Inconel® 718

Material no. 2.4668 · NiCr19Fe19Nb5Mo3 · Precipitation-hardenable nickel-base alloy

Material group: Nickel-base alloy, precipitation hardened (γ' / γ'')

Material no. (EN): 2.4668

EN designation: NiCr19Fe19Nb5Mo3

UNS / ASME: UNS N07718

Trade names: Inconel® 718, Nicrofer® 5219 Nb, Alloy 718

ASTM / ASME equivalent: Forgings: B637 · Sheet/strip: B670 · Bars: B637 · Fittings: B366 WPNCFI

Service temperature: –253 °C to +650 °C (continuous service, optimum strength range)

Standards (pipes / forgings): ASTM B637 · VdTÜV 487

Standards (fittings): EN 10253-4 · ASTM B366 WPNCFI

Forms (Nirotec): Elbows · tees · reducers · caps · flanges · forgings · custom parts

1 Material Equivalents & Comparable Grades

National equivalents

Standard / region	Designation	Material no. / Grade	Remark
EN	NiCr19Fe19Nb5Mo3	2.4668	Current European designation
UNS	Alloy 718	N07718	ASTM/ASME designation
DIN (old)	NiCr19Fe19Nb5Mo3	2.4668	Identical, unchanged
ASTM/ASME	A/SA B637	UNS N07718	Forgings, bars
ASTM/ASME	A/SA B670	UNS N07718	Sheet and strip
ASTM/ASME	A/SA B366 WPNCFI	UNS N07718	Buttweld fittings
AMS	5662 / 5663 / 5664	UNS N07718	Aerospace specifications
Trade names	Inconel® 718, Nicrofer® 5219 Nb	–	Common trade names

Alternative materials

Material	Material no.	Reference / use	Note
Inconel 625 / 2.4856	2.4856	Solid-solution strengthened, better corrosion	Pure corrosion-resistance applications
Waspaloy / 2.4654	2.4654	Higher hot strength up to 760 °C	Gas turbines, elevated temperatures

Material	Material no.	Reference / use	Note
A-286 / 1.4980	1.4980	Iron-based, lower cost	Moderate strength requirements
Inconel 706 / 2.4675	2.4675	Improved weldability	Large forgings

2 Chemical Composition

Composition in mass percent (%). Standard: ASTM B637 / AMS 5662 / VdTÜV 487. Inconel 718 is a precipitation-hardened nickel-base alloy with γ' ($Ni_3(Ti,Al)$) and γ'' (Ni_3Nb) as strengthening phases.

Element	Symbol	Min. (heat)	Max. (heat)	Max. (product)	Function / remark
Nickel + Cobalt	Ni+Co	50.0	55.0	55.0	Matrix
Chromium	Cr	17.0	21.0	21.0	Corrosion resistance
Iron	Fe	–	Rest	Rest	Balance (~17–20 %)
Niobium+Tantalum	Nb+Ta	4.75	5.50	5.50	γ'' / γ' precipitation hardening
Molybdenum	Mo	2.80	3.30	3.30	Strength, pitting resistance
Titanium	Ti	0.65	1.15	1.15	γ' former
Aluminium	Al	0.20	0.80	0.80	γ' former
Cobalt	Co	–	1.0	1.0	Residual
Copper	Cu	–	0.30	0.30	Residual
Carbon	C	–	0.08	0.08	Limit
Manganese	Mn	–	0.35	0.35	Limit
Silicon	Si	–	0.35	0.35	Limit
Phosphorus	P	–	0.015	0.015	Impurity limit
Sulfur	S	–	0.015	0.015	Impurity limit
Boron	B	–	0.006	0.006	Grain boundary strengthening

3 Mechanical Properties

Precipitation hardened – minimum requirements (AMS 5662 / solution + aging)

The high strength of Inconel 718 is achieved by a two-stage heat treatment: solution anneal at 970 °C + aging at 720 °C / 8 h + 620 °C / 8 h. Values apply to this condition.

Property	Symbol	Unit	Minimum value	Remark
Yield strength 0.2 %	Rp0.2	MPa	≥ 1034	Aged condition
Yield strength 0.2 %	Rp0.2	MPa	≥ 414	Solution annealed
Tensile strength	Rm	MPa	≥ 1241	Aged condition

Property	Symbol	Unit	Minimum value	Remark
Tensile strength	Rm	MPa	≥ 827	Solution annealed
Elongation at fracture	A	%	≥ 12	Aged, longitudinal specimens
Impact energy (20 °C)	KV	J	≥ 27	Mean value
Hardness	HRC	–	36 – 44	Aged condition

Hot yield strength Rp0.2 in MPa (typical values per standard)

Temperature	100 °C	200 °C	300 °C	400 °C	500 °C	600 °C	650 °C
Rp0.2 (MPa)	1000	980	950	920	890	860	830

