

# 347H / 1.4961

Material no. 1.4961 · X8CrNiNb16-13 · Nb-stabilised high-temperature austenitic stainless

**Material group:** Austenitic creep-resistant stainless steel, niobium-stabilised

**Material no. (EN):** 1.4961

**EN designation:** X8CrNiNb16-13

**UNS / ASME:** UNS S34709 / 347H

**ASTM / ASME equivalent:** Pipes: A/SA 213 TP347H · A/SA 312 TP347H · Fittings: A/SA 403 WP347H · Flanges: A/SA 182 F347H

**Service temperature:** -196 °C to +800 °C (continuous with creep certification)

**Standards (pipes):** EN 10216-5 · ASTM A213 / A312 · VdTÜV 432

**Standards (fittings):** EN 10253-4 · ASTM A403 WP347H · ASME B16.9

**Forms (Nirotec):** Elbows · tees · reducers · caps · flanges · custom parts

## 1 Material Equivalents & Comparable Grades

### National equivalents

Standard / region	Designation	Material no. / Grade	Remark
EN	X8CrNiNb16-13	1.4961	Current European designation
UNS	347H	S34709	ASTM/ASME designation
ASTM/ASME	A/SA 213 TP347H	UNS S34709	Seamless pipes (boiler)
ASTM/ASME	A/SA 312 TP347H	UNS S34709	Seamless / welded pipes
ASTM/ASME	A/SA 403 WP347H	UNS S34709	Buttweld fittings
ASTM/ASME	A/SA 182 F347H	UNS S34709	Forgings, flanges
JIS	SUS 347H	-	Japanese equivalent

### Alternative materials

Material	Material no.	Reference / use	Note
347 / 1.4550	1.4550	Lower C, no creep certification	Below 525 °C
321H / 1.4878	1.4878	Ti-stabilised instead of Nb	Alternative source
310S / 1.4845	1.4845	Higher Cr+Ni, higher temp.	Above 800 °C
Alloy 800H / 1.4876	1.4876	Nickel-base, higher temperature	Above 850 °C

## 2 Chemical Composition

Composition in mass percent (%). Standard: EN 10216-5 / ASTM A312. 347H is the high-temperature variant of 347 with elevated C content (0.04–0.10 %) for creep strength. Niobium binds C in stable carbides, preventing Cr depletion at grain boundaries (intergranular corrosion) at sensitisation temperatures.

Element	Symbol	Min. (heat)	Max. (heat)	Max. (product)	Function / remark
Carbon	C	0.04	0.10	0.10	Higher C than 347, ensures Nb-precipitation
Silicon	Si	–	1.00	1.00	Limit
Manganese	Mn	–	2.00	2.00	Limit
Phosphorus	P	–	0.045	0.045	Impurity limit
Sulfur	S	–	0.015	0.015	Impurity limit
Chromium	Cr	17.0	19.0	19.0	Oxidation resistance
Nickel	Ni	9.0	13.0	13.0	Austenite stabiliser
Niobium	Nb	8xC	1.10	1.10	Stabiliser ( $\geq 8 \times \%C$ , prevents Cr-carbide)
Tantalum	Ta	–	–	–	Counted with Nb (Nb+Ta)
Nitrogen	N	–	0.10	0.10	Limit

## 3 Mechanical Properties

### Solution annealed – minimum requirements (EN 10216-5)

347H is solution annealed at 1050–1100 °C and rapidly cooled.

Property	Symbol	Unit	Minimum value	Remark
Yield strength 0.2 %	Rp0.2	MPa	$\geq 205$	Solution annealed
Tensile strength	Rm	MPa	510 – 740	Standard
Elongation at fracture	A	%	$\geq 35$	Longitudinal specimens
Impact energy (20 °C)	KV	J	$\geq 100$	Mean value
Hardness	HB	–	$\leq 215$	Solution annealed
Creep strength	$R_{m/100,000h/600^\circ C}$	MPa	$\approx 130$	Creep certification per EN/VdTÜV

### Hot yield strength Rp0.2 in MPa (typical values per standard)

Temperature	100 °C	300 °C	500 °C	600 °C	700 °C	800 °C
Rp0.2 (MPa)	166	138	127	123	117	98

