

# Standard Cr-Ni-Mo Austenitic Stainless Steel

## EN - 1.4404 -EN-1.4432/1.4436 – ASTM 316 /316 L

### PRODEC® / MAXIVAL®

#### A stainless austenitic steel

Typical analysis %	C	Cr	Ni	Mo
EN 1.4404	0,03	17	11	2,2
EN 1.4432/1.4436	0,03	17	10,7	2,7
Delivery condition	Solution annealed			

( EN 1.4432/1.4436 Replaces SS 2343 –02, 27 )

#### Mechanical properties

Values for solution annealed condition to EN 10088 - 3

Tensile strength Rm	N/mm <sup>2</sup>	520 - 700
Proof strength Rp <sub>02</sub>	N/mm <sup>2</sup>	min 210
Elongation A <sub>5</sub>	%	min 45
Impact energy KV – 20°C	J/cm <sup>2</sup>	Min 100
Hardness	HB	Max 215

#### Physical properties

Temperature ° C	20	100	200	300	400	500
Density Kg/dm <sup>3</sup>	7,9					
Modulus of elasticity kN/mm <sup>2</sup>	200	194	186	179	172	165
Mean coeff. of thermal expansion 20 <sup>0</sup> C –Temp. 10 <sup>-6</sup> K <sup>-1</sup>	-	16,0	16,5	17,0	17,5	18,0
Specific Thermal Capacity W/m °C	15					
Electrical Resis- tivity Ω mm <sup>2</sup> /m	0,73					
Specific heat J/kg °C	500					

**EN 1.4404 and 1.4432/1.4436 PRODEC® or MAXIVAL®** are molybdenum-containing austenitic stainless steels intended to provide improved corrosion resistance relative to the standard Cr-Ni steel. The addition of molybdenum provides improved resistance to pitting and crevice corrosion in environments containing chlorides or other halides. They are non-magnetic in the annealed condition but may become slightly magnetic as a result of cold-working or welding.

PRODEC® or MAXIVAL® indicates that the steel has been modified in order to obtain good machinability.

#### Design features

- ⇒ Enhanced corrosion resistance compared to standard Cr-Ni grades
- ⇒ Very good machinability
- ⇒ Excellent weldability
- ⇒ Excellent impact strength

#### Corrosion resistance

**EN 1.4404 and 1.4432/1.4436** have a versatile corrosion resistance and are suitable for a wide range of applications. The grades with higher molybdenum content ( 1.4432,1.4436) have somewhat enhanced corrosion resistance compared with grades with lower Molybdenum content (1.4404).

Also the grades have a good resistance to many organic and inorganic chemicals.

Austenitic stainless steels are sensitive to intergranular corrosion due to grain boundary precipitation of chromium carbides, which can occur in the temperature range 550 - 850°C. It is not a common problem for modern stainless steels since the carbon content is generally kept at a low level. Steels with low carbon content (0,02%) have good resistance to intergranular corrosion.

The resistance to pitting and crevice corrosion can be enhanced by increasing the content of chromium. Molybdenum and nitrogen. These grades have a significantly better resistance to these types of localised corrosion than the standard Cr-Ni grades.

The grades EN 1.4404 and 1.4432/1.4436 -like the standard Cr-Ni steels are susceptible to stress corrosion cracking. Critical service conditions, i. e. applications subjected to combinations of tensile stresses, temperatures above about 50°C and solutions containing chlorides, should be avoided.

#### Heat treatment

**Solution annealing** 1050 - 1100° C. Holding time at solution annealing temperature approx. 30 min., followed by rapid cooling in water.

## Hardening

These grades cannot be hardened by heat treatment. But they can be hardened by cold working.

## Machining

Austenitic stainless steel are more difficult to machine than ordinary carbon steels. They require higher cutting forces than carbon steels, show resistance to chip breaking and a high tendency to built-up edge formation. Generally the machinability decreases with higher contents of alloying elements.

The best machining results are obtained by using high-power equipment, sharp tooling and a rigid set-up.

Also the machining properties can be improved through modifications in the metallurgical practice. This is the case in Avesta Polarit PRODEC® versions and applied under license also by Acciaierie Valbruna or the MAXIVAL®

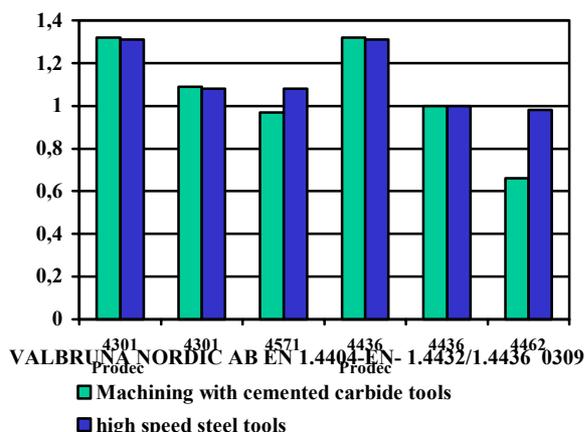
**EN 1.4404 – 1.4432/1.4436 PRODEC® or MAXIVAL®** as such are not "stainless free cutting steel" but high class norm steel.

The machinability have been improved through modifications in the metallurgical practice.

It is an "easy to machine steel", considered for parts where extensive machining is required, and still basically the same corrosion properties are maintained.

The machinability of EN 1.4436 PRODEC in relation to other stainless steels is indicated by the machinability index given in the diagram below. This index, which rises with increased machinability, is based on a compound evaluation of test data from several different machining operations. It gives an indication of the machinability of different stainless steel grades in relation to that of grade (EN 1.4436). It should be noted that it does not describe the relative difficulty of machining with cemented carbide and high speed steel tools.

For more information, contact Valbruna Nordic.



## Machinability index

## Welding

These grades can be readily welded by a full range of conventional welding methods.

## Surface finish

EN 1.4404-1.4432/1.4436 are available with ground, peeled and machined surface.

## Stock standard

Please refer to our stock standard leaflet.

## Technical support

VALBRUNA NORDIC AB will be helpful in giving further advice and recommendations concerning choice of materials, cutting data, welding, heat treatment, etc.

## MATERIAL STANDARDS

EN 10088-3	Stainless steels-Semi-finished products, bars, rods, sections for general purposes
EN 10028-7	Flat products for pressure purposes-Stainless steels
EN 10272	Stainless steel bars for pressure purposes
ASTM A 276/ ASME SA-276	Stainless steel bars for general purposes
ASTM A 479/ ASME SA-479	Stainless steel bars for pressure boilers/pressure vessels

