



# GRADE & MATERIAL REFERENCE CHART

Complete fastener material grades, mechanical properties,  
corrosion resistance ratings and application selection guide.

2025 – 2026 EDITION

Carbon Steel

Stainless Steel

Alloy Steel

Duplex & Super Duplex

Inconel · Hastelloy · Monel

Titanium · Brass · Copper

# Carbon Steel & Alloy Steel Grades

## A · METRIC PROPERTY CLASSES (ISO 898-1 / DIN)

Grade / Class	Min. Tensile Str	Min. Yield Stren	Min. Elongati	Typical Material	Common Application
Grade 4.6	400 MPa	240 MPa	22%	Low carbon steel	Light structural, general duty
Grade 4.8	420 MPa	340 MPa	14%	Low / mid carbon	General engineering fasteners
Grade 5.6	500 MPa	300 MPa	20%	Low alloy steel	Structural applications
Grade 5.8	520 MPa	420 MPa	10%	Low / mid carbon	Machine screws, light bolts
Grade 6.8	600 MPa	480 MPa	8%	Mid carbon steel	Automotive, machinery
Grade 8.8	800 MPa	640 MPa	12%	Med carbon / alloy	General high-strength bolting
Grade 10.9	1040 MPa	940 MPa	9%	Alloy steel Q&T	High-strength structural, automotive
Grade 12.9	1220 MPa	1100 MPa	8%	Alloy steel Q&T	Ultra-high strength, socket cap

## B · IMPERIAL / ASTM GRADES (ASTM / SAE / AISC)

ASTM / SAE Gra	Min. Tensile	Min. Yield	Proof Load	Material	Application
SAE Grade 2	64 ksi	57 ksi	55 ksi	Low carbon steel	Light duty, non-structural
SAE Grade 5	120 ksi	92 ksi	85 ksi	Med carbon Q&T	Automotive, structural
SAE Grade 8	150 ksi	130 ksi	120 ksi	Med carbon alloy Q&T	High-strength structural
ASTM A307 Gr.A	60 ksi	—	—	Low carbon steel	Anchor bolts, general
ASTM A325	120 ksi	92 ksi	85 ksi	Med carbon / alloy	Structural steel connections
ASTM A490	150 ksi	130 ksi	120 ksi	Alloy steel	High-strength structural
ASTM A193 B7	125 ksi	105 ksi	—	Cr-Mo alloy (4140)	Stud bolts — oil & gas, flanges
ASTM A320 L7	125 ksi	105 ksi	—	Cr-Mo (low temp)	Stud bolts — cryogenic service

# Stainless Steel Grades

Stainless steel fasteners resist corrosion through a chromium-oxide passive layer. Grade selection depends on environment, chloride exposure and temperature.

Grade / Designa	UNS No.	Tensile (min)	Yield (min)	Cr%	Ni%	Mo%	Max Temp	Key Property	Best Application
<b>SS 304 / A2-70</b>	S30400	700 MPa	450 MPa	18	8.0	—	870°C	General corrosion	Food, marine, chemical
<b>SS 304L / A2-70</b>	S30403	485 MPa	170 MPa	18	8.0	—	425°C	Low carbon, weldable	Welded fabrications
<b>SS 316 / A4-70</b>	S31600	700 MPa	450 MPa	17	10	2.2	870°C	Chloride resistance	Marine, offshore, pharma
<b>SS 316L / A4-70</b>	S31603	485 MPa	170 MPa	17	10	2.2	425°C	Weldable, low C	Welded marine fittings
<b>SS 310 / A4</b>	S31000	515 MPa	205 MPa	25	20	—	1050°C	High-temp oxidation	Furnaces, heat exchangers
<b>SS 321 / A4</b>	S32100	515 MPa	205 MPa	18	10	—	870°C	Ti-stabilised	High-temp welded service
<b>SS 410 / A1</b>	S41000	690 MPa	550 MPa	12	—	—	650°C	Martensitic, hard	Wear resistance, valves
<b>SS 904L</b>	N08904	490 MPa	220 MPa	21	25	4.5	350°C	Super-austenitic	Sulphuric acid, pulp & paper
<b>SS 17-4 PH</b>	S17400	1170 MPa	1100 MPa	17	4	—	316°C	Precipitation hardened	Aerospace, high strength

# Duplex & Super Duplex Stainless Steel

Duplex grades combine austenitic and ferritic microstructures — offering higher strength and superior chloride/pitting resistance vs standard austenitic grades.

