



## EC400 (UNS N04400) NICKEL-COPPER ALLOY

Electralloy's EC400 is a nickel-copper alloy which has an excellent combination of high strength, ductility, weldability, and corrosion resistance over a wide range of temperatures and conditions. EC400 is a solid solution alloy that cannot be hardened by heat treatment only by cold working. It is generally free from stress corrosion cracking. The alloy is widely used in marine applications and chemical processing.

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

<b>Carbon (max)</b> .....	<b>0.20</b>	<b>Lead (max)</b> .....	<b>0.006</b>
<b>Manganese (max)</b> .....	<b>2.00</b>	<b>Phosphorus (max)</b> .....	<b>0.02</b>
<b>Silicon (max)</b> .....	<b>0.50</b>	<b>Aluminum</b> .....	<b>0.5</b>
<b>Copper</b> .....	<b>28.00 / 34.00</b>	<b>Zinc (max)</b> .....	<b>0.02</b>
<b>Nickel</b> .....	<b>63.00 / 70.00</b>	<b>Tin (max)</b> .....	<b>0.006</b>
<b>Cobalt (max)</b> .....	<b>1.00</b>	<b>Sulfur (max)</b> .....	<b>0.015</b>
<b>Iron (max)</b> .....	<b>2.50</b>		

### TYPICAL APPLICATIONS

- Chemical Processing Equipment: heat exchangers, reactors and vessels, pumps, valves and piping for processing hydrofluoric, hydrochloric, and sulfuric acids, fluorine, dry chlorine, hydrogen chloride and hydrogen fluoride gases, neutral and alkaline salts
- Petroleum Refining: condensers, vessels, heat exchangers, and piping
- Marine Components: pumps, valves, piping, shafts, and fixtures used in sea and brackish water
- Power Industry: expansion bellows, feed-water heaters, heat exchangers, and cooling tower fans
- Electrical and Electronic Components

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## PHYSICAL PROPERTIES

<b>Melting Temperature:</b>	2385°F to 2475°F (1307°C to 1357°C)				
<b>Density:</b>	0.319 lb./in <sup>3</sup> (8.83 gm/cm <sup>3</sup> )				
<b>Specific Heat:</b>	0.12 Btu/lb./°F				
<b>Electric Resistivity:</b>	625 ohm/cm				
<b>Poisson's Ratio:</b>	0.32				
<b>Curie Temperature:</b>	70°F - 120°F				
<b>Thermal Conductivity:</b>	151 Btu/ft <sup>2</sup> /in./hr./°F				
<b>Modulus of Elasticity (E)</b>					
<b>Temperature</b>		<b>Tension</b>		<b>Torsion</b>	
°F	°C	10 <sup>6</sup> psi	10 <sup>3</sup> MPa	10 <sup>6</sup> psi	10 <sup>3</sup> MPa
70	21	26	179	99.5	65.5
<b>Coefficient of Thermal Expansion</b>					
°F	°C	in./in./°F			
70 to 200	21 to 94	7.7 x 10 <sup>-6</sup>			

## MECHANICAL PROPERTIES

<b>Tensile Properties EC400: (bar)</b>					
	UTS (ksi)	.2% YS (ksi)	%EL	%RA	HARD. BHN
QQ-N-281 / ASTM B 164 annealed (min.)	70	25	35		
QQ-N-281 / ASTM B 164 hot finished (min.)	80	40	30		
Typical EC400 hot finished	91	57	36	72	166

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## HEAT TREATMENT

EC400 can be annealed by heating to between 1400°F and 1500°F (760°C - 815°C) for 1 to 3 hours and cooled rapidly in water or air.

## HOT WORKING

Recommended hot working temperature range for this alloy is 2100°F down to 1600°F (1150°C to 870°C). The recommended ingot breakdown temperature is 2100°F (1150°C). Hot finished properties require finishing below 1450°F (790°C).

## CORROSION RESISTANCE

Electralloy EC400 is excellent in marine applications, including continued or intermittent exposure to high velocity brackish or seawater. This alloy is widely used for handling sulfuric acid under reducing conditions. Also offers good resistance to hydrofluoric acid. EC400 exhibits excellent resistance to non-oxidizing halides and good resistance to neutral and alkaline salts such as carbonates, sulfates, nitrates, and acetates.

## WELDING

EC400 can be readily welded using conventional methods such as oxyacetylene welding using matching composition filler metal, gas tungsten arc (GTAW), gas metal arc (GMAW), shielded metal arc (SMAW), and submerged arc (SAW).

## MACHINING

EC400 can be readily machined. Because of its toughness, cutting speeds are slightly slower and the feeds are lighter than those for mild steel.

## SPECIFICATIONS

ASTM B164, ASTM B564, AMS 4675, QQ-N-281, NACE MR0175

## FORMS AVAILABLE

Ingot, billet, bar, and cold drawn rounds and hexes.

