21 | 0.60 | 0.045 | 0.080 | 0.030 | — | — | — |
| L210 or A | 0.22 | 0.90 | — | 0.030 | 0.030 | — | — | — |
| L245 or B | 0.28 | 1.20 | — | 0.030 | 0.030 | c,d | c,d | d |
| L290 or X42 | 0.28 | 1.30 | — | 0.030 | 0.030 | d | d | d |
| L320 or X46 | 0.28 | 1.40 | — | 0.030 | 0.030 | d | d | d |
| L360 or X52 | 0.28 | 1.40 | — | 0.030 | 0.030 | d | d | d |
| L390 or X56 | 0.28 | 1.40 | — | 0.030 | 0.030 | d | d | d |
| L415 or X60 | 0.28 | 1.40 | — | 0.030 | 0.030 | f | f | f |
| L450 or X65 | 0.28 | 1.40 | — | 0.030 | 0.030 | f | f | f |
| L485 or X70 | 0.28 | 1.40 | — | 0.030 | 0.030 | f | f | f |
| Welded (ERW, LSAW, SSAW) pipe | | | | | | | | |
| L175 or A25 | 0.21 | 0.60 | — | 0.030 | 0.030 | — | — | — |
| L175P or A25P | 0.21 | 0.60 | 0.045 | 0.080 | 0.030 | — | — | — |
| L210 or A | 0.22 | 0.90 | — | 0.030 | 0.030 | — | — | — |
| L245 or B | 0.26 | 1.20 | — | 0.030 | 0.030 | c,d | c,d | d |
| L290 or X42 | 0.26 | 1.30 | — | 0.030 | 0.030 | d | d | d |
| L320 or X46 | 0.26 | 1.40 | — | 0.030 | 0.030 | d | d | d |
| L360 or X52 | 0.26 | 1.40 | — | 0.030 | 0.030 | d | d | d |
| L390 or X56 | 0.26 | 1.40 | — | 0.030 | 0.030 | d | d | d |
| L415 or X56 | 0.26 | 1.40 | — | 0.030 | 0.030 | f | f | f |
| L450 or X65 | 0.26 | 1.45 | — | 0.030 | 0.030 | f | f | f |
| L485 or X70 | 0.26 | 1.65 | — | 0.030 | 0.030 | f | f | f |

a. Cu ≤ 0,50 %; Ni ≤ 0,50 %; Cr ≤ 0,50 % and Mo ≤ 0.15%

b. For each reduce of 0.01% Carbon Max, an increase of 0.05% of maximum Mn is permited, up to a maximum of 1.65 for grade ≥ B or L245, but ≤ X52 or L360; Up to max 1.75% for grades above L360 or X52, but below L485 or X70; And up to 2.00% max for grade X70 or L485.

c. Unless otherwise agreed, Nb + V ≤ 0.06%.

d. Nb + V + Ti ≤ 0.15%.

e. Unless otherwise agreed.

f. Unless otherwise agreed, Nb + V + Ti ≤ 0.15%.

g. B shall be not added in on purpose, and maximum B is 0.001%.

