General information

Designation

Nickel-chromium alloy, INCONEL 718, solution treated, wrought (Ni-Cr alloy)

Condition	Solution treated
UNS number	N07718
US name	ASTM Grade N07718; AMS 5662-5664, 5832, 5914, 5962, 5596, 5597, 5950; ASME
EN name	NiCr19NbMo
EN number	2.4668
ISO name	ISO 9723-9725

Tradenames

ALTEMP 718 Solution treated, ATI Allegheny Ludlum (USA); Altemp; C50TF89, B50T68, B50TF16A, GE (USA); CPW407, Pratt & Whitney (USA); DMD423.32, SNECMA (FRANCE); EMS 55458, Garrett (USA); HAYNES 718, Haynes International Inc. (USA); Haynes; INCONEL 718, Special Metals Corp. (USA); Inconel; LA213, Turbomeca (FRANCE); MSRR 7132, MSRR 7228, Rolls Royce (UK); Nicrofer; PWA 649, Pratt & Whitney (USA); PYROMET ALLOY 718, Carpenter Technology Corp. (USA); Pyromet; SUPERMET 718, Firth Rixson (USA); Supermet; Udimar; Unitemp; WA2225.3, MTU (GERMANY)

Typical uses

Aerospace, high temperature applications, heating elements, furnace parts, resistors, electronic parts, combustion systems, after-burners, fuel nozzles, chemical processing equipment, pulp and paper manufacture, marine architecture, nuclear reactors

Included in Materials Data for Simulation	✓
Materials Data for Simulation name	Nickel alloy, Inconel 718, solution treated

Composition overview

Compositional summary

Ni50-55 / Cr17-21 / Fe11-25 / Mo2.8-3.3 / Nb2.4-2.8 / Ta2.4-2.8 / Ti0.65-1.2 / Al0.2-0.8 (impurities: Co<1, Mn<0.35, Si<0.35, Cu<0.3, C<0.08, P<0.015, S<0.015, B<0.006)
Nb + Ta = 4.75 to 5.5

Material family	Metal (non-ferrous)
Base material	Ni (Nickel)

Composition detail (metals, ceramics and glasses)

Al (aluminum)	0,2	-	0,8	%
B (boron)	0	-	0,006	%
C (carbon)	0	-	0,08	%
Co (cobalt)	0	-	1	%
Cr (chromium)	17	-	21	%
Cu (copper)	0	-	0,3	%
Fe (iron)	11,1	-	24,6	%
Mn (manganese)	0	-	0,35	%
Mo (molybdenum)	2,8	-	3,3	%
Nb (niobium)	2,38	-	2,75	%
Ni (nickel)	50	-	55	%
P (phosphorus)	0	-	0,015	%
S (sulfur)	0	-	0,015	%
Si (silicon)	0	-	0,35	%

