



# North American Stainless

## Flat Product Stainless Steel Grade Sheet

**AISI 321**  
**UNS S32100**  
**EN 1.4541**

### INTRODUCTION:

Type 321 is a widely used stainless steel, where parts are heated within carbide precipitation temperature range (800°F–1500°F) and exposed to corrosive atmosphere. Type 321 is similar to 304 SS with higher nickel and stabilized with Titanium. Titanium preferentially reacts with carbon in the steel and prevents precipitation of chromium carbides at the grain boundaries, preventing depletion of chromium near the grain boundaries, during exposure within critical temperature range, and thus preserving its corrosion properties.

This grade responds well to hardening by cold working. It has good welding characteristics. Post-weld annealing is not normally required to restore the excellent performance of this grade in a wide range of corrosive conditions.

### Product Range:

Product is available in Cold Rolled, Continuous Mill Plate and Plate Mill Plate form up to 60" wide in various thicknesses.

For inquiry about minimum quantity, specific thickness and tolerances, contact inside sales at NAS.

### Chemical Composition :

UNS	ASTM/Euro	Carbon	Manganese	Phosphorous	Sulfur	Silicon	Chromium	Nickel	Nitrogen	Titanium
S32100	321/1.4541	0.08 max	2 max	0.045max	0.03 max	0.75max	17-19	9-12	0.1 max	5 (C+N)- 0.7

### Mechanical Properties :

	Tensile Strength min	Yield Strength min	Elongation min	Hardness max
321/1.4541	75 ksi	30 ksi	40%	95 HRB

Note: Enhanced properties available upon request.

**Nominal Physical Properties:** The values are at room temperature, unless otherwise specified.

Density	7.9 kg/m <sup>3</sup>	Mean Co-efficient of Thermal Expansion 0-100°C	17.2 um/mK
Modulus of Elasticity	193		
Specific Heat Capacity	500J/kgK	Melting Range	1400-1450°C
Thermal Conductivity @100°C	16.2W/mK	Relative Permeability*	1.02

Note: This grade is non-magnetic in annealed condition but becomes slightly magnetic after cold working.

**Certification:**

ASTM A240, A480, A666, ASME SA240, SA480, SA666, ASTM A262, EN 10088-2, EN 10028-7.

**PROPERTIES AT ELEVATED TEMPERATURE**

The properties listed below are typical of annealed 321SS compared with 304SS. These values are given as a guideline only, and should not be used for design purposes.

Maximum recommended temperature for 321 SS is 1500°F in continuous operation and 1450°F in intermittent operation.

**SHORT TIME ELEVATED TEMPERATURE TENSILE PROPERTIES**

Property	Type	Temperature (°C)								
		100	300	500	600	700	800	900	1 000	1 100
Tensile Strength (MPa)	304	510	435	410	360	245	135	75	40	20
	321	525	405	380	335	265	175	100	60	25
0.2% Proof Stress (MPa)	304	220	145	125	110	95	70			
	321	210	165	140	130	115	95			
Elongation (% in 50mm)	304	52	40	36	35	35	37	42	73	96
	321	50	43	37	37	48	68	62	62	87

**FATIGUE PROPERTIES**

When looking into the fatigue properties of austenitic stainless steels, it is important to note that design and fabrication—not material—are the major contributors to fatigue failure. Design codes (e.g., ASME) use data from low-cycle fatigue tests carried out on machined specimens to produce conservative S-N curves used with stress concentration factors (k1c) or fatigue strength reduction factors (kt). In essence, the fatigue strength of a welded joint should be used for design purposes, as the inevitable flaws (even only those of cross-sectional change) within a weld will control the overall fatigue performance of the structure.

**ANNEALING**

Annealing is achieved by heating to above 1900°F and holding for 60 minutes per inch thickness followed by water or air quenching. Controlled atmosphere is recommended in order to avoid excessive oxidation of the surface.

## COLD WORKABILITY

321SS can readily be cold worked. Strain-hardening rate will vary depending on the actual chemistry. Operations such as wire drawing, forging, upsetting and bending are common. Severe forming may require intermediate annealing.

## MACHINABILITY

Like most other austenitic steels, this grade machines with rough and stringy chips; therefore, chip curlers can be beneficial.

## WELDING

321SS has good welding characteristics and is suited to all standard welding methods. Either matching or slightly over-alloyed filler wires should be used for maximum corrosion resistance. The weld discoloration should be removed by pickling and passivation to restore maximum corrosion resistance.

## CORROSION RESISTANCE

321SS has excellent corrosion resistance in a wide variety of corrosive media, including foodstuffs, sterilizing solutions, most organic chemicals and dyes and a wide variety of inorganic chemicals.

In service, acid corrosion may be either inhibited or accelerated by the presence of other chemicals or contaminants. The reaction of a material to all the possible service variables can not be fully assessed in the laboratory. Consequently, tests have been carried out in pure acid solutions and are intended only to provide a guide to general uniform corrosion in this media. In situ testing will provide more reliable data for material selection.

## PITTING RESISTANCE

Pitting resistance is important, mainly in applications involving contact with chloride solutions, particularly in the presence of oxidizing media. These conditions may be conducive to localized penetration of the passive surface film on the steel and a single deep pit may well be more damaging than a much greater number of relatively shallow pits. Where pitting corrosion is anticipated, steels containing molybdenum (such as 316L) should be considered.

Pitting-resistance equivalent numbers (PREN) are a theoretical way of comparing the pitting corrosion resistance of various types of stainless steels, based on their chemical compositions. The PREN (or PRE) numbers are useful for ranking and comparing the different grades, but cannot be used to predict whether a particular grade will be suitable for a given application, where pitting corrosion may be a hazard.

## INTERGRANULAR CORROSION

This grade is specially designed to prevent sensitization and can be used safely in temperature range of between 850°F and 1550°F.

## ATMOSPHERIC CORROSION

The atmospheric corrosion resistance of austenitic stainless steel is unequalled by virtually all other uncoated engineering materials.

**Technical Service:** For further information, email [qualitycontrol@northamericanstainless.com](mailto:qualitycontrol@northamericanstainless.com)

For new product development requirements, contact [sales@northamericanstainless.com](mailto:sales@northamericanstainless.com).

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