

309 - 309S STAINLESS STEEL

UNS S30900 / UNS S30908

GENERAL PROPERTIES

//// 309/309s Stainless Steels (UNS designation S30900/S30908) are austenitic, chromium-nickel stainless steels that provide excellent corrosion resistance and heat resistance plus good strength at room and elevated temperatures. Type 309s is the low carbon version of 309 which minimizes carbide precipitation and improves weldability. These alloys are non-magnetic as annealed and become slightly magnetic when cold worked.

//// These alloys exhibit excellent oxidation resistance, high-temperature strength and creep resistance.

APPLICATIONS

- //// Furnace Parts ;
- //// Heating Elements ;
- //// Radiant Tubes ;
- //// Inner Covers ;
- //// Aircraft and Jet Engine Parts ;
- //// Carburizing Annealing Boxes ;
- //// Sulfite Liquor Handling Equipment ;
- //// Kiln Liners ;
- //// Boiler Baffles ;
- //// Refinery and Chemical Processing Equipment ;
- //// Auto Exhaust Parts ;
- //// Fire Box Sheets ;
- //// Radiant Tubes ;
- //// Heat Exchangers.

STANDARDS

Alloy	Specifications		
	ASTM	ASME	EN
309	A167/A240/A262/A480/A666	SA240/SA480/SA666	10088-2/10028-7
309S	A167/A240/A262/A480/A666	SA240/SA480/SA666	10088-2/10028-7

CHEMICAL COMPOSITION (%)

Alloy	C	Mn	P	S	Si	Cr	Ni	Fe
309	0.20	2.00	0.045	0.030	0.75	22.00 - 24.00	12.00 - 15.00	Balance
309S	0.08	2.00	0.045	0.030	0.75	22.00 - 24.00	12.00 - 15.00	Balance



MECHANICAL PROPERTIES //////////////////////////////////////////////////////////////////////

Room temperature mechanical properties of 309/309s are shown below. The material is in the annealed condition.

Condition	Yield Strength 0.2 % offset		Ultimate Tensile Strength		Elongation	Hardness	Impact Strength Izod V-Notch
	psi	MPa	psi	MPa	% to 2" (51 mm)	Rockwell	Ft.lbs (J)
Annealed	45 000	310	90 000	621	45	885	110 (140)

SHORT TIME ELEVATED TEMPERATURE TENSILE PROPERTIES //////////////////////////////////////////////////////////////////////

The following table illustrates the short time tensile properties of 309/309s at temperatures above room temperature. Low temperature properties are added for comparison.

Test temperature		Yield Strength 0.2 % offset		Ultimate Tensile Strength		Elongation
°F	°C	psi	MPa	psi	MPa	% in 2"
400	204	38 000	262	79 000	545	46
600	316	34 500	238	75 000	517	43
800	427	32 000	221	71 000	490	40
1 000	538	29 000	200	64 000	441	38
1 200	649	25 000	172	52 000	359	37
1 400	760	21 500	148	35 000	241	39
1 600	871	17 500	120	21 000	145	50
1 800	982	-	-	10 500	72	118

PHYSICAL PROPERTIES //////////////////////////////////////////////////////////////////////

Density	Magnetic Permeability	Specific Heat	Melting Range
0.290 lbs/in ³	H=200 Oersteds	32→212 °F 0.12 Btu/lb-°F	2250→2650 °F
9.01 g/cm ³	Annealed 1.02 max	0→100 °C 502 J/kg-°K	1399→1454 °C
Electrical Resistivity	Modulus of Elasticity		
Microhm-in (Microhm-cm)	ksi (MPa)		
68 °F (28.4 °C) - 39.8 (78)	29.0 x 10 ³ (200 x 10 ³)		

MEAN COEFFICIENT OF THERMAL EXPANSION //////////////////////////////////////////////////////////////////////

Temperature			
°F	°C	ln/in/°F	µm/m.K
32 - 212	0 - 100	8.3 x 10 ⁻⁶	14.9
32 - 600	0 - 315	9.3 x 10 ⁻⁶	16.7
32 - 1000	0 - 538	9.6 x 10 ⁻⁶	17.3
32 - 1200	0 - 649	10.0 x 10 ⁻⁶	18.0



THERMAL CONDUCTIVITY //////////////////////////////////////////////////////////////////////////////////////////////////////////////////

Thermal Conductivity			
Temperature			
°F	°C	BTU/hr/ft²/ft/°F	W/m.K
212	100	9.0	15.6
932	500	10.8	18.7

CORROSION RESISTANCE //////////////////////////////////////////////////////////////////////////////////////////////////////////////////

////// **309** and **309S** provide excellent general corrosion resistance. They are more resistant to marine atmospheres than Type 304. They exhibit high resistance to sulfite liquors and are useful for handling nitric acid, nitric-sulfuric acid mixtures, and acetic, citric, and lactic acids.

////// These materials are generally considered heat-resisting alloys. Their destructive scaling temperature is about 2000 °F (1093 °C). They exhibit good scaling resistance in both continuous and intermittent service, but the alloys should not be used above 1800 °F (982 °C) for intermittent service.

FABRICATION //////////////////////////////////////////////////////////////////////////////////////////////////////////////////

////// Types **309** and **309S** Stainless Steels can be roll formed, stamped and drawn readily. In-process annealing is usually required to reduce hardness and increase ductility.

WELDING //////////////////////////////////////////////////////////////////////////////////////////////////////////////////

////// The austenitic class of stainless steels is generally considered to be weldable by the common fusion and resistance techniques. Special consideration is required to compensate for a higher coefficient of thermal expansion to avoid warping and distortion. Types **309** and **309S** are generally considered to have weldability nearly equivalent to the most common alloys of this class, Types **304** and **304L**. When a weld filler is needed, AWS E/ER **309** and **310** are most often specified. Types **309** and **309S** are well known in reference literature and more information can be obtained in this way.

HEAT TREATMENT //////////////////////////////////////////////////////////////////////////////////////////////////////////////////

////// These alloys are not hardenable by heat treatment. They can only be hardened by cold working.

ANNEALING //////////////////////////////////////////////////////////////////////////////////////////////////////////////////

////// Anneal at 1900 °F to 2050 °F (1038 °C - 1121 °C), then water quench or rapidly air cool.

