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ATI 303

(Austenitic Stainless Steel)

Filing Code: SS-1361

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ATI 303 is a free-machining stainless steel specifically designed to exhibit improved machinability. It is the free-machining modification of the basic 18% chromium–8% nickel stainless steel. Sulfur is added to produce the free-machining characteristics. The good mechanical and corrosion-resistant properties of the lower-sulfur grade are retained to the extent possible.

Chemical Composition

Element	Composition, wt%(a)
Carbon	0.15
Silicon	1.00
Manganese	2.00
Phosphorus	0.20
Sulfur	≥ 0.15
Chromium	17.0–19.0
Nickel	8.00–10.0
Iron	bal

(a) Maximum values unless indicated otherwise

Physical Properties

See Table 1. ATI 303 is not hardenable by heat treatment.

Magnetic Permeability. ATI 303 is generally non-magnetic in the annealed condition with magnetic permeability values less than 1.02.

Mechanical Properties

See Table 2.

Table 1 Physical Properties

Property	Unit	At	Value
Melting point	°C (°F)	…	1400 (2552)
Density	kg/m^3 (lb/in.^{3})	RT	8030 (0.290)
Coefficient of linear thermal expansion	10^{-6}/K (10^{-6}/°F)	20–100 °C (68–212 °F)	16.6 (9.2)
		20–500 °C (68–932 °F)	18.8 (10.4)
		20–787 °C (68–1450 °F)	19.6 (10.9)
Thermal conductivity	W/(m·K) (Btu/(h·ft·°F))	100 °C (212 °F)	16.4 (9.4)
Specific heat capacity	J/(kg·K) (cal/(g·°C))	0–100 °C (32–212 °F)	500 (0.12)
Electrical resistivity	μΩ·m (Ω·circular-mil/ft)	20 °C (68 °F)	0.72 (433)

Typical values. RT = room temperature

Corrosion Resistance

The addition of certain elements to stainless steels to impart better machining characteristics also slightly lowers corrosion resistance. For dry conditions, and in most mildly corrosive environments, the performance of free-machining grades is similar to that of the corresponding unmodified types. Where moist atmospheres are involved, some free machining grades may tend to form a rust film, and in certain severe environments, they may show somewhat increased corrosion as a result of the free machining additions. In most cases, they will perform nearly the same as the basic parent composition.

Resistance to Oxidation

ATI 303 has good resistance to oxidation at temperatures up to 925 °C (1700 °F). In extreme oxidizing atmospheres, irregular scaling may be encountered, particularly above 760 °C (1400 °F).

Hot Forming

Heat to 1175–1260°C (2150–2300 °F). Wait for equalization of the temperature. Do not finish below 925–955 °C (1700–1750°F).

Heat Treatment

Annealing. For maximum ductility, ATI 303 should be annealed near the upper limit of the 980–1045 °C (1800–2000 °F) range. The material should be water quenched from the annealing temperature to prevent harmful carbide precipitation. For the same reason, heating within the 425–815 °C (800–1500 °F) temperature range should be avoided unless the material can be subsequently annealed.

Table 2 Room temperature mechanical properties in the annealed condition

Property	Unit	Value
Tensile strength	MPa (ksi)	517–621 (75–90)
0.2% Proof strength	MPa (ksi)	207–276 (30–40)
Elongation(a)	%	35–50
Reduction of area	%	50–60

(a) Gauge length = 50 mm (2 in.)

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Machining

The same machining methods commonly used for mild steel are applicable to ATI 303. High machining rates can be obtained for this material in the annealed condition, with hardness in the range of 200 to 240 HBW. However, modifications in machining techniques are necessary to adjust to the special characteristics of ATI 303. Since ATI 303 will work harden, it should be machined at reduced speeds and heavier feeds to prevent glazing at the tool interface.

Machining Data Recommendations. See *ATI 303*, ATI, 2013.

Welding

Although the free machining grades are not recommended for welding, they may be welded with some difficulty. ATI 303 may be welded with Type 310 electrodes and should be annealed after welding to redissolve precipitated carbides, thereby increasing the resistance of the material to intergranular corrosion.

Comparable Grades

ATI	ATI 303
ASTM	Type 303 (UNS S30300)
EN	X8CrNiS18-9 (1.4305)
ISO	X10CrNiS18-9 (4305-303-00-I)
JIS	SUS303

General Characteristics

Non-magnetic in the annealed condition; non-heat-treatable; good strength and corrosion resistance; best machinability of any austenitic stainless steel.

Product Forms

Plate.

Applications

Aircraft fittings; bolts, screws, and nuts; bushings; electrical switchgear components; gears; shafts.

Supplier

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All data from *ATI 303*, ATI, 2013, except where noted.