ATI 718-OP® *Alloy*

Technical Data Sheet

GENERAL

ATI 718-OP Alloy (UNS N07718) is an extremely versatile precipitation-hardening, nickel-based alloy with excellent strength, ductility, and corrosion resistance. These characteristics, combined with good weldability, good formability, and excellent cryogenic properties account for the popularity of this alloy. The main hardening constituent is a niobium containing γ˝, Ni3 (Nb, Al, Ti). The unique welding characteristics of this alloy are attributed to the kinetics of the precipitation reaction. The alloy is produced by vacuum induction melting followed by consumable remelting.

Because of its good resistance to corrosion and oxidation in a variety of media, ATI 718-OP alloy is used in a variety of applications in the oil patch and chemical process industries. Some of the applications are valves, packers, fasteners, hangers, blow-out preventers, and well logging casing.

SPECIFICATIONS

- API 6A 718
- NACE MR0175 - Bar

PHYSICAL PROPERTIES

Melting Range: 2,300 - 2,450° F; (1,260 - 1,343° C)
Density: 0.296 lbs/in3; 8.19 gm/cm3
Specific Heat @ 70° F (21° C): 0.100 BTU/lb - °F (444 J/kg -°K)
Magnetic Permeability @ 70° F (21° C): 1.001 (H = 200 oerstads = 16kA/m)

HEAT TREATMENT

The heat treatment consists of solution treating followed by a single aging treatment solution treat at 1,870 - 1,900° F (1,021 - 1,038° C) for 1 - 2 hours. Rapid cool. Age at 1,425 - 1,475° F (774 - 802° C) for 6 - 8 hours. Air cool.

HARDNESS

The hardness in the solution treated condition is about 20 - 25 HRC which increases upon aging to about 40 HRC max.

FORGEABILITY

ATI 718-OP alloy displays good hotworking characteristics. Recommended forging furnace temperatures for initial forgings are 2,050° F (1,121° C) maximum for initial forging and 1,775 - 1,800° F (968 - 982° C) minimum for finish forging. A reduction of 25% minimum during final forging, together with a low finishing temperature, is required to avoid a duplex grain structure and to establish proper mechanical properties.

FORMABILITY

This alloy is readily formable in the solution treated condition because of its good ductility.

MACHINABILITY

ATI 718-OP alloy is readily machinable in both the solution treated and age-hardened conditions.

WELDABILITY

Satisfactory welds can be produced in both the solution treated and fully-aged conditions using inert gas-shielded arc, plasma arc, electron beam, and resistance welding techniques. Because of the sluggish aging response, ATI 718-OP alloy can be welded without hardening during the heating and cooling cycles, and the aged alloy can be repair welded several times without cracking even in complex weldments.

SPECIAL PRECAUTIONS

All lubricants, or coolants, particularly sulfur-bearing, should be removed prior to heat treating and welding.

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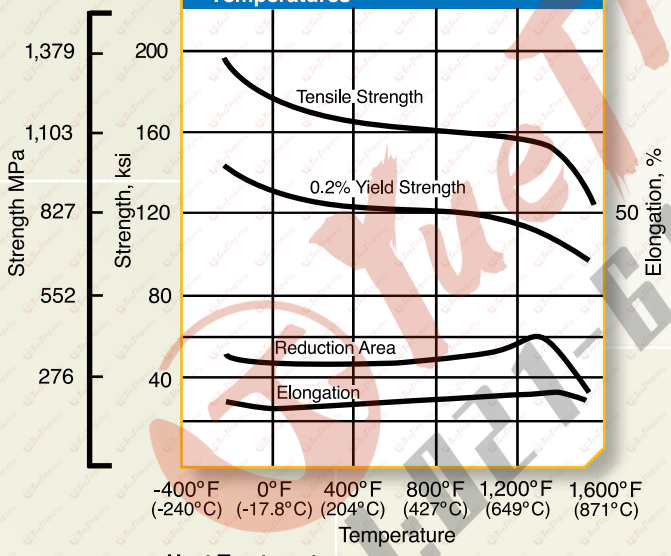
Chemical Composition

	C	Mn	Si	S	P	Cr	Ni	Co	Fe	Mo	Ti	Al	B	Cb+Ta
% w/w, min.	-	-	-	-	-	17.0	50.0	-	Bal.	2.8	0.65	0.20	-	4.87
% w/w, max.	0.08	0.35	0.35	0.010	0.010	21.0	55.0	1.0	-	3.3	1.15	0.8	0.006	5.20

Mechanical Properties of 718-OP Alloy

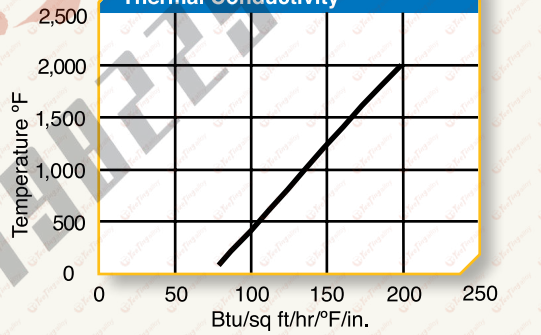
	UTS (ksi)	0.2% YS (ksi)	Elongation (%)	RA (%)	Hardness (HRC)
ST&A Condition	170	120	25	35	38

Typical Tensile Properties at Cyrogenic, Room, and Elevated Temperatures



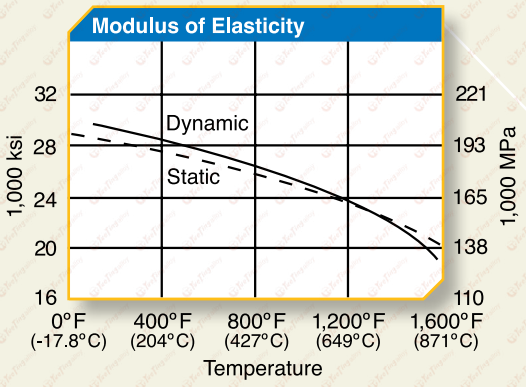
Heat Treatment
Solution Treat: 1,875°F for 1 Hour. Water Quench.
Age: 1,450°F for 6-8 hours. Air cool.

Thermal Conductivity



* Annealed 1,800° 1 hr. AC at 1,325° F. Hold 8 hr. AC

Modulus of Elasticity



C-Ring Tests in NAE Solution*

Alloy	Material Condition	0.2% Yield Srength		Hardness (HRC)	Duration Days	Sulfide Stress Cracking
		ksi	MPa			
625	Cold Worked	125.0	862	30.5	42	No
718-OP	Age Hardened	120.0	826	30.0	42	No
725	Age Hardened	125.0	862	38.0	42	No
925	Age Hardened	115.0	793	38.0	42	No

* Room temperature tests at 100% of yield strength in 5% NaCl plus 0.5% acetic acid saturated with H_2S. All specimens were coupled to carbon steel.