CORROSION MATERIALS

"Your Corrosion Alloy Specialist"

"ISO 9001-2008 Certified
ISO Registered Since 1993"

Alloy K500

UNS N05500 / W.Nr. 2.4375

Available to the QQ-N-286 Rev. E requirements for Oil & Gas applications as well as the QQ-N-286 Rev. F & G requirements for Marine applications.

Alloy K500, commonly referred to as "K-Monel", is a precipitation hardenable, nickel-copper alloy with similar corrosion resistance to that of Alloy 400 but with greater strength. Typical industrial applications for Alloy K500 include fasteners, springs and chains for marine service, pump and valve components for chemical processing facilities as well as blades and scrapers used in pulp and paper production. Oil and gas production utilize Alloy K500 for drill collars, instruments, pump shafts, impellers and valves as well as for sensors and electronic components.

Chemical Composition

Ni.....63.0 – 70.0	Mn ..... 1.5 Max.
Cu..... Remainder	Fe ..... 2.0 Max.
Al.....2.30 – 3.15	S.....0.01 Max.
Ti.....0.35 – 0.85	Si .....0.50 Max.
C .....0.25 Max.	

Resistance to Corrosion

The corrosion resistance of Alloy K500 is virtually the same as Alloy 400 with exception when in the age-hardened condition, Alloy K500 is more susceptible to stress-corrosion cracking in certain environments. Resistance to hydrogen sulfide makes Alloy K500 useful in sour-gas environments making it extremely popular in the oil patch. Low corrosion rates in sea water make Alloy K500 suitable for marine service although pitting may occur in stagnant waters but the rate of pitting slows after initial attack.

Fabrication and Heat Treat

Alloy K500 can be fabricated by using standard commercial procedures. Hot working the alloy should be performed at temperatures between 1600°F and 2100°F avoiding any prolong soaking time at the higher temperatures. Material should be water quenched from a temperature no lower than 1450°F after hot working. Cold forming in the annealed condition can also be performed using standard methods although may require considerable power to form. Machining of Alloy K500 is easiest in the annealed condition therefore the best practice would be to machine oversize, age-harden, then finish to size. Contraction can occur during aging and 0.0002 in/in should be accounted for in size prior to aging. Welding Alloy K500 is best achieved by gas-tungsten-arc-welding (GTAW). Filler metal AWS A5.14 ERNiCu-7 is typically used for joining. Weldments using this filler metal will not have the strength compared to age hardened base metal. For weldments that require strength, AWS A5.14 ERNiFeCr-2 filler metal can be used.

Solution annealing of the alloy should be performed prior to aging to dissolve phases in the structure that may have formed during previous processing. If the material is hot-finished, then the anneal temperature should be 1800°F. If the material was cold worked, the temperature should be 1900°F. Time at temperature should be kept at a minimum to avoid excessive grain growth. Quenching in water immediately after solution annealing will avoid any partial precipitation of age hardening constituents. Age hardening of annealed (soft) material to obtain maximum properties should be performed as follows. Heat material between 1100°F & 1125°F and hold temperature for 16 hours followed by furnace cooling at a rate of 15°F to 25°F per hour until the material reached a temperature of 900°F. Once the material reached 900°F, cooling can continue via furnace cooling, air cooling or quenching.

Physical Properties

Density@ Room Temp.	0.305 lb/in.^{3}
Melting Point	2400°F to 2460°F
Specific Heat[1] @ 70°F	0.097 Btu/lb·°F
Linear Expansion from 70°F to 200°F	7.6 µin./in.·°F
Linear Expansion from 70°F to 400°F	8.1 µin./in.·°F
Linear Expansion from 70°F to 600°F	8.3 µin./in.·°F
Thermal Conductivity[1] @ 70°F	10.0 Btu/ft·h·°F
Magnetic Permeability[2] @ 70°F	1.0018 @ 200 oersted
Curie Temp.[2] for Permeability of 1.01	-153°F

1. Material annealed prior to test. **2.** Material annealed and age-hardened.

Mechanical Properties at Room Temperature

Product Form	Condition	Tensile (ksi)	0.2% Yield (ksi)	Elongation (%)	Hardness
Rod and Bar	Hot-Finished/Aged[1]	140 to 190	100 to 150	30 to 20	27 to 38 HRC
Rod and Bar	Hot-Finished/Annealed	90 to 110	40 to 60	45 to 25	75 to 90 HRB
Rod and Bar	Hot-Finished/Annealed/Aged[1]	130 to 165	85 to 120	35 to 20	24 to 35 HRC
Rod and Bar	Cold-Drawn/Aged	135 to 185	95 to 160	30 to 15	25 to 41 HRC
Rod and Bar	Cold-Drawn/Annealed/Aged	130 to 190	85 to 120	30 to 20	24 to 35 HRC
Plate	Hot-Finished/Aged	140 to 180	100 to 135	30 to 20	27 to 37 HRC
Sheet	Cold-Rolled/Annealed	90 to 105	40 to 65	45 to 25	85 HRB Max.

1. Nominal properties of material aged to produce maximum properties.

Shear Strength

Condition	Maximum Strength	Deflection at Maximum Strength	Tensile Strength	Elongation
Annealed	65.3 ksi	0.08 ksi	97.5 ksi	49.0 %
Annealed/Aged	96.5 ksi	0.06 ksi	147.2 ksi	29.0 %

Fatigue Strength at Room Temperature

Form & Condition	Fatigue Strength @ 10^8 cycles	Tensile Strength	Ratio (Fatigue Strength/Tensile Strength)
Rod - Annealed	38 ksi	88 ksi	0.43
Rod - Hot-Rolled	43 ksi	99 ksi	0.43
Rod - Hot-Rolled/Aged	51 ksi	155 ksi	0.33

Applicable Specifications

Alloy K500	British Standard	Federal Specification	European Standard
Rod & Bar[1,2]	BS 3076-NA18	QQN286[3, 4]	EN 10204-3.1
Wire	BS 3075-NA18	QQN286[4]	EN 10204-3.1

1. Magnetic permeability 1.01Mu maximum @ 200 Oe in room temperature. **2.** Bar condition may be Hot-Finished/Aged, Cold-Drawn/Aged, Hot-Finished/Annealed/Aged or Cold-Drawn/Annealed/Aged. **3.** Revision E, Interim Amendment II, Form 2. **4.** Material made to QQ-N-286 Revision G requires slow strain rate tensile testing to the parameters specified in Sections 4.2.2.2, and 4.3.6.2. Each test is subject to evaluation under Section 4.3.6 and requires fracture surface photography to be reported with all material test reports. Material made to QQ-N-286 Revision E is not subject to this type of testing.

Please contact Corrosion Materials for a complete list of available items from inventory.

In-house machine and weld facilities help insure that the most common items will be in stock. Items not in stock can be fabricated in a short period of time either in-house or through our extensive, approved subcontractor and supplier network.

"We also supply a complete range of items in the following alloys: C276, Alloy 22, Alloy 400, Alloy 405, Alloy K500, Nickel 200/201, Alloy 20, Alloy 600, Alloy 800/HT®, Alloy B2, Alloy F255, Alloy 6B, and various titanium grades."

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The data and information contained in this pamphlet have been taken from open literature and is believed to be reliable. The information contained is intended to be used as a guide. Corrosion Materials does not make any warranty or assume any legal liability for its accuracy, completeness or usefulness.

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