

X6CrNiTi18-10 (321 / 1.4541A)

Mat. No. 1.4541 / 1.4541A · Titanium-stabilised austenitic stainless steel

Mat. No.: 1.4541 · 1.4541A (nuclear / high-purity variant)

EN designation: X6CrNiTi18-10

ASTM/ASME equiv.: Pipes: A/SA 312 TP321 · Fittings: A/SA 403 WP321 · Flanges: A/SA 182 F321

Stabilisation: Titanium (Ti) binds carbon as TiC – prevents sensitisation at 425–815 °C

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	X6CrNiTi18-10	1.4541	Ti-stabilised
EN (nuclear)	X6CrNiTi18-10	1.4541A	High-purity nuclear variant
ASTM	A/SA 312 TP321	–	Pipes
ASTM	A/SA 403 WP321	–	Fittings
ASTM	A/SA 182 F321	–	Flanges
UNS	S32100	–	US material number
GOST	08Ch18N10T	–	Russian equivalent (see separate data sheet)

Alternative Materials

Material	Mat. No.	Relation to X6CrNiTi18-10 (321 / 1.4541A)	When to use
316L (1.4404)	1.4404	Mo + L-grade	Better Cl resistance; for ≤ 400 °C welded
347 (1.4550)	1.4550	Nb-stabilised	Slightly better creep; nuclear preference in some codes
304L (1.4307)	1.4307	L-grade, no stabiliser	Cheaper but avoid in sensitisation temp. range

2 Chemical Composition

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

Ti stabilisation ($Ti \geq 5 \times C$ %) binds C as stable TiC carbides. Allows use in and above the sensitisation temp. range (425–815 °C) without risk of intergranular corrosion.

Element	Sym.	Min. (Heat)	Max. (Heat)	Max. (Prod.)	Function
Carbon	C	–	0.080	0.100	Max. C; Ti must be $\geq 5 \times C$ %
Chromium	Cr	17.00	19.00	19.30	Passivation
Nickel	Ni	9.00	12.00	12.30	Austenite stabiliser
Titanium	Ti	5×C (min)	0.700	0.800	Stabilisation element – binds C as TiC
Nitrogen	N	–	0.100	0.130	Austenite stabilisation

3 Mechanical Properties

Room Temperature – Minimum Requirements

Solution annealed. Ti-stabilised grade for elevated-temperature service.

Property	Sym.	Unit	Min. Value	Note
Yield strength	Rp0.2	MPa	≥ 200	Solution annealed
Tensile strength	Rm	MPa	500–700	–
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)	168	150	138	126	118

4 Physical Properties

Property	Sym.	20 °C	200 °C	400 °C	Unit
Density	ρ	7.90	7.78	7.66	g/cm ³
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 ^{–6} /K

5 Corrosion Behaviour

Medium / Environment	Notes	Rating
Aqueous solutions (neutral)	Broad application	++
High-temp. service 425–815 °C	Ti-stabilised – no sensitisation risk	++
Organic acids	Chemical, pharma	+
Nitric acid	Good resistance (no Mo needed)	+
Dilute chlorides (cold)	No Mo – limited vs. 316L	o
Hot chloride solutions	Pitting risk – 316L/Duplex preferred	-

++ excellent
+ good
o limited
- not suitable

321 / 1.4541 is the standard stabilised grade for applications in or above the sensitisation range. No Mo – same chloride limitations as 304L. 1.4541A is the nuclear high-purity variant with tighter chemical limits.

6 Typical Applications

Industry / Plant	Typical Application	Operating Conditions
Power plants	High-temp. lines 425–550 °C, heat exchangers	Ti-stabilised – no PWHT needed
Chemical industry	Process lines at elevated temperatures	Non-chloride organic media
Nuclear technology	1.4541A specified in some nuclear codes	High-purity variant, ISO 19443

7 Delivery Forms at Nirotec

Component	Standard (EN)	Standard (ASME/ASTM)	Note
Elbows	EN 10253-4	ASME B16.9 · A/SA 403 WP321	LR/SR, 90°/45°
Tees	EN 10253-4	ASME B16.9 · A/SA 403 WP321	Equal and reducing
Reducers	EN 10253-4	ASME B16.9 · A/SA 403 WP321	Concentric and eccentric
Caps	EN 10253-4	ASME B16.9 · A/SA 403 WP321	Ellipsoidal
Flanges	EN 1092-1	ASME B16.5 · A/SA 182 F321	PN 10–400
Pipes	EN 10216-5	A/SA 312 TP321	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
PED 2014/68/EU	Pressure Equipment Directive
ASME B31.1/B31.3	Power/Process Piping
ISO 19443	Nuclear supply chain (1.4541A variant)

9 Fabrication Notes

Weldability

Parameter	Requirement / Recommendation	Note
Preheat	Not required	Austenitic
PWHT	Not required	Ti stabilisation is effective
Filler	321 (TP321) or 347 (preferred for high temp.)	347-type filler avoids Ti burn-off in weld pool
Process	GTAW, SMAW, GMAW	Standard

- Delivery condition: Solution annealed
- Ti may experience burn-off in weld pool – use 347-type filler for elevated-temperature 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.