



## EC276 (UNS N10276) NICKEL BASE ALLOY

EC276 is a nickel base alloy used extensively in severe operating environments including those in chemical processing, pulp and paper, air pollution control, ore processing, and waste treatment. This alloy possesses outstanding resistance to reducing environments, stress corrosion cracking, and oxidation at elevated temperatures. The high molybdenum content and tungsten provides excellent resistance to pitting and crevice corrosion. Low carbon eliminates the need for post-weld treatment of weld joints.

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

Carbon ( <i>max</i> ) .....	0.010	Nickel .....	BALANCE
Manganese ( <i>max</i> ) .....	1.0	Tungsten .....	3.0 / 4.5
Phosphorus ( <i>max</i> ) .....	0.04	Cobalt ( <i>max</i> ) .....	2.5
Sulfur ( <i>max</i> ) .....	0.03	Iron .....	4.0 / 7.0
Silicon ( <i>max</i> ) .....	0.08	Molybdenum .....	15.0 / 17.0
Chromium .....	14.5 / 16.5	Vanadium ( <i>max</i> ) .....	0.35

### TYPICAL APPLICATIONS

#### Chemical Process Equipment

- heat exchangers, reactors and vessels, evaporators, pumps, valves, piping

#### Pulp and Paper

- bleaching, head boxes, waste gas scrubbers

#### Ore Processing

- uranium and aluminum sulfate

**Specifications:** ASTM B472, ASTM B564, ASTM B574, NACE MR0175

#### Air Pollution Control

- power plant scrubbers and related equipment, precipitators, re-heaters, waste-heat recovery systems, industrial boiler scrubbers, marine inert-gas scrubbers

#### Waste Treatment and Disposal

- sewage sludge incinerators, industrial and municipal incinerators, chemical and toxic waste incinerators

**Forms:** ingot, billet, bar, rod, and coil rod

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## PHYSICAL PROPERTIES

<b>Melting Temperature:</b>	2415°F - 2500°F (1324°C - 1371°C)	
<b>Density:</b>	0.321 lb./in. <sup>3</sup> (8.89 gm/cm <sup>3</sup> )	
<b>Specific Heat:</b>	(@ 70°F) 0.102 Btu/lb./°F	
<b>Magnetic Permeability:</b>	(H=200 Oersteds) < 1.001	
<b>Electrical Resistivity:</b>	(@ 70°F) 51.2 microhm-in.	
<b>Coefficient of Thermal Expansion</b>		
Temperature		
°F	°C	in./in./°F
70 to 200	21 to 93	6.2 x 10 <sup>-4</sup>
70 to 600	21 to 316	7.1 x 10 <sup>-4</sup>
70 to 1000	21 to 538	7.4 x 10 <sup>-4</sup>
<b>Thermal Conductivity</b>		
Temperature		
°F	°C	Btu/ft <sup>2</sup> /ft./hr./°F
200	93	6.4
600	316	8.7
1000	538	11.0
<b>Modulus of Elasticity</b>		
Temperature °F		10 <sup>6</sup> psi
70		29.8

## HEAT TREATMENT

EC276 is solution annealed between 2025°F and 2075°F and water quenched.

## WORKABILITY

The recommended hot working temperature range for this alloy is between 1700°F - 2200°F. The recommended ingot breakdown temperature is 2200°F. EC276 can be cold formed in the annealed condition by practices such as drawing, press forming, spinning, bending, and punching. This alloy work hardens more rapidly than austenitic stainless steel and may require intermediate anneals.

## CORROSION & OXIDATION RESISTANCE

EC276 is designed to maintain corrosion resistance even in the weld heat affected zone, thus making the alloy suitable in the as-welded condition. EC276 has excellent resistance to general pitting and stress corrosion cracking. The high nickel and molybdenum content provides excellent resistance to corrosion in reducing atmospheres. High chromium provides excellent resistance to oxidation at temperatures up to 1900 °F.

## MECHANICAL PROPERTIES

<b>Tensile Properties: (Annealed)</b>			
Specification	UTS (ksi) (min)	.2%YS (min)	%EL (min) 2" or (50.8 mm) or 4D
ASTM B564	100 (690 MPa)	41 (283 MPa)	40

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## WELDING

EC276 can be welded using conventional methods such as gas tungsten arc (GTAW), gas metal arc (GMAW), shielded metal arc (SMAW), and resistance welding methods. Low carbon eliminates the need for post-weld treatment of weld joints.

## MACHINING

EC276 can be machined using conventional techniques and equipment similar to those used for 300 series stainless steel. Carbide tipped and high speed tools are recommended. High work hardening characteristics require ridged machine set-ups and sharp tools.

