



Technical Data Sheet

ATI 403™

Martensitic Stainless Steel

(UNS S40300)

INTRODUCTION

ATI 403™ alloy is a corrosion and heat resistant 12% Cr martensitic stainless steel. This alloy offers a wide range of mechanical properties that are obtainable by appropriate heat treatments. It is easily hardened by oil, fan or air cooling and may be tempered at temperatures of up to 1350°F (732°C) to improve fracture toughness. Oil or fan cooling is required in thicker sections.

TYPICAL COMPOSITION

ATI 403™ alloy has a composition that falls within the limits designated for ATI 410™ stainless; however, it has a tighter range of chromium content and lower maximum silicon and nickel contents. This composition was developed to meet the exacting requirements of turbine blade constructions, which demand a material that combines corrosion resistance with a high elastic limit and high impact strength. The following table shows a comparison of the nominal composition of ATI 403™ alloy with that of ATI 410™ material.

Compositional Limits (weight percent)								
Alloy	C	Mn	Si	Cr	Ni	P	S	Fe
ATI 403™	0.15 max.	1.00 max.	0.50 max.	11.50 to 13.00	0.60 max.	0.04 max.	0.03 max.	Bal.
ATI 410™	0.15 max.	1.00 max.	1.00 max.	11.50 to 13.50	0.75 max.	0.04 max.	0.03 max.	Bal.

PHYSICAL PROPERTIES

Melting Temperature (Approximate)	
°F	°C
2720	1495

Density	
lb/in3	g/cm3
0.276	7.64

Linear Coefficient of Thermal Expansion			
Temperature Range		Coefficients of Expansion	
°F	°C	°F ⁻¹	°C ⁻¹
68-212	20-100	5.5×10^{-6}	9.9×10^{-6}
68-932	20-500	6.2×10^{-6}	11.2×10^{-6}
68-1450	20-787	6.6×10^{-6}	11.9×10^{-6}

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Thermal Conductivity			
Temperature		Conductivity	
°F	°C	Btu/(ft•h•°F)	W/(m•K)
212	100	14.4	25.0
932	500	16.6	28.8

Specific Heat			
Temperature Range		Specific Heat	
°F	°C	Btu/(lb•°F)	J/(kg•K)
32-212	0-100	0.11	460

Electrical Resistivity			
Temperature		Resistivity	
°F	°C	μΩ•in	μΩ•cm
68	20	22.4	57.0
212	100	25.2	64.0
392	200	28.4	72.0
752	400	34.6	88.0
1112	600	40.8	103.5
1292	700	43.7	111.0

MAGNETIC PERMEABILITY

ATI 403™ alloy is ferromagnetic in all heat treated conditions. In the annealed condition ATI 403™ alloy will have a maximum magnetic permeability value of 900.

MECHANICAL PROPERTIES

ATI 403™ material is available in both the annealed and hardened and tempered conditions. Depending on tempering parameters used, mechanical properties other than those shown in the table below may be produced.

Condition/Alloy	0.2% Offset Yield Strength ksi (MPa)	Ultimate Tensile Strength ksi (MPa)	Elongation in 2 inches	Hardness
Annealed ATI 403™	30 min. (207)	70 min. (483)	25% min.*	96 R _B max.
Hardened and Tempered ATI 403™	70 min. (483)	100 min. (689)	18% min.	93 to 100 R _B

* 20% min. for material 0.500" and under in thickness.

CORROSION RESISTANCE

ATI 403™ alloy possesses a high degree of resistance to atmospheric corrosion because of its ability to form a tightly adherent oxide film, which protects it from further attack. Maximum corrosion resistance is obtained by hardening and polishing. ATI 403™ alloy is not recommended for use in severely corrosive environments.

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OXIDATION RESISTANCE

ATI 403™ stainless steel resists oxidation up to 1400°F (760°C). For continuous service, the temperature should not exceed 1200-1300°F (649-704°C). Since the rate of oxidation is greatly affected by the atmosphere present and by the operating conditions, no actual data can be presented which apply to all service conditions. For oxidation data on specific applications, please contact the ATI Allegheny Ludlum Technical Center.

HOT WORKING/HEAT TREATMENT

Forging or Rolling

A starting temperature between 2000°F (1093°C) and 2100°F (1148°C) is recommended for forging, with a finishing temperature above 1400°F (760°C). If care is taken not to rupture the steel with hard blows, final forging temperatures as low as 1300°F (704°C) may be used. Better mechanical properties will be obtained in the forged and tempered condition when lower final forging temperatures are used.

Annealing

ATI 403™ steel may be annealed at 1500-1650°F (816-899°C), followed by a slow cool to 1100°F (593°C), and a final air cool.

Hardening

ATI 403™ material may be fully hardened by oil quenching from 1650-1800°F (899-982°C). Light sections may be hardened by air or fan cooling. This alloy will harden, to varying degrees, when cooled from temperatures above 1500°F (816°C) unless it is slowly cooled to below the critical temperature or held for sufficient length of time at a temperature below the critical temperature.

TEMPERING

Tempering may be done at a temperature between 400°F (204°C) and 1400°F (760°C), but it is advisable to avoid the 800°F (427°C) to 1100°F (593°C) range due to a decrease in impact properties and corrosion resistance. Outside of this range, strength and hardness decrease while ductility and toughness increase as the tempering temperature is raised.