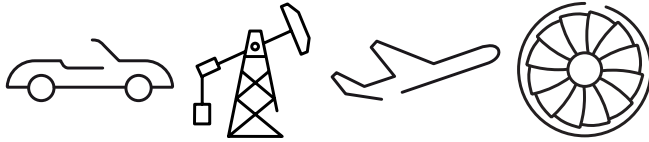


Alloy 718 – UNS N 07718 | NiCr19Fe19Nb5Mo3

High Performance Alloys



Zapp is certified to ISO 9001



Standards Material Alloy 718

- UNS N07718
- Werkstoff-Nr. 2.4668
- DIN abbreviation NiCr19Fe19Nb5Mo3

Categorization

is a precipitation hardenable nickel-chromium-iron-molybdenum alloy. Alloy 718 can be supplied in the “**solution annealed**” condition or in the “**solution annealed and age hardened**” condition.

If the material is to be formed or welded, it is usually processed in the solution-annealed condition. After the manufacturing process, the material can be annealed depending on the specification or application.

For most applications, Alloy 718 is specified in the "solution annealed and age hardened" condition (age hardened here is synonymous with aged, precipitation hardened, precipitation heat treated, aged).

Through a specific **heat treatment**, the precipitation of secondary phases such as nickel (-aluminum, -titanium, -niobium) in the metal matrix the so-called γ' -phases (gamma prime phases) leads to an **increase in strength** (age hardening).

To obtain the different required material properties, various solution heat treatment and aging conditions are combined, so that this alloy is available from ZAPP in several variants according to various standards required on the market.

Typical Applications

- Gas turbines
- Aerospace industry
- Spring applications
- Automotive industry
- Nuclear reactors
- Highly corrosive and mechanically stressed components

Designation and Standards

Standard	Material designation	Standard					
		Sheet/ plate	Bar	Strip	Wire	Forgings	Tubes, seamless
ASTM	UNS N07718	B 670	B 637	B 670		B 637	
AMS		5596	5662	5596	5832	5562	5589
		5597	5663	5597	5962	5563	5590
			5664	5914		5564	
			5962				
DIN	2.4668	17744	17744	17744	17744		
	NiCr19Fe19Nb5Mo3	17750	17752	17750			
DIN EN	2.4668			10302			
	NiCr19Fe19Nb5Mo3			2407			
ISO	NiCr19Nb5Mo3			6208			
ASME		SB 670	SB 637	SB 670		SB 637	
NACE			MR 0175 (ISO 15156)* MR 0103 (ISO 17945)*				
Other			API 6ACRA				

* Does only apply for bar material acc. to API

Overview of Sheets and Plates “Solution Annealed and Age-Hardened”

Standards

Alloy 718 acc. to AMS 5596 / ASTM B670 /
DIN 17744 / DIN 17750

Zapp supplies sheets and plates in the solution annealed condition. The hardenability is certified in the material certificate based on samples.

Alloy 718 combines corrosion resistance and high strength compared to other age-hardenable materials as well as good processing properties especially very good weldability, including resistance to weld cracking.

Alloy 718 has very good creep rupture strength at temperatures up to 700 °C, as well as excellent mechanical properties at low temperatures, and is used in gas turbines, the aerospace industry, for spring applications, in the automotive industry, in nuclear reactors, and as well as for highly corrosive and mechanically stressed components.

Mechanical properties Alloy 718 sheets / plates at room temperature acc. to AMS 5596 / ASTM B670 / DIN 17750

Condition: solution annealed and age-hardened

Delivery condition: solution annealed

Thickness: $t \geq 4.76 - 25.4$ mm (0.1874" - 1.00")

Heat treatment solution annealed	941 °C - 996 °C $\pm$ 14 °C / 8 h (1725 °F - 1825 °F $\pm$ 25 °F)
Yield strength $R_{p0.2}$	max. 724 MPa (max. 105 ksi)
Tensile strength R_m	max. 1034 MPa (max. 150 ksi)
Elongation A_{4D}	min. 30 %
Hardness HRC	max. 25
Heat treatment age-hardening	718 °C $\pm$ 8 °C / 8h (1325 °F $\pm$ 15 °F) / 8 h Cooling in furnace: 621 °C $\pm$ 8 °C (1150 °F $\pm$ 15 °F) / holding for 8 h
Yield strength $R_{p0.2}$	min. 1035 MPa (min. 150 ksi)
Tensile strength R_m	min. 1241 MPa (min. 180 ksi)
Elongation A_{4D}	min. 12 %
Hardness HRC	min. 36

Overview of Bar Material "Solution-Annealed"

The solution-annealed condition of Alloy 718 is essentially the low-hardness, workable and easy-to-machine initial condition prior to precipitation hardening. The hardenability is confirmed by samples in the factory certificate.

Standards

Alloy 718 acc. to AMS 5662 (cap. of AMS 5663) /
ASTM B637 / ASME SB637 / DIN 17744 (cap. of
DIN 17752

Mechanical properties Alloy 718 round bars at room temperature
acc. to AMS 5662 / ASTM B637

Condition/Delivery condition: solution annealed
Diameter Ø: ≤ 254.0 mm (≤ 10.00")

Heat treatment solution annealed Hardness HB	924°C – 1010°C ± 14°C / 0.5 h (1700°F – 1825°F ± 25°F) ≤ 277
Heat treatment precipitation-hardening	718°C – 760°C ± 8°C (1325°F – 1400°F ± 15°F) / 8 h Cooling in furnace: 621°C – 649°C ± 8°C (1150°F – 1200°F ± 15°F) / holding for 8 h
Yield strength Rp _{0,2}	min. 1034 MPa (Ø ≤ 127 mm / ≤ 5.00") min. 150 ksi (Ø ≤ 127 / ≤ 5.00") min. 1000 Mpa (Ø > 127 - 254 mm / > 5" - 10") min. 145 ksi (Ø > 127 - 254 mm / > 5" - 10")
Tensile strength Rm	≥ 1275 MPa (≥ 185 ksi)
Elongation A _{4D}	≥ 12 %
Reduction of area Z	≥ 15 %
Hardness HB	≥ 331

Overview of bar material "solution-annealed and age-hardened"

The solution-annealed and age-hardened condition is characterized by good short- and long-term mechanical properties and high fatigue strength.

