



Quality	X2CrNiMoN22-5-3	Austenitic-Ferritic	<i>Technical card 20</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 10088-3: 2014
+ 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 n° (PRE = Cr +3,3Mo + 16N) higher than 3

Temperature °C

Melting range	Hot-forming	Solution annealing (Solubilization) +AT	Stabilizing	Soft annealing +A	MMA welding – AWS electrodes
1440-1390	1150-950	1100-1020 water	not suitable	not suitable	pre-heating post welding solubilization
Embrittlement	Carbides precipitation	Sigma phase formation	Stress-relieving +SR short stay	Recrystallization +RA	joint with steel
475	800-450	950-700	600-550 air	1100-1020 quick cooling	carbon CrMo alloyed stainless E309L-16 E309MoL-15 E317L cosmetic welding E 2209-17

Chemical treatment - Pickling (52% HNO₃) + (65% HF) hot - Passivation 20 - 45% HNO₃ 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%	A%	Kv ₂ +20 °C	Kv ₂ -40 °C	HBW ^{a)}	
from to	N/mm ²	N/mm ² min	min (L)	min (T)	J min (L)	J min (L) ^{b)}	max	
160	650-880	450	25	-	100	40	270	+AT solubilizat

^{a)} for information only (L) = longitudinal (T) = transversal ^{b)} EN 10272 : 2003

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

size	Testing at room temperature							
mm	R	Rp 0.2	A%	A%	Kv ₂ +20 °C	Kv ₂ +20 °C		
from to	N/mm ²	N/mm ² min	min (L)	min (T)	J min (L)	J min (T)		
10 ^{b)}	850-1150	650	12	-	-	-		
10 16	850-1100	650	12	-	-	-		+AT
16 40	650-1000	450	15	-	100	-		solubilization
40 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 UNI EN 10250-4: 2001

size	Testing at room temperature							
mm	R	Rp 0.2	A%	A%	Kv +20 °C	Kv +20 °C	Kv -196 °C	
from to	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	Testing at room temperature							
mm	R	Z%			R	Z%		
from to	N/mm ²	min			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	850	1000	1120	1210	1300	1340	1370	1370
Rp 0.2	N/mm ²	560	800	960	1080	1160	1270	1280	1330	1350
A	%	34	23	13	8	6	5	4,5	3	2
Riduzione	%	0	10	20	30	40	50	60	70	80

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 10028-7: 2007

R_p 0.2	N/mm ²	422 ^{a)}	360	335	315	300
R	N/mm ²	621 ^{a)}	590	570	550	540
Test at	°C	50	100	150	200	250

a) determined by linear interpolation

Thermal expansion	10 ⁻⁶ • K ⁻¹	▶	13.0	13.5	14.0
Modulus of elasticity	longitudinal GPa	200	194	186	180
Poisson number	ν	0.25			
Electrical resistivity	Ω • 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	7.80			
Thermal conductivity	W/(m • K)	15.0	16.0	17.0	18.0
Relative magnetic permeability	μ _r	magnetizable			
°C		20	100	200	300

The symbol ▶ 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. Air oxidation 1000 °C

Europe	USA	USA	China	Russia	Japan	India	R. Corea
EN	UNS	ASTM	GB	GOST	JIS	IS	KS
X2CrNiMoN22-5-3	S31803	Type 2205	022Cr22Ni5Mo3N	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
--	---	---	--

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
---	--	--	----------------------------------

1.4462 steel +AT - structure: 50% austenite, 30% ferrite, 20% sigma-phase (σ). The sigma-phase is an indication of embrittlement

