



Free Machining Stainless Steel Bar 303

Colour code: Light Blue

Introduction

Atlas 303 represents the optimum in machinability among the austenitic stainless steels. It is primarily used when production involves extensive machining.

Atlas 303 is generally available as a **UGIMA**[®] and new generation **UGIMA2**[®] with machinability significantly higher than that of the standard 303.

The sulphur addition which is responsible for the improved machining and galling characteristics of Atlas 303 lowers its corrosion resistance to below that of Atlas 304. As for other austenitic grades the structure gives Atlas 303 excellent toughness, although the sulphur in 303 reduces its toughness slightly.

Related Specifications

Grade	UNS No	British BS	Euronorm		Swedish SS	Japanese JIS
			No	Name		
303	S30300	303S31	1.4305	X8CrNiS18-9	2346	SUS 303

These comparisons are approximate only. The list is intended as a comparison of functionally similar materials **not** as a schedule of contractual equivalents. If exact equivalents are needed original specifications must be consulted.

Chemical Composition

Specification values in %, according to ASTM A582/A582M

Grade	C	Mn	Si	P	S	Cr	Mo	Ni
303	≤0.15	≤2.0	≤1.00	≤ 0.20	≥ 0.15	17.0-19.0	--	8.0-10.0

Conditions of Supply – Specified Mechanical Properties

Diameter (mm)	Tensile Strength (MPa)	Yield Strength 0.2% Proof (MPa)	Elongation (% in 50mm)	Hardness Brinell (HB)
≤ 15mm	750 – 800 typical	450 – 650 typical	34 typical	262 max
>15mm ≤25.4mm	700 typical	350 – 450 typical	44 typical	262 max
> 25.4mm	650 typical	300 typical	58 typical	262 max

Note that ASTM A582M only specifies hardness – tensile properties included above are not guaranteed and for information only. Drawn bars, generally up to 25.4mm diameter have higher strength values. Proof (yield) stress values in particular are significantly higher and the percentage elongation lower.

Condition of Supply – Typical Physical Properties

Density (kg/m ³)	Elastic Modulus (GPa)	Mean Coefficient of Thermal Expansion			Thermal Conductivity		Specific Heat 0-100°C (J/kg.K)	Electrical Resistivity (nΩ.m)
		0-100°C (µm/m/°C)	0-315°C (µm/m/°C)	0-538°C (µm/m/°C)	at 100°C (W/m.K)	at 500°C (W/m.K)		
7900	193	17.3	17.8	18.4	16.3	21.5	500	720

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Corrosion Resistance

Good resistance to mildly corrosive atmospheres, but significantly less than Atlas 304 due to the sulphur addition; the sulphide inclusions act as pit initiation sites. Atlas 303 should not be exposed to marine or other similar environments, as these will result in rapid pitting corrosion. Because the sulphide inclusions in Atlas 303 are primarily aligned along the rolling direction the corrosion resistance is particularly reduced in cross-sections.

Atlas 303, like other common austenitic stainless steels, is subject to stress corrosion cracking in chloride containing environments above about 50°C.

Consult Atlas Technical Assistance for specific environmental recommendations.

Heat Resistance

Good oxidation resistance in intermittent service to 760°C and in continuous service to 870°C. Continuous use in the 425-860°C range is not usually recommended due to carbide precipitation – Atlas 303 usually does not have a low carbon content so is susceptible to sensitisation, which can lead to intergranular corrosion.

Processing

As well as reducing the corrosion resistance, the sulphur additions in 303 also result in poor weldability and reduced formability compared to Grade 304. Sharp bends should not be attempted in 303. A practical compromise alternative may be a 304 Ugima Improved Machinability grade - this does not machine as readily as 303, but does offer better formability (as well as excellent weldability and significantly better corrosion resistance).

Conditions of Supply – Finish, Dimensions and Tolerances

Surface Finish

Round bar up to 25.4mm diameter is all cold drawn. Round bars over 25.4 and up to 127.00mm diameter are smooth-turned and polished. Round bars over 127.00mm diameter are all peeled.

All hexagon bar and all square bar is cold drawn.

Diameter and A/F Tolerances

Round Bar: Cold drawn h9; Smooth-turned and Polished h10; Peeled up to 160mm k12; Peeled over 160mm +1.5mm/-0; Centreless ground h9 or h8

Square Bar: h11; Hex Bar: h11.

Straightness – maximum deviation from a straight line

Round Bar: 1.5mm in 1500mm and may not exceed: 1.5mm x length in mm / 1500mm

Squares and Hexagon: 1.5mm in 1500mm and may not exceed: 1.5mm x length in mm / 1500mm

Other tolerances may be supplied for more critical applications upon enquiry.

Length Tolerance

Length Tolerance

Sizes up to 25.4mm:

Mill Lengths and Set Lengths, +50mm/-0

Sizes up from 25.4mm to 50.8mm:

Mill Lengths and Set Lengths, +100mm/-0

Sizes over 50.8mm:

Mill Lengths and Set Lengths, +/- 300mm

(varies depending on size)

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UGIMA® 303 and UGIMA2® 303 for top performance in machining

A **UGIMA®** improved machinability version of grade 303 is available in round, hexagon and square bar. **UGIMA®** 303 machines significantly better than standard 303, enabling a higher rate of metal removal and lower tool wear in many operations. Surface quality and reliability of machining results will improve too when using **UGIMA®** 303. **UGIMA2®** 303, is the new generation product offering further benefits of improved chip-breakability, substantially longer tool life and productivity benefits also in the low machining speed range.

For **UGIMA®** 303 and **UGIMA2®** 303 detailed set-up tables are available on request, specifying machining parameters (surface speed, feed rate, depth of cut and type of tool) for high-speed steel tooling and carbide insert tooling for the most common machining operations (roughing, finishing, drilling, parting-off etc.). Machinability assistance is available for optimal set-up and problem-solving for specific machining jobs.

Heat Treatment

The following temperature ranges are applicable for the respective heat treatment operations.

Forging	Annealing
900 – 1200°C	1010 – 1120°C

Cool rapidly rapidly after annealing. Atlas303 cannot be hardened by thermal treatment.

Welding

Not generally recommended but, if unavoidable use Grade 308L or 309 electrodes. AS 1554.6 does not pre-qualify welding of 303. Welds must be annealed for maximum corrosion resistance, but even then poor mechanical and corrosion properties will result.

Applications of Atlas303

Nuts and bolts. Bushings. Shafts. Electrical switchgear components. Gears. In general any component that is heavily machined and where the corrosion resistance and fabrication properties of 303 are viable.

Possible Alternative Grades

Grade	Why it may be chosen instead of Atlas 303
303UX	UGIMA® 303UX offers the highest machinability for long run repetition machining.
304	Better corrosion resistance, formability or weldability are needed, at the expense of lower machinability. Consider UGIMA® 304 or UGIMA® 304Cu
316	Higher resistance to pitting and crevice corrosion is required, in chloride environments. A lower machinability can be accepted.
416	Even higher machinability than 303 is needed, and a lower corrosion resistance can be tolerated. Or hardening by thermal treatment is required, while maintaining a high machinability.

Disclaimer

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