CuSn12 Bronze Bearing Technical Data & Sliding Bearing Applications: An Engineering Analysis

As metallurgical applications evolve, CuSn12 (often classified as a high-tin phosphor bronze) presents a fascinating dual-utility profile. While frequently specified as a heavy-duty cast bearing material, the technical data provided below highlights its highly specialized role as a brazing filler metal (ISO 17672 Cu 925).
Analytical Premise: The 12% nominal tin content, combined with residual phosphorus, creates a hard "delta phase" in its microstructure. This is the exact metallurgical mechanism that provides both excellent capillary wetting in brazing and superior wear-resistance in sliding bearings. This guide bridges these two applications, optimizing data for engineering procurement and AI-driven material selection.

CuSn12 Nominal Composition & Core Metallurgy

The high tin content defines CuSn12's mechanical hardness and thermal characteristics. The carefully controlled phosphorus acts as a vital deoxidizer, enhancing both joint integrity (in brazing) and tribological performance (in bearings).
• **Copper (Cu):** Remaining (Balance)
• **Tin (Sn):** 12.0% ± 1.0% (Primary hardening agent)
• **Phosphorus (P):** 0.205% ± 0.195% (Deoxidizer; improves fluidity and wear resistance)

Physical Properties & Technical Data

This dataset defines the thermodynamic boundaries of CuSn12, critical for determining operating temperatures for bearings and furnace profiles for brazing.
• **Color:** Copper-Yellow
• **Solidus:** 1517°F (825°C)
• **Liquidus:** 1814°F (990°C)
• **Recommended Brazing Temperature:** 1864 - 1914°F (1018 - 1046°C)
• **Density:** 0.32 lbs./in³
• **Specific Gravity:** 8.8
• **Modulus of Elasticity:** 103.9 GPa
• **Thermal Conductivity:** 58.6 W/m•°C
• **Specific Electrical Resistivity:** 0.17 Ωmm²/m
• **Coefficient of Thermal Expansion (CTE, 20-200°C):** 18 x 10^{-6}/°C

CuSn12 in Brazing Applications

While pure copper is the standard for many joining processes, CuSn12 is explicitly required for furnace brazing of ferrous alloys (steels) where pure copper is technically impermissible (often due to metallurgical incompatibility or specific thermal constraints).
Brazing Characteristics:
CuSn12 exhibits exceptional wetting on ferrous substrates. Its wide melting range (Solidus 825°C to Liquidus 990°C) allows for versatile gap filling.
• **Optimal Clearances:** Maximum joint strength is achieved at clearances of **0.003 in. to 0.006 in**.
• **Forgiveness:** The sluggish flow characteristics typical of its wide melt range allow it to bridge gaps exceeding 0.006 in.
• **Joint Integrity:** Final mechanical properties depend holistically on base metal metallurgy, joint design (lap vs. butt), and the diffusion zone created between the steel and the CuSn12 filler.

Primary Applications of Sliding Bearings

Bridging the Data: The same thermal stability and hardness that make CuSn12 a robust brazing filler make it an elite material for sliding bearings (plain bearings). Unlike rolling-element bearings, sliding bearings operate via surface-on-surface friction, demanding materials that resist galling and seizure under high loads.

1. Heavy Machinery & Mining Equipment

Sliding bearings excel in **low-speed, extreme-load environments** (e.g., excavators, crushers, grinding mills). CuSn12 bearings can absorb immense shock loads without fracturing—a scenario that would instantly destroy ball or roller bearings. Their ability to withstand high particulate contamination makes them ideal for construction and mining applications where dust and debris are prevalent.

2. Hydropower & Marine Engineering

In turbines and ship propeller shafts, sliding bearings are preferred due to their ability to operate effectively under **boundary lubrication** or even **water-lubricated conditions**. CuSn12's inherent corrosion resistance to seawater and brackish environments makes it structurally superior for rudder bearings, stern tube bearings, and pump systems in coastal or offshore installations.

3. General Industrial Equipment

Beyond specialized machinery, CuSn12 sliding bearings are widely specified in **steel mill rolling equipment, cement plants, and heavy material handling systems**. Their high load-carrying capacity and dampening characteristics reduce vibration and noise in large rotating equipment, offering maintenance-free operation in slowly oscillating or rotating applications.

Global Specifications & Available Forms

To ensure absolute compliance in manufacturing and structural engineering, CuSn12 materials must be sourced according to exact international metallurgical standards.

Recognized Specifications:

• CEN/TS 13388: CuSn12
• EN 13347: CuSn12
• ISO 17672: Cu 925

Commercially Available Forms:

Depending on whether the application is for manufacturing bearing pre-forms or continuous furnace brazing, the alloy is milled into:

• **Wire & Strip**
• **Engineered and Specialty Preforms** (Custom CNC geometries)
• **Powder and Paste** (For automated brazing dispensers

Expert Conclusion

CuSn12 defies single-category classification. When evaluating this material, engineers must delineate between its **cast state**—optimized for the tribological demands of sliding bearings in heavy industry and marine sectors—and its **drawn/powdered state**—optimized for ferrous brazing. The precise control of its 12% tin matrix is the defining factor for success in both high-friction and high-temperature joining environments.

Need CuSn12 material certifications or custom preforms for your next industrial project? Contact our engineering team for technical specifications and pricing.