Ta (tantalum)	2,38	-	2,75	%
Ti (titanium)	0,65	-	1,15	%

Price

Price	* 20,1	-	30,3	USD/kg
Price per unit volume	* 1,64e5	-	2,5e5	USD/m^3

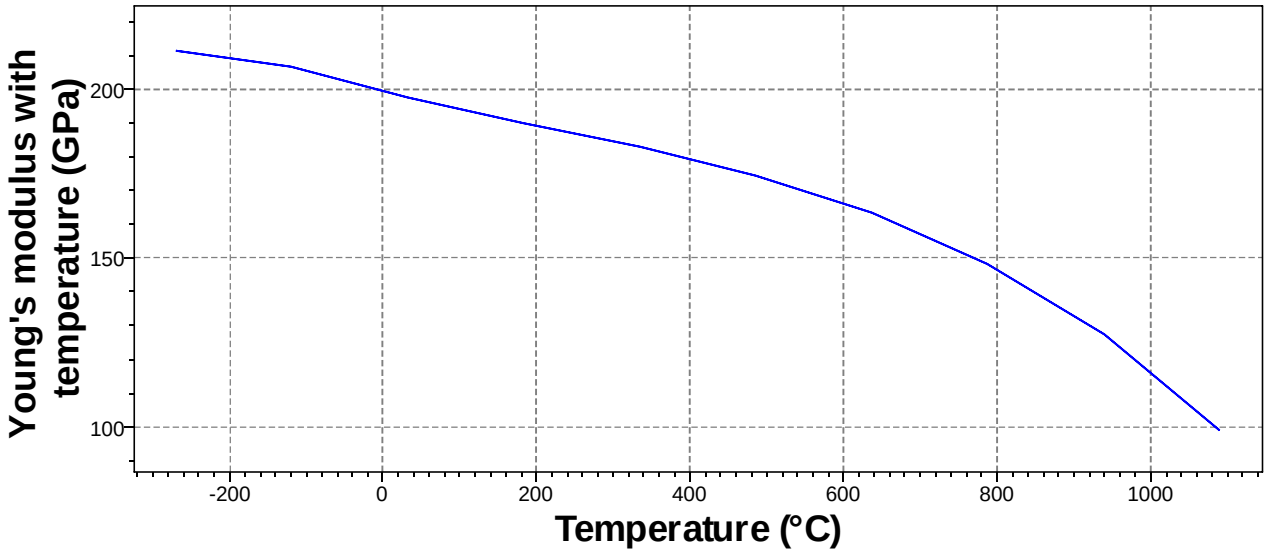
Physical properties

Density	8,18e3	-	8,26e3	kg/m^3

Mechanical properties

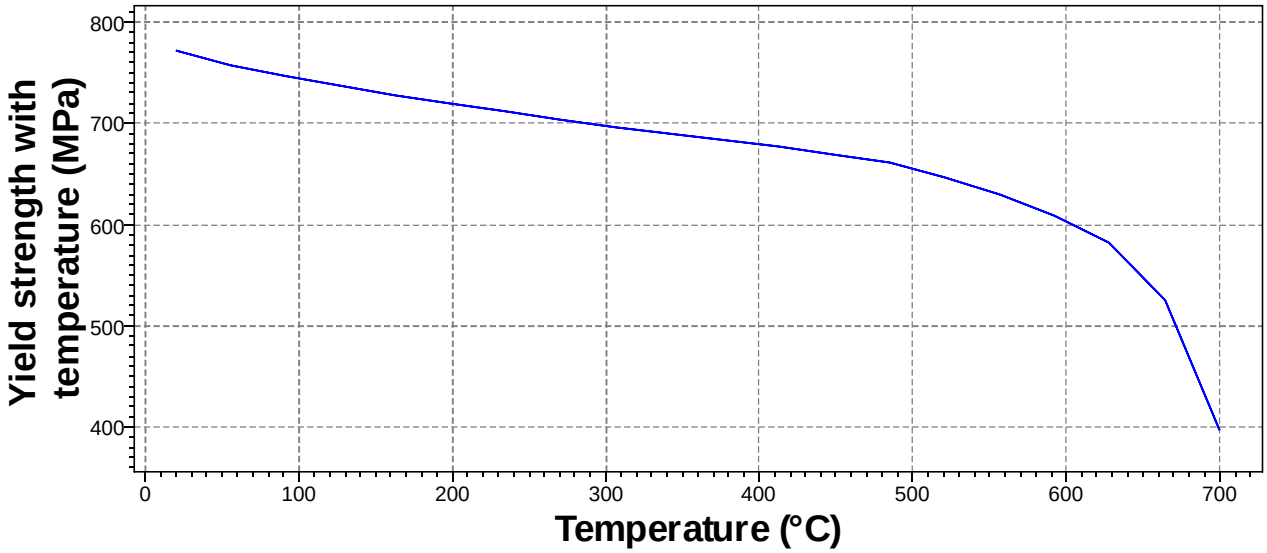
Young's modulus	203	-	213	GPa
Young's modulus with temperature	198	-	198	GPa

