



Nitronic® 50 High Strength (UNS S20910, XM19)

Electralloy's Nitronic® 50 High Strength bar product is a high Nitrogen and Molybdenum bearing austenitic stainless steel product with corrosion resistance comparable to, or surpassing 316L and 317L. The .02% tensile yield strength exceeds 105 ksi and is essentially non-magnetic. Super High Strength (120 ksi minimum yield strength) and Ultra High Strength (140 ksi minimum yield strength) Nitronic® 50 is available in certain sizes for special applications.

CHEMICAL COMPOSITION (Nominal Analysis, weight percent)

Carbon (<i>max.</i>).....	0.03	Nickel	11.5/13.5
Manganese	4.0/6.0	Nitrogen	0.20/0.40
Phosphorus (<i>max.</i>).....	0.04	Molybdenum	1.5/3.0
Sulfur (<i>max.</i>).....	0.010	Niobium	0.10/0.30
Silicon (<i>max.</i>).....	0.20/0.60	Vanadium	0.10/0.30
Chromium	20.5/23.5		

TYPICAL APPLICATIONS

Electralloy's Nitronic® 50 "Super" High Strength bar product exhibits combination of excellent corrosion resistance, low magnetic permeability, and high strength. These qualities make the material an excellent candidate for many marine environment drive shaft and pump shaft applications. Nitronic® 50 High Strength has been ABS approved for tail shaft and rudder shaft application on Coast Guard Fast Response Cutter. Additionally, Nitronic® 50 High Strength is a sound choice for applications in the oil and gas market such as nonmagnetic drill string components and "measurement while drilling (MWD)" housings.

Nitronic® 50 High Strength can be supplied to meet all the requirements of the following specifications, and more...

**ASTM A276, ASTM A479, NACE MR0175/ISO 15156-3, NACE MR0103-2003,
Schlumberger SH329392 & SH619188**

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.

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PHYSICAL PROPERTIES

Melting Temperature:		2550 to 2600°F (1400 to 1430°C)	
Magnetic Permeability: (@ RT, 200 oersted)			
Annealed or "Super" High Strength		—	~1.004
Density:		0.285 lb./in. ³ (7.88 gm/cm ³)	
Coefficient of Thermal Expansion: (Annealed Material)			
Temperature °F	Temperature °C	10 ⁻⁶ 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
Thermal Conductivity:			
Temperature °F	Temperature °C	BTU/ft ² /in./°F/hr	W/m ² *K
300	149	108	15.6
600	316	124	17.9
Electrical Resistivity:			
Temperature		Resistivity	
°F	°C	microhm-cm	
70	21	82	

FABRICATION

The tensile properties of the Nitronic® 50 High Strength bar product are the result of proprietary hot working practices at the mill. Hence, further hot working, heat treating, welding or brazing operations cannot be performed without loss of strength.

CORROSION RESISTANCE

Electralloy's Nitronic® 50 High Strength provides superior corrosion resistance to 316L and 317L in most media. The Nitronic® 50 High Strength bar product may suffer from reduced corrosion resistance in some environments relative to the annealed condition, although that risk is greatly mitigated with the low carbon content.

There is very little difference in susceptibility to stress corrosion cracking, whether the material is in the annealed or "Super" High Strength condition. In boiling 42% MgCl₂ solution (a very accelerated and overly aggressive media), Nitronic® 50 is between 304L and 316L stainless steel in resistance to cracking.

Nitronic® is a registered trademark of AK Steel.

MECHANICAL PROPERTIES

Minimum Acceptable Nitronic® 50 High Strength Tensile Properties:					
	UTS		YS		EI
	ksi	MPa	ksi	MPa	%
1/2" to 10" dia.	135	931	105	724	20
Typical Minimum Room Temperature Tensile: Super High Strength, Ultra High Strength and Large Diameter Bar					
	UTS		YS		EI
1" - 10"Ø, "Super"	140	965	120	827	22
3½" - 6"Ø, "Ultra"	150	1035	140	965	20
>10" - 12"Ø	125	862	90	620	20
Maximum Hardness "Super" High Strength:					35 R _c
Maximum Hardness "Ultra" High Strength:					40 R _c ⁽¹⁾
Minimum Charpy V-Notch:					
Toughness		FT*LBS		Joules	
High Strength		80		108	
"Super" High Strength		60		81	
"Ultra" High Strength		40		54	

(1) note: "Ultra" High Strength is not suitable for NACE requirements due to high hardness and strength.

In more typical "real world" seawater resistance testing and 5% NaCl fog exposure testing, Nitronic® 50 in both annealed and high strength conditions exhibited resistance to general corrosion and pitting exceeding that of 316L.

MAGNETIC PERMEABILITY

Nitronic® 50 does not become magnetic when cold worked. The magnetic permeability of the alloy remains low even at cryogenic temperatures to below -400°F.

MACHINING

Because of the high strength of Nitronic® 50 in general, and Nitronic® 50 High Strength in particular, more powerful, robust and rigid tooling and workpiece set-up is required than for types 304 and 316 stainless steel. Coated carbide tooling is strongly recommended and positive cutting action needs to be accomplished as soon as possible. Nitronic® 50, in all conditions, is more susceptible to cold work hardening than types 304 and 316 stainless steels. Nitronic® 50 provides a good surface finish.