
1018 Cold Rolled Steel – Technical Material Specification

1.0 Material Overview & Common Uses

1018 cold rolled steel is a low-carbon (0.18% carbon) steel grade produced by cold rolling hot rolled steel through a series of dies at room temperature. This process yields a tighter dimensional tolerance, a smoother surface finish, and slightly higher strength compared to hot rolled 1018. It is one of the most widely used grades in general manufacturing due to its excellent machinability, weldability, and formability.

- Common applications: shafts, pins, spindles, gears, bolts, couplings, and general structural components in automotive, agricultural, and industrial equipment.
- Preferred for parts requiring a clean, bright surface finish and tight dimensional control without secondary machining.
- Often used as a cost-effective alternative to higher-carbon or alloy steels where moderate strength and high machinability are required.

2.0 Core Technical Properties & Sizing

- Density: 7.87 g/cm³ (0.284 lb/in³)
- Melting point: Approximately 1450°C (2642°F)
- Tensile strength (cold rolled): 440–540 MPa (64,000–78,000 psi)
- Yield strength (cold rolled): 370–440 MPa (54,000–64,000 psi)
- Elongation at break: 15–20% in 50 mm (2 in)
- Hardness (Rockwell B): 71–85 HRB (as-rolled condition)
- Modulus of elasticity: 205 GPa (29.7 × 10⁶ psi)
- Standard stock forms: round bar (1/8" to 12" diameter), flat bar, square bar, hex bar, sheet/plate (0.020" to 0.500" thickness)
- Diameter tolerance (round bar, cold drawn): ±0.002" for diameters up to 1", ±0.003" for 1–2", ±0.005" for 2–4"
- Flatness tolerance (sheet/plate): 0.005" per foot of width (max deviation)
- Surface finish (as-rolled): 40–60 microinches Ra (smooth, bright)

3.0 Processing, Machinability & Application

1018 cold rolled steel is rated as having excellent machinability (approximately 78% of AISI B1112 free-machining steel). It produces continuous, manageable chips and allows for high cutting speeds with good tool life. Carbide tooling is recommended for high-production runs, while high-speed steel (HSS) is acceptable for lower volumes.

- Recommended cutting speed (carbide): 250–400 SFM (surface feet per minute) for turning; 200–350 SFM for milling.
- Recommended feed rate (turning): 0.005–0.015 inches per revolution (IPR) for roughing; 0.002–0.005 IPR for finishing.
- Use a 30-degree helix end mill for milling operations to improve chip evacuation and reduce built-up edge.
- Flood coolant (water-soluble oil) is recommended to control heat and extend tool life; minimum 5% emulsion concentration.

- **Welding:** Excellent weldability using standard methods (MIG, TIG, stick, oxyacetylene). Preheating is not required for sections under 1"; for thicker sections, preheat to 150–200°C (300–400°F). Use ER70S-6 filler wire for MIG/TIG.
- **Forming:** Good ductility allows for bending, stamping, and drawing. Minimum bend radius: 1× thickness for 90° bends across the grain; 1.5× thickness with the grain.
- **Heat treatment:** Not typically hardened by heat treatment due to low carbon content. Case hardening (carburizing) can achieve surface hardness of 58–62 HRC to a depth of 0.010–0.060".

4.0 Common Defects & Quality Control

- Reject if surface pits, scratches, or gouges exceed 0.005" (0.13 mm) in depth or 0.050" (1.27 mm) in length.
- Reject if longitudinal cracks or seams are visible under 5× magnification or detectable by magnetic particle inspection.
- Reject if out-of-roundness exceeds 50% of the diameter tolerance band (e.g., for a 1" bar with ±0.002" tolerance, reject if ovality > 0.002").
- Reject if flat bar or plate exhibits a bow or twist greater than 0.010" per foot of length.
- Reject if decarburization depth exceeds 0.005" on any surface (measured by microhardness traverse or metallographic etch).
- Reject if hardness exceeds 85 HRB or falls below 71 HRB (as-rolled condition) unless otherwise specified by customer.
- Reject if chemical composition deviates from AISI 1018 limits: C 0.15–0.20%, Mn 0.60–0.90%, P ≤ 0.040%, S ≤ 0.050%.
- Acceptance criteria: Visual inspection per ASTM A29, dimensional check per ASTM A108, and hardness test per ASTM E18.

5.0 Storage, Handling & WHMIS Guidelines

- Store indoors in a dry, climate-controlled environment with relative humidity below 50% to prevent surface rust.
- Shelf life: Indefinite if stored properly; apply a light rust-preventive oil (e.g., LPS-3 or equivalent) if storage exceeds 6 months.
- FIFO (First-In, First-Out) protocol: Rotate stock to use older material first; label each bundle with receipt date and heat number.
- WHMIS classification: Not classified as a hazardous product under WHMIS 2015 in solid form. Dust or fines generated during machining may be classified as a nuisance particulate.
- Mandatory PPE during handling: Cut-resistant gloves (ANSI A4 or higher), safety glasses with side shields, and steel-toed boots.
- During machining: Use local exhaust ventilation to control airborne particulates. Wear hearing protection if noise levels exceed 85 dBA.
- First aid: For skin contact with cutting fluids, wash with soap and water. For eye contact, flush with water for 15 minutes. Seek medical attention if irritation persists.
- Spill procedure: Sweep up solid chips and dispose in metal recycling bin. For cutting fluid spills, contain with absorbent pads and dispose per local regulations.

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