Parameters: Temperature = 23°C



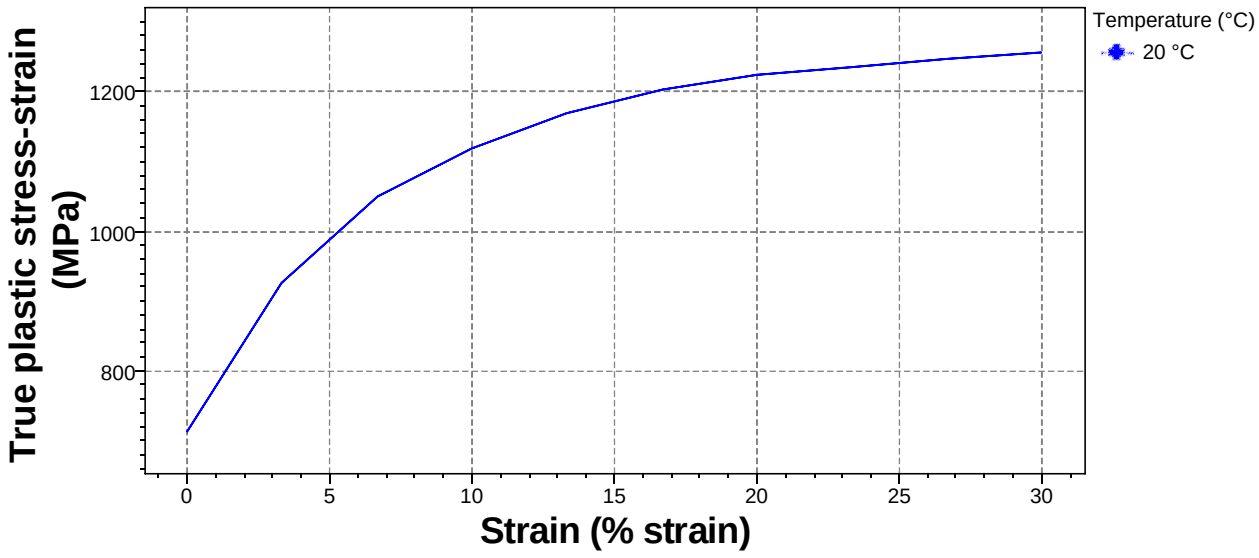
Specific stiffness	24,7	-	26	MN.m/kg
Yield strength (elastic limit)	724	-	800	MPa
Yield strength with temperature	770	-	770	MPa

Parameters: Temperature = 23°C



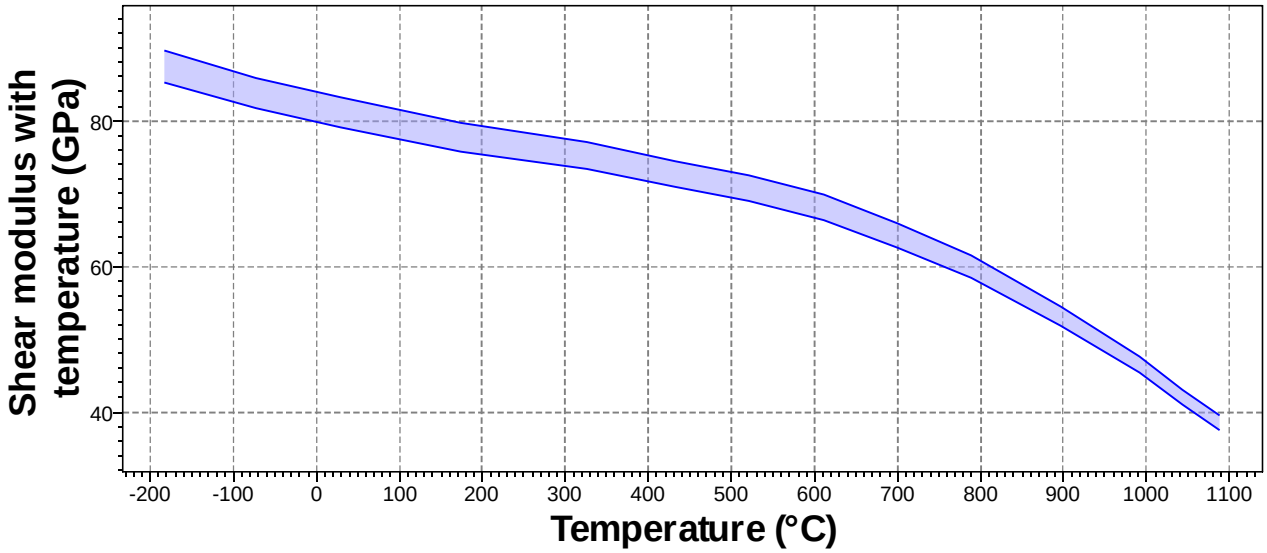
Tensile strength	827	-	914	MPa
Specific strength	88	-	97,4	kN.m/kg
Elongation	35	-	50	% strain
Tangent modulus	1,13e3			MPa
True plastic stress-strain	Out Of Range			MPa

