254 SMO® / 1.4547

Material no. 1.4547 · X1CrNiMoCuN20-18-7 · Super-austenitic stainless steel with 6 % Mo

Material group: Super-austenitic stainless steel (6Mo class), PREN ≈ 43

Material no. (EN): 1.4547

EN designation: X1CrNiMoCuN20-18-7

UNS / ASME: UNS S31254

Trade names: 254 SMO® (Outokumpu), Nicrofer® 3127 hMo

ASTM / ASME equivalent: Pipes: A312 TP S31254 · Fittings: A403 WP-S31254 · Flanges: A182 F44

Service temperature: –196 °C to +400 °C (continuous service)

Standards (pipes): EN 10216-5 · ASTM A312 / A249 · VdTÜV 460

Standards (fittings): EN 10253-4 · ASTM A403 WP-S31254 · ASME B16.9

Forms (Nirotec): Elbows · tees · reducers · caps · flanges · custom parts

1 Material Equivalents & Comparable Grades

National equivalents

Standard / region	Designation	Material no. / Grade	Remark
EN	X1CrNiMoCuN20-18-7	1.4547	Current European designation
UNS	S31254	UNS S31254	ASTM/ASME designation
ASTM	F44 (flanges)	–	ASTM F44 grade
ASTM/ASME	A/SA 312 TP S31254	UNS S31254	Seamless / welded pipes
ASTM/ASME	A/SA 403 WP-S31254	UNS S31254	Buttweld fittings
ASTM/ASME	A/SA 182 F44	UNS S31254	Forgings, flanges
NORSOK	M-630 Type 6Mo	–	Norwegian offshore specification
Trade names	254 SMO®, Nicrofer® 3127 hMo	–	Common trade names

Alternative materials

Material	Material no.	Reference / use	Note
904L / 1.4539	1.4539	Lower Mo, lower cost	Moderate chloride requirements
1.4529 / N08926	1.4529	Very similar 6Mo class	Direct equivalent, different mills

Material	Material no.	Reference / use	Note
1.4410 / S32750	1.4410	Super duplex, higher strength	When strength more critical than processing
Inconel 625	2.4856	Nickel-base, higher corrosion resistance	More aggressive acids or > 400 °C

2 Chemical Composition

Composition in mass percent (%). Standard: ASTM A312 / VdTÜV 460. 254 SMO is a super-austenitic stainless steel with ~6 % Mo, ~18 % Ni, N and Cu additions. PREN ≥ 43 – competes with super duplex in corrosion resistance, but with better processability (fully austenitic, no phase precipitation).

Element	Symbol	Min. (heat)	Max. (heat)	Max. (product)	Function / remark
Carbon	C	–	0.020	0.020	Low-C limit, weldability
Silicon	Si	–	0.80	0.80	Limit
Manganese	Mn	–	1.00	1.00	Limit
Phosphorus	P	–	0.030	0.030	Impurity limit
Sulfur	S	–	0.010	0.010	Impurity limit
Chromium	Cr	19.5	20.5	20.5	Corrosion resistance
Nickel	Ni	17.5	18.5	18.5	Austenite stabiliser
Molybdenum	Mo	6.0	6.5	6.5	Pitting resistance, PREN driver
Nitrogen	N	0.18	0.22	0.22	Austenite stabiliser, strength
Copper	Cu	0.50	1.00	1.00	Sulphuric acid resistance

3 Mechanical Properties

Solution annealed – minimum requirements (ASTM A312)

254 SMO is solution annealed at 1150–1200 °C and rapidly quenched. Fully austenitic structure without ferrite, no intermetallic phases.

Property	Symbol	Unit	Minimum value	Remark
Yield strength 0.2 %	Rp0.2	MPa	≥ 300	Solution annealed
Tensile strength	Rm	MPa	≥ 650	–
Elongation at fracture	A	%	≥ 35	Longitudinal specimens
Impact energy (–196 °C)	KV	J	≥ 100	Excellent low-temperature toughness
Hardness	HRB	–	≤ 96	Solution annealed
PREN	–	–	≥ 43	Pitting Resistance Equivalent

Property	Symbol	Unit	Minimum value	Remark
CCT	–	°C	> 35	Critical Crevice Temperature (NORSOK)

Hot yield strength Rp0.2 in MPa (typical values per standard)

Temperature	100 °C	200 °C	300 °C	400 °C
Rp0.2 (MPa)	230	200	175	155

4 Physical Properties

Property	Symbol	20 °C	200 °C	400 °C	Unit
Density	ρ	8.0	7.95	7.85	g/cm^3
Modulus of elasticity	E	195	185	170	GPa
Thermal conductivity	λ	13.5	16.0	19.0	W/(m·K)
Coeff. thermal expansion	α	16.5	17.0	18.0	10^{-6}/K
Specific heat capacity	cp	500	525	560	J/(kg·K)

