Alloy 718

		EN	UNS	AISI	LMSA
Designation	**NiCr19Fe18Nb5Mo3Ti1AlCo**	2.4668	N07718	-	B635

Chemical composition (Weight %)

Ni (+Co)	Cr	Ti	Fe	Nb + Ta	Mo	Co	Al
50.0-55.0	17.0-21.0	0.65-1.15	Bal.	4.50-5.50	2.8-3.3	≤ 1.00	0.20-0.80
P	B	C	Cu	Si	Mn	S	
≤ 0.015	≤ 0.006	< 0.08	≤ 0.30	≤ 0.35	≤ 0.35	≤ 0.015	

In order to achieve maximum homogeneity and consistent quality, the actual tolerances on both alloy components and impurities are significantly tighter and more precisely defined than the standard composition indicated.

Main technical properties and features

Common Trade Names: Inconel 718®, Nicrofer® 5219, Alvac® 718, Haynes® 718, Altemp® 718

Lamineries MATTHEY SA produces Alloy 718 in precision cold-rolled product forms (strip and sheet). Alloy 718 (UNS N07718/W.Nr. 2.4668) is an age hardenable Ni-Fe-Cr–Nb–Mo–Ti-Al alloy designed to combine excellent strength with good fabrication characteristics in the annealed condition. Alloy 718 is covered by the following specifications: AMS 5596/5597 (sheet, strip and plate) and NACE MR-01-75 (oil field equipment). While limited to applications below 650°C (1200°F), it is significantly stronger at these lower temperatures than materials such as the Alloy X750. It is also much easier to weld and is less susceptible to the strain age cracking problems (occurs during the post-weld heat treatment of restrained welds in certain alloys) common for gamma prime strengthened materials.

Alloy 718 has very good forming and welding characteristics. It can be welded by a variety of processes, including gas tungsten arc, gas metal arc, electron beam, and resistance welding. High heat input processes are not recommended. The hot working temperature range for the alloy is approximately 985-1150°C (1700-2100°F). The alloy has very good ductility in the annealed condition and thus, may also be formed by cold working. All hot- or cold-worked parts should be annealed and rapidly cooled in order to restore the best balance of properties. Alloy 718 has good ductility and may be readily formed by all conventional methods. Because the alloy is stronger than regular steel it requires more powerful equipment to accomplish forming. Heavy-duty lubricants should be used during cold forming. It is essential to thoroughly clean the parts of all traces of lubricant after forming as embrittlement of the alloy may occur at high temperatures if lubricant is left on. The alloy has also excellent properties and ductility at cryogenic temperatures.

If the material is to be formed or welded, it is typically purchased in the annealed condition. The alloy is normally solution heat-treated at 925 to 1010°C (1700 to 1850°F) and rapidly cooled for optimal properties. The material is then fabricated in its most malleable condition. After fabrication, it can be heat treated as required per the applicable specification. Alloy 718 is hardened by the precipitation of secondary phases (e.g. γ' and γ'') into the metal matrix. The precipitation of these Ni-(Al, Ti, Nb) phases is induced by heat treating in the temperature range of 595 to 815 °C (1100 to 1500°F). For this metallurgical reaction to properly take place, the aging constituents (Al, Ti, Nb) must be dissolved in the matrix; if they are precipitated as some other phase or are combined in some other form, they will not precipitate correctly and the full strength of the alloy with not be achieved. Therefore, the material must first be solution heat-treated. Following solution heat treatment, the alloy is normally age-hardened by a two step treatment consisting of 720°C (1325°F) for 8 hours, furnace cooling to 620°C (1150°F), holding for an additional 8 hours, and then air cooling.

Lamineries MATTHEY SA
Route de Neuchâtel 6
CH - 2520 La Neuveville

Phone +41 (0)32 752 32 32
Fax +41 (0)32 752 32 00

E-mail : sales@matthey.ch

www.matthey.ch

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Typical manufacturing range

		Thickness (mm)	Width (mm)	Length (mm)
Rolled products	Strip in coils [1)]	0.010 - 2.000	1.5 - 200.0	-
	Strip as sheets [1)]	0.015 - 1.500	10.0 - 200.0	100 - 3000

1) Not all our production possibilities are presented here. Other dimensions or other product forms available upon request. Certain combinations of thicknesses and widths are not possible.

