

X50CrMnNiNbN21-9 (1.4882) is a robust austenitic [stainless steel](#) tailored for high-temperature applications requiring excellent mechanical strength, creep resistance, and oxidation stability. Its well-balanced chemical composition and favorable fabrication characteristics make it a preferred choice for components like turbine blades and engine valves.

Applications

- Steam and gas turbine blades
- Valves for internal combustion engines
- High-temperature fasteners and components
- Heat exchangers and reactor parts
- Industrial furnaces and boiler internals

International Material Equivalents

Country/Region	Equivalent/Similar Grade	Standard	Remarks
Germany	X50CrMnNiNbN21-9	DIN EN 10088 / DIN 17243	Official designation
USA	A286 (UNS S66286)	ASTM A453, A638	Closest equivalent in high-temp austenitic steels
Russia	ЭП718 (EP718)	GOST 5632	High-strength, creep-resistant austenitic steel
France	Z6CND21-09N	AFNOR NF A 35-572	Similar chemistry and applications
UK	BS 3076 NA16	BS EN 10095	Work-hardening austenitic grade
Japan	SUS XM15J1 or SUS660	JIS G4303	Comparable creep resistance

Equivalent or Similar Grades - Chemical Composition

Element	Min (%)	Max (%)
C	0.45	0.55
Si	—	0.45
Mn	8.00	10.00
P	—	0.045
S	—	0.030
Cr	20.00	22.00
Ni	3.50	5.50

Element	Min (%)	Max (%)
N	0.40	0.60
W	0.80	1.50
Nb+Ta	1.80	2.50

Element	1.4882	A286 (S66286)	ЭП718	XM15J1
C	≤0.10	≤0.08	≤0.10	≤0.10
Mn	5.0–7.0	≤1.0	≤1.0	5.0–8.0
Cr	20.0–22.5	13.5–16.0	19–22	20–23
Ni	8.5–10.5	24–27	18–25	8–10
Nb	0.5–1.5	0.5–1.5	0.3–1.0	0.5–1.0
N	0.15–0.30	—	~0.1	0.15–0.3
Si	≤0.5	≤1.0	≤0.8	≤0.8
S, P	≤0.025	≤0.03	≤0.03	≤0.03

Mechanical Properties

Condition	Tensile Strength (MPa)	Yield Strength (MPa)	Elongation (%)	Hardness (HBW)
Controlled Cooling	≈1300	—	—	≈385
Quenched (1000–1100°C)	≤1300	—	—	≤385
+AT +P (d ≤ 40mm)	950–1150	≥580	≥12	HRC ≥30

Note: +AT = Solution Annealed, +P = Precipitation Hardened

Property	+A (Annealed)	+QT (Quenched & Tempered)	+HT (Solution + Aging)
Yield Strength (Rp0.2), MPa	≥350	≥620	≥750
Tensile Strength, MPa	≥750	850–1100	≥1000
Elongation A5, %	≥35	≥20	≥15
Impact Toughness, J (20 °C)	≥100	≥60	≥50
Hardness (HB)	≤260	280–320	300–340

High-Temperature Mechanical Properties

Temperature (°C)	Tensile Strength (MPa)	0.2% Proof Strength (MPa)
500	680	350
550	650	330
600	610	310
650	550	285
700	480	260
750	410	240
800	340	220

Creep Strength

Temperature (°C)	Creep Strength after 1000h (MPa)
500	220
650	120
725	55

Physical Properties

Property	Value
Density (g/cm³)	7.8
Elastic Modulus (GPa)	205
Thermal Expansion (10 ⁻⁶ /K)	15.5-18.8 (20-700°C)
Thermal Conductivity (W/m·K)	14.5
Specific Heat Capacity (J/kg·K)	500
Magnetic Properties	Non-magnetic

Note: Austenitic steels may exhibit slight magnetism after aging or cold working.

Heat Treatment

Process	Temperature (°C)	Cooling Medium
Hot Forming	1150 to 950	—
Solution Annealing	1160 to 1200	Water
Aging	760 to 815 (4-8h)	Air

Processing Performance

- **Machinability:** Moderate; requires appropriate tooling and parameters.
- **Forming:** Hot forming is preferred due to high strength.
- **Welding:** Good weldability; standard austenitic fillers recommended. Post-weld heat treatment may be necessary to relieve stresses.

Turbine Alloy