



Langley Alloys

Nickel
Alloys

ALLOY 718

Specifications:

UNS N07718, ASTM B637, AMS 5662, AMS 5663, Werkstoff No. 2.4668, NACE MR0175 / ISO 15156, API 6A CRA

Alloy 718 is a high-strength, corrosion-resistant Nickel Chromium alloy supplied in the hot worked, solution annealed and age hardened condition. The addition of Niobium, Titanium, Aluminium and Nickel form a series of precipitates during the controlled solution annealing and ageing process steps, resulting in a significant increase in strength and hardness compared with alternative Nickel alloys. These tensile and creep rupture properties are maintained from cryogenic to elevated temperatures, making it suitable for applications between -250°C and 750°C.

As a Nickel Chromium alloy it possesses acceptable corrosion resistance in a range of environments including sea water, hydrogen sulphide, 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. Alloy 718 is supplied to meet both NACE and API 6A standards, meeting the requirements for application in the oil industry where resistance to stress corrosion cracking is needed together with high strength, high creep resistance and weldability. Ideal applications are in oil tools, such as gate valves and choke stems, and high strength applications such as fasteners and turbines.

Key Features:

- Good strength/ductility properties from sub-zero temperatures to over 760°C
- Acceptable corrosion resistance and fatigue resistance in a wide variety of corrosive chemicals such as seawater and industrial acids
- Non-magnetic and spark resistant
- Excellent resistance to stress corrosion cracking, chloride stress corrosion & sulphide stress cracking
- High fatigue strength in seawater

Typical Applications:

- Oil & Gas industry wellhead components, gate valves, choke stems, fasteners, packers, clamps, tubing hangers, downhole equipment
- Power generation applications such as fasteners, turbines
- Aerospace components
- Nuclear power plant containment vessels, valves
- Engineering applications between 750°C and cryogenic temperatures

Physical Properties:

Density (Kg/m ³)	8230
Magnetic Permeability (20°C)	<1.002
Young's Modulus (kN/mm ²)	200
Specific Electrical Resistance, 20°C (μΩ-m)	1.25
Mean coefficient of thermal expansion, 20 - 100°C (m/m/°C)	12.1 x 10 ⁻⁶
Specific Heat, 20°C (J/kg.K)	435
Thermal Conductivity, 20°C (W/m.K)	11.1
Curie Temperature (°C)	-112 (aged)

Product Forms Available:

Bar	✓
Plate	Enquiry
Tube	Enquiry
Fittings	Enquiry
Forgings	To order
Castings	To order

Mechanical Properties:

	Age hardened 120 ksi				Age hardened 140 ksi			
	Bars up to and including 10" (254) diameter or section		Bars greater than 10" (254mm) diameter or section		Bars up to and including 10" (254) diameter or section		Bars greater than 10" (254mm) diameter or section	
0.2% Proof Stress, min	827 N/mm²	125 ksi	827 N/mm²	125 ksi	965 N/mm²	140 ksi	965 N/mm²	140 ksi
0.2% Proof Stress, Max	1000 N/mm²	145 ksi	1000 N/mm²	145 ksi	1034 N/mm²	150 ksi	1034 N/mm²	150 ksi
Tensile strength, min	1034 N/mm²	150 ksi	1034 N/mm²	150 ksi	1138 N/mm²	165 ksi	1103 N/mm²	160 ksi
Elongation, 5.65√S0 and 4D	20%		20%		20%		20%	
Reduction of Area	35%		25%		35%		25%	
Hardness (Rockwell C)	32 - 40HRC		32 - 40HRC		34 - 40 HRC		34 - 40HRC	
Impact Strength (-60°C) Longitudinal	<3" 68J av (61J min)	<3" 50 ft.lb av (45 ft.lb min)			<3" 68J av (61J min)	<3" 50 ft.lb av (45 ft.lb min)		
Impact Strength (-60°C) Transverse	≥3" - 10" 47J av (41J min)	≥3" - 10" 35 ft.lb av (30 ft.lb min)	41J av (37J min)	30 ft.lb av (27 ft.lb min)	≥3" - 10" 47J av (41J min)	≥3" - 10" 35 ft.lb av (30 ft.lb min)	41J av (37J min)	30 ft.lb av (27 ft.lb min)