## 4 Physical Properties

Property	Symbol	20 °C	300 °C	600 °C	Unit
Density	$\rho$	7.95	7.85	7.74	g/cm <sup>3</sup>
Modulus of elasticity	E	200	181	157	GPa
Thermal conductivity	$\lambda$	15.0	18.5	22.0	W/(m·K)
Coeff. thermal expansion	$\alpha$	16.5	17.5	18.5	10 <sup>-6</sup> /K
Specific heat capacity	cp	500	545	590	J/(kg·K)

## 5 Corrosion Resistance

Medium / environment	Remark	Resistance
High-temperature steam to 700 °C	Standard application in power plants	++
Oxidising atmosphere to 800 °C	Stable Cr oxide layer	++
Intergranular corrosion	Prevented by Nb stabilisation	++
Nitric acid (HNO <sub>3</sub> )	Very good resistance	++
Dry hot gases	Good resistance	+
Hot water steam	Standard application	+
Hot chloride-bearing media	SCC risk like all austenitics	o
Strongly reducing hot acids	Limited resistance	o
Atmosphere > 800 °C continuous	Onset of strength loss	o
Hydrofluoric acid (HF)	Not resistant	-

++ excellent resistance    + good resistance    o limited resistance    - not resistant

347H is the classic power-plant austenitic for steam systems up to 700 °C. Nb stabilisation prevents intergranular corrosion and enables welded constructions without post-weld heat treatment.

## 6 Typical Applications

Industry / plant	Typical application	Operating condition
Power plant construction	Superheater piping, reheaters	Up to 650–700 °C steam
Petrochemical / refining	Cracker plants, reformers	Up to 700 °C
High-temperature process plants	Hot-gas piping	Oxidising atmosphere

Industry / plant	Typical application	Operating condition
Chemical process engineering	Hot aggressive media	High temperature without SCC risk
Waste incineration	Headers, HP piping	Up to 600 °C continuous
Nuclear technology	Primary/secondary system components	ISO 19443 / nuclear specifications

## 7 Forms Available at Nirotec

Component	Standard (EN)	Standard (ASME/ASTM)	Remark
Elbows	EN 10253-4	ASME B16.9 · A403 WP347H	LR/SR, 90°/45°
Tees	EN 10253-4	ASME B16.9 · A403 WP347H	Equal and reducing branch
Reducers	EN 10253-4	ASME B16.9 · A403 WP347H	Concentric and eccentric
Caps	EN 10253-4	ASME B16.9 · A403 WP347H	Hemispherical caps
Weld neck flanges	EN 1092-1 Type 11	ASME B16.5 · A182 F347H	PN 10 – PN 400 / Class 150 – 2500
Custom parts	Per drawing	Per drawing	Custom geometries on request

## 8 Standards, Approvals & Codes

Standard / code	Title / application
EN 10216-5	Seamless tubes for pressure purposes – stainless steels
EN 10253-4	Butt-welding fittings – austenitic stainless steels
EN 1092-1	Flanges and their joints
VdTÜV 432	X8CrNiNb16-13 – material data sheet
ASTM A213 / A312	High-temperature tubes / pressure pipes
ASTM A403 WP347H	Buttweld fittings
ASTM A182 F347H	Forgings, flanges
ASME B31.1	Power piping
PED 2014/68/EU	Pressure Equipment Directive
ISO 19443	Nuclear-grade materials

## 9 Processing Notes

### Weldability

Parameter	Specification / recommendation	Remark
Preheat	Not required	No preheat for austenitics
Post-weld heat treatment	Generally not required	If required: stabilising anneal 850–900 °C
Filler metal	ER347 / E347-XX (AWS A5.9 / A5.4)	Matching Nb-stabilised filler
Welding processes	GTAW, GMAW, SMAW, SAW	All standard processes suitable
Interpass temperature	≤ 150 °C	Standard for austenitic stainless

- Delivery condition: solution annealed (1050–1100 °C) + water quenched
- Stabilising anneal 870–900 °C for 4–6 h binds C into Nb carbides – important under sensitisation risk
- Identification per EN 10216-5: heat no., 1.4961 / 347H, standard, dimensions
- Under H+ specification, creep certification on the certificate – higher C content compared to 347
- Non-magnetic, slight magnetism after cold working

## 10 Inquiry & Contact

For a project-specific inquiry we ideally require:

- Standard and type (e.g. ASTM A403 WP347H LR 90°)
- Highest operating temperature (with creep certification if > 525 °C)
- Dimensions: DN / NPS, wall thickness or schedule
- Quantity and required delivery date
- Required documentation (EN 10204 type 3.1 / 3.2, NDT, creep certification)
- Optional nuclear specification (ISO 19443)

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