Grade Data Sheet

321

Grades 321 is the basic 18/8 austenitic steel (Grade 304) stabilised with Titanium. This grade is not sensitive to intergranular corrosion after heating within the carbide precipitation range of 425-850°C. 321 is the grade of choice for applications in the temperature range of up to about 900°C, combining high strength, resistance to scaling and phase stability with resistance to subsequent aqueous corrosion.

Grade 321H is a modification of 321 with a controlled higher carbon content, to provide improved high temperature strength.

A limitation with 321 is that titanium does not transfer well across a welding arc, so is not usable as a welding consumable. Grade 347 is therefore used - the niobium performs the same carbide stabilisation task but can be transferred across a welding arc. Grade 347 is therefore the standard consumable for welding 321. Grade 347 is only occasionally used as parent plate material.

Like other austenitic grades, 321 has excellent forming and welding characteristics, is readily brake or roll formed and has outstanding welding characteristics. Post-weld annealing is not required. Grade 321 also has excellent toughness, even down to cryogenic temperatures. Grade 321 does not polish well, so is not recommended for decorative applications.

Grade 304L is more readily available in most product forms, and so is generally used in preference to 321 if the requirement is simply for resistance to intergranular corrosion after welding. However 304L has lower hot strength than 321 and so is not the best choice if the requirement is resistance to an operating environment over about 500°C.

Corrosion Resistance

Equivalent to Grade 304 in the annealed condition, and superior if the application involves service in the 425-900°C range. Subject to pitting and crevice corrosion in warm chloride environments, and to stress corrosion cracking above about 50°C. Considered resistant to potable water with up to about 200mg/L chlorides at ambient temperatures, reducing to about 150mg/L at 60°C. Consult Atlas Technical Assistance for specific environmental recommendations.

Heat Resistance

Good oxidation resistance in intermittent service to 900°C and in continuous service to 925°C. These grades perform well in the 425-900°C range, and particularly where subsequent aqueous corrosive conditions are present. 321H has higher hot strength, and is particularly suitable for high temperature structural applications.

Heat Treatment

Solution Treatment (Annealing)

Heat to 950-1120°C and cool rapidly for maximum corrosion resistance.

Stabilising Treatment

This treatment follows normal solution treatment. Heat to approx 870-890°C for 2 hours per 25mm of thickness and air cool. Stabilisation is recommended for most severe service conditions (above 425°C) and particularly for material annealed at the upper side of the annealing temperature range. The exact treatment must be agreed between supplier and purchaser.

Stress Relief

Heat to 700°C for 1 to 2 hours and air cool.

These grades cannot be hardened by thermal treatment.

Welding

Excellent weldability by all standard fusion methods, both with and without filler metals. AS 1554.6 pre-qualifies welding of 321 and 347 with Grades 347 or 347Si rods or electrodes.

"Dual Certification"

Plate is commonly dual-certified as 321 and 321H, suitable for high temperature applications.

Typical Applications

Expansion joints. Bellows. Furnace parts. Heating element tubing. Heat exchangers. Screens for high temperatures. Spiral welded tube for burner pipes and flues.

Grade Data Sheet

321

Specified Properties

These properties are specified for flat rolled product (plate, sheet and coil) in ASTM A240/A240M. Similar but not necessarily identical properties are specified for other products such as pipe in their respective specifications.

Composition Specification (%)

Grade		C	Mn	Si	P	S	Cr	Mo	Ni	N	Other
321	min.	-	-	-	-	-	17.0	-	9.0	-	Ti=5(C+N)
	max	0.08	2.00	0.75	0.045	0.030	19.0		12.0	0.10	0.70
321H	min.	0.04	-	-	-	-	17.0	-	9.0	-	Ti=4(C+N)
	max	0.10	2.00	0.75	0.045	0.030	19.0		12.0		0.70
347	min.	-	-	-	-	-	17.0	-	9.0	-	Nb=10(C+N)
	max	0.08	2.00	0.75	0.045	0.030	19.0		13.0		1.0

Mechanical Property Specification

Grade	Tensile Strength (MPa) min	Yield Strength 0.2% Proof (MPa) min	Elongation (% in 50mm) min	Hardness	
				Rockwell B (HR B) max	Brinell (HB) max
321	515	205	40	95	217
321H	515	205	40	95	217
347	515	205	40	92	201
321H also has a requirement for a grain size of ASTM No 7 or coarser.					

Physical Properties

(typical values in the annealed condition)

Grade	Density (kg/m³)	Elastic Modulus (GPa)	Mean Coefficient of Thermal Expansion			Thermal Conductivity		Specific Heat	Electrical Resistivity
			0-100°C (µm/m/°C)	0-315°C (µm/m/°C)	0-538°C (µm/m/°C)	at 100°C (W/m.K)	at 500°C (W/m.K)	0-100°C (J/kg.K)	(nΩ.m)
321	7900	193	16.6	17.2	18.6	16.1	22.2	500	720

Grade Specification Comparison

Grade	UNS No	Euronorm		Swedish SS	Japanese JIS
		No	Name		
321	S32100	1.4541	X6CrNiTi18-10	2337	SUS 321
321H	S32109	1.4878	X8CrNiTi18-10	-	SUS 321H
347	S34700	1.4550	X6CrNiNb18-10	2338	SUS 347
These comparisons are approximate only. The list is intended as a comparison of functionally similar materials **not** as a schedule of contractual equivalents. If exact equivalents are needed original specifications must be consulted.					

Possible Alternative Grades

Grade	Why it might be chosen instead of 321
304L	The requirement is for resistance to intergranular corrosion, not high temperature strength
AtlasCR12	Only mild "high temperature" environment is present… up to about 450 – 600°C.
304H	Only mild "high temperature" environment is present… up to about 600 – 800°C.
310	The operating temperature is up to about 1100°C - too high for 321 or 321H.
S30815 (253MA)	The operating temperature is up to about 1150°C- too high for 321 or 321H.