- Notes:
- 1. Testing shall be carried out in accordance with ASTM A370 (tensile), ASTM E18 (hardness)
 - 2. Minimum properties quoted (tested at room temperature in a longitudinal direction)
 - 3. Testing performed on each melt of material per heat treatment batch
 - 4. Minimum lateral hole expansion of 0.015" (0.38mm)
 - 5. Additional tests routinely undertaken:
 - a) Macro-etching
 - b) Microstructure certified free from acicular, secondary and laves phases
 - c) Grain size determined to be equiaxed and predominantly ASTM3 or finer (ASTM E112 x100 magnification)

Chemical Composition:

	Cr	Ni	Mo	Co	Nb (+Ta)	Ti	V	W	Cu	C	Mn	N	Si	P	S	Fe	Al
Min	17.00	50.00	2.80		4.70	0.65											0.20
Max	21.00	55.00	3.30	1.00	5.50	1.15			0.30	0.08	0.35		0.35	0.015	0.015	Bal	0.80

- Notes:
- 1. B <0.006%, Ca < 0.003%, Mg < 0.006%, Pb < 0.005%, Se < 0.0003%, Bi < 0.00003%

Product Comparison:

Alloy Comparisons	N07718 (aged)	NO4400	N05500	S31803	Ferralium® 255-SD50
Pitting Resistance Equivalent number	31	n/a	n/a	34	>40
0.2% Proof Strength (N/mm²)	827	170	690	450	600
Corrosion Rate (mm/year) - Seawater	<0.01	0.25	0.18	<0.10	<0.01
Corrosion Rate (mm/year) - 10% sulphuric acid at 80°C	<0.15	0.06	0.1	0.40	<0.15

Machining Advice:

Operation	Cutting Speed m/min (ft/min)	Feed Rate mm/rev (in/rev)	Depth of cut mm (in)
Milling	6 - 9 (19 - 29)	0.05 - 0.15 mm/tooth 0.002 - 0.006 in/tooth	0.2 - 3.0 (0.007 - 0.12)
Drilling 6.4mm (1/4") dia	5 - 8 (16 - 25)	0.02 (0.001)	
Drilling 12.7mm (1/2") dia	5 - 8 (16 - 25)	0.08 (0.003)	
Drilling 25.4mm (1") dia	5 - 8 (16 - 25)	0.13 (0.005)	
Turning - Roughing	9 - 15 (29 - 48)	0.2 - 0.3 (0.008 - 0.011)	2.5 (0.10)
Turning - Finishing	15 - 24 (48 - 77)	0.08 - 0.20 (0.003 - 0.008)	0.25 (0.01)
Tooling	Milling/Turning: Carbide (SANDVIK GC 235, SECO T25M) Drilling: HSS, point angle 118°, chisel angle 120°		

Production Route:

Alloy 718 is produced through high-quality melting processes to ensure cleanliness and consistency.

- a) Melting can be undertaken by Electric Arc Furnace (EAF), followed by Argon Oxygen Decarburisation (AOD) or Vacuum Oxygen Decarbonisation (VOD) and then Vacuum Arc Remelting (VAR) or Electro Slag Refining (ESR)
- b) Alternatively, melting by Vacuum Induction Melting (VIM) followed by further refinement by Electro Slag Refining (ESR) or Vacuum Arc Remelting (VAR) is allowed
- c) The minimum forging ratio utilised is at least 4:1
- d) Solution treatment shall be carried out at a temperature between 1021 - 1052°C for 1-2 hours
- e) This will be followed by immediate quench (water, oil, polymer or inert gas)
- f) Age hardening will follow one of the following schedules
 - a. 120ksi : 775 - 800°C for 6-8 hours followed by immediate quench
 - b. 140ksi : 760 - 800°C for 6-8 hours followed by immediate quench
- g) Bars are supplied peeled and polished to a surface finish of 125CLA or better
- h) Each bar is ultrasonically tested and visually inspected

Further Processing:

- Order processing and stock control is facilitated by a fully-integrated computer system which links to item production and inspection.
- Automated band saws are available for accurate stock cutting up to a section size of 650mm (25")
- First-stage processing, including water jet cutting, turning, boring and grinding can be undertaken to help manage your overall supply chain.
- Additional documentation and certification can be supplied as required

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