5 Corrosion Resistance

Medium / environment	Remark	Resistance
Seawater (flowing)	Outstanding resistance, PREN ≥ 43	++
Sour gas (H_2S)	NACE MR0175 qualified	++
Stress-corrosion cracking (Cl^-)	Highly resistant	++
Sulphuric acid (H_2SO_4)	Good resistance (Cu content helps)	++
Phosphoric acid (H_3PO_4)	Very good resistance	++
Hot chloride-bearing solutions	Resistant, PREN ≥ 43	++
Nitric acid (HNO_3)	Good resistance	+
Hydrochloric acid (HCl) dilute	Limited – other materials better suited	o
High temperature > 400 °C	Limited suitability, no creep strength	o
Hydrofluoric acid (HF)	Not recommended	–
Concentrated oxidising acids	Not resistant	–

++ excellent resistance	+ good resistance	o limited resistance	– not resistant

254 SMO is the economic premium alternative to super duplex and nickel-base alloys for seawater, brine and chloride-bearing applications – fully austenitic, easy to process.

6 Typical Applications

Industry / plant	Typical application	Operating condition
Offshore oil & gas	Topside piping, seawater systems	PREN ≥ 43, NORSOK compliant
Desalination plants	Evaporators, preheaters, piping	Hot concentrated brines
Chemical industry	Acid-resistant vessels, heat exchangers	Sulphuric acid, mixed acids
Pulp & paper	ClO_2 bleaching plants	Chloride-bearing aggressive media
Seawater cooling	Piping, pumps, heat exchangers	Flowing seawater up to 50 °C
Flue-gas treatment (FGD)	Scrubbers, absorbers	Acidic chloride-loaded flue gases

7 Forms Available at Nirotec

Component	Standard (EN)	Standard (ASME/ASTM)	Remark
Elbows	EN 10253-4	ASME B16.9 · A403 WP-S31254	LR/SR, 90°/45°, custom angles
Tees	EN 10253-4	ASME B16.9 · A403 WP-S31254	Equal and reducing branch
Reducers	EN 10253-4	ASME B16.9 · A403 WP-S31254	Concentric and eccentric
Caps	EN 10253-4	ASME B16.9 · A403 WP-S31254	Hemispherical caps
Weld neck flanges	EN 1092-1 Type 11	ASME B16.5 · A182 F44	PN 10 – PN 400 / Class 150 – 2500
Custom parts	Per drawing	Per drawing	Special components on request

8 Standards, Approvals & Codes

Standard / code	Title / application
EN 10216-5	Seamless tubes for pressure purposes – stainless steels
EN 10253-4	Butt-welding fittings – austenitic stainless steels
EN 1092-1	Flanges and their joints
VdTÜV 460	X1CrNiMoCuN20-18-7 (1.4547) – material data sheet
ASTM A312 / A249	Seamless / welded pipes – UNS S31254
ASTM A403	Buttweld fittings – austenitic stainless (WP-S31254)

Standard / code	Title / application
ASTM A182 F44	Forgings, flanges – UNS S31254
NORSOK M-630	Material data sheet 6Mo (offshore)
NACE MR0175 / ISO 15156	Materials for H_2S-containing environments
PED 2014/68/EU	Pressure Equipment Directive

9 Processing Notes

Weldability

Parameter	Specification / recommendation	Remark
Preheat	Not required	Avoids hot cracking
Post-weld heat treatment	Generally not required	If required: solution anneal 1150 °C
Filler metal	ERNiCrMo-3 (Inconel 625 type)	Over-alloyed nickel-base filler – PREN match
Welding processes	GTAW, GMAW, plasma	Low heat input (max. 1.5 kJ/mm)
Interpass temperature	≤ 100 °C	Very strict – hot cracking risk
Shielding gas	Ar (pure) or Ar + N_2	Compensate for N loss

- Delivery condition: solution annealed (1150–1200 °C) + water quenched – essential for PREN ≥ 43
- Welding with nickel-base filler (ERNiCrMo-3) mandatory – no matching filler with same PREN available
- Identification per ASTM A312: heat no., 1.4547 / S31254, standard, dimensions
- Welding requires trained personnel and qualified WPS/WPQR
- CCT test per ASTM G48 or NORSOK MDS common for offshore applications
- Fully austenitic structure – non-magnetic, slight magnetism after cold working

10 Inquiry & Contact

For a project-specific inquiry we ideally require:

- Standard and type (e.g. ASTM A403 WP-S31254 LR 90°)
- Dimensions: DN / NPS, wall thickness or schedule
- Required tests: PREN, NORSOK CCT, possibly ASTM G48
- Quantity and required delivery date
- Required documentation (EN 10204 type 3.1 / 3.2, NDT, external inspection)
- Project-specific specification (NORSOK MDS, NACE MR0175, customer specifications)

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