# Chemical Composition for API 5L PSL2 Pipe with t ≤ 25.0 mm (0.984 in)

| Steel Grade (Steel Name) | Mass fraction, based upon heat and product analyses | | | | | | | | | Carbon equivalent[a] | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | % maximum | | | | | | | | | % maximum | |
| | C[b] | Si | Mn[b] | P | S | V | Nb | Ti | Other | $CE_{IIW}$ | $CE_{Pcm}$ |
| Seamless and welded pipes | | | | | | | | | | | |
| L245R or BR | 0.24 | 0.40 | 1.20 | 0.025 | 0.015 | c | c | 0.04 | e,l | 0.43 | 0.25 |
| L290R or X42R | 0.24 | 0.40 | 1.20 | 0.025 | 0.015 | 0.06 | 0.05 | 0.04 | e,l | 0.43 | 0.25 |
| L245N or BN | 0.24 | 0.40 | 1.20 | 0.025 | 0.015 | c | c | 0.04 | e,l | 0.43 | 0.25 |
| L290N or X42N | 0.24 | 0.40 | 1.20 | 0.025 | 0.015 | 0.06 | 0.05 | 0.04 | e,l | 0.43 | 0.25 |
| L320N or X46N | 0.24 | 0.40 | 1.40 | 0.025 | 0.015 | 0.07 | 0.05 | 0.04 | d,e,l | 0.43 | 0.25 |
| L360N or X52N | 0.24 | 0.45 | 1.40 | 0.025 | 0.015 | 0.10 | 0.05 | 0.04 | d,e,l | 0.43 | 0.25 |
| L390N or X56N | 0.24 | 0.45 | 1.40 | 0.025 | 0.015 | 0.10 | 0.05 | 0.04 | d,e,l | 0.43 | 0.25 |
| L415N or X60N | 0.24[f] | 0.45[f] | 1.40[f] | 0.025 | 0.015 | 0.10 | 0.05 | 0.04 | g,h,l | as agreed | |
| L245Q or BQ | 0.18 | 0.45 | 1.40 | 0.025 | 0.015 | 0.05 | 0.05 | 0.04 | e,l | 0.43 | 0.25 |
| L290Q or X42Q | 0.18 | 0.45 | 1.40f | 0.025 | 0.015 | 0.05 | 0.05 | 0.04 | e,l | 0.43 | 0.25 |
| L320Q or X46Q | 0.18 | 0.45 | 1.40 | 0.025 | 0.015 | 0.05 | 0.05 | 0.04 | e,l | 0.43 | 0.25 |
| L360Q or X52Q | 0.18 | 0.45 | 1.50 | 0.025 | 0.015 | 0.05 | 0.05 | 0.04 | e,l | 0.43 | 0.25 |
| L390Q or X56Q | 0.18 | 0.45 | 1.50 | 0.025 | 0.015 | 0.07 | 0.05 | 0.04 | d,e,l | 0.43 | 0.25 |
| L415Q or X60Q | 0.18[f] | 0.45[f] | 1.70[f] | 0.025 | 0.015 | g | g | g | h,l | 0.43 | 0.25 |
| L450Q or X65Q | 0.18[f] | 0.45[f] | 1.70[f] | 0.025 | 0.015 | g | g | g | h,l | 0.43 | 0.25 |
| L485Q or X70Q | 0.18[f] | 0.45[f] | 1.80[f] | 0.025 | 0.015 | g | g | g | h,l | 0.43 | 0.25 |
| L555Q or X80Q | 0.18[f] | 0.45[f] | 1.90[f] | 0.025 | 0.015 | g | g | g | i,j | as agreed | |
| L625Q or X90Q | 0.16 | 0.45 | 1.90 | 0.020 | 0.010 | g | g | g | j,k | as agreed | |
| L690Q or X100Q | 0.16 | 0.45 | 1.90 | 0.020 | 0.010 | g | g | g | j,k | as agreed | |
| Welded pipe | | | | | | | | | | | |
| L245M or BM | 0.22 | 0.45 | 1.20 | 0.025 | 0.015 | 0.05 | 0.05 | 0.04 | e,l | 0.43 | 0.25 |
| L290M or X42M | 0.22 | 0.45 | 1.30 | 0.025 | 0.015 | 0.05 | 0.05 | 0.04 | e,l | 0.43 | 0.25 |
| L320M or X46M | 0.22 | 0.45 | 1.30 | 0.025 | 0.015 | 0.05 | 0.05 | 0.04 | e,l | 0.43 | 0.25 |
| L360M or X52M | 0.22 | 0.45 | 1.40 | 0.025 | 0.015 | d | d | d | e,l | 0.43 | 0.25 |
| L390 or X56M | 0.22 | 0.45 | 1.40 | 0.025 | 0.015 | d | d | d | e,l | 0.43 | 0.25 |
| L415 or X60M | 0.12[f] | 0.45[f] | 1.60[f] | 0.025 | 0.015 | g | g | g | h,l | 0.43 | 0.25 |
| L450 or X65M | 0.12[f] | 0.45[f] | 1.60[f] | 0.025 | 0.015 | g | g | g | h,l | 0.43 | 0.25 |
| L485M or X70M | 0.12[f] | 0.45[f] | 1.70[f] | 0.025 | 0.015 | g | g | g | h,l | 0.43 | 0.25 |
| L555M or X80M | 0.12[f] | 0.45[f] | 1.85[f] | 0.025 | 0.015 | g | g | g | i,l | 0.43 | 0.25 |
| L625 or X90M | 0.10 | 0.55[f] | 2.10[f] | 0.020 | 0.010 | g | g | g | i,l | — | 0.25 |
| L690M or X100M | 0.10 | 0.55[f] | 2.10[f] | 0.020 | 0.010 | g | g | g | i,j | | 0.25 |
| L830M or X120M | 0.10 | 0.55[f] | 2.10[f] | 0.020 | 0.010 | g | g | g | i,j | | 0.25 |

a. Based upon product analysis. For seamless pipe with t > 20,0 mm (0.787 in), the CE limits shall be as agreed.
The CEIIW limits apply if C > 0,12 % and the CEPcm limits apply if C ≤ 0,12 %.

