High Performance Austenitic Welded Stainless Tubular Products

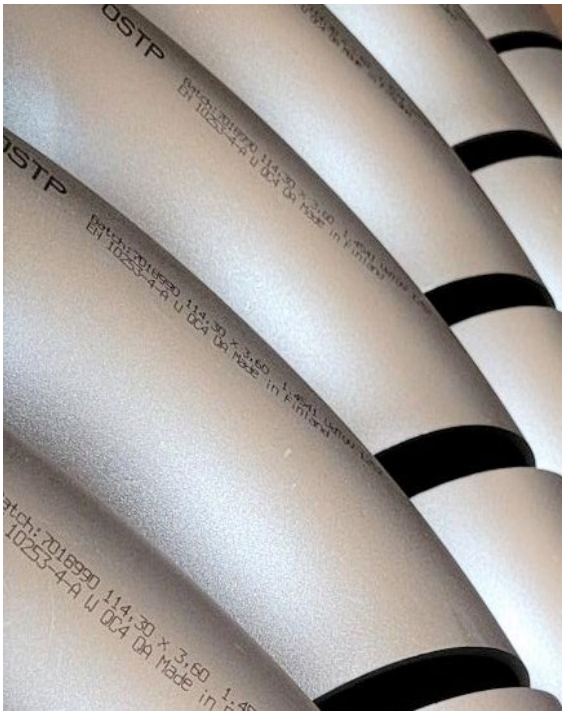
254 SMO/ 1.4547/ S31254

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

Tubes, Pipes and Butt Weld Fittings

- Welded with- or without filler metal
- Unannealed, pickled
- Solution annealed and pickled
- With – 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.

USA
• ASTM A 249: Welded Austenitic steel boiler, superheater, heat-exchanger and condenser tubes.
• ASTM A 269: Seamless and Welded Austenitic Stainless Steel Tubing for General Service
• ASTM A 312: Seamless, Welded, and Heavily Cold
Worked Austenitic Stainless Steel Pipes
• ASTM A 358: Electric-Fusion-Welded Austenitic Cr-Ni
Stainless Steel Pipe for High-Temperature Service and
General Applications
• ASTM A 409: Welded Large Diameter Austenitic Steel
Pipe for Corrosive or High-Temperature Service
• ASTM A 403: Wrought austenitic stainless steel piping
fittings
• ASTM A 774: As-welded wrought austenitic stainless
steel fittings for general corrosive service at low and
moderate temperatures

Pressure vessel requirements

Europe
The Pressure Equipment Directive PED regulates the use of welded stainless steel pipe and fittings in most European countries. OSTP fulfils the Directive, and is an approved manufacturer of welded stainless steel tubular products.

Outside Europe
Pressure vessel regulations are authorized to ASME. ASME Section VIII, Division 1, Table UHA-23, shows design values for tube and pipe manufactured and tested according to ASME SA-249 and SA-312 respectively. ASME B31.1 Power Piping and ASME B31.3 Process Piping prescribes design and design stress values for approved pipe materials.

Norway
NORSOK is a Norwegian standard that regulates the use of materials in some offshore applications. OSTP is an approved manufacturer of Duplex UNS S31803 and UNS S32205 pipe and butt weld fittings based on NORSOK 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)
• FCAW (Flux-Corded 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% N2 and 10% H2 (so called Formier gas).

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, (>600°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.

OSTP

Mechanical Properties (at room temperature)

Grade	EN Grade	ASME/UNS	acc. To EN 10088-2:14 Cold Rolled Strip (C) Rp 0.2 Mpa	Rm Mpa	A %	Hot Rolled Strip (H) Rp 0.2 Mpa	Rm Mpa	A %	Hot rolled Plate (P) Rp 0.2 Mpa	Rm Mpa	A %	Acc to ASTM A240:20 Rp 0.2 Mpa	Rm Mpa	A50 %
304L/4307	1.4307	304L	> 220	520 - 700	> 45	> 200	520 - 700	> 45	> 200	500 - 700	> 45	> 170	> 485	> 40
316L/4404	1.4404	316L	> 240	530 - 680	> 40	> 220	530 - 680	> 40	> 220	520 - 670	> 45	> 170	> 485	> 40
316L/4432	1.4432	316L	> 240	550 - 700	> 40	> 220	550 - 700	> 40	> 220	520 - 670	> 45	> 170	> 485	> 40
Ultra 254 SMO	1.4547	S31254	> 320	650 - 850	> 35	> 300	650 - 850	> 35	> 300	650 - 850	> 40	> 310	> 655	> 35
Ultra 904L	1.4539	N08904	> 240	530 - 730	> 35	> 220	530 - 730	> 35	> 220	520 - 720	> 35	> 220	> 490	> 35
654SMO	1.4652	S32654	> 430	750 - 1000	> 40	> 430	750 - 1000	> 40	> 430	750 - 1000	> 40	> 430	> 750	> 40

1)Elongation according to EN standard:A80 for thickness below 3 mm.A for thickness ≥3 mm.Elongation according to ASTM standard A2" or A50

Physical Properties

Grade	EN Grade	ASME/UNS	Density kg/dm³	Modulus of elasticity Gpa	Poissons´s ratio $\mu = -\varepsilon t/\varepsilon l$	Coefficient of thermal expansion 20 -100°C $10^{-6}/K$
304L/4307	1.4307	304L	7,9	200	0,3	16,0
316L/4404	1.4404	316	8,0	200	0,3	16,0
316L/4432	1.4432	316L	8,0	200	0,3	16,0
Ultra 254 SMO	1.4547	S31254	8,0	195	0,3	16,5
Ultra 904L	1.4539	N08904	8,0	195	0,3	15,8
654SMO	1.4652	S32654	8,0	190	0,3	15,0

Chemical Composition, % (Typical values)

Grade	EN Grade	ASME/UNS	C	Cr	Ni	Mo	N	Others	PRE*
304L/4307	1.4307	304L	0,02	18,1	8,1	–	–	–	18
316L/4404	1.4404	316	0,02	17,2	10,1	2,1	–	–	24
316L/4432	1.4432	316L	0,02	16,9	10,7	2,6	–	–	25
Ultra 254 SMO	1.4547	S31254	0,01	20	18,0	6,1	0,2	Cu	43
Ultra 904L	1.4539	N08904	0,01	19,8	24,2	4,3	–	Cu	34
654SMO	1.4652	S32654	0,01	0,5	24	22	7,3	Cu Mn	56

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

OSTP is a joint venture between Agave Srl and Outokumpu Group. manufactures the broadest range of stainless steel tubular products:

PROCESS PIPES
Jakobstad, Finland

BUTT WELDED FITTINGS
Örnsköldsvik, Sweden
Jakobstad, Finland
PCM Technology, Finland

PROCESS EQUIPMENT
ÖMV, Örnsköldsvik, Sweden