ECK500 (UNS N05500) NICKEL-COPPER-ALUMINUM ALLOY

Electralloy's ECK500 is a precipitation hardening, Nickel-Copper-Aluminum alloy providing the excellent corrosion resistance of Electralloy's Ni-Cu alloy EC400 with the added advantages of higher strength and hardness.

CHEMICAL COMPOSITION (Nominal Analysis, weight percent)

Nickel *(min)*	**63**	**Silicon** *(max)*	**0.50**
Copper	**27.0 / 33.0**	**Cobalt** *(max)*	**0.25**
Aluminum	**2.50 / 3.15**	**Titanium**	**0.35 / 0.85**
Carbon *(max)*	**0.18**	**Iron** *(max)*	**2.00**
Manganese *(max)*	**1.5**	**Sulfur** *(max)*	**0.01**
Zinc *(max)*	**0.02**	**Phosphorus** *(max)*	**0.02**
Lead *(max)*	**0.006**		

TYPICAL APPLICATIONS

Electralloy's **ECK500** exhibits the characteristic corrosion resistance of Nickel-Copper alloy EC400. The added aluminum and titanium provide increased strength and hardness through precipitation of Ni_3(Ti, Al) during age hardening heat treatment. The combination of these qualities makes the alloy an excellent candidate for many marine environment shaft and pump applications. Additionally, the alloy has shown to be resistant to sour gas environments making it a sound choice for applications in the oil and gas market. The alloy also exhibits excellent low temperature properties. Tensile and yield strengths increase as temperature decreases and toughness suffers almost no deterioration as temperature drops into cryogenic ranges.

ECK500 can be supplied to meet requirements of the following specifications, and more…

QQ-N-286G
ASTM B865
AMS 4676
NACE Standard MR0175

ECK500 is available in a wide variety of sizes and forms, including electro-slag remelted ingot, billet, and bar.

ECK500 (UNS N05500) NICKEL-COPPER-ALUMINUM ALLOY

PHYSICAL PROPERTIES

Melting Temperature:		2400°F to 2460°F (1290°C to 1350°C)	
Density:		0.306 lb./in³ (8.44 gm/cm³)	
Magnetic Permeability:		(@ RT, 200 oersted) Annealed + age hardened - ~1.002	
Specific Heat:		(70 TO 212°F) 0.100 Btu/lb/°F	
Poisson's Ratio:		0.32	
Coefficient of Thermal Expansion			
Temperature			
(°F)	(°C)	10⁻⁶ in/in./°F	um/m/°C
-400 to 70	-240 to 21	6.2	11.2
70 to 200	21 to 93	7.6	13.7
70 to 1200	21 to 649	9.1	16.4

Thermal Conductivity			
Temperature			
°F	°C	BTU/ft2/in/°F/hr	W/m*K
70	21	120	17.5

Electrical Resistivity			
Temperature		Resistivity	
°F	°C	ohm/circ mil/ft	mirohm-m
70	21	~370	~0.6

Modulus of Elasticity (E)				
	Tension		Torsion	
C°	10^6psi	10^3MPa	10^6psi	10^3MPa
21	26	179	9.5	65

TYPICAL MECHANICAL PROPERTIES

Room Temperature Tensile:					
Bar & Rod, "Hot finished" + Aged					
	UTS		YS		El
	ksi	MPa	ksi	MPa	%
Spec. min. 1" - 6"Ø	160	1105	110	760	23
Typical	140	965	100	690	20
Bar & Rod, Annealed + Aged					
Spec. min.	130	896	85	386	20
Typical Hardness: (Annealed + Aged)					279 BHN

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.

HEAT TREATMENT

ECK500 is usually used in the "hot finished" and aged condition, or in the annealed and aged condition. Typical annealing temperatures are from 1600°F to 1900°F followed by water quenching. Annealing accomplishes both softening of the matrix after working and solutioning of age-hardening precipitates. Age hardening is typically accomplished at 1100°F (595°C), followed by furnace cooling to 900°F (480°C), and finally air cooling.

HOT WORKING

Recommended hot working temperature range for this alloy is 2100°F down to 1600°F (1150°C - 870°C). Working below 1600°F is not recommended; and upon completion of hot working, material should be water quenched from temperature ≥1450°F (790°C) to avoid age hardening upon cooling and potential cracking.

CORROSION RESISTANCE

ECK500 is essentially equivalent to Nickel-Copper alloy EC400 in a wide spectrum of media including organic acids, alkalies, salts, industrial waters and oxidizing atmospheres. It is, however, more susceptible to stress corrosion cracking in some environments when in the age hardened condition. While the alloy displays good corrosion resistance at elevated temperatures in many environments, service well above 1000°F will result in dissolution of age hardening precipitates and loss of strength.

WELDING

ECK500 can be joined using most welding, soldering, or brazing techniques common in industry. Welding should be accomplished in the annealed condition. The age hardening treatment also serves as a stress relieve process.

MACHINING

Heavy machining of the alloy is most often accomplished in the annealed or hot finished and quenched conditions. The best approach is to machine slightly oversize prior to age hardening since the age hardening results in a slight permanent contraction. The aging also relieves stresses, so possible warpage also needs to be taken into consideration.

ELECTRALLOY
a G.O. CARLSON Inc. Company

G. O. Carlson
Plate Products

2-2019