

INCONEL X-750 TECHNICAL DATA

Type Analysis

Element	Min	Max
Carbon	--	0.08
Manganese	--	0.30
Silicon	--	0.50
Sulfur	--	0.01
Nickel + Cobalt	70.0 min	
Chromium	14.0	17.0
Iron	5.00	9.00
Aluminum	0.40	1.00
Titanium	2.25	2.70
Copper	--	0.50
Cb + Ta	0.70	1.20

Description

Alloy X-750 is a precipitation-hardenable alloy which has been used in applications such as high temperature structural members for gas turbines, jet engine parts, nuclear power plant applications, heat-treating fixtures, forming tools, and extrusion dies. The alloy is highly resistant to chemical corrosion and oxidation and has high stress-rupture strength and low creep rates under high stresses at temperatures up to 1500°F (816°C) after suitable heat treatment.

Corrosion Resistance

Alloy X-750 has excellent resistance to chloride ion stress-corrosion cracking. It exhibits satisfactory resistance to numerous oxidizing environments. The alloy has similar corrosion resistance to alloy 600 in many media.

Physical Properties

Density

lb/cu in..... 0.300

kg/cu m..... 8303

Melting Range

°F..... 2540/2600

°C.....1393/1427

Thermal Conductivity

Temperature		Btu-in/ft ² -hr-°F	W/m-K
°F	°C		
300	149	117	16.9
600	316	142	20.5
1000	538	184	26.5
1200	649	199	28.7
1400	760	218	31.4
1600	871	245	35.3

Electrical Resistivity

Condition	ohm-cir mil/ft	microhm-mm
	At Room Temperature	
Hot Rolled	764	1270
Solution Treated	716	1190
Solution Treated and Aged	746	1240

Modulus of Elasticity

Temperature		psi x 10(6)	MPa x 10(6)
°F	°C		
80	26.7	31.0	213.7
500	260.0	28.7	197.9
1000	538.0	25.0	172.4
1350	732.0	21.0	144.8
1500	816.0	18.5	127.6

Coefficient of Thermal Expansion

Temperature Range		10(-6)°F	10(-6)°C
80°F to	26.7°C to		
200	93	6.7	12.1
600	316	7.5	13.5
1000	538	7.9	14.2
1200	649	8.1	14.6
1600	871	9.0	16.2

Specific Heat	Btu/lb-°F	kJ/kg-K
77/212°F (25/100°C)	0.10-0.11	0.42-0.46
77/1650°F (25/899°C)	0.13	0.54

Heat Treatment

Alloy X-750 is austenitic under all conditions. The alloy is heat treated by several different methods depending upon the application or requirement. Two common treatments are:

1. For maximum creep, relaxation and rupture strength at temperatures above 1100°F (593°C):

Solution Treatment - 2100°F (1149°C), 2 to 4 hrs, air cool.

Intermediate Age - 1550°F (843°C), 24 hrs, air cool.

Final Age - 1300°F (704°C), 20 hrs, air cool.

2. For highest room temperature yield strength and tensile ductility:

Stress Equalization - 1625°F (885°C), 24 hrs, air cool.

Precipitation Age - 1300°F (704°C), 20 hrs, air cool.

Workability

The furnace temperature should be 2100°F (1149°C)-for optimal starting temperatures of 1950/2000°F. For service below 1100°F (593°C), higher strength can be obtained by combining some cold work with heat treatment because the effects are additive.

Machinability

Alloy X-750 work hardens quickly and is more difficult to machine than most standard ferritic and martensitic alloys. The alloy is most easily machined in the stress-equalized condition. Because specific cutting forces are high, the machine tools used must have ample power and the cutting speed should be slow. The tools must have smooth finishes, be sharp, and be very rigid. To avoid work hardening, a continuous, smooth cutting action should be maintained; thus, the machines must have a minimum of backlash and the tool and workpiece must be rigidly supported. If at all possible, avoid very small cuts and feeds.

Welding

Alloy X-750 should be welded in the stress-equalized condition, 1625°F (885°C) heat treatment, and solution treated and age hardened after welding has been completed. If this is not practical, the alloy should be welded in the solution-treated condition and age hardened after welding with or without the inclusion of a short-period stress-relieving treatment at 1625°F. Weld joints, because of softening of the alloy within the heat-affected zone, should be located where lower creep properties are required.

Typical Mechanical Properties

Room Temperature Mechanical Properties

Temper	Tensile Strength, psi	Yield Strength 0.2% offset, psi	Elongation in 2", %	Hardness, Brinell
Hot-finished + 1300°F/20 hr, A.C	170,000-206,000	120,000-163,000	25-15	313-400
Hot-finished + Annealed 1800°F/1 hr, A.C + 1350°F/ 8 hr, F.C. 100°F/hr to 1150°F (total 18 hr), A.C.	162,000-193,000	115,000-142,000	30-15	300-390
Hot-finished + 1625°F/24 hr, A.C + 1300°F/20 hr, A.C.	160,000-188,000	100,000-135,000	30-15	302-363
Cold-rolled, annealed + 1300°F/20 hr, A.C.	160,000-197,000	105,000-150,000	30-20	300-400

Bar Stock:

Treatment #1

Solution treatment 2100°F (1149°C), 2 to 4 hrs., air cool intermediate age 1550°F (843°C), 24 hrs., air cool

Final age 1300°F (704°C), 20 hrs., air cool

Test Temperature		Short-Time Tensile Properties Tests					
°F	°C	Yield Strength 0.2% offset		Ultimate Tensile Strength		% Elongation in 2" (50.8 mm)	% Reduction of Area
		ksi	MPa	ksi	MPa		
70	21.1	92	634	161	1110	22	30
1000	538.0	83	572	140	965	20	30
1200	649.0	82	565	120	827	10	21
1400	760.0	68	469	80	552	10	22
1500	816.0	45	310	47	324	20	32

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