

Quality	X46Cr13	Martensitic	<i>Technical card 2018</i>
Number	1.4034	Stainless Steel	Lucefin Group

Chemical composition

C%	Si%	Mn%	P%	S% ^{a)}	Cr%	
0,43-0,50	max 1,00	max 1,00	max 0,040	max 0,030	12,5-14,5	EN 10088-3: 2014
± 0.02	+ 0.05	+ 0.03	+ 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	Recrystallization +RA	Soft annealing +A	MMA welding – AWS electrodes pre-heating annealing after w.
1480-1470	1180-930	not suitable	850-750 slow cooling to 600, then air	250-200 750
Quenching +Q	Tempering +T	Stress-relieving +SR	Stress-relieving +SR after +C	joint with steel
1050-950	700-650	200	650-600	carbon CrMo alloyed stainless
oil / air (HRC 50 ~)	air	fast cooling in air	furnace cooling	E70 xx E8016-B 2 E309-E308
				cosmetic welding E420

Transformation temperature during heating **Ac1** ~ 805, **Ac3** ~ 870 and during cooling **Ms** ~ 280, **Mf** ~ 130

Chemical treatment = Pickling (10 - 15% HNO₃) + (0,5 -1,05% HF) hot or cold

Mechanical properties

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

size		Testing at room temperature					
mm		R	Rp 0.2	A%	Kv ₂ +20 °C	HBW ^{a)}	^{a)} for information only
from	to	N/mm ²	N/mm ² min	min	J min	max	
		800 max	-	-	-	245	+A annealed material
	160	850-1000	650	10	12	-	+QT850 quenched and tempered

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

size		Testing at room temperature						
mm		R	HBW ^{a)}		R	Rp 0.2	A%	Kv ₂ +20 °C
from	to	N/mm ²	max	max	N/mm ²	N/mm ² min	min	J min
	10 ^{b)}	950	305		900-1150	700	7	-
	16	950	305		900-1150	700	7	-
	40	900	280		850-1100	650	8	12
	63	840	260		850-1000	650	8	12
	160	800	245		850-1000	650	10	12
		+A annealed material			+QT850 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

size		Testing at room temperature					
mm		R	Rp 0.2	A%	Kv +20 °C	HB ^{a)}	
from	to	N/mm ²	N/mm ² min	min	J min	max	
		-	-	-	-	245	+A annealed material

^{a)} for information only

Table of tempering values at room temperature on rounds of Ø 10 mm after quenching at 1000°C in oil

R	N/mm ²	1800	1700	1700	1690	1680	1640	1300	1000	840	750
Rp 0.2	N/mm ²	1400	1320	1300	1300	1290	1250	1000	700	600	550
A	%	6	8	8	9	9	10	11	13	16	16
Kv	J	14	20	18	14	12	12	14	20	28	40
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	650	750	755	760	770	795	805	835	900	930	960
Reduction %		0	5	6	8	10	15	18	20	25	30	36

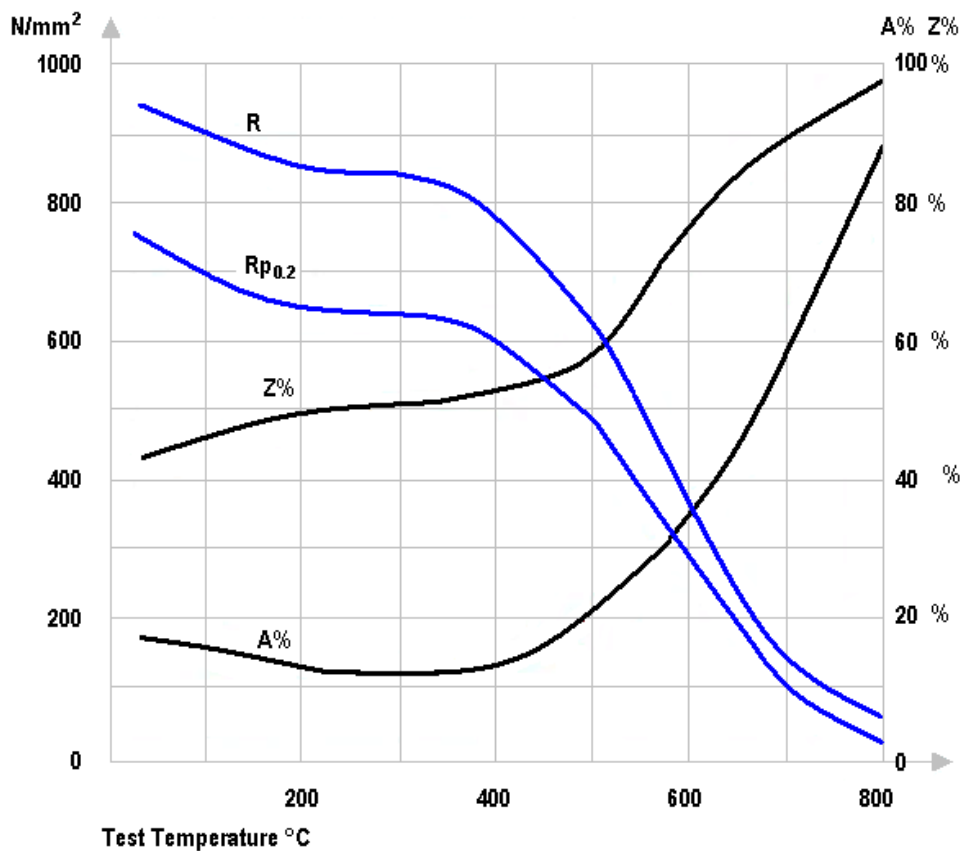
Thermal expansion	$10^{-6} \cdot K^{-1}$	►	10.5	11.0	11.5	12.0	
Modulus of elasticity	longitudinal GPa		215	212	205	190	
Poisson number	ν		0.235				
Electrical resistivity	$\Omega \cdot mm^2/m$		0.55				
Electrical conductivity	Siemens $\cdot m/mm^2$		1.82				
Specific heat	J/(Kg \cdot K)		460				
Density	Kg/dm ³		7.70				
Thermal conductivity	W/(m \cdot K)		30				
Relative magnetic permeability	μ_r		700 ~				
°C			20	100	200	300	400

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

Corrosion resistance	Atmospheric		Chemical			x rust, diluted nitric acid, weak organic acids in the passive state
Fresh water x	<i>industrial</i>	<i>marine</i>	<i>medium</i>	<i>oxidizing</i>	<i>reducing</i>	
Magnetic	yes					
Machinability	good after annealing					
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
X46Cr13	(S42000)	(420)		(4Ch13)			

Behavior of mechanical properties at high temperatures



Approximate values for rounds of Ø 16 mm after quenching at 1000°C in oil and tempering at 650 °C