

Quality	X12CrS13	Martensitic	<i>Technical card 2018</i>
Number	1.4005	Stainless Steel	<i>Lucifin Group</i>

Chemical composition

C%	Si% max	Mn% max	P% max	S%	Cr%	Mo% max	
0,06-0,15	1,00	1,50	0,040	0,15-0,35	12,0-14,0	0,60	EN 10088-3: 2014
± 0.01	+ 0.05	+ 0.04	+ 0.005	± 0.02	± 0.15	+ 0.03	

Product deviations are allowed

Temperature °C

Melting range	Hot-forming	Subcritical annealing	Soft annealing +A	Full annealing	MMA welding – AWS electrodes		
1530-1480	1190-925	790-730 air	780-750 air	870-840 cooling 15 °C/h to 590, then air	pre-heating after welding 300 stress-relieving 600		
Isothermal annealing +I	Quenching +Q	Tempering +T	Stress-relieving +SR	joint with steel			
885-830 cooling 30 °C/h to 720, then air	1010-980 oil/polymer air	680- 660 fast cooling in air	250-210 air	carbon	CrMo alloyed	stainless	
				E309	E309	E309-E308	
				cosmetic welding E410 - E309			

Transformation temperature during heating **Ac1** ~ 820, **Ac3** ~ 930 and during cooling **Ms** ~ 330, **Mf** ~ 180

Chemical treatment - Pickling (10 - 15% HNO₃) + (0.5 – 1.5 HF) cold

Mechanical properties

Heat-treated material 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	
		730 max	-	-	-	220	+A annealed material
	160	650-850	450	12	-	-	+QT650 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)}	880	280	700-1000	550	8	
	16	880	280	700-1000	500	8	
	40	800	250	650-930	450	10	
	63	760	230	650-880	450	10	
	160	730	220	650-850	450	12	
		+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 (ASTM A 473-17a steel ASTM 416)

size mm		Testing at room temperature							
from	to	R	Rp 0.2	A%	Z%	Kv +20 °C	HB	HRC	
		N/mm ² min	N/mm ² min	min	min	J min	max	min	
		485	275	20	45	-	223	-	+A annealed material
		-	-	-	-	-	-	35	Quenching at 955 °C in air

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

		1490	1450	1420	1410	1430	1450	1420	1150	860	740	690
R	N/mm ²											
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	25	30	26	19	18	17	18	20	31	49	90
Tempering °C		200	250	300	350	400	450	500	550	600	650	700

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

		720	740	760	770	780	785	800	820	830	835	840
R	N/mm ²											
Rp 0.2	N/mm ²	480	625	630	650	660	680	700	730	735	750	760
A	%	19	18	18	16	16	16	15	15	14	14	14
Reduction %		0	7	8	10	11	12	13	14	15	16	17

Thermal expansion	10 ⁻⁶ • K ⁻¹	▶	10.5	11.0	11.5	12.0	12.2	12.7	
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 max		750						
°C			20	100	200	300	400	600	800

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

For full annealed material Coercive Force Hc 480 A/m. For heat treated for max. hardness Coercive Force Hc 2900 A/m.

Corrosion resistance	Atmospheric		Chemical			x steam, gasoline, fuel oil, alcohol, ammonia
Fresh water	<i>industrial</i>	<i>marine</i>	<i>medium</i>	<i>oxidizing</i>	<i>reducing</i>	
x						

Magnetic	yes
Machinability	high
Hardening	by quenching
Service temperature in air	continuous service up to 675 °C; intermittent service up to 760 °C

Europe	USA	USA	China	Russia	Japan	India	Republic of Korea
EN	UNS	ASTM	GB	GOST	JIS	IS	KS
X12CrS13	S41600	416	Y1Cr13		SUS 416		STS 416

AISI 416 steel – T.T.T. diagram (Transformation – Time – Temperature)

