High yield SAW welded Pipe API 5L grade X65 PSL 2
Suitable for weldable structural steels for fixed offshore structures

X65 (enhanced) high yield SAW welded 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

<table>
<thead>
<tr>
<th>Minimum Yield</th>
<th>Delivery condition</th>
<th>PSL</th>
</tr>
</thead>
</table>
| At pipe body 450 MPa (65,300 psi) | + M Thermo mechanical rolling  
+ N Normalizing rolling  
+ Q Quenched and tempered | PSL refers to the product specification level where PSL2 provides a more extensive chemical composition complete with a mandatory minimum fracture toughness. |

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.

Chemical composition with thickness (t) ≤ 25mm
Product analysis in % (All values are max. unless otherwise stated.)

<table>
<thead>
<tr>
<th>C</th>
<th>0.04 - 0.09</th>
<th>Cu</th>
<th>0.20</th>
<th>Cr + Mo + Ni + Cu</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Si</td>
<td>0.05 - 0.35</td>
<td>N</td>
<td>0.007</td>
<td>Nb</td>
<td>-</td>
</tr>
<tr>
<td>Mn</td>
<td>1.10 - 1.60</td>
<td>Nb1</td>
<td>0.01 - 0.05</td>
<td>Nb + V + Ti</td>
<td>0.12</td>
</tr>
<tr>
<td>P</td>
<td>0.02</td>
<td>Ti</td>
<td>0.005 - 0.020</td>
<td>CEV (IIW)</td>
<td>see formula below</td>
</tr>
<tr>
<td>S</td>
<td>0.003</td>
<td>V</td>
<td>0.010 - 0.050</td>
<td>Pcm</td>
<td>see formula below</td>
</tr>
<tr>
<td>Cr</td>
<td>0.30</td>
<td>As</td>
<td>-</td>
<td>Bi</td>
<td>-</td>
</tr>
<tr>
<td>Mo</td>
<td>0.05</td>
<td>Sb</td>
<td>-</td>
<td>Ca</td>
<td>-</td>
</tr>
<tr>
<td>Ni</td>
<td>0.30</td>
<td>Sn</td>
<td>-</td>
<td>B</td>
<td>-</td>
</tr>
<tr>
<td>Al</td>
<td>0.010 - 0.055</td>
<td>Pb</td>
<td>-</td>
<td>[ CEV = C + \frac{Mn}{6} + \frac{Cr+Mo+V}{5} + \frac{Ni+Cu}{15} ]</td>
<td>[ Pcm = C + \frac{Si}{30} + \frac{Mn+Cu+Cr}{20} + \frac{Ni}{60} + \frac{Mo}{15} + \frac{V}{10} + 5B ]</td>
</tr>
</tbody>
</table>

- The steel pipe mentioned herein is substantially modified from the API 5L, X65 standard.
- Pipes are fully killed and fine grain steel material.
- This steel offers enhanced yield tensile ratio of 0.90 (max) and impact values verified from as low as -40°C.
- This grade is also known as L450M in USC Units.

1 All nitrogen shall be tied up as nitrides. Al (total) to N ratio shall be at least 2.2:1
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.1 and para E.4.
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.
(c) Area with any indication exceeding the acceptance criteria by automatic/manual UT shall be inspected by radiographic test.

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 / +50mm

Pipe Ends
Pipe Ends are bevelled. End angle shall be 30° +/- 2.5°, root face shall be 1.6mm +/- 0.8mm and fitted with bevel protectors.

Protection
Pipes are varnished on the outside.

Other Technical Properties
(a) Through-Thickness tests conducted to meet class Z35 as per ASTM A370 (from wall thickness 19.1mm).
(b) Low sulphur content – all pipes possess sulphur content not more than 0.006%.