

ALBANY COUNTY FASTENERS

Material Properties Guide

Tensile Strength, Hardness, and Characteristics of Common Fastener Materials

Selecting the Right Material: Fastener material selection impacts strength, corrosion resistance, temperature performance, and cost. Key factors include the application environment (indoor/outdoor, chemical exposure), load requirements, galvanic compatibility with mating materials, and temperature extremes.

Steel Fasteners – Grade Comparison

Grade/Class	Material	Tensile Strength	Yield Strength	Hardness	Common Uses
Grade 2	Low/Medium Carbon Steel	60,000 - 74,000 PSI	36,000 PSI min	HRB 70-100	Light duty, non-critical applications
Grade 5	Medium Carbon Steel, Q&T	105,000 - 120,000 PSI	81,000 - 92,000 PSI	HRC 25-34	Automotive, machinery, general purpose
Grade 8	Medium Carbon Alloy, Q&T	150,000 PSI min	130,000 PSI min	HRC 33-39	High-stress, critical applications
Class 8.8	Medium Carbon Steel, Q&T	116,000 PSI (800 MPa)	92,800 PSI (640 MPa)	HRC 22-32	Metric equivalent to Grade 5
Class 10.9	Alloy Steel, Q&T	145,000 PSI (1040 MPa)	116,000 PSI (940 MPa)	HRC 32-39	Metric high-strength applications
Class 12.9	Alloy Steel, Q&T	174,000 PSI (1220 MPa)	156,600 PSI (1100 MPa)	HRC 39-44	Maximum strength metric fasteners

Q&T = Quenched and Tempered | HRB/HRC = Rockwell Hardness B/C Scale | PSI = Pounds per Square Inch

Stainless Steel Fasteners

Type	Composition	Tensile Strength	Corrosion Resistance	Magnetic	Applications
18-8 (304)	18% Chromium, 8% Nickel	70,000 - 85,000 PSI	Excellent (general)	No*	General purpose, food equipment
316	16% Cr, 10% Ni, 2% Mo	75,000 - 85,000 PSI	Superior (marine/chemical)	No*	Marine, chemical processing, coastal
410	12% Chromium	70,000 - 180,000 PSI	Moderate	Yes	Hardened applications, moderate corrosion
17-4 PH	17% Cr, 4% Ni, 4% Cu	145,000 - 190,000 PSI	Good	Yes	High strength + corrosion resistance

*May become slightly magnetic after cold working

Non-Ferrous Materials

Brass

Composition: Copper + Zinc (typically 60/40 or 70/30)
Tensile Strength: 45,000 - 70,000 PSI
Properties: Corrosion resistant, non-sparking, decorative
Uses: Electrical, plumbing, marine, decorative hardware

Bronze (Silicon Bronze)

Composition: Copper + Silicon (3%)
Tensile Strength: 70,000 - 85,000 PSI
Properties: Excellent corrosion resistance, high strength
Uses: Marine, boat building, outdoor structures

Aluminum

Common Alloys: 2024-T4, 6061-T6, 7075-T6
Tensile Strength: 30,000 - 83,000 PSI
Properties: Lightweight, corrosion resistant, non-magnetic
Uses: Aerospace, electronics, weight-critical applications

Titanium

Common Grades: Grade 2 (CP), Grade 5 (6Al-4V)
Tensile Strength: 63,000 - 150,000 PSI
Properties: High strength-to-weight, biocompatible
Uses: Aerospace, medical, marine, chemical processing



Material Comparison by Property

Strength Ranking (Highest to Lowest)

Rank	Material	Typical Tensile Strength	Relative Cost
1	Class 12.9 Alloy Steel	174,000+ PSI	\$\$
2	Grade 8 Steel	150,000+ PSI	\$\$
3	Titanium (Grade 5)	130,000 - 150,000 PSI	\$\$\$\$
4	17-4 PH Stainless	145,000 - 190,000 PSI	\$\$\$
5	Class 10.9 / Grade 5 Steel	105,000 - 145,000 PSI	\$\$
6	316 / 18-8 Stainless	70,000 - 85,000 PSI	\$\$
7	Silicon Bronze	70,000 - 85,000 PSI	\$\$\$
8	Grade 2 Steel	60,000 - 74,000 PSI	\$
9	Brass	45,000 - 70,000 PSI	\$\$
10	Aluminum (6061-T6)	42,000 - 45,000 PSI	\$\$

Corrosion Resistance Ranking

Rank	Material	Best Environment	Avoid
1	Titanium	All environments, seawater, chemicals	Hydrofluoric acid
2	316 Stainless Steel	Marine, chloride, chemical exposure	Reducing acids
3	Silicon Bronze	Marine, saltwater	Ammonia, sulfur compounds
4	18-8 (304) Stainless	General outdoor, mild chemicals	Chloride-rich environments
5	Aluminum	Atmospheric, mildly acidic	Alkaline environments, concrete
6	Brass	Water, atmospheric	Ammonia (dezincification)
7	Zinc Plated Steel	Indoor, mild outdoor	High humidity, salt spray
8	Plain Steel	Indoor, controlled environments	Any moisture exposure

⚠ Galvanic Corrosion Warning

When dissimilar metals contact in presence of an electrolyte (moisture), galvanic corrosion occurs. The more "active" metal corrodes. Avoid pairing metals far apart on the galvanic series:

More Active (Anodic): Zinc → Aluminum → Steel → Stainless → Copper/Bronze → Titanium **(More Noble/Cathodic)**

Temperature Performance

Material	Min Service Temp	Max Service Temp	Notes
Carbon Steel (Grade 2/5/8)	-40°F (-40°C)	400°F (204°C)	Loses strength at elevated temps
18-8 Stainless	-320°F (-196°C)	800°F (427°C)	Excellent cryogenic properties
316 Stainless	-320°F (-196°C)	800°F (427°C)	Similar to 18-8, better hot corrosion
A286 Stainless	-320°F (-196°C)	1200°F (649°C)	High-temp specialty alloy

Titanium	-320°F (-196°C)	600°F (316°C)	Loses strength above 600°F
Aluminum	-320°F (-196°C)	300°F (149°C)	Strength decreases significantly above 300°F
Brass	-320°F (-196°C)	400°F (204°C)	Good low-temp properties

Quick Selection Guide

General Purpose (Indoor): Grade 2 or Grade 5 Steel, Zinc Plated

High Strength Structural: Grade 8 or Class 10.9

Outdoor/Wet Environments: 18-8 or 316 Stainless Steel

Marine/Saltwater: 316 Stainless, Silicon Bronze, or Titanium

Electrical/Non-Sparking: Brass, Bronze, or Stainless

Lightweight Critical: Aluminum or Titanium

⚠ Important Disclaimer: This guide provides general reference information only. Actual material properties vary by specific alloy, heat treatment, and manufacturing process. Always verify material certifications and consult manufacturer specifications for critical applications. Consider factors including load type, fatigue, temperature cycling, and chemical exposure. Follow all applicable industry standards (ASTM, SAE, ISO). Albany County Fasteners assumes no liability for material selection decisions.

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