Parameters: Strain = 0% strain, Temperature = 23°C



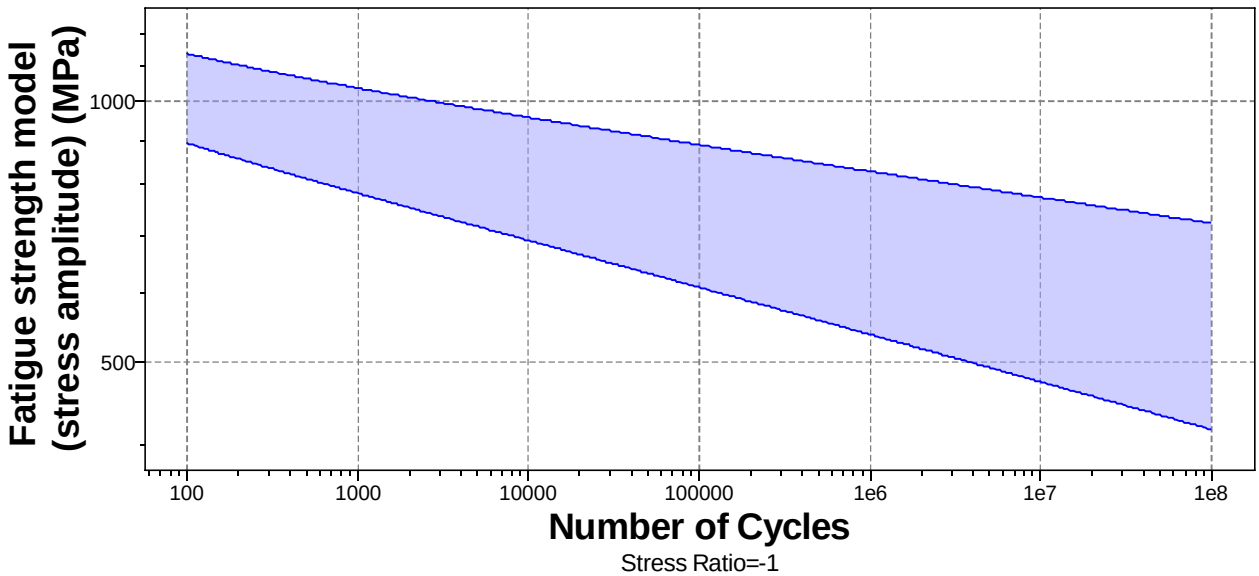
Compressive strength	* 724	-	800	MPa
Flexural modulus	* 203	-	213	GPa
Flexural strength (modulus of rupture)	724	-	800	MPa
Shear modulus	79	-	83,1	GPa
Shear modulus with temperature	79,2	-	83,3	GPa

Parameters: Temperature = 23°C



Bulk modulus		161	-	169	GPa
Poisson's ratio		0,29	-	0,302	
Shape factor		21			
Hardness - Vickers		400	-	500	HV
Hardness - Rockwell B	*	112	-	117	HRB
Hardness - Rockwell C	*	41	-	49	HRC
Hardness - Brinell	*	379	-	471	HB
Elastic stored energy (springs)		1,26e3	-	1,54e3	kJ/m^3
Fatigue strength at 10^7 cycles	*	485	-	755	MPa
Fatigue strength model (stress amplitude)	*	473	-	774	MPa

