
430 Ferritic Stainless Steel – Technical Material Specification

1.0 Material Overview & Common Uses

430 ferritic stainless steel is a non-hardenable, straight-chromium grade (typically 16-18% Cr) with a body-centered cubic (BCC) crystal structure. It offers good corrosion resistance in mild environments, excellent formability, and high thermal conductivity relative to austenitic grades. It is magnetic and cannot be hardened by heat treatment.

Common industrial applications include automotive trim and exhaust systems, kitchen equipment (sinks, range hoods), dishwasher liners, architectural cladding, heat exchangers, and fasteners. It is frequently specified where moderate corrosion resistance and low cost are required, and where welding is minimal.

2.0 Core Technical Properties & Sizing

- Density: 7.80 g/cm³ (0.282 lb/in³)
- Melting point: 1425–1510°C (2597–2750°F)
- Tensile strength (annealed): 450–600 MPa (65–87 ksi)
- Yield strength (0.2% offset, annealed): 205–345 MPa (30–50 ksi)
- Elongation in 50 mm (annealed): 20–30%
- Hardness (annealed): Rockwell B 75–85 (Brinell 150–180)
- Modulus of elasticity: 200 GPa (29,000 ksi)
- Thermal conductivity: 26 W/m·K at 100°C (15 BTU·in/hr·ft²·°F)
- Coefficient of thermal expansion: 10.4×10^{-6} /°C (20–100°C)
- Electrical resistivity: 60 µΩ·cm at 20°C
- Standard forms: sheet, plate, strip, bar, and wire
- Common thickness range (sheet): 0.5 mm to 6.0 mm (0.020 to 0.250 in)
- Width tolerance (sheet): ±1.5 mm for widths up to 1200 mm
- Flatness tolerance: 3 mm per 1000 mm (0.003 in/in) for annealed sheet
- Surface finish options: 2B (bright annealed), BA (bright annealed), No. 4 (brushed), and dull (matte)

3.0 Processing, Machinability & Application

430 stainless steel has moderate machinability (approximately 60% of AISI 1212 free-machining steel). Its tendency to work-harden and produce stringy chips requires careful tool selection and coolant use. Carbide tooling is recommended for production runs; high-speed steel (HSS) can be used for light cuts.

- Cutting speed (carbide): 90–120 m/min (300–400 sfm) for turning; reduce by 20% for milling.
- Feed rate (turning): 0.15–0.30 mm/rev (0.006–0.012 in/rev).
- Depth of cut: 1–3 mm (0.040–0.120 in) for roughing; 0.25–0.75 mm (0.010–0.030 in) for finishing.
- Use sharp, polished inserts with positive rake geometry to minimize work hardening.

- Flood coolant (water-soluble oil at 5–10% concentration) is mandatory to control heat and chip welding.
- Welding: 430 stainless steel has poor weldability due to grain growth and embrittlement in the heat-affected zone (HAZ). Preheating to 150–200°C (300–400°F) is required for sections over 6 mm (0.25 in).
- Filler metal: AWS E430 (for matching corrosion resistance) or 309L (for improved ductility). Avoid 308L as it may cause cracking.
- Post-weld heat treatment (PWHT) at 760–790°C (1400–1450°F) followed by air cooling is recommended to restore corrosion resistance and relieve stress.
- Forming: Excellent for bending, deep drawing, and spinning. Use a minimum bend radius of 1T (one thickness) for sheet under 3 mm; 2T for thicker stock.
- Annealing: Heat to 780–850°C (1436–1562°F), hold for 1 hour per 25 mm thickness, then air cool or water quench. Do not slow cool through 540–400°C (1000–750°F) to avoid embrittlement (475°C embrittlement).

4.0 Common Defects & Quality Control

- Reject if surface pits, scratches, or die marks exceed 0.05 mm (0.002 in) depth on visible surfaces.
- Reject if edge cracks or laminations are visible under 5x magnification on sheared edges.
- Reject if flatness deviation exceeds 3 mm per 1000 mm (0.003 in/in) for sheet and plate.
- Reject if thickness variation exceeds ± 0.10 mm for nominal thickness ≤ 3 mm, or ± 0.15 mm for thickness > 3 mm.
- Reject if width or length tolerance exceeds ± 1.5 mm for widths up to 1200 mm.
- Reject if hardness exceeds Rockwell B 90 (Brinell 200) in the annealed condition.
- Reject if intergranular corrosion is detected after ASTM A262 Practice E (copper sulfate-sulfuric acid test) on welded samples.
- Reject if magnetic permeability is below 1.02 (fully ferritic) – any non-magnetic areas indicate retained austenite or sigma phase.
- Reject if surface roughness (Ra) exceeds 0.8 μm for 2B finish or 0.4 μm for BA finish.
- Reject if chemical composition deviates from ASTM A240 limits: Cr 16.0–18.0%, C $\leq 0.12\%$, Mn $\leq 1.0\%$, Si $\leq 1.0\%$, P $\leq 0.040\%$, S $\leq 0.030\%$.

5.0 Storage, Handling & WHMIS Guidelines

- Store indoors in a dry, climate-controlled environment (relative humidity $< 60\%$, temperature 10–30°C) to prevent surface staining and pitting.
- Do not store in direct contact with carbon steel, copper, or brass to avoid galvanic corrosion and surface contamination.
- Use FIFO (first-in, first-out) inventory rotation; shelf life is indefinite if stored properly, but re-inspect after 12 months for surface oxidation.
- Handle with clean, dry gloves (cotton or nitrile) to avoid oil, grease, and fingerprint corrosion. Use protective paper or plastic interleaving between sheets.
- WHMIS Classification: Not classified as a hazardous material under WHMIS 2015 (no GHS pictograms required for solid form).
- Potential hazards: Dust or fumes from grinding, welding, or machining may contain chromium (VI) compounds. Use local exhaust ventilation and wear a NIOSH-approved N95 respirator during these operations.
- Mandatory PPE during processing: Safety glasses with side shields, cut-resistant gloves (ANSI A4 or higher), and hearing protection if noise exceeds 85 dBA.
- Welding fume control: Use fume extraction at the arc; avoid welding on galvanized or coated surfaces. Provide adequate ventilation to keep airborne chromium (VI) below 0.5 $\mu\text{g}/\text{m}^3$ (ACGIH TLV).
- First aid: For skin contact with sharp edges, clean wound and apply antiseptic. For eye contact with dust, flush with water for 15 minutes. Seek medical attention if irritation persists.

- Spill procedure: Solid material is not a spill risk. For dust, use wet sweeping or HEPA vacuum – do not dry sweep. Dispose of waste per local regulations (non-hazardous solid waste).

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