

303 Stainless Steel Bar

VALPLUS®

VPAU188Z is a Ca- treated free machining austenitic Chromium-Nickel stainless steel with a better machinability than the standard type 303 series. This characteristic is achieved in the steel making process by modifying both sulphide and oxide inclusions favourable to machining, and by controlling the type, shape and composition of inclusions. This grade has the same steel making process of MV188ZHS that allows some advantages in certain kinds of machining operations. VPAU188Z is widely used in applications where the machinability is the most important factor of choice in terms of cost-saving in the production of pieces obtained by multi-spindles and screw machines.

DESIGNATIONS

VALBRUNA	VPAU188Z
AISI	303
W.N.	1.4305
UNS	S30300
EN	X8CrNiS18-9
BS	303S31

DESIGN FEATURES

- Relatively good corrosion resistance
- Excellent Machinability

CHEMICAL COMPOSITION

CHEMICAL ELEMENT	C	Mn	Si	S	P	Ni	Cr	N	Cu
MINIMUM VALUE %	-	-	-	0.25%	-	8%	17%	-	-
MAXIMUM VALUE %	0.1%	2%	1%	0.3%	0.045%	10%	19%	0.11%	1%

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	200 min.	29 min.	35 min.	230 max.

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

HEAT TREATMENT

Description of condition	Condition	Minimum temperature °C	Maximum temperature °C	Cooling
Solution Annealed	A	-	1080	Water

APPLICATIONS

VPAU188Z is suitable for the fabrication of many products such as flanges, valves, bolting, pumps shafts, pins, rings, screws, nuts, beverage industry equipment, many organic chemicals and parts working in mild corrosive environments. VPAU188Z is not recommended for applications in pressure vessels and shouldn't be used for high polishability or mirror finishing processes.

CORROSION RESISTANCE

VPAU188Z is resistant to fresh water, many organic chemicals and inorganic compounds, atmospheric corrosion, rural applications and sterilizing solutions where the chloride content is low. It should be well considered that, as with all free machining grades, Sulphur is added to improve machinability and the formation of MnS inclusions could prime points of pitting if exposed to some corrosive environments. Pitting and crevice corrosion may occur in chloride environments if concentration, pH and temperature are at determinate levels. As other standard austenitic grades, VPAU188Z suffers from stress corrosion cracking about forty degrees (C°) above room temperature and above certain stresses and halogens concentration. 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.

WELDABILITY

VPAU188Z is not suitable for welding because its Sulphur content may generate porosity and cracks in the weld zone. Moreover, VPAU188Z has a different behavior when compared to standard grades of similar alloy composition due to its special steel making process, because its Calcium –treated process, in addition to high Sulphur content, influences the surface tension of liquid and the regular morphology and geometry of the fused (weld) zone. Nevertheless, if welding process were required, VPAU188Z has a chemical composition which avoids the creation of solidification cracks in the fused-zone of autogenous welds due to its Ferrite balance but even so is unlikely to avoid porosity and inadequate geometry of the weld. A welding process with a suitable austenitic filler could help to overcome or reduce these problems using low heat inputs. In order to avoid intergranular corrosion , the welded structure should be annealed after welding if the Carbon content of the supplied heat is above 0,03%. In solid state joining such as Friction Welding, VPAU188Z provides a poor quality bond line, or no joining.

COLD WORKING

VPAU188Z should not be used for cold heading or upsetting due to the embrittlement effect of the Sulphur content. Other austenitic grades for this purpose, such as the AISR /AISRU series, whose chemical balance provides the highest cold deformability, should be used. These grades have a poor machinability due to their low Sulfur content. In the case of moderate cold heading or upsetting, AU188ZU may be used without excessive reduction of machinability or MVAISRU as an alternative choice. This last grade allows a significant improvement of cold deformability but a reasonable fall in the machinability.

MACHINABILITY

VPAU188Z has a very good machinability. Productivity gain depends on the type of machines, the kind of tools and their geometry, cutting fluids and the kind of machine operations on the pieces produced. 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.

HOT WORKING

VPAU188Z is not specifically designed for hot working and is usually supplied as cold finished round, hexagonal and square bars for machining processes. However, when open die forging of large ingots and shapes of this grade it has enough plasticity if suitable soaking and the right temperature are applied. No preheating is required. Small forgings can be cooled rapidly in air or water.

MELTING PRACTICES

Argon Oxygen Decarburization