

# NIROSTA® 4116

<b>Material no.</b>	1.4116 to EN 10 088-2		
<b>Code names</b>	D (DIN/EN)	X 50 CrMoV 15	
	USA (ASTM)	-	
	Japan	-	
	CIS	-	

<b>Chemical composition</b> (in % by weight) <sup>1)</sup>	C	Cr	Mo	V	
	min.	0.45	14.0	0.5	0.1
	max.	0.55	15.0	0.8	0.2

<sup>1)</sup> Special arrangements may be made within the analysis limits depending on the properties required.

**Product forms** Hot-rolled wide strip, cold-rolled wide strip, slit strip, cut sheets, circles, blanks

<b>Mechanical properties</b> (transverse samples) at room temp. <sup>2)</sup> to EN 10 088-2	Dimensions range	$R_m$ (tensile strength) N/mm <sup>2</sup>	$A_5$ (elongation) %	$A_{80}$ (elongation) %	Hardness HB
	Cold-rolled strip $s \leq 8$ mm	max. 850	$\geq 12$	$\geq 12$	$\leq 280$
	Hot-rolled strip $s \leq 13.5$ mm				

<sup>2)</sup> Hardened and tempered approx. 55 HRC. Calculating tensile strength from hardness is subject to wide fluctuations.

<b>Heat treatment</b> Hardened	Hardening temperature °C	Cooling	Microstructure
	980 – 1050	Oil/air	Martensite (transformation structure)

<b>Physical properties</b>	Density kg/dm <sup>3</sup>	Modulus of elasticity in kN/mm <sup>2</sup> at					Thermal expansion in $10^{-6} \cdot K^{-1}$ between 20 °C and			
	7.7	20 °C	100 °C	200 °C	300 °C	400 °C	100 °C	200 °C	300 °C	400 °C
		215	212	207	200	190	10.5	11.0	11.0	11.5
	Thermal conductivity at 20 °C W/m · K	Specific heat capacity at 20 °C J/kg · K			Electrical resistivity at 20 °C $\Omega \cdot mm^2/m$	Magnetisability				
	30	460			0,65	present				

**Surface finish** 1 E (II a), 2 B (III c), 2 R (III d), 2 G (IV)

**Edge finish** Untrimmed, cut edges, dressed edges on request



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**Steel PK5 (Mat.No. 1.4116\*, DIN X50CrMoV15\*, AISI 440A\*)**
**Designation by Standards**

Brand Name	Ravne No.	Mat. No.	DIN	EN	AISI
PK5	812	1.4116*	X50CrMoV15*	X50CrMoV15*	440A*

**Chemical Composition (in weight %)**

C	Si	Mn	Cr	Mo	Ni	V	W	Others
0.50	max. 1.00	max. 1.00	14.50	0.65	-	0.15	-	-

**Description**

This is a high carbon martensitic stainless steel with moderate corrosion resistance good strength and the ability to obtain and keep excellent hardness (Rc 56) and wear resistance.

**Applications**

Ball bearings and races, gage blocks, molds and dies, cutlery, valve components, knives and measuring instruments. All kinds of cutting tools - surgical instruments, pressing dies for synthetic resin.

**Physical properties (average values) at ambient temperature**

Modulus of elasticity [ $10^3 \times \text{N/mm}^2$ ]: 220  
 Density [ $\text{g/cm}^3$ ]: 7.7  
 Thermal conductivity [ $\text{W/m.K}$ ]: 30.0  
 Electric resistivity [ $\text{Ohm mm}^2/\text{m}$ ]: 0.65  
 Specific heat capacity [ $\text{J/g.K}$ ]: 0.46  
 Magnetisable: Yes

**Coefficient of Linear Thermal Expansion  $10^{-6} \text{ }^\circ\text{C}^{-1}$** 

20-100°C	20-200°C	20-300°C	20-400°C	20-500°C
10.5	11.0	11.0	11.5	12.0

**Soft Annealing**

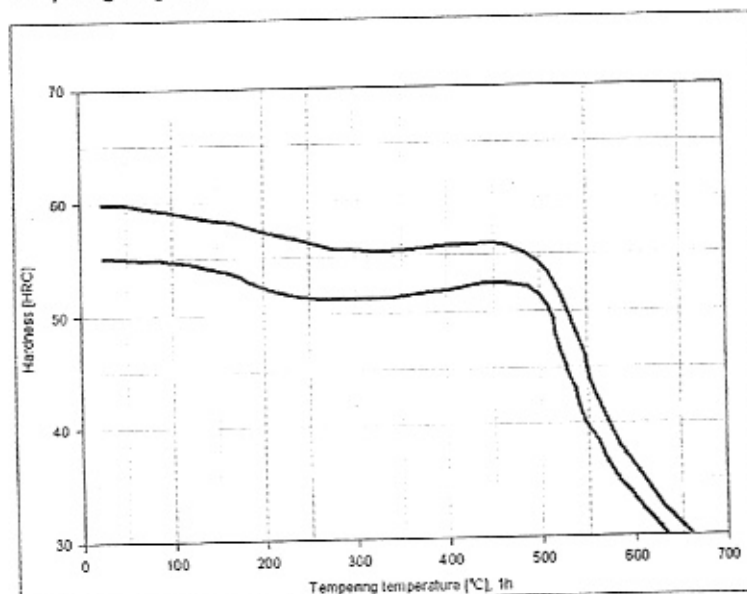
Heat to 730-780°C, cool slowly.

**Hardening**

Harden from a temperature of 980-1030°C followed by oil or air quenching.

**Tempering**

Tempering temperature: Please see the diagram below.

**Tempering Diagram**


Click the image to enlarge the diagram.

**Forging**

Hot forming temperature: 1100-800°C.

**Machinability**

Best machined in the annealed condition. Tough, stringy chips can be best handled by the use of

#### Chemical resistance

Our publication "Chemical Resistance of NIROSTA® Steels" contains tables giving some guide to chemical resistance.

NIROSTA® 4116 belongs to group 1 in the publication.

#### Processing

This material can be heat treated to achieve high strength values due to its high C content.

Machining is comparable to that of an unalloyed structural steel. Tools should be made of good quality high-speed steel or carbide.

Heat tints or scale from heat treatment reduce corrosion resistance and should be removed chemically (e.g. pickling baths or pickling pastes) or mechanically (e.g. by grinding or blasting with glass beads or iron- and sulfur-free quartz sand).

NIROSTA® 4116 can be polished.

#### Welding

Weldability:  
NIROSTA® 4116 is not suitable for welding.

#### Applications

NIROSTA® 4116 is used for parts which are subject to wear, e.g. for high-quality table and kitchen knives, penknife blades and meat knives. Adding vanadium improves wear resistance. The addition of Mo improves corrosion resistance compared to standard martensitics.