



HASTELLOY® C-22

UNS NO - N06022

Other common names: Alloy C22

Hastelloy C-22, also called as alloy C22, is an adaptable austenitic nickel-chromium-molybdenum-tungsten alloy with upgraded resistance to pitting, crevice corrosion and stress corrosion cracking. The high chromium content gives excellent resistance to oxidizing media while the molybdenum and tungsten content give very good resistance to reducing media. This nickel steel alloy likewise has magnificent resistance to oxidizing aqueous media, consisting wet chlorine and mixtures containing nitric acid or oxidizing acids with chlorine ions. Different corrosives Hastelloy C-22 has resistance to are oxidizing acid chlorides, wet chlorine, formic and acetic acids, ferric and cupric chlorides, sea water, brine and many mixed or contaminated chemical solutions, both natural and inorganic. These nickel alloys offer ideal resistance to situations where reducing and oxidizing conditions are experienced in process streams. This is valuable in multi-reason plants where such “upset” conditions happen oftentimes. These nickel alloys resist the development of grain-limit accelerates in the weld heat-influenced area, subsequently making it suitable for most chemical process applications in the as-welded condition. Alloy C-22 ought not to be utilized as a part of service temperatures above 1250° F because of the formation of adverse stages which form over this temperature.

Applications

- Acetic Acid/Acetic Anhydride
- Acid Etching
- Cellophane Manufacturing
- Chlorination Systems
- Complex Acid Mixtures
- Electro-Galvanizing Rolls
- Expansion Bellows
- Flue Gas Scrubber Systems
- Geothermal Wells
- HF Furnace Scrubbers
- Incineration Scrubber Systems
- Nuclear Fuel Reprocessing
- Pesticide Production
- Phosphoric Acid Production
- Pickling Systems
- Plate Heat Exchangers
- Selective Leaching Systems
- SO₂ Cooling Towers
- Sulfonation Systems
- Tubular Heat Exchangers
- Weld Overlay-Valves

Characteristics

- Resistant to pitting, crevice corrosion and stress corrosion cracking
- Outstanding resistance to both reducing and oxidizing media
- Excellent resistance to oxidizing aqueous media
- Exceptional resistance to a wide variety of chemical process environments including strong oxidizers such as ferric acids, acetic anhydride, and seawater and brine solutions
- Resists the formation of grain-boundary precipitates in the weld heat-affected zone
- Excellent weld ability

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Fabrication

Although ductile enough to be formed by cold working, middle of the road annealing might be essential because of work hardening. Forging should be performed between 1750-2050° F took after by fast cooling. Annealing can be performed at a temperature scope within 2020-2150° F took after by a fast quench. Cooling at a quickened rate stays away from the formation of detrimental stages which form between 1400-1800° F. Welding should be possible done by gas tungsten-arc, gas metal-arc and shielded metal-arc processes.

Machining

Machining is best accomplished by utilizing high speed steel tooling for drilling operations. Carbide tools work well for turning or milling. Drilling (high speed steel) speeds 10-15 surface feet /minute with feeds of 0.001" (for 1/8 " dia. hole) to 0.007" (for 1" dia. hole) per revolution. Turning (carbide tools) at 90 to 110 surface feet per minute and feed of 0.010" (for roughing) to 0.006" (for finishing). Machining might be done dry or with standard coolants.

Forming

It can be promptly cold or hot formed. After hot forming or severe cold forming, the parts should be solution heat treated.

Welding

Promptly welded by standard techniques, with the exception of that submerged arc welding should be kept away from because of the high heat input and slow cooling of that technique. Clean the weld areas altogether before welding and utilize coordinating filler metal ER NiCrMo-10 and E NiCrMo-10 for GTAW and SMAW techniques respectively. This alloy might be utilized as a part of the welded structure for most applications as it resists grain limit precipitates during welding.

Heat Treatment

Wrought types of this alloy are furnished in the solution heat-treated condition unless generally determined. The standard solution heat treatment comprises of heating at 2050°F (1121°C) trailed by quick air cooling or water extinguishing. Parts which have been hot shaped or seriously cold formed should be solution heat-treated before further fabrication or installation.

Forging

Hot forging can be done in the temperature scope of 2100 F. A solution heat treatment should be performed after forging.

Hot Working

Hot working might be done followed by a solution anneal heat treatment.

Cold Working

The alloy has very good ductility and albeit stiffer than the austenitic stainless steels, cold working is the favored method for shaping. Serious cold working might bring about work hardening and in this occasion a solution heat treatment might be utilized to restore the original mechanical properties of the alloy.

Annealing

Look at "Heat Treatment" for solution annealing.

Aging

The alloy may be aged at temperatures of 950 F to 1900 F for some expansion in hardness and tensile strength (about 3% gains). However, aging (or long exposure) at temperatures above 1400 F results in degradation of V-notch impact strength.

Other Props

V-notch impact strength is 260 ft. lbs. at 70 F and at minus 320 F.

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Chemical Properties

C	Si	P	S	V	Cr	Mn	Fe	Co	Ni	Mo	W
0.015 max	0.08 max	0.02 max	0.02 max	0.35 max	20.0 - 22.5	0.50 max	2.0-6.0	2.5 max	Remainder	12.5 - 14.5	2.5 - 3.5

Mechanical Properties

Tensile Strength (ksi)	0.2% Yield Strength (ksi)	Elongation% in 2 inches
100	45	45

Physical Properties

Properties	Units	Temperature in °C
Density	8.69 g/cm ³	24°
Specific Heat	0.093 Kcal/kg.C	52°
Melting Range	1357-1399 °C	-
Modulus of Elasticity	205.5 KN/mm ²	-
Electrical Resistivity	113.7 μΩ.cm	24°
Coefficient of Expansion	12.4 μm/m °C	24-93°
Thermal Conductivity	10.1 W/m-°K	48°

ASTM Specifications

Pipe / Tube (SMLS)	Pipe Welded	Tube Welded	Sheet / Plate	Bar	Forging	Fitting
B 622	B 619	B 626	B 575	B 574	B 564	B 366

Availability

MANUFACTURING
Refractory Anchors
Fasteners
Custom Machining
Custom Fabrication
Piping / Spools
Stamped Parts
B/W Fittings
S/W Fittings
Flanges
Compression Fittings

RAW MATERIALS
Pipes
Tubes
Bars
Sheets
Plates
-
-
-
-

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