b. For each reduction of 0,01 % below the specified maximum for C, an increase of 0,05 % above the specified maximum for permissible, up to a maximum of 1,65 % for grades ≥ L245 or B, but ≤ L360 or X52; up to a maximum of 1,75 % for grades > X52, but < L485 or X70; up to a maximum of 2,00 % for grades ≥ L485 or X70, but ≤ L555 or X80; and up to a maximum of grades > L555 or X80.

c. Unless otherwise agreed, Nb + V ≤ 0,06 %.

d. Nb + V + Ti ≤ 0,15 %.

e. Unless otherwise agreed, Cu ≤ 0,50 %; Ni ≤ 0,30 %; Cr ≤ 0,30% and Mo ≤ 0,15 %.

f. Unless otherwise agreed.

g. Unless otherwise agreed, Nb + V + Ti ≤ 0,15 %.

h. Unless otherwise agreed, Cu ≤ 0,50 %; Ni ≤ 0,50 %; Cr ≤ 0,50% and Mo ≤ 0, 50 %.

i. Unless otherwise agreed, Cu ≤ 0,50 %; Ni ≤ 1,00 %; Cr ≤ 0,50% and Mo ≤ 0, 50 %.

j. B ≤ 0,004 %.

k. Unless otherwise agreed, Cu ≤ 0,50 %; Ni ≤ 1,00 %; Cr ≤ 0,55% and Mo ≤ 0, 80 %.

l. For all PSL 2 pipe grades except those grades to which footnote j already applies, the following applies.
Unless otherwise agreed no intentional addition of B is permitted and residual B ≤ 0,001%.

# API 5L PSL 1 Pipe Mechanical Properties (Tensile strength, Yeild strength, Elongation)

| Pipe grade | Pipe body of seamless and welded pipe | | | Weld seam of EW, LSAW, SSAW and COW pipes |
|---|---|---|---|---|
| | Yield strength | Tensile strength | Elongation (on 50mm or 2 in) | Tensile strength |
| | Rt0.5 | Rm | Af | Rm |
| | MPa (psi), min | MPa (psi), min | % minimum | MPa (psi), min |
| 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) |

c. For the specified minimum elongation, Af shall be using below equation:

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

Where

C is 1940 for calculations using IS units and 625000 for calculations using USC units;

Axc is the applicable tensile test piece cross-section area, expressed in square mm or square inch, as follows:

- for circular cross-section test pieces, 130mm$^2$ for 12.7 mm and 8.9 mm 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 mm2 (0.75 in2) 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 mm2 (0.01 in$^2$);

