**Characteristics**
Grade 254 SMO® is a Molybdenum and Nitrogen alloyed super austenitic stainless steel with low Carbon content. The high performance austenitic stainless steels such as 254 SMO® have a fully austenitic microstructure in the quench annealed condition.

**Characteristic properties**
- Very good resistance to uniform corrosion
- Good to exceptionally good resistance to pitting and crevice corrosion
- Very good resistance to stress corrosion cracking
- Very good formability

**Dimensions**
254 SMO® is considered a stock standard material for OSTP in selected production standards and dimension ranges.

**Tubes, Pipes and Butt Weld Fittings**
- OD: 21.3–1219.0 mm
- WT: 1.5–25.4 mm
- Lengths: up to 12 m

Tubes below 21.3 mm OD and tubes with wall thickness below 1.5 mm or length over 12 m on special request.

**Executions**
- Welded with- or without filler metal
- Unannealed, pickled
- Solution annealed and pickled
- Wth – or Without BCW (Bead Cold Work) – Tubes Only
- Bevelled ends according to standards

**Corrosion resistance**
Grade 254 SMO® possesses excellent resistance to general corrosion, SCC, pitting corrosion and crevice corrosion. It has similar resistance to sea water conditions as the Super-Duplex 2507 grade, and has hence been widely used in offshore oil & gas and sea water desalination.

**Product standards**
**Europe**
- EN 10217-7: Welded steel tubes for pressure purposes
  - Technical delivery conditions
- Part 7: Stainless steel tubes
- EN 10296-2: Welded circular steel tubes for mechanical and general engineering purposes
  - Technical delivery conditions
- Part 2: Stainless steel
- EN 10253-3: Butt-welding pipe fittings
  - Part 3: Wrought austenitic and austenitic-ferritic (Duplex) stainless steels without specific inspection requirements
- EN 10253-4: Butt-welding pipe fittings
  - Part 4: Wrought austenitic and austenitic-ferritic (Duplex) stainless steels with specific inspection requirements

**Fabrication**
- **Welding**
  - Common welding methods for tubular products are:
    - MMA, SMAW (Shielded Metal Arc Welding)
    - TIG, GTAW (Gas Tungsten Arc Welding)
    - MIG, MAG, GMAW (Gas Metal Arc Welding)
    - PAW (Plasma Arc Welding)
    - FCW (Flux-Cored Arc Welding)
    - SAW (Submerged Arc Welding)

  General filler recommendation for steel grade 254 SMO® can be found in the table below. Welding without filler metal not followed by post weld heat treatment, will reduce the corrosion resistance of the weld, and is therefore not recommended. The base of the shielding and welding gases should consist of pure Ar with additions of 2–3% Nitrogen and 2–3% Hydrogen, in order to get optimal penetration and corrosion resistance. As root gas the recommendation is pure Ar or an gas mix of 90% H₂ and 10% H₂ (so called Formier gas). More welding information can be found in Outokumpu Welding Handbook.

- **Cold forming**
  - Since the yield strength is higher than for standard austenitic grades, a higher initial force is necessary in operations such as bending or expanding tubes into tube sheets.

- **Hot forming**
  - Grade 254 SMO® is slightly harder at higher temperatures than austenitic standard grades. Forming at temperatures in the range 1000–1200°C does not require any post heat treatment, if the operation is followed by a reasonable fast cooling, (>60°C/min).

- **Heat treatment**
  - Normal annealing temperature is 1150–1200°C followed by rapid cooling to at least 700°C. At temperatures between 800–900°C, inter metallic phases that impair the properties will form within a few minutes.

**Applications**
Due to high levels of chromium, molybdenum, and nitrogen, 254 SMO® is especially suited for high-chloride environments such as brackish water, seawater, pulp mill bleach plants, and other high-chloride process streams.

**Pipe systems within:**
- Offshore
- Chemical and petrochemical
- Hydrometallurgy
- Desalination
- Oil & gas

**Design**
The allowable design values are about 50% higher than those for standard austenitic steels. This means that the possibility of designing thinner walls can save costs in material, transport, welding and maintenance. Please use our Press Calculation Tool on www.ostp.biz for design purposes.
General filler recommendation for high performance austenitic stainless steels

Welding consumables

<table>
<thead>
<tr>
<th>Outokumpu</th>
<th>EN</th>
<th>ASTM / UNS</th>
<th>Covered electrodes</th>
<th>Wires</th>
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<tbody>
<tr>
<td>904L</td>
<td>1.4539</td>
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<td>Ni Cr 21 Mo Fe Nb / Ni Cr 25 Mo 16R or P54*</td>
<td>Ni Cr 22 Mo 9 Nb</td>
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</table>

Type of weld process and NDT

- EFW = Electric Fusion Welded
- ET = Eddy Current Test
- RT = Radiographic Test

The joint coefficient (z used in EN standards) or Joint quality factor (Ej, used in ASME standards) is used for calculation of the wall thickness for welded tubes.

The type of welding process, amount and type of NDT decide the factor.

Chemical composition, % (Typical values)

<table>
<thead>
<tr>
<th>Outokumpu</th>
<th>EN</th>
<th>ASTM / UNS</th>
<th>Cr</th>
<th>Ni</th>
<th>Mo</th>
<th>N</th>
<th>PRE*</th>
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</table>

* PRE = % Cr + 3.3% Mo + 16% N (The formula is used as a ranking tool to estimate pitting corrosion resistance in the material).

Mechanical properties (At room temperature)

<table>
<thead>
<tr>
<th>Outokumpu</th>
<th>EN</th>
<th>ASTM / UNS</th>
<th>Min values acc. to EN 10228-7:2007</th>
<th>Min values according to ASTM A240-10</th>
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<td>R@Module, MPa</td>
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<td>P    H    C</td>
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<td>415  795  35</td>
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</table>

* Min values according to EN 10088-4:2009
P = Hot rolled plate  H = Hot rolled strip  C = Cold rolled coil and strip

Physical properties

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<tr>
<th>Outokumpu</th>
<th>EN</th>
<th>ASTM / UNS</th>
<th>Density, g/cm³</th>
<th>Modulus of elasticity, GPa</th>
<th>Poisson’s ratio ν = -εtrans/εlongitudinal</th>
<th>Average linear expansion at RT - 100°C x10^-6 °C</th>
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<tbody>
<tr>
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OSTP is a joint-venture between Tuboxia and Outokumpu Group. OSTP manufactures the broadest range of stainless steel tubular products:

- PROCESS PIPE
  - Jakobstad, Finland
  - Riyadh, Saudi Arabia
- HEAVY WALL PIPES
  - Storfen, Sweden
- BUTT WELDED FITTINGS
  - Örnsköldsvik, Sweden
  - Jakobstad, Finland
- PROCESS EQUIPMENT
  - ÖMV, Örnsköldsvik, Sweden