

## Super Austenitic stainless steel F44 / S31254 / 1.4547

6% Molybdenum

Corresponding Standards:	
<b>EN/DIN</b>	<ul style="list-style-type: none"><li>• 1.4547 EN10088-3</li><li>• X1CrNiMoN20-18-7</li><li>• X1CrNiMoCuN20-18-7</li></ul>
<b>AFNOR</b>	<ul style="list-style-type: none"><li>• Z1 CNDU 20.18.06 AZ</li></ul>
<b>UNS</b>	<ul style="list-style-type: none"><li>• S31254</li></ul>
<b>AISI</b>	<ul style="list-style-type: none"><li>• F44 (A182 / A276 / A479)</li></ul>
<b>SS</b>	<ul style="list-style-type: none"><li>• 2378</li></ul>
<b>NORSOK</b>	<ul style="list-style-type: none"><li>• M630-MDS R17 BAR</li><li>• M630-MDS R14 FORGINGS</li><li>• M630-MDS R15 PLATE</li><li>• M650 Qualification of Manufacturer</li></ul>

Stainless steel grade 254 SMO™ is a very high end austenitic stainless steel. It is designed with a combination of impact toughness resistance to chloride stress corrosion cracking, and pitting and crevice corrosion with strength that is twice that of the stainless steel 300 series.

For certain applications, grade 254 SMO™ has been reported to be a cost-effective substitute for high nickel and titanium alloys. It is known to possess excellent workability as well.

The following sections will discuss in detail about stainless steel grade 254 SMO™.

### Availability :

SMO 254 is available as round / flat / sheet / hexagonal / plate/ square / coil / pipe & fittings.

### Other Designations

Other designations that are equivalent to stainless steel grade 254 SMO™ include the following.

ASTM A813	ASTM A469	ASTM A269	ASTM A240	ASTM A182 (F44)
ASTM A814	ASTM A312	ASTM A249		

**Similar to:**

- 1.4529
- AL6XN™ / AL6XN PLUS™
- ALLOY 926
- ALLOY SSC-6MO
- INCOLOY® 25-6 HN
- INCOLOY® 25-6 MO
- NAS 254 NM
- NAS 255 NM
- UNS N08367
- UNS N08926 (Formerly N08925)
- 254SMO® / 6Mo® / 6MOLY

**Other Standards / Specifications:**

- ASTM / ASME A.SA 182
- ASTM / ASME A.SA 276
- ASTM / ASME A.SA 479
- ASTM A370
- NACE MR01-03
- NACE MR01-75
- ANSI / NACE ISO 15156
- ASTM G48 METH.A(50°/24H)
- ASTM A262 Practice E
- EN/ISO 3651-2A SENSITISED T1
- PED 97/23/EC
- ASTM A388
- API 6A PSL3

## Chemical Composition

The chemical composition of stainless steel grade 254 SMO™ is outlined in the following table.

Element	Content (%)
Iron, Fe	55.69
Chromium, Cr	20
Nickel, Ni	18
Molybdenum, Mo	6.1
Nitrogen, N	0.20
Carbon, C	0.010

## Physical Properties

The physical properties of stainless steel grade 254 SMO™ are tabulated below.

Properties	Metric	Imperial
Density	8 g/cm <sup>3</sup>	0.289 lb/in <sup>3</sup>

## Mechanical Properties

The following table shows mechanical properties of stainless steel grade 254 SMO™.

Properties	Metric	Imperial
Tensile strength	680 MPa	98600 psi
Yield strength	300 MPa	43500 psi
Modulus of elasticity	195 GPa	28300 ksi
Shear modulus	75 GPa	10900 ksi
Poisson's ratio	0.30	0.30
Elongation at break	50 %	50 %
Hardness, Brinell	210	210

## Thermal Properties

The thermal properties of stainless steel grade 254 SMO™ are tabulated below.

Properties	Metric	Imperial
Thermal expansion co-efficient (@20-100°C/68-212°F)	16.5 µm/m°C	9.17 µin/in°F
Thermal conductivity	14 W/mK	97.2 BTU in/hr.ft <sup>2</sup> .°F

## **Fabrication and Heat Treatment**

### **Annealing**

Annealing of this material should be performed at 1149-1204°C (2100-2200°F), which should be followed by a water quench.

### **Hot Working**

Forging, upsetting and other operations relating to this material can be performed at 982 - 1149°C (1800 - 2100°F). It is recommended that temperatures do not exceed this range as it would result in scaling and reduction in the workability of the material. To re-attain maximum corrosion resistant properties, it is advisable to perform post-process annealing.

### **Cold Working**

Cold working can be carried out using all the traditional methods; however the process would be tough due to its high work hardening rate. The result will provide the material with increased strength and toughness.

### **Hardening**

Stainless steel grade 254 SMO™ does not respond to heat treatment. Hardening is possible only through cold reduction.

### **Applications**

Stainless steel grade 254 SMO™ is used in the following areas:

- Saltwater handling
- Tall oil distillation columns
- Flue gas desulfurization scrubbers
- Components used in petroleum production
- Food processing equipment
- Process equipment in chemical industry
- Bleaching equipment in the pulp and paper industry
- Flue-gas cleaning
- Desalination
- Heat exchangers

### **Machinability**

Stainless steel grade 254 SMO™ is quite tough to machine due to the extremely high work hardening rate and lack of sulfur content; however using sharp tools, overpowered machine tools, positive feeds, good amount of lubrication, and slow speeds tend to provide good machining results.

### **Welding**

Welding of stainless steel grade 254 SMO™ requires filler material without which it results in poor strength properties. Filler metals such as AWS A5.14 ERNiCrMo-3, and alloy 625 are recommended. Electrodes used in the process, have to match with AWS A5.11 ENiCrMo-12.

## **ADDITIONAL INFORMATION :**

Super-Austenitic 1.4547 / 31254 / F44 Stainless steel Acier, inoxydable, Rostfreier, Stahl, Acciaio, Inossidabile, Aco, Inoxidável, Acero, Inox, Inoxidables, Rostfrei, Roestvrij material. The nickel and chromium contents of this alloy make it resistant to a wide range of corrosive environments. The alloy is especially resistant to non-oxidizing acids such as sulphuric and phosphoric. The high molybdenum content and nitrogen provide resistance to pitting and crevice corrosion, while copper enhances resistance to sulphuric acid. Alloy 254SMO / 6Mo / F44 is a fully austenitic alloy containing 6% molybdenum and offering excellent corrosion resistance in a wide variety of aggressive, aqueous environments. It replaces the conventional, austenitic stainless steels (AISI 316 and 317), where their capabilities are pushed to their performance limits. The alloy, therefore, falls into a "super austenitic stainless steel" category. It can also represent a cost-effective alternative to the higher nickel alloys in some marine and chemical processing environments. One of the outstanding attributes of S31254 / 1.4547 alloy is its resistance to environments containing chlorides or other halides. This alloy is especially suited to handle high-chloride environments such as brackish water, sea water, caustic chlorides and pulp mill bleach systems. Applications include chemical and food processing, pulp and paper bleaching plants, marine and offshore platform equipment, salt plant evaporators, air pollution control systems, and condenser tubing, service water piping, and feed-water heaters for the power industry.

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. 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  $PRE = \%Cr + 3.3 \times \%Mo + 16 \times \%N$ .

The above text is given as an overview of Super Austenitic Stainless Steel and is not to be relied upon for a specification.