

Quality	X12Cr13	Martensitic	<i>Technical card</i>
Number	1.4006	Stainless Steel	<i>Lucefin Group</i>

Chemical composition

C%	Si% max	Mn% max	P% max	S% ^{a)} max	Cr%	Ni% max	EN 10088-1: 2005
0,08-0,15	1,00	1,50	0,040	0,015	11,5-13,5	0,75	
± 0.01	+ 0.05	± 0.04	+ 0.005	+ 0.003	± 0.15	± 0.03	

Product deviations are allowed

^{a)} for improving machinability, it is allowed a sulphur content of 0,015 % - 0,030; for polishability, it is suggested a controlled sulphur content of max 0,015 %

Temperature °C

Melting range	Hot-forming	Recrystallization	Soft annealing	Full annealing	MMA welding – AWS electrodes
1530-1480	1100-800	not suitable	825-745 air	870-840 cooling 15 °C/h to 590, then air	<i>pre-heating</i> 200 <i>annealing after w.</i> 750-700
Isothermal annealing	Quenching	Tempering	Stress-relieving		<i>joint with steel</i> carbon CrMo alloyed stainless E60 xx E8018-B 2 E309 – E308 <i>cosmetic welding</i> E410
885-830 controlled cooling to 705, then air	1000-950 oil / polymer (HRC 36 ~)	780-650 air	200 air		

Transformation temperature during heating **Ac1** ~ 810, **Ac3** ~ 885 and during cooling **Ms** ~ 340, **Mf** ~ 190

Mechanical properties

Hot formed EN 10088-3: 2005 in conditions 1C, 1E, 1D, 1X, 1G, 2D

size mm		Testing at room temperature					HB ^{a)}	^{a)} for information only
from	to	R	Rp _{0.2}	A%	Kv +20 °C			
		N/mm ²	N/mm ² min	min	J min	max		
		730 max				220	+A annealed material	
	160	650-850	450	15	25		+QT650 quenched and tempered	

Cold-processed EN 10088-3: 2005 in conditions 2H, 2B, 2G, 2P

size mm		Testing at room temperature					R	Rp _{0.2}	A%	Kv +20 °C
from	to	R	HB ^{a)}							
		N/mm ² max	max			N/mm ²	N/mm ² min	min	J min	
	10 ^{b)}	880	280			700-1000	550	9		
	16	880	280			700-1000	500	9		
	16	800	250			650-930	450	10	25	
	40	760	230			650-880	450	10	25	
	63	730	220			650-850	450	15	25	
		+A annealed material				+QT650 quenched and tempered material				

^{a)} for information only

^{b)} in the range of 1 mm ≤ d < 5 mm, values are valid only for rounds – the mechanical properties of non round bars of < 5 mm of thickness have to be agreed at the time of request and order

Forged EN 10250-4: 2001

size mm		Testing at room temperature					Kv +20 °C	HB
from	to	R	Rp _{0.2}	A%	C%			
		N/mm ²	N/mm ² min	min	min	J min	max	
		730 max					220	
	160	650-850	450	15		25	+A annealed +QT650 quenched and tempered	

Table of tempering values at room temperature on rounds of Ø 10 mm after quenching at 980°C in oil

R	N/mm ²	1490	1450	1420	1410	1430	1450	1420	1150	860	740	690
Rp _{0.2}	N/mm ²	1210	1170	1150	1150	1160	1180	1140	870	650	550	500
A	%	10.8	10.8	10.9	12.0	12.5	13.0	16.0	16.5	18.0	20.0	21.5
Kv	J	35	40	36	29	28	27	28	30	41	49	100
Tempering °C		200	250	300	350	400	450	500	550	600	650	700

Transition-curve determined with Kv. Material quenched at 970 °C in oil and tempered at 650 °C air

Average	J	2	3	20	50	88	110	122
Tests at	°C	-160	-120	-80	-40	0	+40	+80

Effect of **cold-working** (hot-rolled +A+C). Approximate values

R	N/mm ²	580	650	700	750	790
Rp 0.2	N/mm ²	380	500	580	600	690
A	%	20	10	8	8	8
Reduction	%	0	10	20	30	40

Minimum values at high temperatures on quenched and tempered material EN 10088-3: 2005

Rp 0.2	N/mm ²	420	410	400	385	365	355	305	+QT 650
Test at	°C	100	150	200	250	300	350	400	

Thermal expansion $10^{-6} \cdot K^{-1}$ ► 10.5 11.0 11.5 12.0**Modulus of elasticity** longitudinal GPa 215 212 205 200 190**Poisson number** ν 0.235 0.210**Electrical resistivity** $\Omega \cdot mm^2/m$ 0.60**Electrical conductivity** Siemens·m/mm² 1.67**Specific heat** J/(Kg·K) 460**Density** Kg/dm³ 7.70**Thermal conductivity** W/(m·K) 30**Relative magnetic permeability** μ_r 900 ¹⁾**Temperature** °C **20** **100** **200** **300** **400** **600** **800**

The symbol ► indicates temperature between 20 °C and 100 °C, 20 °C and 200 °C

¹⁾ max 900 for material in its natural state; max 750 for full annealed material

Corrosion resistance	Atmospheric		Chemical			x petroleum, gasoline, alcohol, ammonia, mercury, food
	Fresh water	<i>industrial</i> <i>marine</i>	<i>medium</i>	<i>oxidizing</i>	<i>reducing</i>	
x			x			

Magnetic yes**Machinability** good on annealed and quenched and tempered**Hardening** by quenching**Service temperature in air** continuous service up to 650 °C; intermittent service up to 750 °C

Europe	USA	USA	China	Russia	Japan	India	Republic of Korea
EN	UNS	ASTM	GB	GOST	JIS	IS	KS
X12Cr13	S41000	410	1Cr12	12Ch13	SUS 410	X12Cr12	STS 410

Schematic diagram - Loss of resistance to corrosion - AISI 410 steel