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

# API 5L PSL 2 Pipe Mechanical Properties (Tensile Strength, Yield Strength, Elongation)

| Pipe grade | Pipe body of seamless and welded pipes | | | | | | Weld seam of HFW, SAW and COW pipes |
|---|---|---|---|---|---|---|---|
| | Yield strength [a] | | Tensile strength [a] | | Ratio [a,c] | Elongation (on 50 mm or 2 in) | Tensile strength [d] |
| | $R_{t0.5}$ | | Rm | | $R_{t0.5}/R_m$ | $A_f$ | Rm |
| | MPa (psi) | | MPa (psi) | | | % | MPa (psi) |
| | minimum | maximum | minimum | maximum | maximum | minimum | minimum |
| L245R or BR<br>L245N or BN<br>L245Q or BQ<br>L245M or BM | 245<br>(35 500) | 450 e<br>(65 300) e | 415<br>(60 200) | 655 (95 000) | 0.93 | f | 415<br>(60 200) |
| L290R or X42R<br>L290N or X42N<br>L290Q or X42Q<br>L290M or X42M | 290<br>(42 100) | 495<br>(71 800) | 415<br>(60 200) | 655(95 000) | 0.93 | f | 415<br>(60 200) |
| L320N or X46N<br>L320Q or X46Q<br>L320M or X46M | 320<br>(46 400) | 525<br>(76 100) | 435<br>(63 100) | 655 (95 000) | 0,93 | f | 435<br>(63 100) |
| L360N or X52N<br>L360Q or X52Q<br>L360M or X52M | 360<br>(52 200) | 530<br>(76 900) | 460<br>(66 700) | 760<br>(110 200) | 0,93 | f | 460<br>(66 700) |
| L390N or X56N<br>L390Q or X56Q<br>L390M or X56M | 390<br>(56 600) | 545<br>(79 000) | 490<br>(71 100) | 760<br>(110 200) | 0,93 | f | 490<br>(71 100) |
| L415N or X60N<br>L415Q or X60Q<br>L415M or X60M | 415<br>(60 200) | 565<br>(81 900) | 520<br>(75 400) | 760<br>(110 200) | 0,93 | f | 520<br>(75 400) |
| L450Q or X65Q<br>L450M or X65M | 450<br>(65 300) | 600<br>(87 000) | 535<br>(77 600) | 760<br>(110 200) | 0,93 | f | 535<br>(77 600) |
| L485Q or X70Q<br>L485M or X70M | 485<br>(70 300) | 635<br>(92 100) | 570<br>(82 700) | 760<br>(110 200) | 0,93 | f | 570<br>(82 700) |
| L555Q or X80Q<br>L555M or X80M | 555<br>(80 500) | 705<br>(102 300) | 625<br>(90 600) | 825<br>(119 700) | 0,93 | f | 625<br>(90 600) |
| L625M or X90M | 625<br>(90 600) | 775<br>(112 400) | 695<br>(100 800) | 915<br>(132 700) | 0,95 | f | 695<br>(100 800) |
| L625Q or X90Q | 625<br>(90 600) | 775<br>(112 400) | 695<br>(100 800) | 915<br>(132 700) | 0,97 [g] | f | 695<br>(100 800) |
| L690M or X100M | 690 [b]<br>(100 100) [b] | 840 [b]<br>(121 800) [b] | 760<br>(110 200) | 990<br>(143 600) | 0,97 [h] | f | 760<br>(110 200) |
| L690Q or X100Q | 690 [b]<br>(100 100) [b] | 840 [b]<br>(121 800) [b] | 760<br>(110 200) | 990<br>(143 600) | 0,97 [h] | f | 760<br>(110 200) |
| L830M or X120M | 830 [b]<br>(120 400) [b] | 1050 [b]<br>(152 300) [b] | 915<br>(132 700) | 1 145<br>(166 100) | 0,99 [h] | f | 915<br>(132 700) |

a. For intermediate grades, the difference between the specified maximum yield strength and the specified minimum yield strength shall be as given in the table for the next higher grade, and the difference between the specified minimum tensile strength and the specified minimum yield strength shall be as given in the table for the next higher grade. For intermediate grades up to Grade L320 or

X46, the tensile strength shall be ≤ 655 MPa (95 000 psi). For intermediate grades greater than Grade L320 or X46 and lower than Grade L555 or X80, the tensile strength shall be ≤ 760 MPa (110 200 psi).For intermediate grades higher than Grade L555 or X80, the maximum permissible tensile strength shall be obtained by interpolation. For SI units, the calculated value shall be rounded to the nearest 5 MPa. For USC units, the calculated value shall be rounded to the nearest 100 psi.

b. For grades > L625 or X90, Rp0,2 applies.

c. This limit applies for pipe with *D* > 323,9 mm (12.750 in).

d. 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).

e. For pipe requiring longitudinal testing, the maximum yield strength shall be ≤ 495 MPa (71 800 psi).

f. The specified minimum elongation, *A* f, shall be as determined using the following equation:

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

Where

C is 1940 for calculations using IS units and 625000 for calculations using USC units;

Axc is the applicable tensile test piece cross-section area, expressed in square mm or square inch, as follows:

- for circular cross-section test pieces, 130mm$^2$ for 12.7 mm and 8.9 mm 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 mm2 (0.75 in2) 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 mm2 (0.01 in$^2$);

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

Lower values of *R* t0,5/*R* m may be specified by agreement.

g. Lower values of Rt0,5/Rm may be specified by agreement.

h. For grades > L625 or X90, Rp0,2 /Rm applies. Lower values of Rp0,2 /Rm may be specified by agreement.