Mechanical properties of strips

Temper	Tensile strength, Rm (N/mm^2)	Yield strength, Rp_{02} (N/mm^2)	Elongation, A (%)	Hardness HV
Annealed	800-1000	400-750	> 25	210-320
½ hard	1000-1200	> 700	-	320-380
Hard	> 1200	> 900	-	> 370

After suitable heat treatment, see AMS-5597, high stress-rupture strength and low creep rates under high stresses at temperature up to 650°C can be achieved. Values of tensile strength higher than 1200 N/mm^2 (typical value 1250 N/mm^2) and elongation higher than 15% can be obtained by age hardening of annealed delivered material.

Physical properties

Modulus of elasticity	kN/mm^2	200 (191 at 200°C, 179 at 400°C, 167 at 600°C)
Poisson ratio		0.32
Density	kg/dm^3	8.19 (annealed), 8.22 (Annealed and heat treated)
Melting point / Melting range	°C	1260-1340
Linear dilatation coefficient (20-90°C)	10^{-6}/ °C	12.8 (15.5 from 20 to 700°C)
Thermal conductivity at 20°C	W/m °K	11.4 (17.5 at 400°C, 22.2 at 700°C)
Electrical resistivity	μΩcm	132
Electrical conductivity	MS/m	0.80
Electrical conductivity	%IACS	1.25
Specific heat J/kg K	J/kg K	435
Magnetic properties		Non magnetic (slightly diamagnetic)
Permeability		μ = 1.0013 (annealed), μ = 1.0011 (annealed and heat treated)

Typical uses

The ease and economy with which Alloy 718 can be fabricated, combined with good tensile, fatigue, creep, and rupture strength, have resulted in its use in a wide range of applications. The use of Alloy 718 is suitable in both aircraft turbine engines and land-based turbines. Other applications include rings, casings, components for liquid fueled rockets, cryogenic tankage, fasteners and instrumentation parts, pressure membranes and many types of formed sheet metal components.

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Tolerances

Thickness

The table shown is an outline of our typical thickness tolerances available. They are tighter than industry standards.

Our "Precision" and "Extreme" tolerances are available upon request.

Thickness (mm)		Lamineries MATTHEY SA		
≥	<	LMSA Standard	LMSA Precision	LMSA Extreme
	0.025	-	-	± 0.001
0.025	0.050	± 0.003	± 0.002	± 0.0015
0.050	0.065	± 0.004	± 0.003	± 0.002
0.065	0.100	± 0.006	± 0.004	± 0.003
0.100	0.125	± 0.008	± 0.006	± 0.003
0.125	0.150	± 0.008	± 0.006	± 0.004
0.150	0.250	± 0.010	± 0.008	± 0.004
0.250	0.300	± 0.012	± 0.008	± 0.005
0.300	0.400	± 0.012	± 0.009	± 0.005
0.400	0.500	± 0.015	± 0.010	± 0.006
0.500	0.600	± 0.020	± 0.012	± 0.007
0.600	0.800	± 0.020	± 0.014	± 0.007
0.800	1.000	± 0.025	± 0.015	± 0.009
1.000	1.200	± 0.025	± 0.018	± 0.0012
1.200	1.250	± 0.030	± 0.020	± 0.0012
1.250	1.500	± 0.035	± 0.025	± 0.0014

Width

Our width tolerance is + 0.2 -0.0 mm (or ± 0.1 mm upon request). They are available for slit widths < 125 mm and thicknesses < 1.00 mm. Special tolerances upon request.

Camber

Our tolerance "standard" respects the EN Standard 1654 (Length of measurement 1000 mm).
Other tolerances upon request.

Width (mm)		Camber max. (mm/m)			
		LMSA standard		LMSA extreme	
>	≤	≤ 0.5 mm	> 0.5 mm	≤ 0.5 mm	> 0.5 mm
3	6	12	-	6	-
6	10	8	10	4	5
10	20	4	6	2	3
20	250	2	3	1	1.5

Surface

Special surface qualities upon request

Flatness

Special requirement on the longitudinal or transversal flatness upon request

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