

Quality	X2CrNiMoN22-5-3	Austenitic-Ferritic	<i>Technical card</i>
Number	1.4462 ^{a)}	Stainless Steel (Duplex)	<i>Lucefin Group</i>

Chemical composition

C%	Si%	Mn%	P%	S%	Cr%	Ni%	N%	Mo%	
max	max	max	max	max					
0,03	1,00	2,00	0,035	0,015	21,0-23,0	4,5-6,5	0,10-0,22	2,5-3,5	EN 10088-1: 2005
± 0.005	+ 0.05	+ 0.04	+ 0.005	+ 0.003	± 0.25	± 0.10	± 0.02	± 0.10	

Product deviations are allowed

^{a)} subject to agreement, this steel grade can be delivered with a Pitting Resistance Equivalent number (PRE = Cr +3,3Mo + 16N) higher than 34

Temperature °C

Melting range	Hot-forming	Solution annealing (Solubilization)	Stabilizing	Soft annealing	MMA welding – AWS electrodes
1440-1390	1150-950	1100-1020 water	not suitable	not suitable	<i>pre-heating</i> 150 <i>post welding</i> slow cooling
Sensitization	Quenching	Tempering	Stress-relieving	Recrystallization	<i>joint with steel</i>
not suitable	not suitable	not suitable	600-550 air	1100-1020 quick cooling	carbon CrMo alloyed stainless E309L-16 E309MoL-15 E317L <i>cosmetic welding</i> E 2209-17

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	R _p 0.2	A% (L)	A% (T)	Kv +20 °C (L)	Kv -40 °C (L)	HB ^{a)}	
		N/mm ²	N/mm ² min	min		J min ^{b)}	J min	max	
160		650-880	450	25		40	40	270 +AT solubilization	

^{a)} for information only

(L) = longitudinal (T) = transversal ^{b)} EN 10272 : 2003

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

size mm		Testing at room temperature						
from	to	R	R _p 0.2	A% (L)	A% (T)	Kv +20 °C (L)	Kv +20 °C (T)	
		N/mm ²	N/mm ² min	min	min	J min	J min	
10	10 ^{b)}	850-1150	650	12				
16	16	850-1100	650	12			+AT solubilization	
40	40	650-1000	450	15		100		
63	63	650-1000	450	15		100		
63	160	650-880	450	25		100		

^{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

(L) = longitudinal (T) = transversal

Forged +AT solubilization EN 10250-4: 2001

size mm		Testing at room temperature						
from	to	R	R _p 0.2	A%	A%	Kv +20 °C	Kv +20 °C	Kv -196 °C
		N/mm ²	N/mm ² min	min (L)	min ((T)	J min (L)	J min (T)	J min (T)
350		650-880	450	25	20	100	60	

Cold-hardened EN 10263-5: 2003

size mm		Testing at room temperature				
from	to	R	Z%			
		N/mm ²	min			
5	10	1020 max		+AT+C		900 max 55 +AT+C+AT
10	25	1000 max		+AT+C		880 max 55 +AT+C+AT

Effect of **coldworking** (hot-rolled +AT+C). Approximate values

R	N/mm ²	750	840	870	900	940	960	990	1010	1040	1060
R_p 0.2	N/mm ²	560	650	670	690	760	780	810	850	880	920
A	%	34	32	30	28	26	24	22	20	18	16
Riduzione	%	0	4	6	8	10	12	14	16	18	20

After cold deformation with a reduction higher than 10%, it is recommended solution annealing

Minimum yield stress and tensile strength values at high temperatures on material +AT, EN 10088-3: 2005

R_{p 0.2}	N/mm ²	360	335	345	300						
R	N/mm ²	590	570	550	540						
Test at	°C	100	150	200	250	300	350	400	450	500	550
Thermal expansion		$10^{-6} \cdot K^{-1} \blacktriangleright$			13.0	13.5	14.0				
Modulus of elasticity	longitudinal	GPa	200	194	186	180					
Poisson number		ν	0.25								
Electrical resistivity		$\Omega \cdot mm^2/m$	0.80	0.85	0.90	1.00					
Electrical conductivity		Siemens·m/mm ²	1.25								
Specific heat		J/(Kg·K)	500	530	560	590					
Density		Kg/dm ³	7.8								
Thermal conductivity		W/(m·K)	15.0	16.0	17.0	18.0					
Relative magnetic permeability		μ_r	magnetizable								
Temperature		°C	20	100	200	300	400	600	800		

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

Corrosion resistance	Atmospheric		Chemical			x intercrystalline, pitting, crevice, stress corrosion cracking
Brackish water	<i>industrial</i>	<i>marine</i>	<i>medium</i>	<i>oxidizing</i>	<i>reducing</i>	
x	x	x	x	x		
Magnetic	yes					
Machinability	difficult					
Hardening	cold-drawn and other cold plastic deformations					
Service temperature	in pressure vessels, up to -200 °C; do not use over +340 °C					

Europe	USA	USA	China	Russia	Japan	India	R. Corea
EN	UNS	ASTM	GB	GOST	JIS	IS	KS
X2CrNiMoN22-5-3	S31803		(S22453)	02Ch22N5AM2	(SUS 329J3L)		(STS 329J3L)

Empirical formulas for stainless steels; classification by EN 10088-1 microstructure

FNA Ferrite number based on complemented Schaeffler/De Long diagram ASME III div. 1 NB-2433	FNA = 3,34F – 2,46A – 28,6 FNA = 4,44F – 3,39A – 38,4 FNA = 4,06F – 3,23A – 32,2 where: F = 1,5Si + Cr + Mo + 2Ti + 0,5Nb A = 30C + 0,5Mn + 30N + Ni + 0,5Cu + 0,5Co	for FNA = max 5,9 for FNA = 6,0 – 11,9 for FNA = min 12	Austenitic when: FNA = (-40) - 20 Austenitic-Ferritic (Duplex) when: FNA = 30 – 50 or SM = 8 - 15
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PRE Pitting Resistance Equivalent Herbsleb (30N) -Truman (16N)	PRE = Cr + 3,3Mo + 16N PRE = Cr + 3,3Mo + 30N	most common formula for super-austenitic/duplex/ferritic steels; also for austenitic steels with Mo>3%	Resistant when: PRE = 40 - 60
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1.4462 steel +AT - structure: 50% austenite, 30% ferrite, 20% sigma-phase (σ). The sigma-phase is an indication of embrittlement

