

Quality	X20Cr13	Martensitic	<i>Technical card 2018</i>
Number	1.4021	Stainless Steel	<i>Lucefin Group</i>

Chemical composition

C%	Si%	Mn%	P%	S% a)	Cr%	
	max	max	max	max		
0,16-0,25	1,00	1,50	0,040	0,030	12,0-14,0	EN 10088-3: 2014
± 0.01	+ 0.05	± 0.04	+ 0.005	± 0.005	± 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	Subcritical annealing	Soft annealing +A	Full annealing	MMA welding – AWS electrodes pre-heating annealing after w.
1510-1460	1200-930	790-730 air	825-745 air	900-870 cooling 15 °C/h to 590, then air	250-200 750
Isothermal annealing +I	Quenching +Q	Tempering +T	Stress-relieving +SR		joint with steel carbon CrMo alloyed stainless
885-830 cooling 30 °C/h to 705, then air	1050-950 oil/polymer/air (HRC 46 ~)	700-650 fast cooling in air	250-150 air		E60 xx E8018-B 2 E309 cosmetic welding E420 – E410

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

Chemical treatment = Pickling (10 - 15% HNO₃) + (0,5-1,5% HF) hot or cold

Mechanical properties

Heat-treated material EN 10088-3: 2014 in conditions 1C, 1E, 1D, 1X, 1G, 2D

size mm	Testing at room temperature					
from to	R	Rp 0.2	A%	Kv ₂ +20 °C	HBW a)	a) for information only
	N/mm ²	N/mm ² min	min	J min	max	
	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

Bright bars of heat-treated material EN 10088-3: 2014 in conditions 2H, 2B, 2G, 2P

size mm	Testing at room temperature					
from to	R	HBW a)	R	Rp 0.2	A%	Kv ₂ +20 °C
	N/mm ² max	max	N/mm ²	N/mm ² min	min	J min
10 ^{b)}	910	290	750-1000	600	8	-
16	910	290	750-1000	550	8	-
16	850	260	700-950	500	10	25
40	800	250	700-900	500	12	25
63	760	230	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 UNI EN 10250-4: 2001

size mm	Testing at room temperature					
from to	R	Rp 0.2	A%	Kv +20 °C	HB	
	N/mm ²	N/mm ² min	min	J min	max	
	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

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

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: 2014

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	$\Omega \cdot \text{mm}^2/\text{m}$		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		31			
Relative magnetic permeability	μ_r		950 ¹⁾					
°C			20	100	200	300	400	

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

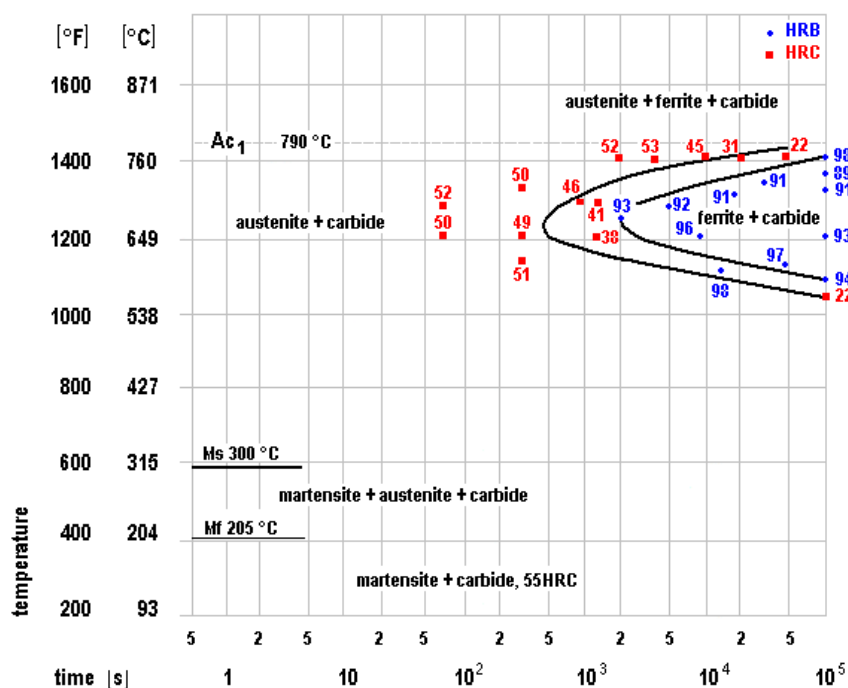
¹⁾ max 950 for full annealed material

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)	(420)	2Cr13	20Ch13	SUS 420J1		STS 420J1

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



Curie Temperature 700 °C