Alloy 800H / 800HT

Material no. 1.4876 / 1.4959 · X10NiCrAlTi32-21 (H) / X8NiCrAlTi32-21 (HT) · Heat-resistant nickel-iron-chromium alloy

Material group: Heat-resistant nickel-iron-chromium alloy with controlled C, Al and Ti content

Material no. (EN): 1.4876 (800H) · 1.4959 (800HT)

EN designation: X10NiCrAlTi32-21 (800H) · X8NiCrAlTi32-21 (800HT)

UNS / ASME: UNS N08810 (800H) · UNS N08811 (800HT)

Trade names: Incoloy® 800H, Incoloy® 800HT, Nicrofer® 3220 H/HT

ASTM / ASME equivalent: Pipes: B407 · Fittings: B366 WPNIC (800H), WPNIC11 (800HT) · Flanges: B564

Service temperature: –196 °C to +1100 °C (continuous for 800H/HT, optimised for high temperatures)

Standards (pipes): EN 10216-5 · ASTM B407 · VdTÜV 412

Standards (fittings): EN 10253-4 · ASTM B366 WPNIC / WPNIC11

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

1 Material Equivalents & Comparable Grades

National equivalents

Standard / region	Designation	Material no. / Grade	Remark
EN (800H)	X10NiCrAlTi32-21	1.4876	High-temperature variant
EN (800HT)	X8NiCrAlTi32-21	1.4959	Highest creep strength
UNS (800H)	Alloy 800H	N08810	ASTM/ASME designation
UNS (800HT)	Alloy 800HT	N08811	ASTM/ASME designation
ASTM/ASME	A/SA B407	UNS N08810 / N08811	Seamless pipes
ASTM/ASME	A/SA B366 WPNIC / WPNIC11	UNS N08810 / N08811	Buttweld fittings
ASTM/ASME	A/SA B564	UNS N08810 / N08811	Forgings, flanges
Trade names	Incoloy® 800H/HT, Nicrofer® 3220 H/HT	–	Common trade names

Alternative materials

Material	Material no.	Reference / use	Note
Alloy 800 / 1.4876	1.4876	Lower C content	Up to 550 °C, no creep requirement
Inconel 600 / 2.4816	2.4816	Pure nickel-base	More aggressive oxidising atmospheres

Material	Material no.	Reference / use	Note
Alloy 600 / 2.4816	2.4816	Better corrosion resistance	Acids at moderate temperatures
AISI 310S / 1.4845	1.4845	Lower-cost alternative	Up to ~1050 °C, simple oxidation

2 Chemical Composition

Composition in mass percent (%). Standard: ASTM B407 / VdTÜV 412. The higher controlled C content and the Al+Ti sum are decisive for the creep strength of the H/HT variants.

Element	Symbol	Min. (heat)	Max. (heat)	Max. (product)	Function / remark
Nickel	Ni	30.0	35.0	35.0	Matrix
Chromium	Cr	19.0	23.0	23.0	High-temperature oxidation resistance
Iron	Fe	39.5	Rest	Rest	Balance (~46 %)
Carbon	C	0.05	0.10	0.10	Required for creep strength (800H)
Aluminium	Al	0.15	0.60	0.60	γ′ former, oxidation resistance
Titanium	Ti	0.15	0.60	0.60	γ′ former
Al + Ti	Al+Ti	0.30	1.20	1.20	Combined limit for creep strength
Manganese	Mn	–	1.5	1.5	Limit
Silicon	Si	–	1.0	1.0	Limit
Copper	Cu	–	0.75	0.75	Limit
Phosphorus	P	–	0.030	0.030	Impurity limit
Sulfur	S	–	0.015	0.015	Impurity limit

3 Mechanical Properties

Solution annealed – minimum requirements (ASTM B407)

800H and 800HT are solution annealed at 1100–1150 °C to produce the coarse-grain structure required for creep strength. Grain size ASTM 5 or coarser.

Property	Symbol	Unit	Minimum value	Remark
Yield strength 0.2 %	Rp0.2	MPa	≥ 170	Solution annealed
Tensile strength	Rm	MPa	≥ 450	Solution annealed
Elongation at fracture	A	%	≥ 30	Longitudinal specimens
Impact energy (20 °C)	KV	J	≥ 60	Mean value
Hardness	HB	–	≤ 192	Reference value

Property	Symbol	Unit	Minimum value	Remark
Grain size	–	ASTM	≤ 5	Coarse grain for creep

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

Temperature	100 °C	300 °C	500 °C	700 °C	900 °C	1000 °C	1100 °C
Rp0.2 (MPa)	157	135	120	115	95	75	50

