TIN-LEAD BRONZES (Anti-friction)

These are copper alloys with up to 34% Pb, 14% Sn, 4% Zn, and 2.5% Ni, featuring a highly complex metallurgical structure influenced by their chemical composition, melting process, casting, cooling, and other factors. Their load-bearing capacity varies with the copper, tin, and nickel content.

The Pb, which is insoluble in Cu and its alloys, can be mixed with it through agitation in the liquid state and, with the presence of nickel (Ni has a greater affinity for Cu, reducing the Sn retained in the first crystallization phase α and allowing more Sn into the second phase δ, forming smaller nucleation centers and interdendritic spaces, resulting in finer grains), is finely dispersed, solidifying at the end (327°C) in the form of irregular, isolated fine globules between the grain boundaries of the cast piece. Thus, the harder elements Cu and Sn, which make up the eutectoid phase δ, bear the load, while Pb forms the soft matrix of α crystals, providing plasticity.

Tin bronzes with a high lead content (> 7% Pb) are considered the most resistant to fatigue and capable of withstanding heavy loads at medium and high speeds, performing well under proper service conditions and adequate lubrication. The lead particles, due to their high plasticity and greasy nature, provide a smooth surface and excellent anti-friction qualities to the bearing. This allows it to adjust to misalignment, deformation, or flexing of the shafts, while also helping to maintain the lubricant film intact during the critical startup period and preventing shaft seizure in case of a momentary interruption in the lubricant supply.

ALLOY: VP - 938 = UNS C93800 = SAE 67

Bronze with high plasticity, making it particularly suitable for bearings that will endure vibrations and abrupt starts; it also offers the advantage of having nearly the same friction coefficient as good babbitt, while providing significantly superior wear resistance, fatigue resistance, temperature tolerance, and thermal conductivity, allowing for 20-25% higher working pressures.

As a bushing and sliding plate, it operates under moderate to high loads and speeds (500 to 1000 rpm), with semi-hardened shafts (tempered) and standard lubrication.

Chemical Composition:

%Cu	% Sn	%Pb	%Zn	%Fe	% Ni
75 - 79	6,3 - 7,5	13 - 16	0,8 max.	0,15 max.	1 max.

Mechanical and Physical Properties:

- **Tensile Strength,** *Kg/mm²*..... 18,3 - 23,2
- **Yield Strength,** *Kg/mm²*..... 9,8 - 14,1
- **Elongation,** *%*..... 18 - 5
- **Hardness,** *HB (10 mm / 500 Kg)*..... 50 - 60
- **Thermal Conductivity,** *W / m °C (20 °C)*..... 52,3
- **Coefficient of thermal Expansion,** *10^{-6} / °C (20 - 300 °C)*..... 18,5
- **Electrical Conductivity,** *% IACS (20 °C)*..... 11
- **Operating Temperature,** *°C*..... -233 - 260
- **Operating Load or Pressure,** *Kg/mm²*..... 3,1 - 5,1 (high)

Technical manufacturing standards:

- Chemical Composition and Mechanical Properties: UNS C 93800 = SAE 67 = DIN 1716 CuPb15Sn
- Sand Mold Casting : ASTM B584 / SAE J462
- Continuous Casting : ASTM B505 / 505M

Main Uses and Application:

Bearings for mineral mills and crushers, sugar mills, locomotives, and railway cars ● Fire pumps, gasoline pumps, acid mine water pumps, and sulfite fluid pumps ● Bushings, seats, and guides for plungers, pistons, connecting rods, camshafts, and crankshafts of large gasoline and diesel engines ● Hydraulic seals.

✱ ***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***

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