ASTM A453 Grade 660 specification

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high-temperature bolting applications (such as stud bolts for pressure vessels, flanges, and valves).

Property	Details
Standard	ASTM A453 / A453M – Standard Specification for High-Temperature Bolting, with Expansion Coefficients Comparable to Austenitic Stainless Steels
Material Type	Precipitation-hardening austenitic stainless steel
Common Product Form	Bars, rods, wires, and fasteners (e.g., stud bolts, nuts)
Typical Use	High-temperature bolting (up to 704°C / 1300°F) in pressure vessels, turbine casings, flanges, As well as low temperature upto -198°C

ASTM A453 Grade 660 are with 4 **Classes**:

Class	Condition	Description / Use
A	Solution treated only	Lowest strength class, minimal usage
B	Solution treated + aged	**Most commonly used** (especially in petrochemical)
C	Higher strength, aged	For higher strength requirements
D	Highest strength	Rare, very high strength requirement cases

🛠️ **Most commonly used class: Grade 660 Class B**

Chemical Composition (Typical, per ASTM A453)

Element	Range (wt%)
Carbon (C)	≤ 0.08
Manganese (Mn)	≤ 2.00
Silicon (Si)	≤ 1.00
Phosphorus (P)	≤ 0.040
Sulfur (S)	≤ 0.030
Chromium (Cr)	24.0 – 27.0
Nickel (Ni)	13.5 – 16.0
Molybdenum (Mo)	1.0 – 1.5
Titanium (Ti)	1.9 – 2.35
Aluminum (Al)	0.3 – 0.8
Boron (B)	≤ 0.010

Mechanical Properties (Grade 660 Class B, at Room Temp)

Property	Minimum Value
Tensile Strength	≥ 895 MPa (130 ksi)
Yield Strength (0.2% offset)	≥ 585 MPa (85 ksi)
Elongation (in 4D)	≥ 20%
Reduction of Area	≥ 35%
Hardness	≤ 35 HRC

High-Temperature Strength

ASTM A453 Grade 660 is **designed for service temperatures up to ~700° C (1300° F)**, and is often used in:

- Steam turbines
- High-temp reactor bolts
- Flange stud bolts in petrochemical and nuclear systems

Related Standards / Equivalents

Standard	Equivalent Material
UNS Number	**S66286** (for Grade 660)
Trade Name	Alloy A-286 (similar but not identical)
DIN / EN	X6NiCrTiMoVB25-15-2 (similar use)

- Material is typically supplied **solution annealed and age hardened** for maximum strength.
- Post-fabrication **heat treatment per class** is crucial to achieve desired mechanical properties.