TIN BRONZE

They are composed of Copper, Tin, and small additions of Ni, Zn, Pb; during the refining process, they are deoxidized with P, which is why they are commonly referred to as "phosphor bronze." These alloys are used without heat treatment, so the high mechanical properties are obtained solely by increasing the nucleation rate in the liquid state to reduce the grain size of the primary phase **α** and improve the proportion and distribution of the phase **δ** during solidification. The faster the cooling, the finer the **α** dendrites will be, and there will be a greater dispersion of phase **δ** in the microstructure.

When up to 8% Tin is added, some Sn atoms replace Cu atoms in the F.C.C. lattice, and during solidification, the first solid solution to form as dendrites is the Cu-rich **α** phase. The Sn atoms, having a larger diameter than the Cu atoms (Cu = 1.57 Å, Sn = 1.72 Å), distort the lattice, altering the distances between atoms and increasing the mechanical strength compared to pure Cu; however, the crystal structure remains F.C.C., so its sliding and high ductility characteristics are maintained.

When the Sn content exceeds 8%, some of the **α** phase becomes enriched with Sn, forming the **δ** phase (Cu31Sn8) finely dispersed as islands between the inter-dendritic spaces of the **α** phase (the higher the Sn %, the greater the proportion of **δ** phase), tough but ductile, which supports impact loads. Meanwhile, the hard intermetallic compound **δ** provides mechanical strength, wear, and abrasion resistance due to the significant increase in hardness, but it decreases ductility. The smooth surface of the **α** matrix, slightly inferior to **δ**, forms a pocket and retains lubricants, reducing metal-to-metal contact.

ALLOY: VE - 925 = UNS C92500 = SAE 640

Bronze with good hardness, elasticity, and high mechanical strength, wear resistance, moderate impact resistance, hydraulic and steam pressure resistance; medium corrosion resistance. Avoid exceeding the maximum operating temperature for extended periods, as the "**δ**" phase will tend to precipitate along the grain boundaries, causing material embrittlement.

Recommended for bearings with high load and low/medium speed; requires reliable lubrication with grease or oil and shaft hardness of 300 - 400 HB.

Chemical Composition:

%Cu	% Sn	%Pb	%Zn	%Fe	% Ni
85 - 88	10 - 12	1,0 - 1,5	0,5 max.	0,3 max.	0,8 - 1,5

Mechanical and Physical Properties:

- **Tensile Strength,** *Kg/mm²*…………………………………………………. 24,6 - 30,9
- **Yield Strength,** *Kg/mm²*……………………………………………………. 14,1 - 16,9
- **Elongation,** *%*………………………………………………………………. 20 - 8
- **Hardness,** *HB (10 mm / 500 Kg)*………………………………………... 80 - 110
- **Thermal Conductivity,** *W / m °C (20 °C)*……………………………… 63
- **Coefficient of thermal Expansion,** *10^{-6} / °C (20 - 300 °C)*…………. 18
- **Electrical Conductivity,** *% IACS (20 °C)*………………………………... -
- **Operating Temperature,** *°C*…………………………………………... -233 - 287
- **Operating Load or Pressure,** *Kg/mm²* ………………………………… 2,5 - 3,6 (medium)

Technical manufacturing standards:

- Chemical Composition and Mechanical Properties: UNS C 92500 = SAE 640 = DIN 1705 CuSn12Pb
- Centrifugal Casting : ASTM B427 / SAE J462
- Sand Mold Casting : ASTM B427 / SAE J462
- Continuous Casting : ASTM B505 / 505M

Main Uses and Application:

Impellers for centrifugal pumps for freshwater with suspended materials ● Crowns, pinions, nuts, and toothed parts for industrial reducers and elevators, subjected to very high stresses and low speeds (for optimal performance, they should operate submerged in oil).

✱ *Referential Specifications for Chemical Composition, Mechanical, and Physical Properties based on the Unified Numbering System (UNS-C) of the Copper Development Association (CDA) for cast and forged copper alloys; subject to written confirmation by VULCANO METALS*