309S Stainless Steel Pipe & Tube (UNS S31803/WNR 1.4833)

ASTM A213 Gr 309s/ASME SA 213 Gr 309s Stainless Steel Tube, is typically used for elevated temperature applications. It has high chromium and nickel content provides comparable corrosion resistance, superior resistance to oxidation, and the retention of a larger fraction of room temperature strength than austenitic Alloy 304.

309S Stainless Steel Tube is a highly alloyed austenitic stainless steel which is useful for high temperature strength, excellent oxidation resistance and creep resistance. At high temperature the lower nickel content of Sx309 improves resistance to sulphur attack. It is tough and ductile, and can be readily fabricated and machined.

It is the low-carbon version of 309, and it is suggested for applications where sensitisation, and subsequent corrosion by high temperature gases or condensates during shutdown may create a problem. Stainless Steel 309 is manufactured to ASTM A167 and Stainless Steel 309S to ASTM A240 specifications.

309S stainless steel pipe is frequently used for higher temperature applications. While its resistance to oxidation exceeds that of 310 alloy and its resistance to corrosion is equivalent to 310 alloy. Alloy 309 can be cold formed and it is highly weldable, although it needs continuous increasing pressure and strong forming machines. Typical methods of machining are used for stainless steel grade 309, but it is tougher and does tend to get harden more rapidly. Like 310 Stainless Steel,309S Stainless Steel has a high chromium and nickel content which grants excellent resistance to aqueous corrosion.

309S Stainless Steel Chemical Composition

	Alloy 309S (UNS S30908)
Carbon	0.20
Manganese	2.00
Phosphorus	0.045
Sulfur	0.030
Silicon	0.75
Chromium	22.00 min/24.00 max
Nickel	12.00 min/15.00 max
Iron	Balance

309S Stainless Steel Heat Treatment

The main reason for annealing 1.4833 Stainless Steel is to develop a recrystalized microstructure with a uniform grain size and for dissolving detrimental chromium carbide precipitates. To ensure complete annealing, pieces should be held in the range 2050-2150°F for approximately 30 minutes per inch of section thickness. This is a general suggestion only for specific cases and may require further investigation. It is primarily austenitic at room temperature when it is properly annealed.

During air annealing its scale formation is inevitable. The scale that forms is rich in chromium and comparatively adherent. Prior to further processing or service the annealing scale generally needs to be removed. There are typically two methods for removing scale i.e. chemical and mechanical.

A surface blasting combination prior to chemical scale removal is effective at removing all but the most tightly adherent scale. Glass beads or Silica sand are a good choice for the blasting media. Steel or iron shot can also be used but it will guide to embedded free iron in the surface which can then result in discoloration or surface rusting unless the surface is subsequently pickled.

Scale chemical removal is usually executed with mixed nitric-hydrofluoric acids. A typical pickling bath used consists of 5-15% HNO3 and 1/2-3% HF in aqueous solution. It leads to more aggressive scale removal due to higher concentrations of hydrofluoric acid. Bath temperature generally ranges from ambient to about 140°F (50°C). Resulting in surface grooving, higher temperature result in faster descaling but can attack grain boundaries aggressively. Acid pickling must be followed with a thorough water wash to remove all traces of pickling acids. Drying should then be used to avoid spotting and staining.

Alloys 309 pipe contains only of austenite at room temperature it cannot be hardened through heat treatment. Higher mechanical strengths are achievable by warm or cold working, but these grades are commonly not available in such situations. The higher tensile and yield strength are obtainable through cold working and not need to be followed by full annealing and are not stable at higher temperature at which these alloys are usually used. Creep properties in particular may be adversely affected by the use of cold worked material at elevated temperatures.

309S Stainless Steel Fabrication

It is widely used in the heat treatment/process industries due to high temperature properties and corrosion resistance. As such, they are usually fabricated into complex structures. In most metal forming operations mild carbon steel is usually considered as the standard for performance. With respect to carbon steel, the austenitic stainless steel tubing exhibit a significant difference – they are tougher and tend to work harden rapidly. While this does not change the general methods used for machining, cutting, forming, etc., it affect the specifics of those methods.

It can be cut and machined readily accomplished using standard techniques typically employed for common mild steel, with some modifications. Their cutting behavior can be quite different – they are tougher and tend to harden rapidly during working. Its tooling should be kept sharp and be rigidly held. Slow speeds and deep cuts are generally used to cut below work hardened zones. During cutting and machining operations heat removal and dimensional tolerances must be considered due to its low thermal conductivity and high coefficient of thermal expansion

It can be readily cold formed by standard methods such as bending, stretch forming, roll forming, hammer forming, flaring/flanging, spinning, drawing, and hydroforming. It can be work harden easily, which is exhibited by steadily increasing amounts of force required to continue deformation. As a result stronger forming machines are used and which eventually limits the amount of deformation possible without cracking.

Due to numerous environmental and metallurgical factors narrow range of temperatures can be used for effective hot working. Forging should start in the temperature range 1800-2145°F and finish no cooler than 1800°F. Working at higher temperature results in a fall-off of hot ductility due to environmental and metallurgical factors, particularly the formation of ferrite.