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# API 5L Sour Service Pipe Mechanical Properties (Tensile Strength, Yield Strength, Elongation)

| Chemical composition for API 5L Sour Service Pipe with wall thickness ≤ 25.0 mm (0.984 in) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Steel Grade (Steel Name) | Mass fraction, based upon heat and product analyses % maximum | | | | | | | | | Carbon equivalent % maximum | |
| | C[b] | Si | Mn[b] | P | S | V | Nb | Ti | other [c,d] | $CE_{IIW}$ | $CE_{Pcm}$ |
| Seamless and welded pipes | | | | | | | | | | | |
| L245NS or BNS | 0.14 | 0.40 | 1.35 | 0.020 | 0.03[e] | | | 0.04 | g | 0.36 | 0.19[h] |
| L290NS or X42NS | 0.14 | 0.40 | 1.35 | 0.020 | 0.03[e] | 0.05 | 0.05 | 0.04 | | 0.36 | 0.19[h] |
| L320NS or X46NS | 0.14 | 0.40 | 1.40 | 0.020 | 0.03[e] | 0.07 | 0.05 | 0.04 | g | 0.38 | 0.2[h] |
| L360NS or X52NS | 0.16 | 0.45 | 1.65 | 0.020 | 0.03[e] | 0.10 | 0.05 | 0.04 | g | 0.43 | 0.22h |
| L245QS or XQBS | 0.14 | 0.40 | 1.35 | 0.020 | 0.03[e] | 0.04 | 0.04 | 0.04 | | 0.34 | 0.19[h] |
| L290QS or X42QS | 0.14 | 0.40 | 1.35 | 0.020 | 0.03[e] | 0.04 | 0.04 | 0.04 | | 0.34 | 0.19[h] |
| L320QS or X46QS | 0.15 | 0.45 | 1.40 | 0.020 | 0.03[e] | 0.05 | 0.05 | 0.04 | | 0.36 | 0.2[h] |
| L360QS or X52QS | 0.16 | 0.45 | 1.65 | 0.020 | 0.03[e] | 0.07 | 0.05 | 0.04 | g | 0.39 | 0.2[h] |
| L390QS or X56QS | 0.16 | 0.45 | 1.65 | 0.020 | 0.03[e] | 0.07 | 0.05 | 0.04 | g | 0.40 | 0.21[h] |
| L415QS or X60QS | 0.16 | 0.45 | 1.65 | 0.020 | 0.03[e] | 0.08 | 0.05 | 0.04 | g,i,k | 0.41 | 0.22[h] |
| L450QS or X65QS | 0.16 | 0.45 | 1.65 | 0.020 | 0.03[e] | 0.09 | 0.05 | 0.06 | g,i,k | 0.42 | 0.22[h] |
| L485QS or X70QS | 0.16 | 0.45 | 1.65 | 0.020 | 0.03[e] | 0.09 | 0.05 | 0.06 | g,i,k | 0.42 | 0.22[h] |
| Welded pipe | | | | | | | | | | | |
| L245MS or BMS | 0.10 | 0.40 | 1.25 | 0.020 | 0.002[e] | 0.04 | 0.04 | 0.04 | | | 0.19 |
| L290MS or X42MS | 0.10 | 0.40 | 1.25 | 0.020 | 0.002[e] | 0.04 | 0.04 | 0.04 | | | 0.19 |
| L320MS or X46MS | 0.10 | 0.45 | 1.35 | 0.020 | 0.002[e] | 0.05 | 0.05 | 0.04 | | | 0.20 |
| L360MS or X52MS | 0.10 | 0.45 | 1.45 | 0.020 | 0.002[e] | 0.05 | 0.06 | 0.04 | | | 0.20 |
| L390MS or X56MS | 0.10 | 0.45 | 1.45 | 0.020 | 0.002[e] | 0.06 | 0.08 | 0.04 | g | | 0.210 |
| L415MS or X60MS | 0.10 | 0.45 | 1.45 | 0.020 | 0.002[e] | 0.08 | 0.08 | 0.06 | g,i | | 0.210 |
| L450MS or X65MS | 0.10 | 0.45 | 1.60 | 0.020 | 0.002[e] | 0.10 | 0.08 | 0.06 | g,i,k | | 0.220 |
| L485MS or X70MS | 0.10 | 0.45 | 1.60 | 0.020 | 0.002[e] | 0.10 | 0.08 | 0.06 | g,i,k | | 0.220 |

a. Based upon product analysis (see 9.2.4 and 9.2.5). The CEIIW limits apply if C > 0,12 % and the CEPcm limits apply if C ≤0,12 %.

b. For each reduction of 0,01 % below the specified maximum for C, an increase of 0,05 % above the specified maximum for Mn is permissible, up to a maximum increase of 0,20 %.

