

Quality	X20Cr13	Martensitic
Number	1.4021	Stainless Steel

Chemical composition

C%	Si%	Mn%	P%	S% ^{a)}	Cr%	
	max	max	max	max		
0,16-0,25	1,00	1,50	0,040	0,015	12,0-14,0	EN 10088-1: 2005
± 0.01	+ 0.05	± 0.04	+ 0.005	+ 0.003	± 0.15	

Product deviations are allowed

^{a)} for improving machinability, it is allowed a controlled 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
1510-1460	1100-800	not suitable	825-745 air	900-870 cooling 15 °C/h to 590, then air	<i>pre-heating</i> <i>annealing after w.</i> 250-200 750
Isothermal annealing	Quenching	Tempering	Stress-relieving		<i>joint with steel</i> carbon CrMo alloyed stainless
885-830 controlled cooling to 705, then air	1050-950 oil/polymer/air (HRC 46 ~)	700-650 air	250-150 air		E60 xx E8018-B 2 E309
					<i>cosmetic welding</i> E420 – E410

Transformation temperature during heating **Ac1** ~ 790, **Ac3** ~ 850 and during cooling **Ms** ~ 240, **Mf** ~ 90

Mechanical properties

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

size mm		Testing at room temperature					
from	to	R N/mm ²	R _p 0.2 N/mm ² min	A% min	Kv +20 °C J min	HB ^{a)} max	^{a)} for information only
		760 max				230	+A annealed
160		700-850	500	13	25		+QT700 quenched and tempered
160		800-950	600	12	20		+QT800 quenched and tempered

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

size mm		Testing at room temperature						
from	to	R N/mm ²	HB ^{a)} max		R N/mm ²	R _p 0.2 N/mm ² min	A% min	Kv +20 °C J min
	10 ^{b)}	910	290		750-1000	600	8	
10	16	910	290		750-1000	550	8	
16	40	850	260		700-950	500	10	25
40	63	800	230		700-900	500	12	25
63	160	760	220		700-850	500	13	25
		+A annealed material			+QT700 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					
from	to	R N/mm ²	R _p 0.2 N/mm ² min	A% min	C% min	Kv +20 °C J min	HB max
		760 max					230
160		700-850	500	13		25	+A annealed
160		800-950	600	12		20	+QT700 quenched and tempered- +QT800 quenched and tempered

Table of tempering values at room temperature on rounds of Ø 10 mm after quenching at 970°C in oil

R	N/mm ²	1650	1550	1540	1530	1530	1500	1200	900	790	600
Rp 0.2	N/mm ²	1320	1280	1260	1250	1230	1180	980	680	600	560
A	%	12	11	10.5	10.5	11	12	15	17	18	20
Kv	J	25	22	18	12	10	12	18	32	36	60
Tempering	°C	200	300	350	400	450	500	550	600	650	700

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

R	N/mm ²	580	650	670	680	685	690	720	745	760
Reduction	%	0	8	10	12	14	16	18	20	22

X20Cr13 n° 1.4021 martensitic stainless steel

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

R	N/mm ²	760	810	830	840	855	870	880	895
Rp 0.2	N/mm ²	570	740	770	780	795	800	820	830
A	%	18	16	15	15	14	13	12	11
Reduction	%	0	8	10	12	14	16	18	20

Minimum values at high temperatures EN 10088-3: 2005

Rp 0.2	N/mm ²	460	445	430	415	395	365	330	material +QT700
Rp 0.2	N/mm ²	515	495	475	460	440	405	355	material +QT800
Test at	°C	100	150	200	250	300	350	400	

Thermal expansion	10 ⁻⁶ • 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	Ω • mm ² /m	0.60						
Electrical conductivity	Siemens•m/mm ²	1.67						
Specific heat	J/(Kg•K)	460						
Density	Kg/dm ³	7.70						
Thermal conductivity	W/(m•K)	30						
Relative magnetic permeability	μr	950 ¹⁾						
Temperature	°C	20	100	200	300	400	600	800

The symbol ▶ indicates temperatures between 20 °C and 100 °C, 20 °C and 200 °C

¹⁾ max 950 for full annealed material

Corrosion resistance	Atmospheric	Chemical	x aggressive atmosphere lacking chlorine-derived substances
Fresh water	<i>industrial</i> <i>marine</i>	<i>medium</i> <i>oxidizing</i> <i>reducing</i>	
x			

Magnetic	yes
Machinability	good
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
X20Cr13	S42000	420A	2Cr13	20Ch13	SUS 420J1		STS 420J1

AISI 420 steel - T.T.T. diagram (Transformation - Time - Temperature)