309S Application

It exhibit excellent elevated temperature strength along with resistance to creep deformation and environmental attack. Hence, it is widely used in the heat treatment industry for furnace parts such as refractory supports, rollers, conveyor belts, burner parts, retorts and oven linings, tube hangers, fans, and baskets and trays to hold small parts. It is also used in the chemical process industry to contain hot concentrated acids, sulfur dioxide and ammonia. In the food processing industry it is used in contact with hot acetic acid and citric acids.

309S 1.4833 Welding

It is considered to be the most weldable stainless steel. It can be welded by using all of the common processes. Matching compositions are generally used when filler metal is required. Its elevated alloy contents can make the weld pool inactive. If weld pool fluidity is a problem, filler metal containing silicon can help.

It exhibits relatively low thermal conductivity and high coefficient of thermal expansion and form low levels of ferrite in the solidifying weld metal and these factors can lead to hot cracking. The problem can be more severe for restrained and wide joints. Filler metal with low alloy content reduces the tendency for hot cracking and increase the amount of ferrite in the weld deposit.

309S grade is relatively low in carbon. With correct weld operation, intergranular of the heat affected zone is unlikely. In order to ensure complete restoration of corrosion resistance near the weld scale or heat tint should be removed. Brushing or grinding with a stainless steel brush can be used to remove the heat tint scale. Acid pickling will also remove heat intent. It can be pickled by using a special paste consisting of a mixture of nitric acid and HF or hydrochloric acid suspended in an inert filler. A thorough water wash should be immediately followed for completely removal of all traces of pickling paste.

309S Stainless Steel Aqueous Corrosion Resistance

It is primarily used at elevated temperature to take advantage of their oxidation resistance. However, both of these stainless steel grades are resistant to aqueous corrosion due to their high chromium and nickel contents.

Although it's higher nickel content offers marginal improvement with respect to chloride stress corrosion cracking compared to the 18-8 stainless steel, it remain susceptible to this form of attack.

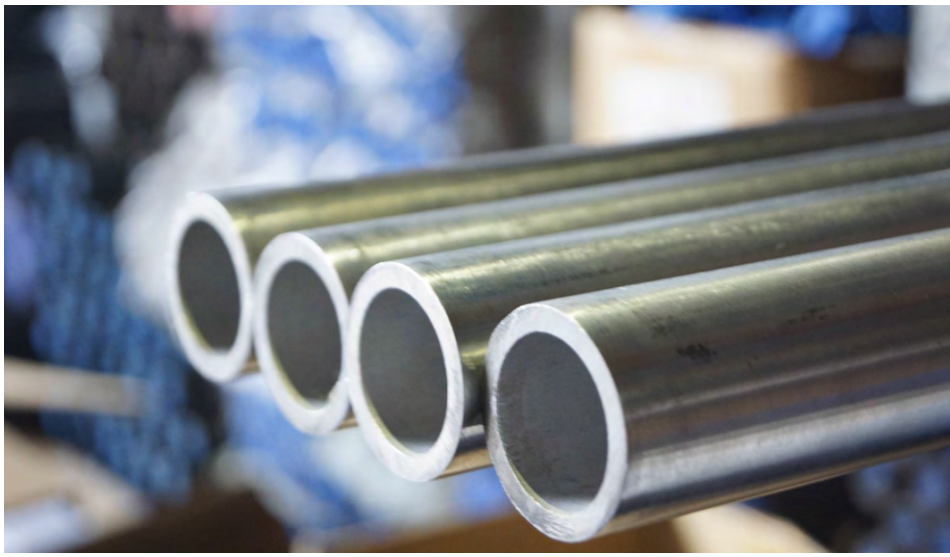
Certain applications specify the use of Alloy 309/309S stainless steel tubing where increased resistance to aqueous corrosion is needed. An example is service in concentrated nitric acid, where preferential attack of grain boundaries may occur.

309S Stainless Steel Mechanical Properties at Room Temperature

+		TP309S	TP309S
		TYPICAL	MIN
Tensile Stength MPa		570	515
Proof Stress (0.2% Offset)	MPa	280	205
Elongation (Percent in 50 mm)		48	35
Hardness (Rockwell)		-	90 HRB Max
Endurance (fatigue) limit	MPa	260	

ASTM A213 TP309s Pipe Size

Size: 1/4" × 0.035"
Size: 3/8" × 0.035"
Size: 1/2" × 0.035"
Size: 5/8" × 0.035"
Size: 3/4" × 0.035"
Size: 1" × 0.035"
Size: 5/16" × 0.035"
Size: 1/4" × 0.049"
Size: 3/8" × 0.049"
Size: 1/2" × 0.049"
Size: 5/8" × 0.049"
Size: 3/4" × 0.049"
Size: 1" × 0.049"
Size: 1/4" × 0.065"
Size: 3/8" × 0.065"
Size: 1/2" × 0.065"
Size: 5/8" × 0.065"
Size: 3/4" × 0.065"
Size: 1" × 0.065"
Size: 1" × 0.120"



107 Kika Street, Supariwala Bldg,
Gulalwadi, Mumbai - 400 004.

web: www.tubos.in
email: info@tubos.com
Tel: +91-22-6636 2001