Parameters: Stress Ratio = -1, Number of Cycles = 1e7cycles



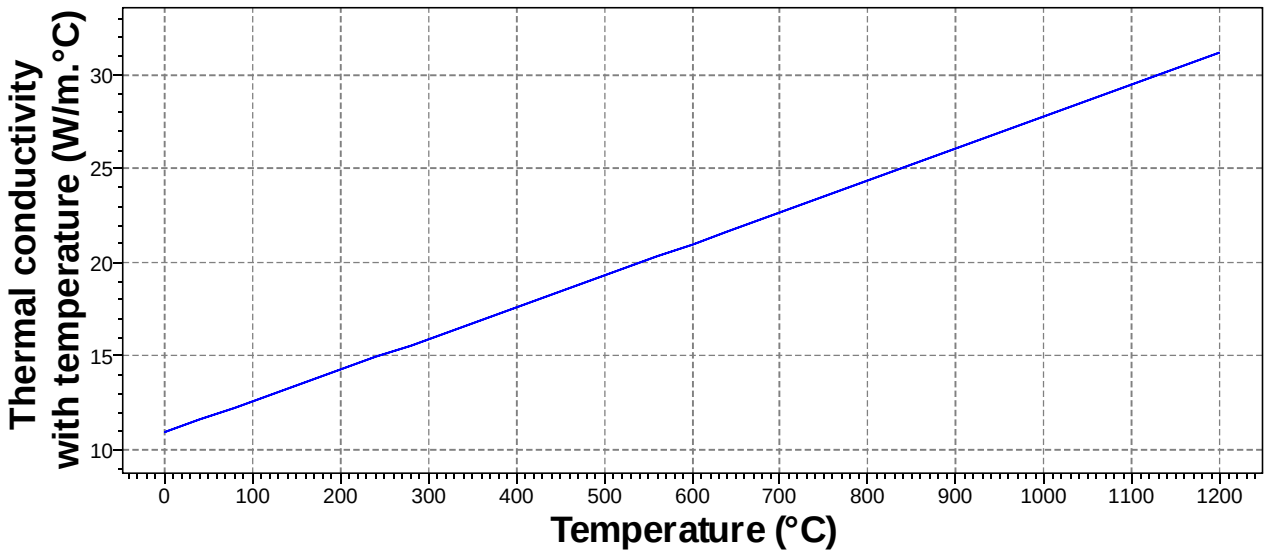
Impact & fracture properties

Fracture toughness	*	244	-	271	MPa.m^0.5
Toughness (G)		285	-	352	kJ/m^2

Thermal properties

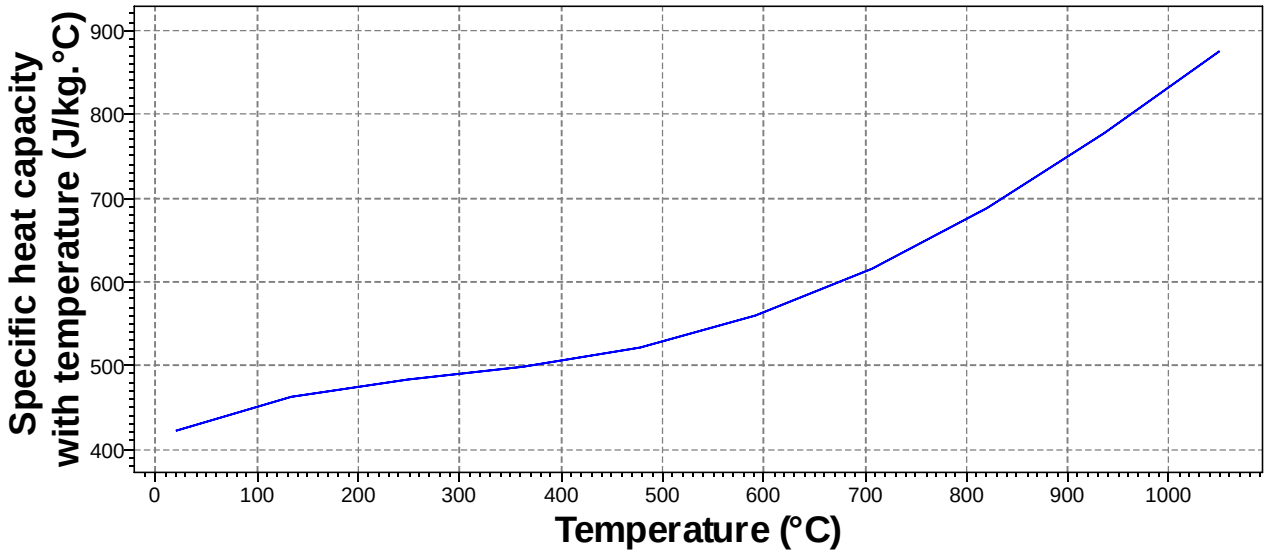
Melting point	1,26e3	-	1,34e3	°C
Maximum service temperature	632	-	705	°C
Minimum service temperature	-273			°C
Thermal conductivity	11,6	-	12,6	W/m.°C
Thermal conductivity with temperature	11,3	-	11,3	W/m.°C

