

Brass 360 Free Machining – Technical Material Specification

1.0 Material Overview & Common Uses

Brass 360 (UNS C36000) is a leaded brass alloy containing approximately 61.5% copper, 35.5% zinc, and 3% lead. The lead content acts as a chip breaker and lubricant, making it the most machinable brass alloy available, with a machinability rating of 100% relative to free-cutting brass standards. It is the standard material for high-speed screw machine operations and is widely used in plumbing fittings, valve components, gears, pinions, and electrical connectors.

- Primary applications: plumbing fittings, valve stems, faucet components, gears, pinions, electrical terminals, and decorative hardware.
- Common stock forms: round rod, hex rod, square rod, rectangular bar, and extruded shapes.
- Compliance: ASTM B16, SAE J461, and CSA G40.20/G40.21 for general engineering applications.

2.0 Core Technical Properties & Sizing

- Density: 8.50 g/cm³ (0.307 lb/in³) at 20°C.
- Melting point: 900–930°C (1650–1710°F) liquidus; 885°C (1625°F) solidus.
- Tensile strength: 340–470 MPa (49–68 ksi) depending on temper (H02 half-hard typical).
- Yield strength (0.2% offset): 140–310 MPa (20–45 ksi).
- Elongation at break: 18–30% in 2 inches for rod forms.
- Hardness: Rockwell B 60–85 (Brinell 100–150) for half-hard temper.
- Electrical conductivity: 26% IACS (International Annealed Copper Standard) at 20°C.
- Thermal conductivity: 115 W/m·K at 20°C.
- Coefficient of thermal expansion: 20.5 µm/m·°C (11.4 µin/in·°F) from 20–300°C.
- Standard rod diameters: 1/8 inch to 6 inches (3.175 mm to 152.4 mm) in 1/16 inch increments; metric sizes 3 mm to 150 mm.
- Diameter tolerance for cold-drawn rod: ±0.002 inches for diameters up to 1 inch; ±0.003 inches for 1–2 inches; ±0.004 inches for 2–4 inches.
- Length tolerance: standard 12-foot (3.66 m) random lengths with ±1/2 inch tolerance; custom lengths available with ±1/8 inch per foot.
- Straightness tolerance: 1/16 inch in any 4-foot length for rod up to 1 inch diameter; 1/8 inch for larger diameters.

3.0 Processing, Machinability & Application

Brass 360 is the benchmark for machinability, achieving a 100% rating on the free-cutting brass scale. It produces short, broken chips that evacuate easily, allowing high cutting speeds and excellent surface finishes. The material is not weldable by conventional fusion methods due to lead content and hot cracking risk; mechanical joining or brazing is preferred.

- Recommended cutting speed for HSS tooling: 300–600 surface feet per minute (SFM) for turning; 200–400 SFM for drilling.

- For carbide tooling: 600–1200 SFM for turning; 400–800 SFM for drilling and milling.
- Feed rate: 0.005–0.020 inches per revolution (IPR) for roughing; 0.002–0.008 IPR for finishing.
- Depth of cut: up to 0.250 inches for roughing; 0.010–0.050 inches for finishing.
- Tool geometry: use positive rake angles (10–15 degrees) and sharp cutting edges to minimize built-up edge.
- Coolant: flood coolant recommended for high-speed operations; soluble oil or synthetic coolant at 5–10% concentration.
- Threading: single-point threading at 100–200 SFM; thread rolling is preferred for high-volume production.
- Drilling: use high-helix twist drills with 118–135 degree point angle; peck drilling cycle recommended for depths exceeding 3x diameter.
- Tapping: use spiral-point or spiral-flute taps; cutting speed 30–60 SFM; use water-soluble tapping fluid.
- Brazing: silver brazing with flux (AWS BCuP-5 or BAg-1) at 620–760°C; clean surfaces thoroughly to remove lead oxide.
- Soldering: soft soldering with 60/40 tin-lead or lead-free solder; use rosin flux for electrical applications.
- Welding: not recommended for structural applications; gas tungsten arc welding (GTAW) possible with deoxidized filler but risk of porosity and cracking.
- Forming: cold bending possible with radii greater than 2x diameter; hot forming at 600–750°C for complex shapes.

4.0 Common Defects & Quality Control

- Reject if surface cracks, seams, or laps are visible under 5x magnification on any surface.
- Reject if surface pits or porosity exceed 0.005 inch (0.13 mm) in depth or 0.030 inch (0.76 mm) in diameter.
- Reject if diameter is out of tolerance by more than 0.001 inch for precision applications (e.g., valve stems).
- Reject if straightness deviation exceeds 1/16 inch in any 4-foot length for rod under 1 inch diameter.
- Reject if out-of-roundness exceeds 50% of the diameter tolerance band.
- Reject if chemical composition deviates from ASTM B16 limits: Cu 60.0–63.0%, Pb 2.5–3.7%, Fe max 0.35%, Zn remainder.
- Reject if hardness exceeds Rockwell B 85 for half-hard temper or falls below B 60.
- Reject if tensile strength is below 340 MPa (49 ksi) for rod diameters over 1 inch.
- Reject if elongation is less than 15% in 2 inches for any temper.
- Reject if dezincification corrosion is observed (white powdery residue) on stored material.
- Reject if material exhibits stress corrosion cracking (season cracking) – visible as branched intergranular cracks near edges.
- Acceptance criteria: visual inspection per ASTM E10 for hardness, ASTM E8 for tensile, and ASTM B16 for dimensional compliance.

5.0 Storage, Handling & WHMIS Guidelines

- Store in a dry, indoor environment with relative humidity below 60% to prevent tarnishing and dezincification.
- Temperature range: -20°C to 40°C; avoid condensation by allowing material to acclimate before unpacking.
- Shelf life: indefinite under proper storage; FIFO (First In, First Out) rotation recommended for inventory control.
- Separate brass from steel, aluminum, and stainless steel to prevent galvanic corrosion; use plastic or wood dunnage.
- WHMIS classification: Not classified as a hazardous material under WHMIS 2015 for solid form; dust and fumes are hazardous.
- Hazardous combustion products: metal oxide fumes (zinc oxide, lead oxide) when heated above 900°C; avoid inhalation.
- PPE for machining: safety glasses with side shields, hearing protection (machining noise >85 dBA), and cut-resistant

gloves (ANSI A4 or higher) for handling sharp edges.

- PPE for grinding/welding: N95 respirator for dust/fume protection; welding helmet with shade 10–12 filter; leather gloves and apron.
- Ventilation: local exhaust ventilation required for machining operations to control airborne lead and copper dust below OEL (0.05 mg/m³ for lead).
- Spill procedure: sweep or vacuum dry dust (do not use compressed air); dispose as hazardous waste per provincial regulations.
- First aid: for eye contact, flush with water for 15 minutes; for skin contact, wash with soap and water; for inhalation of fumes, move to fresh air and seek medical attention.
- SDS availability: Safety Data Sheet must be accessible in the workplace per WHMIS 2015; review Section 8 (exposure controls) and Section 11 (toxicological information) before use.

Regulatory Disclaimer: This document is a generic technical material specification provided for educational purposes. The end-user assumes all liability for reviewing, adapting, and validating all tolerances, properties, and safety protocols against specific OEM data sheets and local regulations before deployment.