ValbrunaNordic

High alloy Austenitic Stainless Steel
EN 1.4547 – UNS S31254 – 254 SMO®*

A stainless austenitic steel

Typical analysis %	C	Cr	Ni	Mo	Others
EN 1.4547	0,01	20	18	6,1	N, Cu
Delivery condition			Solution annealed		

(EN 1.4547 replaces SS 2378 –02)

Characteristic temperatures

	Temperature°C
Solidification range Scaling temperature in air	1400-1325 1000
Hot forming Solution annealing Stress relief annealing (max 5h)	1200-950 1140-1200 500
Use in pressure vessels	(-60)-400

Mechanical properties

Values for solution annealed condition acc. to EN 10272

Tensile strength Rm	N/mm^2	650-850
Proof strength $Rp_{0,2}$	N/mm^2	Min 300
Proof strength $Rp_{1,0}$	N/mm^2	Min 340
Elongation A_5	%	Min 35 (30)
Impact energy KV 20ºC	J/cm^2	Min 100 (60)
Hardness	HB	Max 260

( ) 160<d≤250

Physical properties acc. to EN 10088

Temperature ºC	20	100	200	300	400
Density kg/dm^3	8,0	-	-	-	-
Modulus of elasticity E GPa	200	195	185	178	170
Mean coeff. of therm.expansion 20°C –Temp. $x10^{-6} \cdot K^{-1}$	-	16	16	16,5	17
SpecificTherm.Capacity $W/m \cdot K$	13	14	15	17	18
Electrical Resistivity $\Omega \cdot mm^2/m$	0,85	0,90	0,95	1,03	1,10
Specific heat $J/kg \cdot K$	500	520	540	555	570

EN 1.4547 – 254SMO®* is an austenitic stainless steel which due to its high molybdenum content possesses very high resistance to pitting and crevice corrosion. The steel grade was developed for use in halide-containing environments such as seawater. **EN 1.4547** also shows good resistance to uniform corrosion and, especially in acids containing halides, this steel grade is superior to conventional stainless steel. Due to its high nitrogen content **EN 1.4547** has higher mechanical strength than most other austenitic stainless steels.It is non-magnetic in the annealed condition but may become slightly magnetic as a result of cold-working or welding.

Design features

⇒ Good to very good resistance to uniform corrosion
⇒ Good to exceptionally good resistance to pitting and crevice corrosion
⇒ Very good resistance to various types of stress corrosion cracking
⇒ Good ductility and weldability

Corrosion resistance

Uniform corrosion

The high content of alloy materials gives the steel exceptionally good resistance to uniform corrosion. Acids and acid solutions containing halide ions are very aggressive and **EN 1.4547** is preferable to use. Examples of such acids are hydrochloric acid, hydrofluoric acid, chloride contaminated sulphuric acid, phosphoric acid and pickling acids based on nitric acid and hydrofluoric acid solutions.

Intercrystalline corrosion

EN 1.4547 has a very low carbon content. This means that there is very little risk of carbide precipitation in connection with heating. On the other hand there is a risk of precipitation of intermetallic phases in the temperature range 600-1000° C. These precipitations do not involve a risk of intercrystalline corrosion in the corrosive media where this steel is used. Thus welding can be carried out without risk of intercrystalline corrosion.

Stress corrosion cracking

Conventional steels of the 1.4301 and 1.4401 type are sensitive to stress corrosion cracking (SCC) under certain conditions, i.e. a special environment in combination with tensile stress in the material and often also an elevated temperature. Resistance to SCC increases with the increased content of nickel and molybdenum. This implies that the high-alloyed **EN 1.4547** has very good resistance to SCC.

Pitting and crevice corrosion

Resistance to pitting corrosion and crevice corrosion is determined mainly by the content of chromium, molybdenum and nitrogen in the material. This is often illustrated by using the pitting resistance equivalent (PRE) for the material,which can be calculated using the formula

PRE = %Cr + 3.3 x %Mo + 16 x %N

Heat treatment

Solution annealing 1140-1200° C. Holding time at solution annealing temperature approx. 30 min, followed by rapid cooling in air or water.

Hardening

This grade cannot be hardened by heat treatment, but it can be hardened by cold working.

Fabrication

Hot and cold forming

Hot forming should be carried out in the temperature range 1200-950˚C. It is important that the entire workpiece has been exposed to a sufficiently high temperature. In the case of partial heating, or cooling that is too slow, hot working should be followed by solution annealing. The temperature should be at least 1150˚C to avoid residual intermetallic phases from the working.

Bending, pressing and other forming operations can easily be done in cold condition. The steel work-hardens rapidly. In complicated cold-forming operations, it may sometimes be necessary for intermediate annealing, especially if it includes welds.

Machining

High alloy austenitic steels, such as **EN 1.4547**, are generally more difficult to machine than conventional austenitic steels. It requires higher cutting forces and causes more rapid tool wear than lower alloyed stainless steels, due to its higher strength and alloy content.

Welding

EN 1.4547 has a good weldability and the methods used for welding conventional austenitic steels are used. However, due to its stable austenitic structure, it is somewhat more sensitive to hot cracking in connection with welding and generally welding should be performed using the lowest heat input possible. Remelting of the parent metal, such as during welding without filler metal may cause microscale variations in composition for elements such as chromium, nickel and particulary, molybdenum. These variations may reduce the pitting resistance of the weld. GTA- (TIG) and plasma-arc-welding without filler metal should therefore be avoided.

Filler metal of type Avesta Welding P12 and P16 with a very high alloy type of composition are recommended. These filler metals will give a weld with a pitting resistance comparable to the base metal.

More detailed information concerning the procedures for welding these steels can be obtained from Avesta Welding AB

Surface finish

EN 1.4547 is available with pickled or machined and peeled surface.

Stock standard

Please refer to our stock standard leaflet.

Technical support

VALBRUNA NORDIC AB will be helpful in giving further advice and recommendations concerning choice of materials, welding, heat treatment, etc.

MATERIAL STANDARDS

SS-EN 10272	Stainless steel bars for pressure purposes
SS-EN 10088-3	Stainless steels-Part 3 Technical delivery conditions for semi-finished products, bars, rods and sections for general use.
ASTM A 276/ ASME SA-276	Stainless steel bars for general purposes
ASTM A 479/ ASME SA-479	Stainless steel bars for pressure boilers/pressure vessels