Parameters: Temperature = 23°C



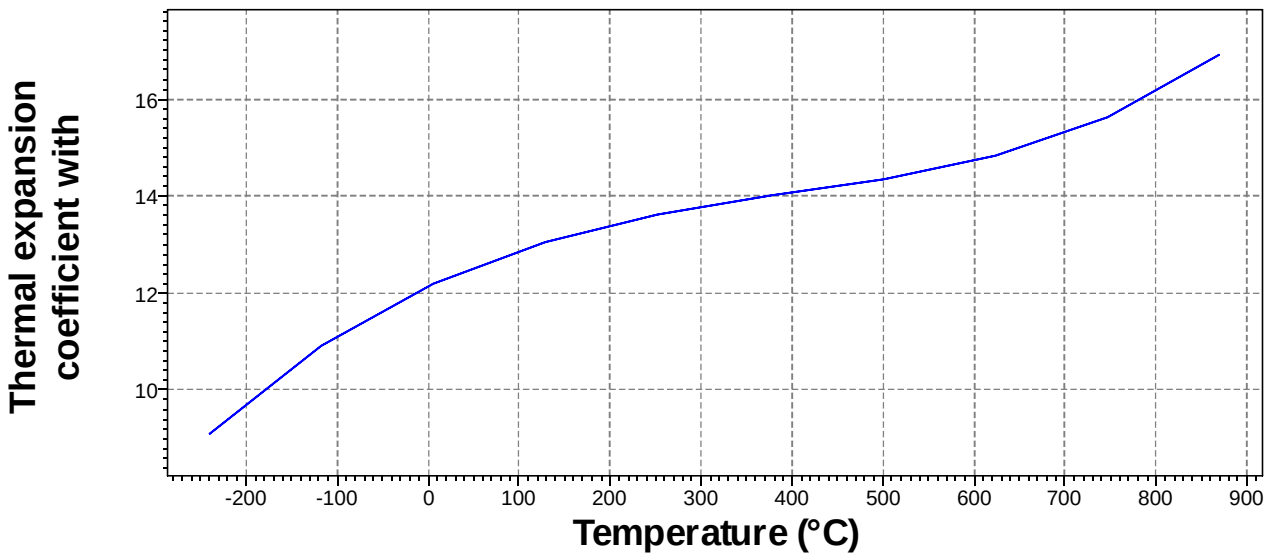
Specific heat capacity	440	-	458	J/kg.°C
Specific heat capacity with temperature	423	-	423	J/kg.°C

Parameters: Temperature = 23°C



Thermal expansion coefficient	12,8	-	13,4	µstrain/°C
Thermal expansion coefficient with temperature	12,3	-	12,3	µstrain/°C

Parameters: Temperature = 23°C



Reference temp		20			°C
Thermal shock resistance		263	-	297	°C
Thermal distortion resistance	*	0,879	-	0,966	MW/m
Latent heat of fusion	*	275	-	300	kJ/kg

Electrical properties

Electrical resistivity		115	-	125	µohm.cm
Electrical conductivity		1,38	-	1,5	%IACS
Galvanic potential	*	-0,05	-	0,03	V

Magnetic properties

Magnetic type		Non-magnetic

Optical, aesthetic and acoustic properties

Transparency		Opaque			
Acoustic velocity		4,97e3	-	5,1e3	m/s
Mechanical loss coefficient (tan delta)	*	1e-4	-	3e-4	

Restricted substances risk indicators

SIN List indicator (0-1, 1 = high risk)		0

Critical materials risk

Contains >5wt% critical elements?		Yes

Processing properties

Metal casting		Unsuitable	
Metal cold forming		Acceptable	
Metal hot forming		Limited use	
Metal press forming		Acceptable	
Metal deep drawing		Limited use	
Machining speed		3,35	m/min
Weldability		Good	
Notes		Preheating is not required, post weld heat treatment is required	

Weldability - MIG	Good
Weldability - plasma	Good
Weldability - SAW	Good
Weldability - TIG	Good
Brazeability	Good

Durability

Water (fresh)	Excellent
Water (salt)	Excellent
Weak acids	Excellent
Strong acids	Excellent
Weak alkalis	Excellent
Strong alkalis	Excellent
Organic solvents	Excellent
Oxidation at 500C	Excellent
UV radiation (sunlight)	Excellent
Galling resistance (adhesive wear)	Limited use

Notes

Bronze or zinc alloy dies should be used to minimize galling.

