Alloy 718 Data Sheet

Quick Facts

- Nickel Chromium alloy
- Available in a variety of conditions
- High strength
- Excellent corrosion resistance
- Combination of excellent mechanical properties over a wide range of temperatures
- Outstanding weldability with resistance to post-weld cracking
- Excellent creep-rupture strength at temperatures up to 700◦C (1300◦F)
- Commonly referred to as Inconel® 718

Alloy 718 is a high strength, corrosion resistant nickel chromium alloy, initially developed for the aerospace industry and still considered the material of choice for the majority of aircraft engine components. Its excellent strength and corrosion resistance have been recognised by the oil industry and it is now widely used in this field.

Typical Applications

Typical applications in the oil industry are gate valves, choke stems, fasteners, tubing hangers and fire safe valves. In the aerospace and power generation industries this grade is also used for gas turbines, aircraft engines, fasteners and other high strength applications.

Stock Range

We stock a comprehensive range of sizes between 12.7mm and 284mm diameter round bar but can convert this to enable us to supply flat, rings, blocks and slabs.

Material is stocked in three heat treatment conditions:-

- Solution annealed and aged in accordance with API 6A718
- Annealed in accordance with AMS 5662
- Annealed and aged in accordance with AMS 5663

Primarily manufactured in: Europe, US

Industry Specifications

- ASTM B637
- UNS NO7718
- API 6A 718
- AMS 5662/5663
- NACE MR0175/ISO15156

Material may also be supplied to Customer specifications, subject to enquiry

Melting Practices

- VIM/ESR or VAR
- EF/AOD or VOD/VAR
- Triple Melted

Chemical Analysis

Alloy 718 is hardened by the precipitation of secondary nickel- (aluminium, titanium, niobium) phases giving the alloy a combination of high strength and good corrosion resistance.

Chemical Composition of Alloy 718 for Aerospace:

	C	Mn	Si	P	S	Cr	Ni	Mo	Nb + Ta	Ti	Al	Co	B	Cu	Fe	-
Min	-	-	-	-	-	17.0	50.0	2.80	4.75	0.65	0.20	-	-	-	Bal	%
Max	0.08	0.35	0.35	0.015	0.015	21.0	55.0	3.30	5.50	1.15	0.80	1.0	0.006	0.30	-	%

Machinability

Alloy 718 can be readily machined but due to its high strength and work hardening characteristics, tooling, operating speeds and coolants should be considered. Machining in the age hardened condition improves the surface finish and chip action, whereas machinability and tool life are improved when machining material in the solution annealed condition.

Material Conditions

There are generally two heat treatments used for Alloy 718:

- Solution annealed between 1021 – 1038°C (1870°F - 1900°F) followed by rapid cooling and precipitation hardened around 778°C (1432°F)
- Solution annealed between 941 - 1010°C (1726°F - 1850°F) followed by rapid cooling and precipitation hardened at 718°C (1324°F) furnace cooled to 621°C (1150°F) for a further age

These provide either a combination of high strength, high fatigue and rupture life for use in aerospace applications (often referred to as High strength 718) or impact strength and low temperature notch tensile strength and lower hardness meeting the requirements of NACE MR-01-75/ISO15156 for use in oil field applications (often referred to as API 6A 718). However the high strength version is being seen increasingly in the oil field applications due to increasingly demanding environments.

Here is a summary of the differences:

Type	Condition	Applicable Specifications	Typical Applications
API 6A 718 Oil Patch	Solution Annealed and Aged	API 6PA meeting NACE MR 0175 ASTM B637 (analysis only)	Gate Valves, choke stems, fasteners, tubing hangers and well head components
High strength/AMS Aerospace	Solution Annealed	AMS 5662	Rotating parts, turbine blades, bearing, fasteners
	Solution Annealed and Aged	AMS 5663	

Corrosion Resistance

Alloy 718 has excellent corrosion resistance in a range of environments including sea water, HS2, CO2, elemental sulphur and chloride ions over various temperatures. It is resistant to sulphide stress cracking and is capable of passing the sulphide stress corrosion test in accordance with NACE TM 0177 Method C solution A.

Typical results:

Critical Pitting Temperature 0-5◦C (32-41◦F) ASTM G48 Method C

Crevice Corrosion Temperature 40-45◦C (104-113◦F) ASTM G48 Method D

Mechanical Properties

Type	Tensile (PSI (MPA))	Yield (0.2% offset), (PSI (MPA) Min)	Elongation in 2" or 4D min%	Reduction of Area	Hardness	Charpy Impacts at -60◦C (-76◦F) J (ft.lb)
API 6A 718 Oil Patch	150,000 (1034)	120,000 (827)	20	35	40 HRC Max	<76.2mm dia: 61J (45) min/68J(50) average 76.2mm to 254mm dia: 41J(30) min/ 47J (35) average
High Strength/ AMS Aerospace	185,000 (1275)	150,000 (1034)	12	15	331HB Min	

Physical Properties

Typical properties at room temperature

Melting Range	1260°C - 1336°C (2300°F- 2437°F)
Room Temp Density	8.22 g/cm ³ (0.297 lb/in ³)
Young's Modulus (Annealed)	200 GPa (29.0 x 10³KSI)
Shear Modulus (Annealed)	77.2 GPa (11.2 x 10³ KSI)
Poisson's Ratio	0.294
Thermal Conductivity	11.4W/m.K (79.1Btu-in./ft2hr.- °F)
Specific Heat	435 Joules/kg-K (0.104 Btu/lb°F)
PREN	22.5
Magnetic Permeability @ 200 Oersted	1.0011

All material we supply has full traceability with inspection certification in accordance with BS EN 10402 3.1. We can supply material with BS EN 10402 3.2 inspection certification on request.
We have onsite PCN and SNT Level III inspectors who can test material to your requirements.
All information included in this sheet is intended as a guide only and is correct to the best of our knowledge.