

# HASTELLOY® X TECHNICAL DATASHEET

UNS N06002 | Alloy X

Nickel–Chromium–Iron–Molybdenum High-Temperature Superalloy

## 1. GENERAL INFORMATION

Property	Value
Alloy Designation	Hastelloy® X / Alloy X
UNS Number	N06002
W. Nr. (DIN)	2.4665
Material Density	8.22 g/cm <sup>3</sup> (0.297 lb/in <sup>3</sup> )
Melting Range	1260 – 1355 °C (2300 – 2470 °F)
Heat Treatment	Solution Annealed: 1175 °C ± 15 °C, Rapid Water Quench / Forced Air Cool
Magnetic Permeability	≤ 1.002 (non-magnetic)

## 2. CHEMICAL COMPOSITION (wt%) — ASTM B572 / ASME SB564

Element	Symbol	Content Range (wt%)
Nickel	Ni	Remainder (Balance)
Chromium	Cr	20.50 – 23.00
Iron	Fe	17.00 – 20.00
Molybdenum	Mo	8.00 – 10.00
Cobalt	Co	0.50 – 2.50
Carbon	C	0.05 – 0.15
Tungsten	W	0.20 – 1.00
Manganese	Mn	≤ 1.00
Silicon	Si	≤ 1.00
Phosphorus	P	≤ 0.040
Sulfur	S	≤ 0.030
Boron	B	≤ 0.010

Note: All values expressed as weight percent (wt%). Nickel reported as remainder after accounting for all other elements. Check analysis tolerance per AMS 2269.

## 3. TENSILE MECHANICAL PROPERTIES (Minimum Values) — AMS 5754

Nominal Thickness (in.)	Tensile Strength (psi / MPa)	0.2% Yield Strength (psi / MPa)	Elongation (% in 2 in.)
0.010 (exc) – 0.020 (exc)	105,000 / 724	45,000 / 310	29 %
0.020 – 0.187 (incl)	105,000 / 724	45,000 / 310	35 %

Nominal Thickness (in.)	Tensile Strength (psi / MPa)	0.2% Yield Strength (psi / MPa)	Elongation (% in 2 in.)
0.187 – 2.000 (incl)	100,000 / 690	40,000 / 276	35 %
Over 2.000	95,000 / 655	40,000 / 276	35 %

Note: Values shown are minimum requirements. MPa conversions are approximate (1 psi = 0.006895 MPa). All test specimens solution-annealed.

#### 4. STRESS RUPTURE PROPERTIES — AMS 5754

Nominal Thickness (in.)	Temperature	Stress (psi)	Min. Life (Hours)	Elongation (%)
0.010 – 0.020 (exc)	1500 °F / 815 °C	16,000	15	3 %
0.020 and over	1500 °F / 815 °C	16,000	24	8 %

Test condition: 1500 °F (815 °C). Values shown are minimum requirements per AMS 5754.

#### 5. GRAIN SIZE REQUIREMENTS

Thickness Range	ASTM Grain Size No.	Reference Standard
≤ 0.125 in (≤ 3.175 mm)	No. 4 or finer	ASTM B572 / AMS 5754
0.125 – 0.188 in (3.175–4.775 mm)	No. 3	ASTM B572
0.188 – 2.00 in (4.775–50.8 mm)	No. 2	ASTM B572
Critical Components (AMS 5754)	No. 5 or finer	AMS 5754 / Customer Spec.

#### 6. ADDITIONAL MECHANICAL & METALLURGICAL REQUIREMENTS

Test / Inspection	Requirement / Limit
Hardness (HB)	170 – 230 HB (solution-annealed condition)
Bend Test (Room Temp.)	180° / 150° bend angle per thickness — No cracking at 20x magnification
Intergranular Crack Depth	≤ 0.0005 in (0.0127 mm), inspected at 500x magnification
Non-Destructive Testing	100% UT (Ultrasonic) + MT (Magnetic Particle) per shipment
Chemical Verification	100% spectrometer check; check analysis per AMS 2269

#### 7. PHYSICAL PROPERTIES

Property	Value (RT unless noted)
Density	8.22 g/cm <sup>3</sup> (0.297 lb/in <sup>3</sup> )
Thermal Conductivity (RT)	≈ 11.3 W/(m·K)
Specific Heat Capacity	≈ 461 J/(kg·K)
Electrical Resistivity (RT)	≈ 1.18 μΩ·m
Mean CTE (21–871 °C)	≈ 15.8 × 10 <sup>-6</sup> /°C
Max. Continuous Service Temp.	1200 °C (2200 °F) — oxidising atmosphere

Note: Typical values for reference only. Actual values may vary slightly with heat treatment and test direction.

## 8. APPLICABLE STANDARDS & SPECIFICATIONS

Standard / Specification	Scope / Application
AMS 5754	Sheet, strip, plate — primary aerospace spec.
AMS 5536	Welding wire (UNS N06002)
ASTM B572	Rod & bar forgings
ASME SB564	Nickel alloy forgings — pressure vessels
AMS 2269	Check analysis — chemical composition tolerances
AMS 2750	Pyrometry — heat treatment furnace qualification
ASTM E8	Tension testing of metallic materials
ASTM E112	Average grain size estimation
ASTM E139	Creep and stress-rupture tests
ASME Section III	Nuclear power plant components
EN 10204 3.1 / 3.2	Material test certificate — European market
GE S-400 / S-SPEC-35	GE gas turbine material specification
GE B14H74 / B50A436 / B50A463	GE specific component standards
Rolls-Royce Sabre Stds.	RR aerospace turbine components
Pratt & Whitney LCS F-17	P&W; aerospace material standard

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