

# X6CrNiMoTi17-12-2 (316Ti)

Mat. No. 1.4571 · Titanium-stabilised austenitic Cr-Ni-Mo stainless steel

**Mat. No.:** 1.4571

**EN designation:** X6CrNiMoTi17-12-2

**ASTM/ASME equiv.:** Pipes: A/SA 312 TP316Ti · Fittings: A/SA 403 WP316Ti · Flanges: A/SA 182 F316Ti

**Key property:** Combines Mo advantage of 316L with Ti stabilisation of 321

**PREN value:** approx. 25–28

**Temperature range:** –196 °C to +550 °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	X6CrNiMoTi17-12-2	1.4571	Ti-stabilised Mo grade
ASTM	A/SA 312 TP316Ti	–	Pipes
ASTM	A/SA 403 WP316Ti	–	Fittings
ASTM	A/SA 182 F316Ti	–	Flanges
UNS	S31635	–	US material number

### Alternative Materials

Material	Mat. No.	Relation to X6CrNiMoTi17-12-2 (316Ti)	When to use
316L (1.4404)	1.4404	L-grade, no Ti	For welded service ≤ 400 °C without sensitisation concern
321 (1.4541)	1.4541	Ti only, no Mo	When chloride resistance not required

## 2 Chemical Composition

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

316Ti = 316 base + Ti stabilisation. Retains Mo-based pitting resistance while preventing sensitisation in the 425–815 °C range.

Element	Sym.	Min. (Heat)	Max. (Heat)	Max. (Prod.)	Function
Carbon	C	–	0.080	0.100	Ti-stabilised – C level controlled
Chromium	Cr	16.50	18.50	18.70	Passivation
Molybdenum	Mo	2.00	2.500	2.700	Pitting resistance – key vs. 321
Nickel	Ni	10.50	13.50	13.80	Austenite stabiliser
Titanium	Ti	5×C (min)	0.700	0.800	Stabilisation element

### 3 Mechanical Properties

#### Room Temperature – Minimum Requirements

*Solution annealed. Combines benefits of 316L (Mo) and 321 (Ti stabilisation).*

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	–
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)	170	152	138	126	118

### 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	++

High-temp. service 425–815 °C	Ti-stabilised – no sensitisation risk	++
Dilute chloride solutions (cold)	Mo content provides improved resistance	+
Organic acids	Chemical, pharma	++
Hot concentrated chlorides	Pitting risk – check PREN	o
HCl (hydrochloric acid)	Not suitable	-

++ excellent
+ good
o limited
- not suitable

316Ti (1.4571) is the preferred grade when service temperature is in the sensitisation range AND chloride resistance is required. Most common stainless grade in European chemical plants at elevated temperatures.

## 6 Typical Applications

Industry / Plant	Typical Application	Operating Conditions
<b>Chemical industry</b>	Process piping at elevated temperatures (425–550 °C)	Most common European choice for this condition
<b>Power plants</b>	Elevated-temp. stainless lines, heat exchangers	Ti stabilisation prevents PWHT requirement
<b>Pharmaceutical / food</b>	Elevated-temp. process lines	Hygienic, CIP-capable

## 7 Delivery Forms at Nirotec

Component	Standard (EN)	Standard (ASME/ASTM)	Note
<b>Elbows</b>	EN 10253-4	ASME B16.9 · A/SA 403 WP316Ti	LR/SR, 90°/45°
<b>Tees</b>	EN 10253-4	ASME B16.9 · A/SA 403 WP316Ti	Equal and reducing
<b>Reducers</b>	EN 10253-4	ASME B16.9 · A/SA 403 WP316Ti	Concentric and eccentric
<b>Caps</b>	EN 10253-4	ASME B16.9 · A/SA 403 WP316Ti	Ellipsoidal
<b>Flanges</b>	EN 1092-1	ASME B16.5 · A/SA 182 F316Ti	PN 10–400
<b>Pipes</b>	EN 10216-5	A/SA 312 TP316Ti	Seamless

## 8 Standards, Approvals & Codes

Standard / Code	Title / Application
<b>EN 10216-5</b>	Seamless stainless steel tubes

EN 10253-4	Butt-welding fittings
AD 2000-W10	Austenitic steels
PED 2014/68/EU	Pressure Equipment Directive
ASME B31.3	Process Piping

## 9 Fabrication Notes

### Weldability

Parameter	Requirement / Recommendation	Note
Preheat	Not required	Austenitic
PWHT	Not required	Ti stabilisation effective
Filler	316Ti or 316L (for $\leq 400$ °C service)	316L filler acceptable for lower-temp. service
Process	GTAW, SMAW, GMAW	Standard

- Delivery condition: Solution annealed
- Ti burn-off in weld pool possible – use 316L filler for low-temp. service
- Pickling and passivation after welding recommended

## 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

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