

Valbruna Grade

AISL

Steel type

Austenitic Stainless Steel

Description of material

AISL is a low-carbon austenitic stainless steel with good general corrosion resistance, as well as good intergranular corrosion resistance after welding processes.

Applications

AISL is suitable for the fabrication of many products such as flanges, valves, bolting, pumps shafts, food /beverages industry equipment, storage tanks, many organic chemicals and parts working in the mild medium corrosive environments.

Melting practices

Argon Oxygen Decarburization

Corrosion resistance

AISL is resistant to fresh water, several organic chemicals and inorganic compounds, atmospheric corrosion, rural applications and sterilizing solutions where the chloride content is on the low side. Pitting and crevice corrosion may occur in chloride environments if concentration, pH and temperature are at determinate levels. As with other standard austenitic grades, AISL suffers from stress corrosion cracking about thirty degrees (C°) above room temperature with certain stress and halogen concentrations. Strain hardened structures increase the risk of stress corrosion cracking. It should be noted that this grade, as for every kind of stainless steel, surfaces should be free of contaminant and scale, heat tint, and passivated for optimum resistance to corrosion.

Cold working

AISL is readily fabricated by cold working operations such as cold drawing and bending, but should only be used for a moderate amount of cold heading because its chemical balance does not allow it to obtain a soft strain hardening structure after cold deformation due to a high CWHF (Cold Working Hardening Factor). This could result in rapid die wear. Other grades for this purpose such as AISR or AISRUH, whose chemical balance provide the highest cold deformability and the lowest CWHF, should be used. However these grades have a poor machinability due to their low Sulfur content.

Head office and works:

Viale della Scienza, 25
36100 VICENZA
Tel. +39 0444 968211
Fax. +39 0444 963836
www.valbruna-stainless-steel.com

Via Volta, 4
39100 BOLZANO
Tel. +39 0471 924111
Fax. +39 0471 924497
www.valbruna-stainless-steel.com

2400 Taylor Street West
46801 Fort Wayne, IN - USA
Tel. +1 260 434 2800
Fax. +1 260 434 2801
E-mail: info@valbruna.us
www.valbrunastainless.com

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Machinability

Austenitic grades are different from Ferritic and Alloy steels and require more rigid and powerful machines in addition to the correct choice of tools, coating and cutting fluids. The Austenite structure is prone to transform in to α' Martensite caused by strain hardening of the tool on the surface of the machined piece. The knowledge of this behavior must be correctly considered when a piece requires two or several cutting steps to be finished. The layer of α' Martensite is very hard and, if the subsequent turning or milling processes work on this hardened layer, a rapid tool wear could happen. The tool must work under this layer. AISL has a special chemical balance to create a micro re-sulphured structure that aids machining, but also this structure has a very low risk of hot cracks in the weld zone of autogenous welds.

Weldability

In solid state joining operations such as Friction Welding, AISL provides a quality bond line. In addition, this grade has a special chemical composition which helps to avoid solidification cracks in the fused-zone of autogenous welds due to a suitable Ferrite balance. The typical ER for type 304L series could be used.

Hot working

Long products of AISL are not specifically designed for hot working and are usually supplied as cold finished round, hexagonal, flat and square bars for machining processes or general use. More suited to hot working, Valbruna produces a group of grades with a different process and with low Ferrite. For instance: AISLF (instead of AISL). However, for the open die forging of large ingots and shapes, AISL has a good hot plasticity if a suitable soaking and a right temperature are applied. No preheating is required. Small forgings can be cooled rapidly in air or water.

Designations

AISI	304/304L
W.N.	1.4301/1.4307
UNS	S30400/S30403
EN	X5CrNi18-10/X2CrNi18-9
BS	304S15/304S31

Specifications

ASTM	A182 / A276 / A479
ASME	SA182 / SA276 / SA479
EN	10088-3 / 10222-5 / 10272

Chemical composition

Chemical element	C	Mn	Si	S	P	Ni	Cr	Mo	Cu	N
Minimum value %	-	-	-	-	-	8%	18%	-	-	-
Maximum value %	0,03%	2%	1%	0,03%	0,04%	10%	19,5%	1%	1%	0,1%

Heat treatment

Description of condition	Condition	Minimum temperature °C	Maximum temperature °C	Cooling
Solution Annealed	A	1040	1100	Water / Air

Physical properties

Physical property	SI/metric units	US/BS Imperial units
Density	7,9 kg/dm ³	0,285 lb/in ³
Specific Thermal Capacity 20° C	500 J/(kg·K)	0,119 Btu/lb°F
Thermal conductivity 20° C	15 W/(m·K)	104,002 Btu in/ ft ² h °F
Thermal expansion 20° - 100° C	16 (10 ⁻⁶ /K)	8,889 (10 ⁻⁶ /°F)
Electrical Resistivity 20° C	0,73 Ω·mm ² /m	28,74 μΩin
Modulus of Elasticity 20° C	200 GPa	29007,548 ksi

Mechanical properties

Condition	Subtype	Rm [N/mm ²]	Rm [Ksi]	Rp0.2% [N/mm ²]	Rp0.2% [Ksi]	A5D [%]	HBW
Solution Annealed	A	500 - 700	73 - 102	205 min.	30 min.	45 min.	215 max.

Hot working

Condition	Minimum temperature °C	Maximum temperature °C	Cooling
Forging / Hot Rolling	900	1260	Water / Air