Quality	**X46Cr13**	**Martensitic Stainless Steel**	*Technical card 2018*
Number	**1.4034**		*Lucefin Group*

Chemical composition

C%	Si% max	Mn% max	P% max	S% a) max	Cr%	
0,43-0,50	1,00	1,00	0,040	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**
1480-1470	1180-930	not suitable	850-750 slow cooling to 600, then air
Quenching +Q	**Tempering +T**	**Stress-relieving +SR**	**Stress-relieving +SR** after +C
1050-950 oil / air (HRC 50 ~)	700-650 air	200 fast cooling in air	650-600 furnace cooling

MMA **welding –** AWS electrodes

pre-heating	*annealing after w.*
250-200	750

joint with steel

carbon	CrMo alloyed	stainless
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% HNO_3)+ (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 mm		Testing at room temperature R	Rp 0.2	A%	Kv_2 +20 °C	HBW a)	a) for information only
from	to	N/mm²	N/mm² 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 mm		Testing at room temperature R	HBW a)
from	to	N/mm² max	max
	10 b)	950	305
10	16	950	305
16	40	900	280
40	63	840	260
63	160	800	245
		+A annealed material	

R	Rp 0.2	A%	Kv_2 +20 °C
N/mm²	N/mm² min	min	J min
900-1150	700	7	-
900-1150	700	7	-
850-1100	650	8	12
850-1000	650	8	12
850-1000	650	10	12
+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 mm		Testing at room temperature R	Rp 0.2	A%	Kv +20 °C	HB a)	
from	to	N/mm²	N/mm² 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/mm²	1800	1700	1700	1690	1680	1640	1300	1000	840	750
Rp 0.2	N/mm²	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/mm²	650	750	755	760	770	795	805	835	900	930	960
Reduction	**%**	**0**	**5**	**6**	**8**	**10**	**15**	**18**	**20**	**25**	**30**	**36**

X46Cr13 **n° 1.4034** martensitic stainless steel *Lucefin Group*

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	*v*	0.235				
Electrical resistivity	$\Omega \cdot mm^2/m$	0.55				
Electrical conductivity	Siemens•m/mm²	1.82				
Specific heat	J/(Kg•K)	460				
Density	Kg/dm^3	7.70				
Thermal conductivity	W/(m•K)	30				
Relative magnetic permeability	μr	700 ~				
°C		**20**	**100**	**200**	**300**	**400**

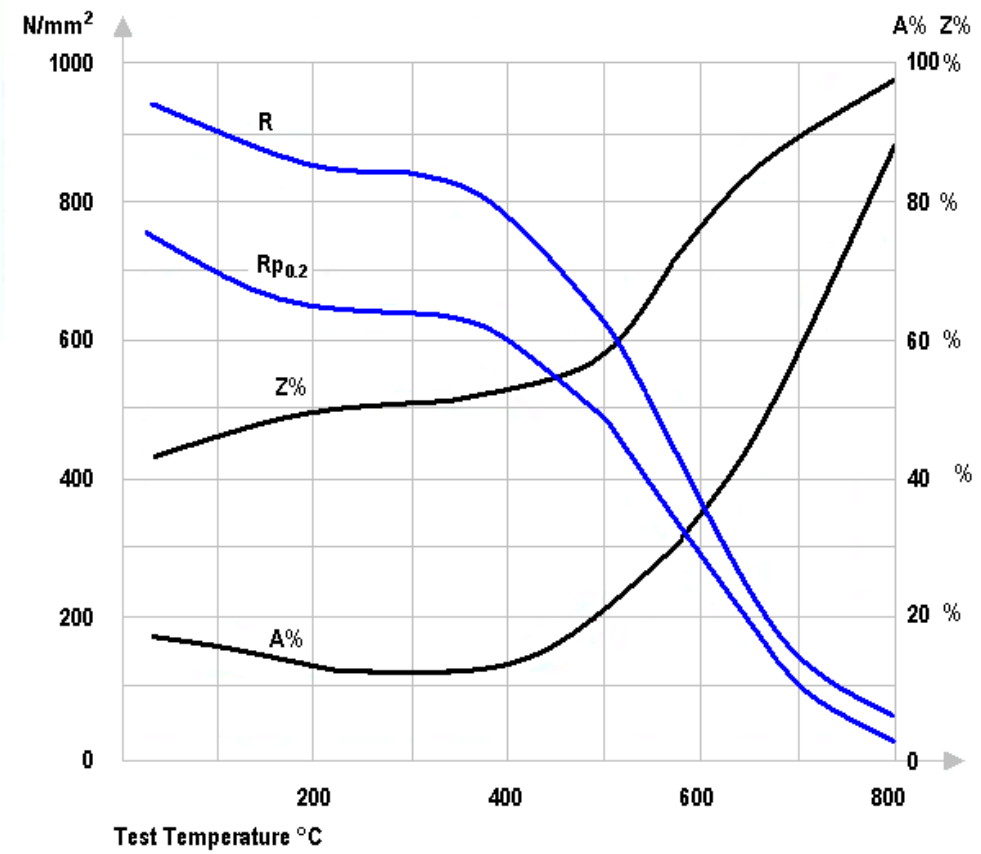
The symbol ► indicates temperature between 20 °C and 100 °C, 20 °C and 200 °C …..

Corrosion resistance	Atmospheric		Chemical			**x** rust, diluted nitric acid, weak organic acids in the passive state
Fresh water	*industrial*	*marine*	*medium*	*oxidizing*	*reducing*	
x						

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 EN	**USA** UNS	**USA** ASTM	**China** GB	**Russia** GOST	**Japan** JIS	**India** IS	**Republic of Korea** 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