Grade / UNS	Tensile	Yield	Cr% Ni% Mo%	PREN*	Max Cl <sup>-</sup> pp	Typical Service	Key Standard
<b>Duplex 2205</b> S31803	620 MPa	450 MPa	22 5.5 3.2	35	1000	Offshore pipelines, heat exch	ASTM A815 / A182 F51
<b>Duplex 2304</b> S32304	600 MPa	400 MPa	23 4.5 0.3	26	500	Low-chloride chemical servic	ASTM A240
<b>S.Duplex 2507</b> S32750	800 MPa	550 MPa	25 7.0 4.0	43	5000	Seawater, desalination, subs	ASTM A182 F53
<b>S.Duplex 2507</b> S32760	800 MPa	600 MPa	25 7.0 3.7	43	5000	Offshore, chemical injection	ASTM A890 6A
<b>Lean Duplex</b> S32101	650 MPa	450 MPa	21 1.5 0.3	22	200	Architecture, general corrosic	ASTM A240
<b>Zeron 100</b> S32760	750 MPa	550 MPa	25 7.0 3.5	41	4000	Pumps, valves — seawater	ASTM A182 F55

**\*PREN = Pitting Resistance Equivalent Number = %Cr + 3.3x%Mo + 16x%N**

Higher PREN = better pitting corrosion resistance. PREN > 40 recommended for seawater service.

# Nickel Alloys — Inconel, Hastelloy & Monel

Nickel-base alloys offer exceptional performance at elevated temperatures, under aggressive chemical attack and in combination of both conditions.

Alloy / UNS	Tensile	Yield	Max Temp	Ni%	Cr%	Mo%	Outstanding Property	Primary Application
<b>Inconel 600</b> N06600	655 MPa	310 MPa	1175°C	72	15	—	Oxidation & heat resistance	Gas turbines, heat treat fixtures
<b>Inconel 625</b> N06625	827 MPa	414 MPa	980°C	62	21	9.0	High-strength + corrosion	Subsea, chemical, aerospace
<b>Inconel 718</b> N07718	1275 MPa	1034 MPa	700°C	52	19	3.0	Precipitation hardened	Aerospace fasteners, turbines
<b>Incoloy 825</b> N08825	586 MPa	310 MPa	540°C	42	21	3.0	Sulphuric & phosphoric acid	Chemical, nuclear, oil & gas
<b>Inconel 800</b> N08800	520 MPa	205 MPa	1100°C	33	21	—	High-temp strength	Furnace, heat exchangers
<b>Hastelloy C-276</b> N10276	690 MPa	283 MPa	1040°C	57	16	16	Widest corrosion resistance	Chemical, FGD, pharma, pulp
<b>Hastelloy C-22</b> N06022	690 MPa	310 MPa	1040°C	56	22	13	Oxidizing + reducing acids	Flue gas, waste treatment
<b>Hastelloy B-2</b> N10665	760 MPa	350 MPa	870°C	69	1	28	Hydrochloric acid resistance	HCl, H2SO4, acid services
<b>Monel 400</b> N04400	550 MPa	240 MPa	480°C	67	—	—	Seawater & brine corrosion	Marine, valves, offshore
<b>Monel K500</b> N05500	900 MPa	620 MPa	480°C	65	—	—	High strength + marine	Shafts, fasteners, springs

**Legend:** ■ INCONEL series ■ HASTELLOY series ■ MONEL series

# Titanium, Brass, Copper & Engineering Polymers

## TITANIUM — Lightweight · Corrosion resistant · High strength-to-weight ratio

Grade / UNS	Tensile	Yield	Density	Max Temp	Key Property	Application
Grade 1 R50250	240 MPa	170 MPa	4.51 g/cc	300°C	Pure Ti — most ductile	Chemical, medical, marine
Grade 2 R50400	345 MPa	275 MPa	4.51 g/cc	300°C	General purpose pure Ti	Fasteners, marine, chemical
Grade 4 R50700	550 MPa	483 MPa	4.51 g/cc	300°C	High-strength pure Ti	Structural, demanding service
Grade 5 R56400	950 MPa	880 MPa	4.43 g/cc	315°C	Ti-6Al-4V — aerospace	Aerospace, offshore, racing
Grade 7 R52400	345 MPa	275 MPa	4.51 g/cc	300°C	Pd-stabilised, acid res.	Reducing acid environments

## BRASS & COPPER — Electrical conductivity · Machinability · Corrosion resistance

Alloy / UNS	Tensile	Yield	Conductivity	Key Property	Application
Brass C360 UNS C36	490 MPa	415 MPa	26% IACS	Free-machining	Threaded inserts, fittings, valves
Brass C464 UNS C46	380 MPa	170 MPa	26% IACS	Naval brass, dezinc. res.	Marine hardware, bolts
Copper C110 UNS C1	220 MPa	69 MPa	100% IACS	Pure copper, max conduc.	Electrical busbars, grounding
Admiralty Br. C44300	380 MPa	140 MPa	28% IACS	Dezincification resistant	Heat exchangers, marine pipe

