DATA SHEET

INCOLOY® alloy 925

UNS No - N09925

Other common names: Alloy 925

Alloy 925 is a nickel-chromium-molybdenum alloy intended to oppose an extensive variety of extremely corrosive situations, pitting and crevice corrosion. This nickel steel alloy additionally shows uncommonly high return, tensile and creep-rupture properties at high temperatures. These nickel alloys are utilized from cryogenic temperatures up to long term service at 1200° F. One of the recognizing components of Inconel 925 composition is the expansion of niobium to allow age hardening which allows annealing and welding without unconstrained hardening during heating and cooling. The expansion of niobium acts with the molybdenum to harden the alloy´s matrix and give high strength without a strengthening heat treatment. Other famous nickel-chromium alloys are age hardened through the expansion of aluminium and titanium. This nickel steel alloy is promptly created and might be welded in either the annealed or precipitation (age) hardened condition. This super alloy is utilized in a variety of industries such as aerospace, chemical processing, marine engineering, pollution-control equipment, and nuclear reactors.

Applications

- Gas well components
- Petroleum industry
- Valves and tubing
- High-strength piping systems

Characteristics

- Good mechanical properties - tensile, fatigue and creep-rupture
- Yield tensile strength, creep, and rupture strength properties are exceedingly high
- Highly resistant to chloride and sulphide stress corrosion cracking
- Resistant to aqueous corrosion and chloride ion stress corrosion cracking
- High temperature resistant
- Age-hardenable with a unique property of slow aging response that permits heating and cooling during annealing without the danger of cracking
- Excellent welding characteristics, resistant to post weldage cracking

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shaping exotic metals

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Corrosion Resistance

Alloy 925 has a higher level of corrosion resistance. In both decreasing and oxidizing situations, the alloy opposes general corrosion, crevice corrosion, pitting, intergranular corrosion and stress-corrosion cracking. A few situations in which INCOLOY alloy 925 is especially valuable are “sour” (H2S containing) crude oil and natural gas, sulfuric acid, phosphoric acid and sea water. The work of INCOLOY alloy 925 under conditions representing to sour gas wells is demonstrated in Figure 6 and Tables 8, 9 and 10. Figure 6 indicates resistance to stress corrosion cracking in a sharp situation at high pressure and temperature. Table 8 demonstrates that the alloy resists sulfide stress cracking, a type of hydrogen embrittlement. The tests include exposure of stressed on C-ring examples (produced using a bit of tubing, cross area) to a solution containing hydrogen sulfide, sodium chloride and acidic acid.

Machining

Standard machining methods utilized for iron based alloys might be utilized. This alloy works harden during machining and has higher strength and “gumminess” not typical of steels. Heavy duty machining equipment as well as tooling should be utilized to minimize chatter or work-hardening of the alloy in front of the cutting. Most any business coolant might be utilized as a part of the machining operations. Water-base coolants are favored for high speed operations, for example, turning, grinding or milling. Heavy lubricants work best for tapping, drilling, broaching or boring. Turning: Carbide tool is recommended for turning with a nonstop cut. High speed steel tooling should be utilized for interfering with slices and for smooth completing to close resilience. Tools should have a positive rake angle. Cutting speeds and feeds are in the accompanying reaches: For High-Speed Steel Tools For Carbide Tooling Depth Surface Feed Depth Surface Feed of cut pace in inches of cut rate in inches feet/min. per rev. inches feet/min. per rev. 0.250” 25-35 0.030 0.250” 150-200 0.020 0.050” 50-60 0.010 0.050” 325-375 0.008 Drilling: Steady feed rates must be utilized to maintain a strategic distance from work hardening because of harping of the drill on the metal. Rigid setups are crucial with as short a stub drill as practical. Heavy duty, high speed steel drills with heavy web is recommended. Feeds fluctuate from 0.0007 inches for each rev. for holes of less than 1/16” measurement, 0.003 inches for each rev. for 1/4” dia., to 0.010 inches for each rev. for holes of 7/8”diameter. Processing: To acquire great exactness and a smooth completion, it is fundamental to have unbending machines and fixtures and sharp cutting devices. High speed steel cutters, for example, M-2 or M-10 work best with cutting speeds of 30 to 40 feet per minute and feed of 0.004”- 0.006” per cutting tooth. Grinding: The alloy should be wet ground and aluminium oxide wheels or belts are favored.

Forming

This alloy has good ductility and might be promptly formed by every standard technique. Since the alloy is more powerful than consistent steel it need more power to perform forming. Heavy-duty lubricants should be utilized during cold forming. It is crucial to altogether clean the part of all traces of lubricant to shaping as embrittlement of the alloy might occur at high temperatures if lubricant is left on.

