Grade Data Sheet

304 304L 304H

Grade 304 is the standard "18/8" austenitic stainless; it is the most versatile and most widely used stainless steel, available in the widest range of products, forms and finishes. It has excellent forming and welding characteristics.

Grade 304L, the low carbon version of 304, does not require post-weld annealing and so is extensively used in heavy gauge components (about 5mm and over). Grade 304H with its higher carbon content finds application at elevated temperatures. The austenitic structure also gives these grades excellent toughness, even down to cryogenic temperatures.

Grade 304 can be severely deep drawn without intermediate annealing, which has made this grade dominant in the manufacture of drawn stainless parts such as sinks, hollow-ware and saucepans. For severe applications it is common to use special "304DDQ" (Deep Drawing Quality) variants.

Corrosion Resistance

Very good in a wide range of atmospheric environments and many corrosive media. Subject to pitting and crevice corrosion in warm chloride environments, and to stress corrosion cracking above about 60°C. Considered resistant to pitting corrosion in potable water with up to about 200mg/L chlorides at ambient temperatures, reducing to about 150mg/L at 60°C. Consult Atlas Technical Assistance for specific environmental recommendations.

There is usually no difference in corrosion resistance between 304 and 304L.

Heat Resistance

Good oxidation resistance in intermittent service to 870°C and in continuous service to 925°C. Continuous use of 304 in the 425-860°C range is not recommended if subsequent aqueous corrosion resistance is important. Grade 304L is resistant to carbide precipitation and can be heated into this temperature range.

Grade 304H has higher strength at elevated temperatures so is often used for structural and pressure-containing applications at temperatures above about 500°C and up to about 800°C. 304H will become sensitised in the temperature range of 425-860°C; this is not a problem for high temperature applications, but will result in reduced aqueous corrosion resistance.

Heat Treatment

Solution Treatment (Annealing)

Heat to 1010-1120°C and cool rapidly. These grades cannot be hardened by thermal treatment.

Welding

Excellent weldability by all standard fusion methods, both with and without filler metals. AS 1554.6 pre-qualifies welding of 304 with 308, and 304L with 308L rods or electrodes (or their high silicon equivalents). Heavy welded sections in Grade 304 may require post-weld annealing for maximum corrosion resistance. This is not required for Grade 304L. Grade 321 may also be used as an alternative to 304 if heavy section welding is required and post-weld heat treatment is not possible.

Machining

A "Ugima" improved machinability version of grade 304 is available in bar products. "Ugima" machines significantly better than standard 304, giving higher machining rates and lower tool wear in many operations.

"Dual Certification"

It is common for 304 and 304L to be stocked in "Dual Certified" form, particularly in plate, pipe and round bar. These items have chemical and mechanical properties complying with both 304 and 304L specifications. Such dual certified product may be unacceptable for high temperature applications.

Typical Applications

Food processing, transport and storage equipment, particularly in beer brewing, milk processing and wine making. Kitchen benches, sinks, troughs, equipment and appliances. Architectural panelling, railings & trim. Chemical containers, including for transport. Heat Exchangers. Woven or welded screens. Threaded fasteners. Springs.

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Specified Properties

These properties are specified for flat rolled product (plate, sheet and coil) in ASTM A240/A240M. Similar but not necessarily identical properties are specified for other products such as pipe and bar in their respective specifications. Minor changes to 304 and 304L composition limits were made in 2006-7 to harmonise with similar grades specified in ISO and European standards.

Composition Specification (%)

Grade		C	Mn	Si	P	S	Cr	Mo	Ni	N
304	min.	-	-	-	-	-	17.5	-	8.0	-
	max.	0.07	2.0	0.75	0.045	0.030	19.5		10.5	0.10
304L	min.	-	-	-	-	-	17.5	-	8.0	-
	max.	0.030	2.0	0.75	0.045	0.030	19.5		12.0	0.10
304H	min.	0.04	-	-	-	-	18.0	-	8.0	-
	max.	0.10	2.0	0.75	0.045	0.030	20.0		10.5	

Mechanical Property Specification (single values are minima except as noted)

Grade	Tensile Strength (MPa) min	Yield Strength 0.2% Proof (MPa) min	Elongation (% in 50mm) min	Hardness	
				Rockwell B (HR B) max	Brinell (HB) max
304	515	205	40	92	201
304L	485	170	40	92	201
304H	515	205	40	92	201
304H also has a requirement for a grain size of ASTM No 7 or coarser.					

Physical Properties

(typical values in the annealed condition)

Grade	Density (kg/m³)	Elastic Modulus (GPa)	Mean Coefficient of Thermal Expansion			Thermal Conductivity		Specific Heat	Electrical Resistivity
			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)	0-100°C (J/kg.K)	(nΩ.m)
304/L/H	7900	193	17.2	17.8	18.4	16.3	21.5	500	720

Grade Specification Comparison

Grade	UNS No	Euronorm		Swedish SS	Japanese JIS
		No	Name		
304	S30400	1.4301	X5CrNi18-10	2332	SUS 304
304L	S30403	1.4307	X2CrNi18-9	2352	SUS 304L
304H	S30409	1.4948	X6CrNi18-11	-	-
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.					

Possible Alternative Grades

Grade	Why it might be chosen instead of 304
301/L	A higher work hardening rate grade is required for roll formed or stretch formed components.
F20S	Lower cost needed in thin gauge sheet and coil. Durinox F20S also has easier fabrication.
303	Higher machinability needed; lower corrosion resistance, formability & weldability are acceptable
316	Higher resistance to pitting and crevice corrosion is required, in chloride environments
253MA	Better resistance high temperatures is needed. 253MA is optimised for temperatures to 1150°C.
430	A lower cost is required, and the reduced corrosion resistance and fabrication characteristics are acceptable.