Flammability	Non-flammable

Corrosion resistance of metals

Stress corrosion cracking	Not susceptible

Notes: Rated in chloride; Other susceptible environments: Hydroxide

Intergranular (weld line) corrosion resistance	Excellent
Inorganic acids	Excellent
Organic acids	Excellent
Alkalis	Excellent
Humidity / water	Excellent
Sea water	Excellent
Sour oil and gas	Excellent

Primary production energy, CO2 and water

Embodied energy, primary production (virgin grade)	* 220	-	243	MJ/kg

Sources

Estimated from sources including Institute for Prospective Technological Studies, 2005; Hekkert, 2000; Norgate, Jahanshahi, Rankin, 2007; ecoinvent v3.9.1; Sullivan and Gaines, 2010; Nickel Institute, 2003; Fthenakis, Wang, Kim, 2009; Dhingra, Overly, Davis, 1999

Embodied energy, primary production (typical grade)	* 130	-	152	MJ/kg
CO2 footprint, primary production (virgin grade)	* 15,7	-	17,4	kg/kg

Sources

Estimated from sources including Voet, van der and Oers, van, 2003; ecoinvent v3.9.1; Norgate, Jahanshahi, Rankin, 2007; Nickel Institute, 2003; Hammond and Jones, 2008

CO2 footprint, primary production (typical grade)	* 9,37	-	10,9	kg/kg
Water usage	* 235	-	259	l/kg

Processing energy, CO2 footprint & water

Roll forming, forging energy	* 6,15	-	6,8	MJ/kg
Roll forming, forging CO2	* 0,461	-	0,51	kg/kg
Roll forming, forging water	* 4,18	-	6,27	l/kg
Extrusion, foil rolling energy	* 12	-	13,3	MJ/kg
Extrusion, foil rolling CO2	* 0,901	-	0,996	kg/kg

Extrusion, foil rolling water	* 6,69	-	10	l/kg
Wire drawing energy	* 44,3	-	48,9	MJ/kg
Wire drawing CO2	* 3,32	-	3,67	kg/kg
Wire drawing water	* 16,7	-	25	l/kg
Metal powder forming energy	* 32,5	-	35,8	MJ/kg
Metal powder forming CO2	* 2,6	-	2,87	kg/kg
Metal powder forming water	* 35,4	-	53,1	l/kg
Vaporization energy	* 1,15e4	-	1,27e4	MJ/kg
Vaporization CO2	* 860	-	950	kg/kg
Vaporization water	* 4,78e3	-	7,17e3	l/kg
Coarse machining energy (per unit wt removed)	* 1,35	-	1,5	MJ/kg
Coarse machining CO2 (per unit wt removed)	* 0,102	-	0,112	kg/kg
Fine machining energy (per unit wt removed)	* 9,27	-	10,2	MJ/kg
Fine machining CO2 (per unit wt removed)	* 0,695	-	0,768	kg/kg
Grinding energy (per unit wt removed)	* 18,1	-	20	MJ/kg
Grinding CO2 (per unit wt removed)	* 1,35	-	1,5	kg/kg
Non-conventional machining energy (per unit wt removed)	* 115	-	127	MJ/kg
Non-conventional machining CO2 (per unit wt removed)	* 8,6	-	9,5	kg/kg

Recycling and end of life

Recycle	✓			
Embodied energy, recycling	* 36,7	-	39,5	MJ/kg
CO2 footprint, recycling	* 2,88	-	3,11	kg/kg
Recycle fraction in current supply	44,7	-	49,4	%
Downcycle	✓			
Combust for energy recovery	✗			
Landfill	✗			
Biodegrade	✗			

Notes

Warning

All nickel compounds should be regarded as toxic. Some can cause cancer and/or fetal abnormalities.

Keywords

2.4668; ALLOY 718; Altemp 718; Altemp 718 Solution Treated; B50T68; B50Tf16A; C50Tf89; Cpw407; Dmd423.32; ELECTRALLOY TOOLWARE 718; ERNiFeCr-2 to AWS A5.14/A5.14M; Ems 55458; Emvac 718; Haynes 718; Haynes Alloy No. 718; ISO 9723-9725; Inconel 718; J30012; La213; Lss 718 Ep; Msrr 7132; Msrr 7228; N07718 to ASTM B637; N07718 to ASTM B670; NCF 718; NCF718; NW7718; NiCr19Fe19Nb5Mo3; NiCr19NbMo; Nicrofer 5219Nb-Alloy 718; Pwa 649; Pyromet Alloy 718; Supermet 718; UNS N07718; UNS N07719; Udimet 718 (Wrought); Unitemp 718; Wa2225.3; XEV-I

Standards with similar compositions

- USA:
ERNiFeCr-2 to AWS A5.14/A5.14M, N07718 to ASTM B637, N07718 to ASTM B670, UNS N07718, UNS N07719

Links

ProcessUniverse
Producers
Reference

Shape

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