

High yield seamless Pipe API 5L grade X65 PSL 2

Suitable for weldable structural steels for fixed offshore structures

X65 (enhanced) high yield seamless pipes, modified to suit offshore structural purposes. Intended for (but not limited to) use in fixed offshore structures, designed to operate in the offshore sector.

Applicable codes and standards

API 5L, 45th Edition / ISO 3183

Specification for line pipe - technical delivery conditions

Grade

X 65 Q PSL 2

X	Minimum Yield	Delivery condition	PSL
The X symbol followed by a two or three digit number equal to the specified minimum yield strength in 1000 psi rounded down to the nearest integer.	At pipe body 450 MPa (65,300 psi)	+ N Normalizing rolling + Q Quenched and tempered where Q refers to a heat treatment process consisting of quench hardening followed by tempering.	PSL refers to the product specification level where PSL2 provides a more extensive chemical composition complete with a mandatory minimum fracture toughness.

- The steel pipe mentioned herein is substantially modified from the API 5L, X65 standard.
- Pipes are fully killed and fine grain steel material.
- NACE MR0175: "Satisfactory"
- This steel offers enhanced yield tensile ratio of 0.87 (max) and impact values verified from as low as -30°C.
- This grade is also known as L450Q in USC Units.

Chemical composition with thickness (t) ≤ 25mm

Product analysis in % (All values are max. unless otherwise stated.)

C	0,16	Cu	0,20	Cr+Mo+Ni+Cu	0,5 ⁴
Si	0,50	N	0,014	Nb+V	0,10
Mn	1,10 - 1,60	Nb ¹	0,05	Nb+V+Ti	0,15
P	0,022	Ti	0,02	CEV (IIW) see formula below	0,43 ²
S	0,005	V	0,10	Pcm see formula below	0,25 ²
Cr	0,50	As	0,02		
Mo	0,20 ³	Sb	0,01	Bi	0,010
Ni	0,20	Sn	0,015	Ca	0,005
Al	0,020 - 0,060	Pb	0,010	B	0,0005

$$CEV = C + \frac{Mn}{6} + \frac{Cr+Mo+V}{5} + \frac{Ni+Cu}{15}$$

$$Pcm = C + \frac{Si}{30} + \frac{Mn+Cu+Cr}{20} + \frac{Ni}{60} + \frac{Mo}{15} + \frac{V}{10} + 5B$$

¹ All nitrogen shall be tied up as nitrides. Al (total) to N ratio shall be at least 2.2:1

² CEV & Pcm may vary as wall thickness of pipe increases.

³ Mo, max 0.25% for thickness (t) > 25mm.

⁴ Max 0.60% for thickness (t) > 25mm.

Mechanical properties

API 5L, enhanced grade X65Q, PSL 2

Thickness t	Yield R_{eh}	Tensile R_m	R_{eh} / R_m	CVN	EI
mm	MPa	MPa	-	-30 °C	%
-	min. 450	Min. 535 Max. 760	max. 0,93	min. $\geq 36J$ avg. $\geq 42J$ transverse	min. 22

Surface

- (a) All surfaces have been 100% visually inspected. The surface condition complies with API 5L Annex E.
- (b) External surface of pipe shall be coated with a layer of varnish.

NDT

All pipes will be ultrasonic tested on pipe body and pipe end as per API 5L Annex E, Table E.2 and para E.3.3.

Coverage:

- (a) longitudinal: 100% of the pipe surface
- (b) pipe ends not scanned by automatic ultrasonic system shall be inspected by manual UT or Magnetic Particle Examination.

Hydrostatic test

- (a) Test pressure may not exceed 2970 psi in accordance to API 5L requirements
- (b) Holding time: minimum 5 seconds

Certification and traceability

All dimensions will be supplied with a 3.2 certificate according to EN 10204, endorsed by recognized and independent inspection agency. Marking shall be in SI units (X65) accordance with API requirements & mill standard.

Dimensional control

All dimensions will be supplied according to API 5L clause 9.11; In addition, the following tolerances apply:

- (a) Pipe body: +/- 0,75%
- (b) Pipe end: +/- 0,5%
- (c) Wall thickness: +15%, -12,5%
- (d) Length: -0 / +100mm

Pipe Ends

Pipe Ends are bevelled. End angle shall be $30^\circ - 0^\circ / +5^\circ$, root face shall be 1.6mm +/- 0.8mm and fitted with bevel protectors.

Protection

Pipes are varnished on the outside.