4 Physical Properties

Property	Symbol	20 °C	200 °C	400 °C	600 °C	Unit
Density	ρ	8.19	8.11	8.00	7.89	g/cm^3
Modulus of elasticity	E	200	192	179	163	GPa
Thermal conductivity	λ	11.4	13.4	16.4	19.6	W/(m·K)
Coeff. thermal expansion	α	13.0	13.5	14.4	15.4	$10^{-6}/K$
Specific heat capacity	cp	430	452	490	535	J/(kg·K)

5 Corrosion Resistance

Medium / environment	Remark	Resistance
Hydrogen at high temperature	Resistant	++
Salt solutions / chlorides	Very good resistance	++
Oxidising acids (HNO_3)	Good resistance	++
Sour gas (H_2S)	NACE MR0175 qualified	++
Stress-corrosion cracking (Cl^-)	Highly resistant	++
High-temperature oxidation	Stable oxide layer up to 980 °C	++
Reducing acids (HCl, H_2SO_4)	Limited suitability	+
Sulphidising atmospheres	Limited at high temperatures	o
Halogen acids concentrated	Not recommended	–

++ excellent resistance | + good resistance | o limited resistance | – not resistant

Inconel 718 combines outstanding mechanical properties with good corrosion resistance – ideal for high-stress components in corrosive media.

6 Typical Applications

Industry / plant	Typical application	Operating condition
Aerospace	Turbine discs, shafts, fasteners	Up to 650 °C, high strength
Gas turbines	Blades, rotors, casing components	High-temperature loading
Oil & gas (downhole)	Completion equipment, packers, connectors	Sour service (NACE MR0175)
Nuclear	Fasteners, springs, reactor components	Irradiation resistant
High-pressure systems	Bolting, pressure-vessel components	Up to +650 °C
Cryogenic applications	LNG pumps, low-temperature structures	Down to –253 °C

7 Forms Available at Nirotec

Component	Standard (EN)	Standard (ASME/ASTM)	Remark
Elbows	EN 10253-4 (analog.)	ASME B16.9 · B366 WPNCFI	LR/SR, custom angles on request
Tees	EN 10253-4 (analog.)	ASME B16.9 · B366 WPNCFI	Equal and reducing branch
Reducers	EN 10253-4 (analog.)	ASME B16.9 · B366 WPNCFI	Concentric and eccentric
Caps	EN 10253-4 (analog.)	ASME B16.9 · B366 WPNCFI	Hemispherical caps
Weld neck flanges	EN 1092-1 type 11	ASME B16.5 · B637	PN 25 – PN 400 / Class 300 – 2500
Forgings	Per drawing	ASTM B637	Solid, hollow, rings
Custom parts	Per drawing	Per drawing	Custom geometries on request

8 Standards, Approvals & Codes

Standard / code	Title / application
ASTM B637	Bars, rods and forgings of precipitation-hardenable nickel-base alloys
ASTM B670	Sheet and strip of precipitation-hardenable nickel-chromium-iron
ASTM B366	Factory-made wrought nickel and nickel-alloy fittings (WPNCFI for 718)
AMS 5662 / 5663 / 5664	Aerospace specifications for 718 (forgings, bars)
VdTÜV 487	NiCr19Fe19Nb5Mo3 (2.4668) – material data sheet
NACE MR0175 / ISO 15156	Materials for H_2S-containing environments (sour service)
API 6A / 6CRA	Specifications for wellhead equipment

Standard / code	Title / application
PED 2014/68/EU	Pressure Equipment Directive
ASME B31.1 / B31.3	Power piping / process piping

9 Processing Notes

Weldability

Parameter	Specification / recommendation	Remark
Preheat	Not required	Room-temperature welding
Welding condition	Solution annealed before welding	Followed by full heat treatment
Post-weld heat treatment	Solution anneal 970 °C + aging	720 °C/8 h + 620 °C/8 h, two-stage
Filler metal	ERNiFeCr-2 (AWS A5.14)	Matching precipitation-hardening filler
Welding processes	GTAW (TIG), GMAW, SMAW, EB, laser	All standard processes suitable
Interpass temperature	≤ 120 °C	Prevents hot cracking

– Delivery condition: solution annealed (AMS 5662 / B637 solution annealed) or already precipitation hardened (aged)
– Post-weld heat treatment is mandatory to achieve full mechanical properties
– Identification per ASTM B637: heat no., 2.4668 / UNS N07718, standard, dimensions, condition
– Suitable for sour service per NACE MR0175
– Caution when held at 540–760 °C for extended time – loss of strength due to δ-phase formation possible

10 Inquiry & Contact

For a project-specific inquiry we ideally require:

– Standard and type (e.g. ASTM B637 / B366 WPNCFI)
– Heat-treatment condition: solution annealed or aged
– Dimensions: DN / NPS, wall thickness or schedule, or forging dimensions
– Quantity and requested delivery date
– Required documentation (EN 10204 type 3.1 / 3.2, NDT, external inspection)
– Project-specific specification (NACE MR0175, AMS, API 6A, etc.)

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