INCONEL 718 TECHNICAL DATA

Type Analysis

Element	Min	Max
Carbon	--	0.08
Manganese	--	0.35
Silicon	--	0.35
Phosphorus	--	0.015
Sulfur	--	0.015
Nickel + Cobalt	50.0	55.0
Chromium	17.0	21.0
Cobalt	--	1.00
Iron	Balance	
Aluminum	0.35	0.80
Molybdenum	2.80	3.30
Titanium	0.65	1.15
Boron	0.001	0.006
Copper	--	0.15
Cb + Ta	4.75	5.50

Description

Alloy 718 is a precipitation hardenable nickel-based alloy designed to display exceptionally high yield, tensile and creep-rupture properties at temperatures up to 1300°F. The sluggish age-hardening response of alloy 718 permits annealing and welding without spontaneous hardening during heating and cooling. This alloy has excellent weldability when compared to the nickel-base superalloys hardened by aluminum and titanium. This alloy has been used for jet engine and high-speed airframe parts such as wheels, buckets, spacers, and high temperature bolts and fasteners.

Physical Constants

Density
lb/cu in 0.293
kg/cu m 8220
Melting Range
°F 2200-2450
°C 1210/1344

Electrical resistivity
ohms-cir mil/ft 728
microhm-mm 1210

Modulus of Elasticity (E)

Temperature		psi x 10(6)	MPa x 10(3)
°F	°C		
70	21	29.6	208
200	93	29.2	205
400	204	28.8	202
600	316	27.6	194
800	427	26.5	186
1000	538	25.5	179
1200	649	24.5	172
1400	760	23.1	162
1600	871	18.1	127
1750	954	11.1	78

Coefficient of Thermal Expansion

Temperature Range		10(-6)/°F	10(-6)/°C
77°F to	25°C to		
200	93	7.1	12.8
400	204	7.5	13.5
600	316	7.7	13.9
800	427	7.9	14.2
1000	538	8.0	14.4
1200	649	8.4	15.1
1400	760	8.9	16.0

Heat Treatment

The following heat treatment should be used to obtain the best combination of tensile properties and stress rupture properties:
1 hr 1750°F to 1800°F (954 to 982°C) air cool + 8hr 1325°F (718°C) cool 100°F /hr to 1150°F (56 °C/hr to 621°C), hold 8 hrs and air cool.
To obtain the best room temperature and cryogenic tensile properties, the following heat treatment should be used:
1 to 2 hr 1950°F (1066°C), air cool + 8 hr 1325°F (718°C) cool 100°F/hr to 1150°F (56°C/hr to 621°C), hold 8 hr and air cool.

Workability

Hot Working
Hot-working is carried out using a 2050°F (1121°C) maximum furnace temperature. Hot-cold working in the range 1700/1850°F (927/1010°C) will improve the strength of the forging if the service temperature is below about 1100°F (593°C). Prolonged soaking at the forging temperature is not desirable. The material should be given uniform reductions to avoid the formation of duplex grain structures.

Machining
The alloy can be readily machined in either the annealed or the age-hardened condition. The age-hardened condition gives better chip action on chip breaker tools and produces a better finish. The annealed condition will give a slightly longer tool life.

Welding
Alloy 718 can be welded in either the annealed or the age condition. Welding in the aged condition will cause the formation of a softened heat-affected zone.

Typical Mechanical Properties

Elevated Temperature Tensile Tests
1/2" bar stock

Test Temperature		0.2% Yield Strength		Tensile Strength		% Elongation 2"
°F	°C	ksi	MPa	ksi	MPa	
200	93	170	1172	204	1407	21.0
400	204	163	1124	198	1365	20.0
600	316	159	1096	195	1344	20.0
800	427	156	1076	191	1317	19.0
1000	538	155	1069	185	1276	18.0
1200	649	149	1027	168	1158	19.0
1400	760	110	758	110	758	27.0

Heat Treatment: 1 hr - 1800°F, air cool + 8 hr-1325°F, cool 100°F/hr to 1150°F, hold 8 hr, air cool.

Stress Rupture Data

Test Temperature		Stress for Rupture							
		100 Hours				1000 Hours			
		Smooth		Notch		Smooth		Notch	
°F	°C	ksi	MPa	ksi	MPa	ksi	MPa	ksi	MPa
1100	593	170	1172	220	1517	130	896	205	1416
1200	649	110	758	195	1344	85	586	170	1172
1300	704	75	517	130	896	55	379	80	552
1400	760	44	303	63	434	25	172	35	241

Heat Treatment: 1 hr - 1850°F, air cool + 8 hr - 1325°F, furnace cool to 100°F/hr to 1150°F, hold 8 hr, air cool.