Welding

The usually utilized welding strategies work well with this alloy. The coordinating alloy filler metal should be utilized. In the event that coordinating alloy is not available, then the closest alloy richer in the essential chemistry (Ni, Co, Cr and Mo) should be utilized. All welds dots should be marginally curved. It is not important to utilize preheating. Surfaces to be welded must be perfect and free from oil, paint or crayon marking. The cleaned area should stretch out no less than 2” past either side of a welded joint. Gas-Tungsten Arc Welding: DC straight polarity (electrode negative) is recommended. Keep as short an arc length as could be expected under the circumstances and use consideration to keep the hot end of filler metal dependably inside of the protected environment. Shielded Metal-Arc Welding: Electrodes should be kept in dry storage and if dampness has been grabbing the electrodes should be prepared at 600 F for one hour to safeguard dryness. Current settings shift from 60 amps for material (0.062” thick) up to 140 amps for material of 1/2” and thicker. It is best to weave the electrode marginally as this alloy weld metal does not tend to spread.
Cleaning of slag is finished with a wire brush (hand or powered). Complete evacuation of all slag is essential before progressive weld passes furthermore after final welding. Gas Metal-Arc Welding: Reverse-polarity DC should be utilized and best results are acquired with the welding weapon at 90 degrees to the joint. For Short-Circuiting-Transfer GMAW a typical voltage is 20-23 with a current of 110-130 amps and a wire feed of 250-275 inches per minute. For Spray-Transfer GMAW voltage of 26 to 33 and current in the scope of 175-300 amps with wire feed rate of 200-350 inches per minute, relying on filler wire diameter. Submerged-Arc Welding: Matching filler metal, the same concerning GMAW, should be utilized. DC current with either turn around or straight polarity might be utilized. Convex weld globules are favored.

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Heat Treatment
Solution anneal at 1900 F to 1800 F and air cool. Aging is done at 1350 F for 8 hours, furnace cool at 75 F for every hour down to 1175 F and hold at 1175 F for no less than 12 hours then air cool.

Forging
Forging should be done within the scope of 2150 F to 1700 F.

Hot Working
Hot working might be done within the scope of 1800 F down to 1600 F. Try to avoid working at temperatures above 1800 F to retain corrosion resistance.

Cold Working
Cold forming might be done utilizing standard tooling albeit plain carbon tool steels are not recommended for shaping as they tend to produce galling. Soft die materials (bronze, zinc alloy, and so forth.) minimize galling and deliver great completions, yet the die life is to some degree short. For long production runs the alloy tool steels (D-2, D-3) and high speed steels (T-1, M-2, M-10) give great results particularly if hard chromium plated to decrease galling. Tooling should be, for example, to take into consideration liberal clearances and radii. Heavy duty lubricants should be utilized to minimize galling in all forming operations. Twisting of sheet or plate through 180 degrees is for the most part constrained to a twist sweep of 1 T for material up to 1/8” thick and 2 T for material thicker than 1/8”.

Annealing
Anneal at 1850 F for at least 2 hours at temperature, air cool.

Hardening
Might be hardened by heat treatment and also hardens because of cold working.

Chemical Properties

C	Al	Si	P	S	Ti	Cr	Mn	Fe	Ni	Cu	Nb	Mo
0.03 max	0.1 - 0.5	0.5 max	0.03 max	0.03 max	1.9 - 2.4	19.5 - 22.5	1.0 max	22.0 min	42.00-46.00	1.5 - 3.0	0.5 max	2.5 - 3.5

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Mechanical Properties

Tensile Strength (ksi)	0.2% Yield Strength (ksi)	Elongation% in 2 inches
99.3	39.3	56

Physical Properties

Properties	Units	Temperature in °C
Density	8.08 g/cm^3	Room
Specific Heat	0.104 Kcal/kg. C	20°
Melting Range	1311 - 1366 °C	-
Modulus of Elasticity	199 KN/mm^2	21°
Electrical Resistivity	117 µΩ.cm	Room
Coefficient of Expansion	13.2 µm/m °C	20 - 100°
Thermal Conductivity	12.0 W/m -°K	20°

ASTM Specifications

Pipe / Tube (SMLS)	Pipe Welded	Sheet / Plate	Bar	Forging	Fitting
Cold drawn / Extruded	-	-	-	-	-

Availability

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

RAW MATERIALS
Pipes (Cold Drawn / Extruded)
Tubes
Bars
Sheets
Plates
Wires
-
-
-