NIROSTA® 4006

Material no.	1.4006 to EN 10 088-2		
Code names	D	(DIN/EN)	X 12 Cr 13
	USA	(ASTM)	410
	Japan		SUS 410
	CIS		12 CH 13

Chemical composition (in % by weight)

	C	Cr	Mn	Ni
min.	0.08	11.5	–	–
max.	0.15	13.5	1.5	0.75

Product forms

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

Mechanical properties (transverse samples) at room temp. to EN 10 088-2

Dimensions range	$R_{p\,0.2}$ (0.2% yield strength) N/mm²	R_m (tensile strength) N/mm²	A_{80} (elongation) %	Hardness HB
Cold-rolled strip s ≤ 8 mm	–	≤ 600	≥ 20	≤ 200
Hot-rolled strip s ≤ 13.5 mm	–	≤ 600	≥ 20	≤ 200

Minimum properties at elevated temperatures (in hardened condition)

Temperature °C	100	150	200	250	300	350	400
$R_{p\,0.2}$ (0.2% yield strength) N/mm²	420	410	400	385	365	335	305

Heat treatment

Hardening temperature °C	Cooling	Microstructure
950 – 1010	Oil/air	Martensite (transformation structure)

Physical properties

Density kg/dm³	Modulus of elasticity in kN/mm² at 20 °C	100 °C	200 °C	300 °C	400 °C	Thermal expansion in $10^{-6} \cdot K^{-1}$ between 20 °C and 100 °C	200 °C	300 °C	400 °C	500 °C
7.7	215	212	205	200	190	10.5	11.0	11.5	12.0	12.0

Thermal conductivity at 20 °C W/m · K	Specific heat capacity at 20 °C J/kg · K	Electrical resistivity at 20 °C Ω · mm²/m	Magnetisability
30	460	0.60	present

Surface finish

1 D (II a), 2 B (III c)

Edge finish

Untrimmed, cut edges, dressed edges on request

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Chemical resistance

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

Processing

NIROSTA® 4006 is usually supplied in the solution heat-treated condition. The strength properties can be varied within a wide range by hardening treatment. The temperature range from 425 to 525 °C should be avoided due to the 475 °C embrittlement. The steel should preferably be formed in the warm condition (100 to 300 °C). Hot forming at 700 to 800 °C may also be necessary depending on amount of deformation and thickness. In this case, stress-relieving at about 50 °C below the tempering temperature but above 525 °C is recommended.

Heat tints or scale from hot forming or welding reduce corrosion resistance and should be removed by pickling (e.g. with pickling pastes) or grinding/sand-blasting (iron-free).

Machining procedures for solution heat-treated material are the same as for unalloyed carbon steels of similar strength.

NIROSTA® 4006 can be polished.

Welding

Weldability:
NIROSTA® 4006 can be readily welded by manual arc, TIG, MIG and MAG welding methods as well as, to a limited extent, by resistance welding.
Preheating to 200 to 300 °C is recommended depending on wall thickness.

Filler metals:

Material no.	1.4018	1.4316	1.4370
THERMANIT®	14 K	JE	X

Applications

NIROSTA® 4006 is a hardenable, stainless engineering steel. It is predominantly used in the hardened condition.

Typical applications are valve and pump components. The material is also used in crackers due to its resistance to hydrogen and hydrogen sulfide.

This chromium steel requires a smoothened (industrially polished) surface free from residues in order to achieve optimum resistance to corrosion. The corrosion resistance of this steel is generally greater in the hardened condition than in the annealed condition.