

X2CrNiMoN22-5-3 (Duplex 2205)

Mat. No. 1.4462 · Austenitic-ferritic duplex stainless steel

Mat. No.: 1.4462

EN designation: X2CrNiMoN22-5-3

ASTM/ASME equiv.: Pipes: A/SA 790 S31803 · Fittings: A/SA 815 S31803 · Flanges: A/SA 182 F51

Key property: PREN ~35 · Yield strength \geq 450 MPa – approx. 2× higher than 316L

PREN value: approx. 33–36

Temperature range: –50 °C to +300 °C · embrittlement risk above 300 °C

Standard: EN 10216-5 · EN 10253-4

Delivery forms: Elbows · Tees · Reducers · Caps · Flanges · Pipes

1 Material Equivalents & Comparable Grades

International Equivalents

Standard / Region	Designation	Mat. No. / Grade	Note
EN	X2CrNiMoN22-5-3	1.4462	Standard duplex grade
ASTM	A/SA 790 S31803	–	Pipes
ASTM	A/SA 815 S31803	–	Fittings
ASTM	A/SA 182 F51	–	Flanges
UNS	S31803 / S32205	–	US material numbers

Alternative Materials

Material	Mat. No.	Relation to X2CrNiMoN22-5-3 (Duplex 2205)	When to use
316L (1.4404)	1.4404	Austenitic, PREN ~25	Where lower corrosion resistance acceptable
Super Duplex 2507 (1.4410)	1.4410	PREN ~43	Where Duplex 2205 insufficient
6Mo (1.4529)	1.4529	Austenitic, PREN ~42	No embrittlement risk, better weldability

2 Chemical Composition

Values in mass percent (%). Standard: EN 10216-5.

Duplex microstructure: ~50 % austenite + ~50 % ferrite. Approx. 2× the yield strength of austenitic grades. PREN ~35 greatly exceeds 316L (PREN ~25).

Element	Sym.	Min. (Heat)	Max. (Heat)	Max. (Prod.)	Function
Carbon	C	–	0.030	0.035	Very low C
Chromium	Cr	21.00	23.00	23.30	High Cr for passivation
Molybdenum	Mo	2.50	3.500	3.700	Pitting resistance
Nickel	Ni	4.50	6.500	6.800	Austenite stabiliser
Nitrogen	N	0.10	0.220	0.250	Austenite stabilisation + PREN contribution

3 Mechanical Properties

Room Temperature – Minimum Requirements

Solution annealed. Approx. 2× higher yield strength vs. austenitic grades.

Property	Sym.	Unit	Min. Value	Note
Yield strength	Rp0.2	MPa	≥ 450	approx. 2× higher than 316L
Tensile strength	Rm	MPa	650–880	–
Elongation	A	%	≥ 25	–
Impact (–50 °C)	KV	J	≥ 27	–
Hardness	HB	–	≤ 290	–

Elevated Temperature Yield Strength Rp0.2 in MPa (indicative values)

Temp.	50 °C	100 °C	150 °C	200 °C	250 °C	300 °C
Rp0.2 (MPa)	430	400	375	355	335	315

4 Physical Properties

Property	Sym.	20 °C	200 °C	400 °C	Unit
Density	ρ	7.80	7.70	7.60	g/cm ³
Modulus of elasticity	E	200	192	183	GPa
Thermal conductivity	λ	14	16	18	W/(m·K)
Thermal expansion	α	13.0	13.5	14.0	10 ⁻⁶ /K

5 Corrosion Behaviour

Medium / Environment	Notes	Rating
Seawater / offshore (flowing)	PREN ~35 – suitable for most applications	++
Chloride-containing media	Significantly better than 316L	++

Stress corrosion cracking (SCC)	Ferritic phase reduces SCC risk vs. austenitic	++
H ₂ S service (NACE)	Suitable per NACE MR0175 (HB ≤ 290)	+
Organic acids	Chemical industry	+
Temperatures > 300 °C	Sigma phase + 475 °C embrittlement	-

++ excellent + good o limited - not suitable

Duplex 2205 offers the best cost-performance ratio in the duplex family. Max. 300 °C – above this, embrittlement risks apply.

6 Typical Applications

Industry / Plant	Typical Application	Operating Conditions
Offshore / oil & gas	Topside and subsea piping, sour service	Cl + H ₂ S environment
Chemical industry	Chloride-containing process lines	Where 316L insufficient
Seawater systems	Pumps, piping, heat exchangers	PREN > 35 required
Pulp & paper	Bleaching, chloride-rich environments	Cl + moderate temperature

7 Delivery Forms at Nirotec

Component	Standard (EN)	Standard (ASME/ASTM)	Note
Elbows	EN 10253-4	ASME B16.9 · A/SA 815 WPS31803	LR/SR, 90°/45°
Tees	EN 10253-4	ASME B16.9 · A/SA 815 WPS31803	Equal and reducing
Reducers	EN 10253-4	ASME B16.9 · A/SA 815 WPS31803	Concentric and eccentric
Caps	EN 10253-4	ASME B16.9 · A/SA 815 WPS31803	Ellipsoidal
Flanges	EN 1092-1	ASME B16.5 · A/SA 182 F51	PN 10–400
Pipes	EN 10216-5	A/SA 790 S31803	Seamless

8 Standards, Approvals & Codes

Standard / Code	Title / Application
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EN 10216-5	Seamless stainless steel tubes
EN 10253-4	Butt-welding fittings – austenitic-ferritic
NACE MR0175 / ISO 15156	Sour service
PED 2014/68/EU	Pressure Equipment Directive
ASME B31.3	Process Piping

9 Fabrication Notes

Weldability

Parameter	Requirement / Recommendation	Note
Preheat	Not required	Duplex
Heat input	Max. 1.5 kJ/mm – strict control	Too high → sigma phase; too low → excess ferrite
PWHT	Solution anneal 1020–1100 °C (if required)	Restores microstructure
Filler	2209 (S32209)	Overalloyed filler for microstructure balance
Ferrite content	Target: 35–65 %	Check with ferritescope after welding

- Delivery condition: Solution annealed
- Welding parameters more critical than for austenitic grades
- Ferrite content 35–65 % after welding – check recommended
- Pickling and passivation mandatory after welding

10 Enquiry & Contact

For a project-specific quotation, please provide:

- Standard and execution (e.g. LR 90° elbow per EN 10253-4)
- Dimensions: DN / NPS and wall thickness or schedule
- Quantity and requested delivery date
- Documentation: EN 10204 Type 3.1 / 3.2, NDT, third-party inspection
- Any project-specific specifications or special requirements

Nirotec GmbH & Co. KG

Otto-Hahn-Str. 4 · 59423 Unna · Germany
 Tel.: +49 (0) 02303 / 985-0 · info@nirotec.de · www.nirotec.de

All information is provided without warranty. Applicable standards and project specifications at time of order are authoritative.