

# X2CrNiMo17-12-2 (316L)

Mat. No. 1.4404 · Austenitic Cr-Ni-Mo stainless steel, L-grade

**Mat. No.:** 1.4404

**EN designation:** X2CrNiMo17-12-2

**ASTM/ASME equiv.:** Pipes: A/SA 312 TP316L · Fittings: A/SA 403 WP316L · Flanges: A/SA 182 F316L

**Key property:** Mo content 2–2.5 % – enhanced chloride corrosion resistance vs. 304L

**PREN value:** approx. 25–28

**Temperature range:** –196 °C to +550 °C

**Standard:** EN 10216-5 · EN 10253-4

**Certifications:** ISO 19443 (Nuclear) · ISO 9001 · AD 2000

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

## 1 Material Equivalents & Comparable Grades

### International Equivalents

Standard / Region	Designation	Mat. No. / Grade	Note
EN	X2CrNiMo17-12-2	1.4404	Current European designation
ASTM	A/SA 312 TP316L	–	Pipes – most common stainless pipe worldwide
ASTM	A/SA 403 WP316L	–	Fittings
ASTM	A/SA 182 F316L	–	Flanges
UNS	S31603	–	US material number
JIS	SUS 316L	–	Japanese equivalent

### Alternative Materials

Material	Mat. No.	Relation to X2CrNiMo17-12-2 (316L)	When to use
304L (1.4307)	1.4307	No Mo	For non-chloride environments, lower cost
316Ti (1.4571)	1.4571	Ti-stabilised	For service in sensitisation range 425–815 °C
904L (1.4539)	1.4539	Higher Ni+Mo+Cu	For H <sub>2</sub> SO <sub>4</sub> and aggressive chlorides

## 2 Chemical Composition

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

*L-grade: C ≤ 0.030 % prevents Cr carbide formation during welding. Mo (2–2.5 %) provides significantly better pitting resistance vs. 304L in chloride-containing media.*

Element	Sym.	Min. (Heat)	Max. (Heat)	Max. (Prod.)	Function
Carbon	C	–	0.030	0.035	L-grade: max. 0.03 %
Silicon	Si	–	1.000	1.100	Deoxidation
Chromium	Cr	16.50	18.50	18.70	Passivation layer
Molybdenum	Mo	2.00	2.500	2.700	Pitting/crevice corrosion resistance
Nickel	Ni	10.00	13.00	13.30	Austenite stabiliser
Nitrogen	N	–	0.110	0.130	Austenite stabilisation

## 3 Mechanical Properties

### Room Temperature – Minimum Requirements

*Solution annealed. Most widely used stainless steel in chemical and process industries.*

Property	Sym.	Unit	Min. Value	Note
Yield strength	Rp0.2	MPa	≥ 200	Solution annealed
Tensile strength	Rm	MPa	520–670	–
Elongation	A	%	≥ 35	–
Impact (–20 °C)	KV	J	≥ 100	Cryogenic capable
Hardness	HB	–	≤ 215	–

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

Temp.	100 °C	200 °C	300 °C	400 °C	500 °C
Rp0.2 (MPa)	168	148	134	122	114

## 4 Physical Properties

Property	Sym.	20 °C	200 °C	400 °C	Unit
Density	ρ	7.98	7.86	7.73	g/cm <sup>3</sup>
Modulus of elasticity	E	200	186	170	GPa
Thermal conductivity	λ	15	18	21	W/(m·K)
Thermal expansion	α	16.0	16.8	17.5	10 <sup>-6</sup> /K

## 5 Corrosion Behaviour

Medium / Environment	Notes	Rating
Aqueous solutions (neutral to mildly acidic)	Broad application range	++
Organic acids (acetic, citric, lactic)	Chemical, food, pharma	++
Dilute chloride solutions (cold)	Mo content provides improved resistance	+
Hot concentrated chloride solutions	Pitting risk – check PREN vs. chloride level	o
Seawater (continuous service)	PREN ~25 – marginal for continuous exposure	o
Hydrochloric acid (HCl)	Not suitable	-
Sensitisation range 425–815 °C (welded)	L-grade: no sensitisation after welding	++

++ excellent
+ good
o limited
- not suitable

316L (1.4404) is the most widely used stainless steel in process piping worldwide. For concentrated hot chlorides, Duplex or higher alloys should be considered.

## 6 Typical Applications

Industry / Plant	Typical Application	Operating Conditions
<b>Chemical industry</b>	Process piping, heat exchangers	Cl-containing media, organic acids
<b>Pharmaceutical / food</b>	Process lines, vessels	Hygienic requirements, CIP-capable
<b>Offshore / marine</b>	Utility piping where Duplex not required	Lower Cl concentration applications
<b>Nuclear technology</b>	Qualified per ISO 19443 supply chain	Certified traceability

## 7 Delivery Forms at Nirotec

Component	Standard (EN)	Standard (ASME/ASTM)	Note
<b>Elbows</b>	EN 10253-4	ASME B16.9 · A/SA 403 WP316L	LR/SR, 90°/45°
<b>Tees</b>	EN 10253-4	ASME B16.9 · A/SA 403 WP316L	Equal and reducing
<b>Reducers</b>	EN 10253-4	ASME B16.9 · A/SA 403 WP316L	Concentric and eccentric
<b>Caps</b>	EN 10253-4	ASME B16.9 · A/SA 403 WP316L	Ellipsoidal

<b>Flanges</b>	EN 1092-1 Type 11	ASME B16.5 · A/SA 182 F316L	PN 10–400
<b>Pipes</b>	EN 10216-5	A/SA 312 TP316L	Seamless

## 8 Standards, Approvals & Codes

Standard / Code	Title / Application
EN 10216-5	Seamless stainless steel tubes for pressure purposes
EN 10253-4	Butt-welding fittings – austenitic stainless steels
AD 2000-W10	Austenitic steels
PED 2014/68/EU	Pressure Equipment Directive
ASME B31.3	Process Piping
ISO 19443	Nuclear supply chain (Nirotec certified)
NACE MR0175 / ISO 15156	Sour service (conditional)

## 9 Fabrication Notes

### Weldability

Parameter	Requirement / Recommendation	Note
<b>Preheat</b>	Not required	Austenitic
<b>PWHT</b>	Not required	L-grade prevents sensitisation
<b>Filler</b>	316L (EN ISO 14343: W 19 12 3 L)	Low-carbon filler essential
<b>Process</b>	GTAW, SMAW, GMAW	Standard

- Delivery condition: Solution annealed
- No PWHT required, even after multi-pass welding
- Pickling and passivation after welding strongly recommended
- Avoid iron contamination of surface during fabrication

## 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](mailto:info@nirotec.de) · [www.nirotec.de](http://www.nirotec.de)

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