



AS/EN/JISQ 9100:2009



## Nitronic® 50 Stainless Steel (UNS S20910, XM19)

Electralloy's Nitronic® 50 Stainless Steel is a high Nitrogen, Molybdenum bearing austenitic stainless steel that provides corrosion resistance superior to Types 316L and 317L with nearly twice the yield strength at room temperature. Nitronic® 50 possesses good mechanical properties at both elevated and sub-zero temperatures. Unlike other austenitic stainless steel, Nitronic® 50 does not become magnetic when cold worked or cooled to sub-zero temperatures.

### CHEMICAL COMPOSITION (Nominal Analysis, weight percent)

<b>Carbon</b> ( <i>max.</i> ).....	<b>0.06</b>	<b>Chromium</b> .....	<b>20.5/23.5</b>
<b>Manganese</b> .....	<b>4.0/6.0</b>	<b>Nickel</b> .....	<b>11.5/13.5</b>
<b>Phosphorus</b> ( <i>max.</i> ).....	<b>0.04</b>	<b>Molybdenum</b> .....	<b>1.5/3.0</b>
<b>Sulfur</b> ( <i>max.</i> ).....	<b>0.010</b>	<b>Nitrogen</b> .....	<b>0.20/0.40</b>
<b>Silicon</b> ( <i>max.</i> ).....	<b>1.0</b>	<b>Niobium</b> .....	<b>0.10/0.30</b>
		<b>Vanadium</b> .....	<b>0.10/0.30</b>

### TYPICAL APPLICATIONS

Outstanding corrosion resistance of **Nitronic® 50** gives it advantage where 316L or 317L are only marginally effective in petroleum, petrochemical, fertilizer, nuclear fuel handling, paper & pulp, food processing and marine applications. The combination of corrosion resistance and strength lead to applications in marine hardware and boat and pump shafting. **Nitronic® 50** also sees uses in oil field production and blow-out preventer hydraulic manifold blocks. NACE has included **Nitronic® 50** into their standards for "Sulfide Stress Cracking Resistance . . ." leading to oil field "down-hole" applications and refinery applications. High strength, corrosion resistance, and low magnetic permeability also make **Nitronic® 50** a suitable material for medical implants.

Electralloy's Nitronic® 50 Stainless Steel is supplied in ingot, forging billet, bar and plate to meet the requirements of the following specifications, and more . . .

**AMS 5764, ASTM A240, ASTM A276, ASTM A312, ASTM A314, ASTM A403, ASTM A479,  
ASTM F1314, NACE MR0175/ISO 15156-3, NACE MR0103**

The information and data contained in this Product Data sheet are intended for general information and do not constitute any warranty, expressed or implied, of suitability for any applications or design.

## PHYSICAL PROPERTIES

<b>Magnetic Permeability @ RT, 200 oersted:</b>			
Annealed or High Strength	—	~1.004	
<b>Density:</b> 0.285 lb./in. <sup>3</sup> (7.88 gm/cm <sup>3</sup> )			
<b>Coefficient of Thermal Expansion: (Annealed Material)</b>			
Temperature °F	Temperature °C	10 <sup>-6</sup> in/in./°F	um/m/°C
70 to 200	21 to 93	9.0	16.2
70 to 600	21 to 316	9.6	17.3
70 to 1200	21 to 649	10.5	18.8
<b>Laboratory corrosion Test Data: (Annealed Material)</b>			
<b>Corrosion Rate</b>			
Test Medium	Nitronic® 50	316L	
10% FeCl <sub>3</sub> , 25°C – plain	<0.001 g/in <sup>2</sup>	0.011 g/in <sup>2</sup>	
10% FeCl <sub>3</sub> , 25°C – crevice	<0.001 g/in <sup>2</sup>	0.186 g/in <sup>2</sup>	
1% HCl, 35°C	<0.001 in/yr	0.012 in/yr	

## WORKABILITY

Nitronic® 50 may be formed by the same methods used with other austenitic stainless steels. However the alloy is stronger and requires more power for forming and forging. Forging should be accomplished after heating to 2150°F to 2200°F. Additional reheats will be required relative to Type 316. In-process annealing for fabrication or cold forming are best done at 2050°F.

## HEAT TREATMENT

Final annealing for most applications is done at 1950°F followed by water quenching. When as-welded material is used in strongly corrosive environment, annealing should be done at 2050°F. Nitronic® 50 cannot be hardened by heat treatment.

## CORROSION RESISTANCE

General corrosion resistance of Electralloy's Nitronic® 50 Stainless Steel is superior to Types 316L or 317L in many media. Resistance to intergranular attack is excellent even after sensitized at 1250°F. In hot, highly concentrated chloride test conditions, Nitronic® 50 stress corrosion cracking resistance is between that of 304 and 316. Nitronic® 50 does offer superior chloride pitting resistance and stress corrosion cracking resistance than Type 316 in more "real life" marine and seacoast environments. Nitronic® 50 has excellent resistance to sulfide stress cracking and is acceptable by NACE for sour-well service.

## MACHINABILITY

Nitronic® 50 has machinability characteristics similar to other austenitic stainless steels, but requires more power, slower

## MECHANICAL PROPERTIES

<b>Sub-Zero and Elevated Temperature Tensile:</b>					
	UTS		YS		EI
	ksi	MPa	ksi	MPa	%
<i>Nominal 1" (25.4 mm) dia. bars</i>					
-320°F (-196°C)	226	1558	128	883	41
-100°F (-73°C)	146	1007	85	586	50
75°F (24°C)	121	834	57	393	46
600°F (204°C)	104	717	46	317	38
1200°F (649°C)	83	572	42	290	36
<b>Minimum Acceptable Tensile Properties: (Annealed Bar)</b>					
Room Temperature	100	690	55	379	35
<b>Impact Data, Annealed Bar:</b>					
°F	°C		ft*lb	J	
75°	24°		170	230	
-100°	-73°		115	156	
-320°	-196°		50	68	

speeds and higher rigidity due to its high work hardening rate. Use of coated carbide tooling is suggested.

## WELDABILITY

Nitronic® 50 is readily weldable using conventional joining processes. Autogenous, high power density joining processes such as EB or laser welding, should be used with caution due to low FN potential and severe outgassing possibility in vacuum atmosphere due to high nitrogen content. When filler metal added Nitronic® 50W (AWS E/ER209) is recommended.

## MAGNETIC PERMEABILITY

Nitronic® 50 is characterized by low magnetic permeability even after severe cold working and at cryogenic temperatures. Although the magnetic permeability of Nitronic® 50 remains very low at cryogenic temperatures, it does not equal levels of Nitronic® 33 and Nitronic® 40.

## NITRONIC® 50 HIGH STRENGTH BAR

Electralloy's Nitronic® 60 bars are also available in a high-strength condition attained by proprietary processing. Bars cannot be subsequently hot forged or welded without loss of strength. Refer to Electralloy's Nitronic® 50 Product Data Bulletin and/or Electralloy's Nitronic® 50 High Strength Bar Datasheet for additional information.