Alloy Descriptions

Corrosion Resistant Alloys

ALLOY	DESCRIPTION
304 **UNS S30400**	An austenitic stainless steel with approximately 18% chromium and 8% nickel used for heat exchangers, chemical processing, and milder chemicals. Alloy 304 has excellent weldability and forming characteristics. This alloy is resistant to moderately aggressive organic acids, such as acetic acid and reducing acids, such as phosphoric acid. Post-welding heat treatment and rapid quenching will improve corrosion resistance.
304L **UNS S30403**	The low carbon variant of 304 having a carbon content less than 0.035% provides enhanced post-welding corrosion resistance. The low carbon content prevents carbide precipitation during heating and cooling through the critical range of 800 °F to 1,500 °F. Alloys 304 and 304L are the most susceptible of the austenitic stainless steels to stress corrosion cracking (SCC) because of their relatively low nickel content. This alloy is most resistant in the stress-relieved condition. SCC is caused by exposure of parts containing residual stresses to halides at temperatures above 120 °F.
316 **UNS S31600**	A molybdenum-bearing austenitic stainless steel which is more resistant to general corrosion, pitting, and crevice corrosion than chromium-nickel austenitic stainless steels. This Cr-Ni-Mo alloy also provides greater creep, stress-to-rupture, and tensile properties at elevated temperatures. The addition of molybdenum and the higher nickel content makes the steel more resistant to pitting and crevice corrosion in chloride environments.
316L **UNS S31603**	The low carbon variant of 316, having a carbon content less than 0.035%, provides similar corrosion characteristics as 316 and will not form chromium carbides during heating or welding; therefore in many applications post-weld heat treatment is not required. This alloy should not be exposed to prolonged temperatures between 800 °F and 1,500 °F.
316L 2.5% Min. Moly. **UNS S31603**	316L 2.5% Min. Moly. is a low carbon austenitic stainless steel with a molybdenum content range of 2.5% to 3.0%. The added molybdenum improves pitting and crevice corrosion resistance compared to standard 316L chemistries with typical molybdenum contents as low as 2.1%. The alloy is susceptible to intergranular corrosion if exposed to temperatures between 800 °F and 1,500 °F.

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ALLOY	DESCRIPTION
316Ti **1.4571** **UNS S31635**	Alloy 316Ti (1.4571) is similar to 316L, but offers better high temperature strength and mechanical properties. The addition of titanium reduces the risk of intergranular corrosion as carbon preferentially forms titanium carbo-nitrides preventing the formation of chromium carbides in the temperature range of 800 °F to 1,500 °F. This alloy exhibits inferior pitting and stress corrosion cracking resistance compared to 316L, but is considered to have similar general corrosion resistance.
317L **UNS S31703**	317L is a molybdenum-bearing low carbon alloy exhibiting improved resistance to chemical attack compared to 304 and 316L. The higher molybdenum content of this alloy compared to 316L results in higher creep, stress-to-rupture, and tensile properties at elevated temperatures. The low carbon content provides resistance to sensitization during welding and other high temperature processes. The alloy has superior resistance to many organic and inorganic chemicals compared to 316L due to the increased molybdenum content of 3.0% to 4.0%.
6MO **UNS S31254**	UNS S31254 is an austenitic stainless steel with low carbon content which reduces the possibility of precipitation of chromium carbides in the sensitization temperature range. The alloy contains elevated nitrogen, chromium, nickel, and 6% to 6.5% molybdenum by weight. The nitrogen addition provides higher yield and tensile strengths, however the alloy is readily cold worked. S31254 exhibits excellent resistance to uniform corrosion and good resistance to pitting corrosion. The nickel and molybdenum contents of S31254 result in improved stress corrosion cracking resistance compared to other austenitic stainless steels.
N200 **UNS N02200**	Nickel alloy 200 is a solution-strengthened, commercially-pure material. The alloy demonstrates good mechanical properties over a fairly wide range of temperatures. The alloy has excellent corrosion resistance to alkaline solutions and high velocity flowing seawater; however stagnant or low velocity seawater will severely attack N200. Service temperatures should be limited to less than 600 °F. The alloy is used in the chemical and petro-chemical industries.