In many cases, the use of already age-hardened round bars for further processing has proven successful.

1. Standards

Alloy 718 bar material acc. to AMS 5663 / AMS B637 /
DIN 17744 / DIN 17752

Mechanical Properties Alloy 718 round bars at room temperature acc. to AMS 5663 / ASTM B637 / DIN 17744 / DIN 17752

Condition /delivery condition: solution annealed and age-hardened
Diameter Ø: ≤ 254.0 mm (≤ 10.00")

Heat Treatment solution annealed	924°C – 1010°C ± 14°C / 0,5 h (1700°F – 1825°F ± 25°F)
Heat Treatment age-hardening	718°C – 760°C ± 8°C (1325°F – 1400°F ± 15°F) / 8 h Cooling in furnace: 621°C – 649°C ± 8°C (1150°F – 1200°F ± 15°F) / holding for 8 h
Yield strength Rp _{0,2}	min. 1035 MPa (Ø ≤ 127 mm / ≤ 5.00") min. 150 ksi (Ø ≤ 127 / ≤ 5.00") min. 1000 MPa (Ø > 127 - 254 mm / > 5" - 10") min. 145 ksi (Ø > 127 - 254 mm / > 5" - 10")
Tensile strength Rm	≥ 1.275 MPa (≥ 185 ksi)
Elongtion A _{4D}	≥ 12 %
Reduction of area Z	≥ 15 %
Hardness HRC	≥ 36
Hardness HB	≥ 331

2. Standards

Alloy 718 bar material acc. to API 6A Standard (API American Petroleum Institute)

Alloy 718 to API standard is specifically designed for **oil and gas** production requirements and is primarily used for the design of **drilling equipment** and **pump shafts** that must withstand critical pressures and temperatures in sour gas environments (H₂S, CO₂).

Alloy 718 according to API standard are compliant with NACE MR0175, i.e. with a specific chemical composition, as well as solution heat treatment and precipitation hardening according to API 6A CRA, in order not to exceed at the same time the maximum hardness required by NACE.

Mechanical properties Alloy 718 round bars at room temperature acc. to API 6A CRA / NACE MR0175 (ISO 15145) / NACE MR0103 (ISO 17945)

Condition/Delivery condition: solution annealed and age-hardened

	Alloy 718 API - 120K	Alloy 718 API - 150K
Heat Treatment solution annealed	1021°C – 1052 °C (1870°F – 1925°F) 1 h – 2.5 h	1021°C – 1052 °C (1870°F – 1925°F) 1 h – 2.5 h
Heat Treatment age-hardening	774°C – 802°C (1425°F – 1475°F) 6 h – 8 h	700°C – 750°C (1292°F – 1382°F) / 8h cooling down to 600°C – 650°C (1112°F – 1202°F) holding for 8 h
Yield strength R _{p0.2}	min. 827 MPa – max. 1000 MPa (min. 120 ksi – max. 145 ksi)	min. 1034 MPa – max. 1207 MPa (min. 150 ksi – max. 175 ksi)
Tensile strength R _m	≥ 1034 MPa (≥ 150 ksi)	≥ 1207 MPa (≥ 175 ksi)
Elongation A ₄₀	≥ 20 %	≥ 20 %
Reduction of area Z	≥ 35 % / ≥ 25 % (Ø ≥ 254 mm / 10")	≥ 35 % / ≥ 25 % (Ø ≥ 254 mm / 10")
Hardness HRC	32 - 40	35 - 45

Physical Properties

Melting range	1260 – 1335 [°C]
Density*	8.2 [g / cm ³]
Thermal conductivity*	11.4 [W / m·K]
Modulus of elasticity (guide value)	200 GPa
Specific heat	435 [J / kg·K]
Thermal expansion at 25 – 100 °C	12.8 x 10 ⁻⁶ ·K
Spec. electrical resistance*	1.32 [Ω·mm ² / m]

* at room temperature

Chemical composition* acc. to UNS N07718

Individual listed and additional elements may be restricted depending on the specification.

	C	Mn	Si	P	S	Cr	Co	Mo	Nb+Ta	Ti	Al	B	Fe	Cu	Ni
min.	-	-	-	-	-	17.0	-	2.80	4.75	0.65	0.20	-	Rest	-	50.0
max.	0.08	0.35	0.35	0.15	0.015	21.0	1.0	3.30	5.50	1.15	0.80	0.006	Rest	0.30	55.0

* weight percent

Welding filler material

	DIN EN ISO	AWS/ASME	DIN material grade DIN abbreviation code
Bar welding rods (WIG) / Wire (MIG)	18274	AWS A5.14	
	Ni7718 / NiCr19Fe19Nb5Mo3	ERNiFeCr-2	2.4668 / SG-NiCr19NbMoTi

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Last revision: March 2026