



## Technical Data

Ferguson Metals, Inc. ♦ Hamilton, Ohio

### Nickel-Base Superalloy

#### Type Hastelloy X

(UNS Designation N06002)

#### GENERAL PROPERTIES

Hastelloy X is an austenitic nickel base alloy containing approximately 22 percent chromium for outstanding resistance to oxidation at high temperatures. In addition, the alloy, which is solid solution strengthened, possesses exceptional strength at elevated temperatures. The alloy has good high temperature and stress rupture properties above 1450°F (788°C) and can be used for applications up to 2200°F (1204°C).

With the high levels of chromium, nickel and molybdenum in the material, Hastelloy X exhibits levels of corrosion resistance similar to high nickel alloys more customarily used in corrosion applications.

Hastelloy X exhibits good fabricability. The work hardening rate of the alloy is comparable to that of the austenitic stainless steels. Machinability is good in the annealed condition. The alloy can be welded by most of the fusion and resistance welding processes.

Hastelloy X is available as sheet, strip and plate. The alloy is supplied in the solution treated (annealed) condition.

#### CHEMICAL COMPOSITION

Typical Analysis	
Element	Percent
Carbon	0.05 - 0.15
Manganese	1.00 max
Phosphorus	0.040 max
Sulfur	0.030 max
Silicon	1.00 max
Chromium	20.50 - 23.00
Molybdenum	8.00 - 10.00
Cobalt	0.50 - 2.50
Tungsten	0.20 - 1.00
Iron	17.00 - 20.00
Aluminum	0.50 max
Titanium	0.15 max
Boron	0.01 max
Copper	0.50 max
Nickel	Balance

#### RESISTANCE TO CORROSION AND OXIDATION

Hastelloy X has good resistance to oxidizing, reducing and neutral atmospheres encountered in furnace and jet engine operations up to 2200°F (1204°C). The alloy develops a protective, tenacious oxide film which does not spall off and, therefore, retains oxidation resistance at high temperatures.

#### PHYSICAL PROPERTIES

##### Typical Values

Density	0.297 lb/in <sup>3</sup>	8.22 g/cm <sup>3</sup>
Specific Gravity	8.22	
Melting Range	2300-2470°F	1260-1355°C
Magnetic Permeability	<1.002	

#### THERMAL CONDUCTIVITY

Temperature Range		Thermal Conductivity	
°C	°F	Btu-ft/h-ft <sup>2</sup> -°F	W/m-°K
21	70	5.23	9.1
93	200	6.33	11.0
260	500	8.17	14.1
593	1100	12.0	20.8
704	1300	13.2	22.9
816	1500	14.5	25.0
927	1700	15.7	27.2

#### ELECTRICAL RESISTIVITY

Temperature		Electrical Resistivity
°C	°F	microhm-cm
21	70	115.8
200	392	120
400	752	123
500	1112	127
800	1472	128
1000	1832	129

#### MECHANICAL PROPERTIES

##### Typical Short Time Tensile Properties

Typical short time cryogenic and elevated temperature tensile properties for sheet and plate materials solution treated at 2150 to 2175°F (1177 to 1190°C) and rapidly cooled are shown below:

Temperature		0.2% Yield Strength		Ultimate Tensile Strength		Elongation
°F	°C	psi	MPa	psi	MPa	Percent
-321	-196	-	-	150,200	1035	46
-108	-78	-	-	118,800	819	51
72	22	47,000	324	104,500	720	46
400	204	48,700	336	103,400	713	41
600	316	42,600	294	100,200	691	40
800	427	43,700	301	99,700	687	44
1000	538	41,500	286	94,000	648	45
1200	649	39,500	272	83,000	472	37
1400	760	37,800	261	63,100	435	37
1600	871	25,700	177	36,500	252	51
1800	982	16,000	110	22,500	155	45
2000	1093	8,000	55	13,000	90	40
2200	1204	3,700	26	5,400	37	31

Data shown are typical, and should not be construed as maximum or minimum values for specification or for final design. Data on any particular piece of material may vary from those shown herein.