ATI

Technical Data Sheet

ATI 50™ / ATI XM-19™

Stainless Steel: Austenitic

(UNS 20910)

GENERAL INFORMATION

ATI 50™ / ATI XM-19™ alloy is a nitrogen-strengthened austenitic stainless steel with corrosion resistance superior to Types 316 and 317 austenitic stainless in combination with significantly higher strength. ATI 50 alloy also has very good mechanical properties at both sub-zero and moderately elevated temperatures.

The alloy can be fabricated and welded by the conventional equipment and procedures employed for austenitic stainless steel. It is non-magnetic as annealed and after severe cold work.

ATI 50 alloy has an excellent combination of corrosion resistance and strength for application in heat exchanger parts, pumps, spent nuclear fuel containers, flood control barriers, pulp and paper, food processing, petrochemical, fertilizer, structural components, and other similar equipment.

COMPOSITION

Element	ASTM A240 Limits (Wt. %)
Carbon	0.06 max
Manganese	4.0 - 6.0
Phosphorus	0.040 max
Sulfur	0.030 max
Silicon	0.75 max
Chromium	20.5 - 23.5
Nickel	11.5 - 13.5
Molybdenum	1.50 - 3.00
Columbium	0.10 - 0.30
Vanadium	0.10 - 0.30
Nitrogen	0.20 - 0.40
Iron	Balance

SPECIFICATIONS

ASTM A240 (XM-19) ASME SA-240 (XM-19) AMS 5861

HEAT TREATMENT

Annealing is performed at 1950 to 2050°F (1065 to 1120°C) followed by rapid cooling. Thin sections are usually cooled in air and heavy sections in water. ATI 50 alloy is fully austenitic and not hardenable by heat treatment.

WORKABILITY

ATI 50 alloy has good hot workability. A forging temperature of 2100 to 2200°F (1150 to 1205°C) is normally employed. Preheating to an intermediate temperature is not required and rapid cooling can be accomplished without cracking. Annealing after hot working improves corrosion resistance.

FORMABILITY

ATI 50 alloy can be formed by conventional equipment and procedures used with other austenitic stainless steels. Because of its higher strength and work hardening rate, the alloy will require a somewhat greater force than the 300 Type stainless steels. In-process annealing could be required and should be done at 1950 to 2050°F (1065 to 1120°C).

MACHINABILITY

The machinability of ATI 50 alloy is more difficult than for ATI 316 stainless steel. Slower speeds and higher feeds will be required and the tools must be sharp and not ride the surface without cutting. Chips tend to be tough and stringy, so chip breakers or curlers are helpful.

WELDABILITY

The alloy is weldable by the conventional methods employed for stainless steels. A weld joint having the strength of the base metal can be obtained using ER209 filler metal of the same composition. Addition of 3-5% nitrogen to the shielding gas is beneficial. Where lower strength is acceptable, ATI 316L stainless can be used.

CORROSION RESISTANCE

ATI 50 alloy has very good corrosion resistance in many reducing and oxidizing acids, chlorides, and pitting environments. The alloy provides excellent resistance to sea water, boiling 65% nitric acid, ferric sulfate-sulfuric acid, and ammonium carbamate. In common with most stainless steels, under certain conditions, ATI 50 alloy may stress corrosion crack in hot chloride environments. In boiling 42% MgCI2 solution, however, it is as resistant to cracking as ATI 316 alloy.

FORMS AVAILABLE

Plates are available from 0.1875 inch (4.7 mm) to 0.875 inch (22.23 mm), 96 inch (2440mm) maximum width at 240 inches (6100mm) maximum length. Plates as thick as 4.50 inches (115 mm) are available at reduced width and length. Consult manufacturer for exact details. Also a wide variety of plate shapes are available, including abrasive cut bar.

PHYSICAL PROPERTIES

Density	0.285 lb/in^3 7.89 g/cm^3
Magnetic Permeability	<1.010

Thermal Expansion (mean coefficient over range)			
Temperature Range			
°F	°C	in/in/°F x 10^{-6}	mm/mm/°C x 10^{-6}
75-200	24-93	9.0	16.2
75-400	24-204	9.3	16.7
75-600	24-316	9.6	17.3
75-800	24-427	9.9	17.9
75-1000	24-538	10.2	18.4
75-1200	24-649	10.5	19.0
75-1400	24-760	10.8	19.6
75-1600	24.871	11.1	20.0

Thermal Conductivity			
Temperature			
°F	°C	Btu-in/ft^2 * hr-°F	W/m * K
200	93	103	14.3
400	204	113	16.3
600	316	125	17.9
800	427	136	19.5
1000	538	144	21.1
1200	649	158	22.7
1400	760	170	24.3
1600	871	181	25.9

Electrical Resistivity			
Temperature			
°F	°C	Ohm-Circular Mil/ft	Microhm-mm
75	24	493	820

MECHANICAL PROPERTIES – ANNEALED PLATE

Room Temperature Tensile Properties (Min.)								
Specification	Ultimate Tensile Strength		0.2% Yield Strength		Elongation in 2” or 50 mm	Hardness (Max.)	
	ksi	MPa	ksi	MPa	%	BHN	RB
ASTM A240	100	690	55	380	35.0	241	100
AMS 5861	100	690	55	380	35.0		

TYPICAL PROPERTIES – ANNEALED PLATE

°F	°C	Ultimate Tensile Strength ksi	Ultimate Tensile Strength MPa	0.2% Yield Strength ksi	0.2% Yield Strength MPa	Elongation in 2” or 50 mm %
Sub-Zero Temperatures						
-320	-196	226	1558	128	883	40
-100	-73	146	1007	85	586	50
Room Temperature						
75	24	120	827	65	448	45
Elevated Temperatures						
600	316	104	717	46	317	36
800	427	98	676	45	310	30
1000	538	90	621	41	283	40