



## Technical Data

Ferguson Metals, Inc. ♦ Hamilton, Ohio

### Stainless Steels

### Chromium-Nickel-Molybdenum

### Types 321 (S32100),

### 347 (S34700)

#### GENERAL PROPERTIES

Types 321 (S32100) and 347 (S34700) are stabilized stainless steels which offer as their main advantage an excellent resistance to intergranular corrosion following exposure to temperatures in the chromium carbide precipitation range from 800 to 1500°F (427 to 816°C). Type 321 is stabilized against chromium carbide formation by the addition of titanium. Type 347 is stabilized by the addition of columbium and tantalum.

While Types 321 and 347 continue to be employed for prolonged service in the 800 to 1500°F (427 to 816°C) temperature range, Type 304L has supplanted these stabilized grades for applications involving only welding or short time heating.

Types 321 and 347 stainless steels are also advantageous for high temperature service because of their good mechanical properties. Types 321 and 347 stainless steels offer higher creep and stress rupture properties than Type 304 and, particularly, Type 304L which might also be considered for exposures where sensitization and intergranular corrosion are concerns. This results in higher elevated temperature allowable stresses for these stabilized alloys for ASME Boiler and Pressure Vessel Code applications. The Types 321 and 347 alloys have maximum use temperatures of 1500°F (816°C) for code applications like Type 304, whereas T304L is limited to 800°F (426°C).

Applications for Types 321 and 347 include those for welded construction and parts subjected to heating in the carbide precipitation range, aircraft collector rings, aircraft exhaust stacks, boiler casings, cabin heaters, carburetor air intensifier tubes, exhaust manifolds, fasteners, fire walls, flash boilers, flexible couplings, furnace heating elements, jet engine parts, large mufflers for stationary diesel engines, pressure vessels, stack liners, all-welded tank car for carrying chemicals, annealing box inner covers, collector rings, expansion joints, heat resistors, heavy wall welded equipment, welded tanks for storing organic chemicals, wire cloth and screens (industrial).

#### CHEMICAL COMPOSITION

Represented by ASTM A240 and ASME SA-240

Element	Maximum Unless Range is Specified	
	321	347
Carbon	0.08	0.08
Manganese	2.00	2.00
Phosphorus	0.045	0.045
Sulfur	0.030	0.030
Silicon	0.75	0.75
Chromium	17.00-19.00	17.00-19.00
Nickel	9.00-12.00	9.00-13.00
Columbium+	-	10xC min to
Tantalum	-	1.00 max
Titanium	5x(C+N) min to 0.70 max	-
Nitrogen	0.10	-
Iron	Balance	Balance

#### RESISTANCE TO CORROSION

Types 321 and 347 alloys offer similar resistance to general, overall corrosion as the unstabilized chromium nickel Type 304. Heating for long periods of time in the chromium carbide precipitation range may affect the general resistance of Types 321 and 347 in severe corrosive media.

#### TYPICAL PHYSICAL PROPERTIES

Grade	Density		Modulus of Elasticity in Tension	Melting Range
	g/cm <sup>3</sup>	lb/in <sup>3</sup>		
321	7.92	0.286	28 x 10 <sup>6</sup> psi 193 GPa	1398-1446°C 2550-2635°F
347	7.96	0.288	28 x 10 <sup>6</sup> psi 193 GPa	1398-1446°C 2550-2635°F

#### MEAN COEFFICIENT OF LINEAR THERMAL EXPANSION

Temperature Range		Coefficients	
°C	°F	cm/cm/°C	in/in/°F
20-100	68-212	16.6 x 10 <sup>-6</sup>	9.2 x 10 <sup>-6</sup>
20-600	68-912	18.9 x 10 <sup>-6</sup>	10.5 x 10 <sup>-6</sup>
20-1000	68-1832	20.5 x 10 <sup>-6</sup>	11.4 x 10 <sup>-6</sup>

#### THERMAL CONDUCTIVITY

Temperature Range		W/m·K	Btu·in/ hr·ft <sup>2</sup> ·°F
°C	°F		
20-100	68-212	16.3	112.5
20-500	68-932	21.4	147.7

#### SPECIFIC HEAT

Temperature Range		J/kg K	Btu/lb·°F
°C	°F		
0-100	32-212	500	0.12

#### MAGNETIC PERMEABILITY

H/m Annealed

1.02 Max

#### ELECTRICAL RESISTIVITY

Temperature Range		microhm·cm
°C	°F	
20	68	72
100	213	78
200	392	86
400	752	100
600	1112	111
800	1472	121
900	1652	126

#### MECHANICAL PROPERTIES

##### Room Temperature Tensile Properties

Minimum mechanical properties of the stabilized Types 321 and 347 chromium-nickel grades in the annealed condition (2000°F[1093°C], air cooled) are shown below.

##### MINIMUM ROOM TEMPERATURE MECHANICAL PROPERTIES PER, ASTM A240 AND ASME SA-240

Property	Type 321	Type 347
Yield Strength, 0.2% Offset psi MPa	30,000 205	30,000 205
Ultimate Tensile Strength, psi MPa	75,000 515	75,000 515
Percent Elongation in 2 in. or 51 mm	40.0	40.0
Hardness, Max., Brinell (Plate) RB (Sheet & Strip)	217 95	201 92