4 Physical Properties

Property	Symbol	20 °C	400 °C	700 °C	1000 °C	Unit
Density	ρ	7.94	7.79	7.59	7.39	g/cm^3
Modulus of elasticity	E	195	176	153	127	GPa
Thermal conductivity	λ	11.5	16.3	21.1	26.5	W/(m·K)
Coeff. thermal expansion	α	14.4	16.0	17.5	18.7	$10^{-6}/K$
Specific heat capacity	cp	460	519	563	598	J/(kg·K)

5 Corrosion Resistance

Medium / environment	Remark	Resistance
Oxidising atmosphere (air)	Stable Cr_2O_3 layer up to 1100 °C	++
Carburising atmosphere (CO/CH_4)	Excellent resistance, hence reformer applications	++
Hydrogen atmosphere (H_2)	Resistant, suitable for ammonia plants	++
High-temperature steam	Resistant up to 1000 °C	+
Nitrogen-bearing atmosphere	Resistant, slight nitriding possible	+
Aqueous acids	Not the primary application area	o
Sulphur-bearing atmosphere (SO_2)	Limited, not under reducing conditions	o
H_2S / sulphidation	Not suitable – heavy sulphide formation	–
Halogen acids	Not resistant	–
Chloride-bearing high-temperature gases	Not recommended	–

++ excellent resistance | + good resistance | o limited resistance | – not resistant

Alloy 800H/HT is the reference material for high-temperature applications requiring creep strength – especially in reformer plants and cracking furnaces.

6 Typical Applications

Industry / plant	Typical application	Operating condition
Petrochemical	Olefin crackers, ethylene furnaces, reformer tubes	Up to 1100 °C
Chemical process eng.	Methanol reformers, ammonia plants	Up to 1000 °C, H_2 atmosphere
Power generation	Fluidised-bed boilers, superheater piping	High wall temperatures
Heat-treatment furnaces	Belts, furnace internals, muffles	Cyclic high-temperature load
Nuclear (HTR)	High-temperature reactor components	Per ISO 19443
Waste incineration	Superheaters in boiler plants	Aggressive combustion gases

7 Forms Available at Nirotec

Component	Standard (EN)	Standard (ASME/ASTM)	Remark
Elbows	EN 10253-4	ASME B16.9 · B366 WPNIC/WPNIC11	LR/SR, custom angles on request
Tees	EN 10253-4	ASME B16.9 · B366 WPNIC/WPNIC11	Equal and reducing branch
Reducers	EN 10253-4	ASME B16.9 · B366 WPNIC/WPNIC11	Concentric and eccentric
Caps	EN 10253-4	ASME B16.9 · B366 WPNIC/WPNIC11	Hemispherical caps
Weld neck flanges	EN 1092-1 type 11	ASME B16.5 · B564	PN 10 – PN 250 / Class 150 – 1500
Custom parts	Per drawing	Per drawing	Custom geometries on request

8 Standards, Approvals & Codes

Standard / code	Title / application
EN 10216-5	Seamless pipes for pressure purposes – stainless and nickel-base alloys
EN 10253-4	Butt-welding fittings – austenitic and nickel-base alloys
EN 1092-1	Flanges and their joints
VdTÜV 412	X10NiCrAlTi32-21 (1.4876 / 1.4959) – material data sheet
ASTM B407	Seamless pipes – UNS N08810 / N08811
ASTM B366	Buttweld fittings (WPNIC for 800H, WPNIC11 for 800HT)

Standard / code	Title / application
ASTM B564	Nickel-alloy forgings
ASTM B408	Bars and shapes – UNS N08810 / N08811
PED 2014/68/EU	Pressure Equipment Directive
ASME B31.1 / B31.3	Power / process piping

9 Processing Notes

Weldability

Parameter	Specification / recommendation	Remark
Preheat	Not required	Room-temperature welding
Post-weld heat treatment	Generally not required	Solution anneal for critical components
Filler metal	ERNiCrCoMo-1 or ERNiCr-3 (AWS A5.14)	Nickel-base filler, depending on application
Welding processes	GTAW (TIG), GMAW, SMAW	All standard processes suitable
Interpass temperature	≤ 150 °C	Prevents hot cracking

- Delivery condition: solution annealed at 1100–1150 °C, water quenched – essential for creep strength
- Grain structure: ASTM 5 or coarser required (micrograph in certificate)
- Identification per ASTM B407: heat no., 1.4876/1.4959, UNS no., standard, dimensions
- Caution for sustained service > 600 °C: consider carbide precipitation effects
- Not suitable for H_2S atmospheres – sulphidation at high temperatures

10 Inquiry & Contact

For a project-specific inquiry we ideally require:

- Variant: 800H (1.4876) or 800HT (1.4959)
- Standard and type (e.g. ASTM B407 / B366 WPNIC11)
- Dimensions: DN / NPS, wall thickness or schedule
- Quantity and required delivery date
- Required documentation (EN 10204 type 3.1 / 3.2, micrograph, grain size)
- Project-specific specification (ASME code case, creep certification)

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