

420 Stainless Steel Bar

Steel Type - Martensitic

VAL2B is a 12% Chromium martensitic stainless with a medium Carbon content capable of high hardness after heat treatment together with a moderate corrosion resistance.

DESIGNATIONS

VALBRUNA	VAL2B
AISI	420
W.N.	1.4028
UNS	S42000
EN	X30Cr13
BS	420S45

SPECIFICATIONS

EN	10088-3
ASTM	A276

CHEMICAL COMPOSITION

CHEMICAL ELEMENT	C	Mn	Si	P	S	Cr
MINIMUM VALUE %	0.28%	-	-	-	-	12%
MAXIMUM VALUE %	0.35%	1%	1%	0.04%	0.03%	14%

APPLICATIONS

All applications where both hardness and corrosion resistance are indispensable, such as dental and surgical instruments, parts of brakes, valve seats, plastic molds, parts of pumps, pump shafts, wear resistant devices and table cutlery. This grade after hardening and low temperature tempering provides a hardness higher than that of VAL1 and VAL2A.

HEAT TREATMENT

VAL2B should be double tempered after hardening in order to reduce or avoid retained austenite obtaining high values of hardness. Double tempering is not normally used in cutlery production where a single one should be sufficient.

HEAT TREATMENT

Description of condition	Condition	Minimum temperature °C	Maximum temperature °C	Cooling
Annealed	A	745	825	Air
Hardened	H	950	1050	Air
Tempered	T	625	675	Air

COLD WORKING

In the annealed condition, this grade is suitable for cold forming operations such as cold heading or up-setting. It should be pointed out that VAL2B is prone to surface decarburization: a protective atmosphere should be considered in the heat treatment of finished pieces.

HOT WORKING

Blooms and ingots require a suitable preheating to avoid cracks and a slow cooling in the furnace after forging. Overheating must always be avoided, in order to reduce the risk of internal bursts. An improper cooling could result in stress cooling cracks. Large forgings and large cross – section shapes should be left to cool until their core reaches room temperature and, then, immediately heat treated. A right and suitable heat treatment of pieces after the forging process creates a structure with no or little retained austenite, avoiding delayed cracks.

PHYSICAL PROPERTIES

Physical Property	SI / Metric Units	US / BS Imperial Units
Density	7.7 kg/dm ³	0.278 lb/in ³
Specific Thermal Capacity 20° C	460 J/(kg·K)	0.11 Btu/lb°F
Thermal conductivity 20° C	30 W/(m·K)	208.004 Btu in/ ft ² h °F
Thermal expansion 20° - 100° C	10.5 (10 ⁻⁶ /K)	5.833 (10 ⁻⁶ /°F)
Electrical Resistivity 20° C	0.65 Ω·mm ² /m	25.591 μΩin
Modulus of Elasticity 20° C	215 GPa	31183.114 ksi

MELTING PRACTICES

EAF + AOD

CORROSION RESISTANCE

VAL2B has its maximum corrosion resistance when in the hardened + low temperature tempered condition and with its maximum hardness. Its use in the annealed condition or any other situation able to reduce the surface hardness and in environments containing Chloride, should be avoided. VAL2B has good corrosion resistance in mild environments such as fresh water, industrial and rural atmospheres, petroleum products, gasoline fuel oil and alcohol. This grade could be supplied in the micro-resulphured condition, but in the case of mirror finishing, such as for table cutlery or similar specific purposes, this condition should be avoided. In the case of high polish - ability requirements, a special steel making process and/or heat treatments should be chosen. 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.

MECHANICAL PROPERTIES

Condition	Subtype	Rm [N/mm ²]	Rm [Ksi]	HBW	Rp0.2% [N/mm ²]	Rp0.2% [Ksi]	A5D [%]
Annealed	A	800 max.	116 max.	245 max.	-	-	-
Hardened and Tempered	QT850	850-1000	123 - 145	-	650 min.	94 min	10 min.

WELDABILITY

This process for martensitic stainless grades is always risky and a special care must be applied in the choice of welding parameters. In any case, if a welding process were required, a preheating is mandatory and the part must be maintained at temperature and followed by immediate annealing or tempering. Fillers of the same composition can be used to obtain mechanical properties close to that of the base metal. Alternatively, austenitic fillers may be used considering an inevitable reduction of these properties. In solid state joining such as Friction Welding, VAL2B provides a quality bond line. When friction welded with different grades, a tempering or annealing of the welded piece must be done in order to soften the martensitic structure of HAZ and bond line.

MACHINABILITY

Micro-resulphured VAL2B in the annealed condition, and in the high temperature tempered after hardening condition, offers a good machinability. It's important to know that the productivity gain depends on the type of machines used, the kind of tools used and their geometry, cutting fluids and the kind of machine operations on the pieces produced. The grinding and polishing of hardened + tempered material at maximum values of hardness must be carried out with great care, in order to avoid the overheating of the surface of the piece resulting in poor corrosion resistance and/or grinding cracks.