## ENGINEERING POLYMERS — Non-conductive · Lightweight · Chemical resistant

Material	Tensile	Max Temp	Chemical Resis	Key Property	Application
Nylon PA6 / PA66	70–85 MPa	120°C	Good (dilute acids)	Tough, wear resistant	Washers, inserts, standoffs
PTFE / Teflon	14–35 MPa	260°C	Excellent (all)	Chemically inert	Seals, liners, chemical service
Delrin / POM	65–70 MPa	100°C	Good (most)	High stiffness, low creep	Precision inserts, gears
PEEK	100 MPa	250°C	Excellent	Ultra-high performance	Aerospace, medical, high-temp

# Coatings, Platings & Surface Treatments

Coating / Treatment	Process	Thickness	Salt Spray (hr)	Temp Resistant	Best Application
<b>Electroplated Zinc</b>	Electroplating	5–12 µm	96–200h	120°C	General purpose indoor/mild outdoor
<b>Hot-Dip Galvanized (HDG)</b>	Hot dip zinc bath	45–150 µm	1000h+	200°C	Outdoor, buried, structural, marine
<b>Zinc Flake (Geomet 321)</b>	Mechanical + bake	8–12 µm	720–1000h	200°C	Automotive, construction — no H2 embrittlement
<b>Zinc Flake (Dacromet)</b>	Dip-spin + bake	8–10 µm	500–1000h	300°C	Fasteners — high corrosion, no H2 risk
<b>Sherardizing</b>	Diffusion zinc	15–30 µm	600h+	400°C	Threaded parts — uniform coating, no distortion
<b>Zinc Nickel Alloy</b>	Electroplating	8–15 µm	500–1000h	120°C	Automotive underbody, brake systems
<b>PTFE / Teflon Coating</b>	Spray + bake	15–25 µm	100h	260°C	Chemical service — dry film lubricant
<b>Electroless Nickel (ENi)</b>	Autocatalytic Ni-P	12–50 µm	200–500h	180°C	Precision engineering, uniform thickness
<b>Cadmium Plating</b>	Electroplating	8–25 µm	500h+	200°C	Aerospace, defence (restricted use)
<b>Phosphate + Oil (Parco.)</b>	Chemical conversion	5–15 µm	48h	120°C	Corrosion inhibitor + oil retention, general
<b>Black Oxide</b>	Alkali conversion	1–2 µm	24h	120°C	Decorative, mild corrosion inhibition only
<b>GEOMET 500 (silver)</b>	Mech. + bake	10–15 µm	1000h+	250°C	Highest-spec zinc flake — construction, EPC

# Material Selection Guide & Corrosion Resistance Matrix

**CORROSION RESISTANCE MATRIX** — ●● Excellent ●■ Good ■■ Limited × Not Recommended

Material	Atmos.	Fresh H <sub>2</sub> O	Seawater	Dilute Acid	Conc. Acid	Alkali	Chlorides	H <sub>2</sub> S / Sour
CS (Uncoated)	G	G	N	N	N	L	N	N
CS + HDG	●●	●●	●■	N	N	■■	N	N
SS 304	●●	●●	■■	■■	N	●■	■■	N
SS 316	●●	●●	●■	●■	N	●●	●■	L
Duplex 2205	●●	●●	●●	●■	L	●●	●●	●■
Super Duplex	●●	●●	●●	●●	L	●●	●●	●●
Inconel 625	●●	●●	●●	●●	●●	●●	●●	●●
Hastelloy C-276	●●	●●	●●	●●	●●	●●	●●	●●
Monel 400	●●	●●	●●	●■	■■	■■	■■	●■
Titanium Gr.2	●●	●●	●●	●●	●●	●●	●●	●■

**QUICK SELECTION GUIDE** — Match your service environment to the right material

Service Environment	Recommended Material / Grade	Notes
General engineering, indoor	Carbon Steel Grade 8.8 / 10.9	Cost-effective, widely available
Outdoor / underground structural	HDG Carbon Steel / Grade 8.8 + Zinc Flake	Long-term corrosion protection
Food, pharma, hygiene	SS 304 or SS 316	FDA compliant, easy to clean
Marine, offshore bolting	SS 316 / Duplex 2205 / Super Duplex 2507	Chloride & crevice resistance
Oil & gas flanged joints (ambient)	ASTM A193 B7 + A194 2H	Industry standard — ASME B16.5
Oil & gas sour service (H <sub>2</sub> S)	ASTM A193 B7M / SS 316 — NACE MR0175	Hardness controlled per NACE
High temperature (>500°C)	Inconel 625 / 718 or Alloy F91	Creep resistance, oxidation
Strong acid (HCl, H <sub>2</sub> SO <sub>4</sub> )	Hastelloy C-276 or Titanium Grade 2	Excellent acid resistance
Cryogenic / low temperature	ASTM A320 L7 / SS 316L / Incoloy 825	Impact toughness at -100°C+
Lightweight + high strength	Titanium Grade 5 (Ti-6Al-4V)	Aerospace / offshore fasteners
Electrical / non-magnetic	Brass C360 or Nylon PA66	Insulation, conductivity