c. $Al_{total}$ ≤ 0,060 %; N ≤ 0,012 %; Al/N ≥ 2:1 (not applicable to titanium-killed or titanium-treated steel); Cu ≤ 0,35 % (if agreed, Cu ≤ 0,10 %); Ni ≤ 0,30 %; Cr ≤ 0,30 %; Mo ≤ 0,15 %; B ≤ 0,0005 %.

d. For welded pipe where calcium is intentionally added, unless otherwise agreed, Ca/S ≥ 1,5 if S > 0,0015 %. For SMLS and welded pipes, Ca ≤ 0,006 %.

e. The maximum limit for S may be increased to ≤ 0,008 % for SMLS pipe and, if agreed, to ≤ 0,006 % for welded pipe. For such higher S levels in welded pipe, lower Ca/S ratios may be agreed.

f. Unless otherwise agreed, Nb + V ≤ 0,06 %.

g. Nb + V + Ti ≤ 0,15 %.

h. For SMLS pipe, the listed CEPcm value may be increased by 0,03.

i. If agreed, Mo ≤ 0,35 %.

j. If agreed, Cr ≤ 0,45 %.

k. If agreed, Cr ≤ 0,45% and Ni ≤ 0,50%.

# Chemical Composition for API 5L PSL1 Sour Service Pipe Wall thickness ≤ 25.0 mm (0.984 in)

| Mechanical Properties for API 5L Sour Service Pipe | | | | | | | |
|---|---|---|---|---|---|---|---|
| Pipe steel grade | Yield strength [a] $R_{t0,5}$ MPa(psi) | | Tensile strength [a] $R_m$ MPa(psi) | | Ratio [b] $R_{t0,5}/R_m$ | Elongation (on 50 mm or 2 in) $A_f$ % | Tensile strength [c] $R_m$ MPa(psi) |
| | minimum | maximum | minimum | maximum | maximum | minimum | minimum |
| L245NS or BNS<br>L245QS or BQS<br>L245MS or BMS | 245 (35500) | 450 (65300) | 415 (60200) | 655 (95000) | 0.93 | e | 415 (60200) |
| L290NS or X42NS<br>L290QS or X42QS<br>L290MS or X42MS | 290 (42100) | 495 (71800) | 415 (60200) | 655 (95000) | 0.93 | e | 415 (60200) |
| L320NS or X46NS<br>L320QS or X46QS<br>L320MS or X46MS | 320 (46400) | 525 (76100) | 435 (63100) | 655 (95000) | 0.93 | e | 435 (63100) |
| L360NS or X52NS<br>L360QS or X52QS<br>L360MS or X52MS | 360 (52200) | 530 (76900) | 460 (66700) | 760 (110200) | 0.93 | e | 460 (66700) |
| L390QS or X56QS<br>L390MS or X56MS | 390 (56600) | 545 (79000) | 490 (71100) | 760 (110200) | 0.93 | e | 490 (71100) |
| L415QS or X60QS<br>L415MS or X60MS | 415 (60200) | 565 (81900) | 520 (75400) | 760 (110200) | 0.93 | e | 520 (75400) |
| L450QS or X65QS<br>L450MS or X65MS | 450 (65300) | 600 (87000) | 535 (77600) | 760 (110200) | 0.93 | e | 535 (77600) |
| L485QS or X70QS<br>L485MS or X70MS | 485 (70300) | 635 (92100) | 570 (82700) | 760 (110200) | 0.93 | e | 570 (82700) |

a. For intermedia grades, the difference between the specified maximum yield strength and the specified minimum yield strength shall be as given in the table for the next higher grade, and the difference between the specofied minimum tensile strength and the specified minimum yield strength shall be given in the table for the next higher grade. For intermediate grades, the tensile strength shall be ≤760MPa(110200psi).

b. This limit applies for pipe with D＞323.9mm (12.750 in).

c. For intermedia 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).

d. For pipe requiring longitudinal testing, the maximum yield strength shall be ≤495MPa (71800 psi).

e. The specified minimum elongation, Af on 50 mm or 2 in, expressed in percent and rounded to the nearest percent, shall be as determined using the following equition:

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

where

C is 1940 for calculations using SI units and 625000 for calculations using USC units;

Axc 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 (0.2 in) for 12.7mm (0.5 in) and 8,9mm(0.350 in)diameter test

- for full-section test pieces, the esser of a) 485mm2 (0.75 in2) 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 mm2(0.01 in2);

- for strip test pieces, the lesser of a) 485mm2 (0.75 in2) 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 mm2

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

https://www.octalsteel.com/api-5l-pipe-specification