

Stainless Steel Grade 303 / 1.4305

Stainless steel type 1.4305 is popularly known as grade 303 stainless steel. Grade 303 is the most readily machineable of all the austenitic grades of stainless steel.

The machineable nature of grade 303 is due to the presence of Sulphur in the steel composition. Whilst the Sulphur improves machining, it also causes a decrease in the corrosion resistance and a slight lowering of the toughness. The corrosion resistance of type 303 is lower than that for 304. The toughness is still excellent as with other austenitic grades.

Property data given in this document is typical for bar products covered by ASTM A582. ASTM, EN or other standards may cover products sold by Aalco. It is reasonable to expect specifications in these standards to be similar but not necessarily identical to those given in this datasheet.

Applications

Grade 303 is used in applications that require parts to be heavily machined. These applications include:

- ◆ Nuts and bolts
- ◆ Screws
- ◆ Gears
- ◆ Aircraft fittings
- ◆ Bushings
- ◆ Shafts

Typical Chemical Composition

| % | 303 |
|----|---------|
| C | 0.15max |
| Mn | 2.0 |
| Si | 1.0 |
| P | 0.20 |
| S | 0.15min |
| Cr | 17-19 |
| Ni | 8-10 |

Typical Mechanical Properties

| Grade | 303 |
|-------------------------|--------|
| Tensile Strength (MPa) | 500 |
| Proof Stress 0.2% (MPa) | 190 |
| Elongation A5 (%) | 35 |
| Hardness Rockwell (HB) | 262max |

Typical Physical Properties

| Property | Value |
|------------------------|-----------------------------------|
| Density | 8.03 g/cm ³ |
| Melting Point | 1455°C |
| Modulus of Elasticity | 193 GPa |
| Electrical Resistivity | 0.072x10 ⁻⁶ Ω.m |
| Thermal Conductivity | 16.3 W/m.K at 100°C |
| Thermal Expansion | 17.3x10 ⁻⁶ /K at 100°C |

Alloy Designations

Stainless steel 303 also corresponds to the following standard designations and specifications:

| Euronorm | UNS | BS | En | Grade |
|----------|--------|--------|-----|-------|
| 1.4305 | S30300 | 303S31 | 58M | 303 |

Corrosion Resistance

Sulphur additions to the composition act as initiation sites for pitting corrosion. This decreases the corrosion resistance of 303 stainless steel to less than that for 304. However, corrosion resistance remains good in mild environments.

In chloride containing environments over 60°C, 303 stainless steel is subject to pitting and crevice corrosion. Grade 303 stainless is not suitable for use in marine environments.

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All Data is indicative only and must not be seen as a substitute for the full specification from which it is drawn. In particular, the mechanical property requirements vary widely with product form and product dimensions. For more complete details please refer to the relevant specification – The BS EN Specifications for Stainless Steel are listed on a separate Datasheet.

Heat Resistance

Grade 303 stainless steel has good resistance to oxidation when intermittently exposed to temperature up to 760°C temperatures. It also has good oxidation resistance in continuous service to 870°C. This, however, is not recommended as 303 is sensitive to carbide precipitation with continuous use at 425-860°C.

Fabrication

Fabrication of all stainless steels should be done only with tools dedicated to stainless steel materials. Tooling and work surfaces must be thoroughly cleaned before use. These precautions are necessary to avoid cross contamination of stainless steel by easily corroded metals that may discolour the surface of the fabricated product.

Cold Working

Type 303 is not readily cold workable. Some cold working is possible but sharp bending should not be attempted.

Hot Working

Fabrication methods, like forging, that involve hot working like should occur after uniform heating to 1149-1260°C. The fabricated components should then be rapidly cooled to ensure maximum corrosion resistance.

Heat Treatment

Grade 303 stainless steel cannot be hardened by heat treatment.

Solution treatment or annealing can be done by rapid cooling after heating to 1010-1120°C.

Machinability

Grade 303 stainless steel has excellent machinability. Machining can be enhanced by adhering to the following rules:

- ◆ Cutting edges must be kept sharp. Dull edges cause excess work hardening.
- ◆ Cuts should be light but deep enough to prevent work hardening by riding on the surface of the material.
- ◆ Chip breakers should be employed to assist in ensuring swarf remains clear of the work
- ◆ Low thermal conductivity of austenitic alloys results in heat concentrating at the cutting edges. This means coolants and lubricants are necessary and must be used in large quantities.

Welding

The sulphur addition present in 303 stainless steel results in poor weldability. If 303 must be welded the recommended filler rods or electrodes are grades 308L and 309 stainless steels. For maximum corrosion resistance, the welds must be annealed.

Supplied Forms

Type 303 is typically only supplied by Aalco as:

- ◆ Round bar
- ◆ Hexagonal bar.

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