Alloy Descriptions

Corrosion Resistant Alloys

ALLOY	DESCRIPTION
400 **UNS N04400**	Alloy 400 is a nickel-copper alloy that resists seawater, steam, salt solutions, and caustics. This alloy is easily welded and has good mechanical strength with excellent resistance to stress-corrosion cracking. Alloy 400 is resistant to de-aerated hydrochloric and hydrofluoric acids. The nickel-copper alloy has good mechanical properties from sub-zero temperatures to 1,000 °F. The mechanical properties can be increased for applications requiring higher strength by applying cold work after the final annealing operation.
825 **UNS N08825**	Alloy 825 is a nickel-iron-chromium alloy with molybdenum and copper added. It has excellent resistance to oxidizing and reducing acids, to stress corrosion cracking, pitting, and crevice corrosion. This alloy is used in chemical processing, pollution control equipment, oil and gas wells, acid production, and pickling systems.
C22 **UNS N06022**	Alloy C22 is a nickel-based alloy that is alloyed with chromium, molybdenum, and tungsten. This alloy has exceptional corrosion resistance to many chemicals including strong oxidizers, chlorides, many acids, seawater, and flue gases. It resists pitting, crevice corrosion, and stress corrosion cracking. Alloy C22 resists general corrosion and localized corrosion better than Alloy C276 and 625.
C276 **UNS N10276**	Alloy C276 is a nickel-molybdenum-chromium alloy alloyed with tungsten demonstrating excellent corrosion resistance to a wide range of corrosive materials. This alloy is especially resistant to pitting and crevice corrosion and is used in chemical processing, pulp and paper manufacturing, pollution control equipment, and the manufacture of various acids. The high molybdenum and chromium content results in very good chloride corrosion resistance.
904L **UNS N08904**	Alloy 904L is a low carbon high alloy austenitic stainless steel. Copper gives this grade improved resistance to strong reducing acids such as sulfuric acid. This alloy is very resistant to pitting, crevice corrosion, and stress corrosion cracking caused by chlorides. Alloy 904L is a high chromium-nickel-molybdenum-copper alloy exhibiting excellent corrosion resistance, has good formability and weldability, and resists intergranular corrosion. This alloy is used in acid production, pulp and paper processes, gas scrubbers, oil refining, and seawater cooling.

Alloy Descriptions

Heat Resistant Alloys

ALLOY	DESCRIPTION
321 **UNS S32100**	Alloy 321 is a titanium-stabilized stainless steel providing resistance to intergranular corrosion and resists chromium carbide formation in the 800 °F to 1,500 °F range. The chemical composition of 321 is very similar to 304, but the titanium addition to 321 makes it suitable for high temperature applications where 304 would sensitize and where 304L has inadequate hot strength. 321 has excellent forming and welding characteristics and does not require post-weld annealing. Typical applications include thermal expansion joints, bellows, aircraft exhaust system components, heating element sheath tubing, furnace parts, and heat exchangers.
347 **UNS S34700**	Alloy 347 is a columbium and tantalum stabilized stainless steel providing resistance to intergranular corrosion and resists chromium-carbide formation in the temperature range between 800 °F and 1,500 °F. Alloy 347 offers good mechanical properties for high temperature applications where higher creep and stress rupture properties are required as compared to alloys 304 and 304L. Good high temperature performance of 347 makes it suitable for use in engines, power generation, welded fabrications, high temperature applications in aircraft systems, heat exchangers, steam service, and some high temperature chemical processes.
600 **UNS N06600**	Alloy 600 is a stable austenitic solid solution material. The high nickel content makes the alloy essentially immune to chloride-ion stress corrosion cracking. The high nickel and chromium contents result in good corrosion resistance to organic and inorganic compounds, and oxidation resistance. The alloy exhibits good high temperature mechanical properties and is used in heat treating applications. The alloy is not precipitation hardenable and can only be strengthened by cold work.
625 **UNS N06625**	Alloy 625 is a nickel-chromium-molybdenum-niobium alloy that exhibits excellent resistance to pitting, crevice corrosion, intergranular corrosion, and stress corrosion cracking. The alloy provides good corrosion resistance to inorganic acids such as nitric, phosphoric, sulfuric, and hydrochloric acids. The alloy is also used in applications with alkali and organic acids, and seawater. Alloy 625 also exhibits good high temperature strength and can be used for short term exposures to 1,500 °F; however long-term exposures should be limited to 1,100 °F. This alloy is used in pulp and paper processes, acid cooling heat exchangers, and in high temperature aircraft service.