Austral Wright Metals
at the cutting edge

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PRODUCT DATA SHEET

Alloys for Bearings

Copper Alloys

Copper alloys are frequently used for bearings, usually bronzes (copper tin alloys). These alloys have higher strength than the white metals which are also used.

It is not at all unusual to come across a bronze sleeve bearing that has been performing satisfactorily for decades, even under severe operating conditions. In fact, a properly designed and maintained bronze bearing often outlasts the equipment it serves. Achieving such performance is not difficult, but it requires sound design, the right bearing material, accurate manufacture and, as with any mechanical equipment, diligent maintenance.

Bronzes are unquestionably the most versatile class of bearing materials, offering a broad range of properties from a wide selection of alloys and compositions. This data sheet describes the most used standard bearing bronzes and is aimed at helping the designer select the right bronze for the job at hand.

Bearing bronzes offer broad ranges of strength, ductility, hardness, wear resistance, anti-seizing properties, low friction and the ability to conform to irregularities, tolerate dirty operating environments and contaminated lubricants. The corrosion resistance of bearing bronzes is generally superior to other bearing materials, and can be selected to meet particular ambient conditions. Bronzes permit easy and economical manufacture, allowing bearings to be made in special and one-of-a-kind configurations simply and at low cost. No bearing metals have better machinability than the leaded and high-leaded bearing bronzes. Almost without exception, a bearing bronze can be selected to satisfy any bearing application that exists.

Table 1 compares the relative performance of several metallic bearing materials. Table 2 details some of the properties and availability of the most common bronzes used for bearings. Figure 1 shows the areas of applicability of bearing types.

Selection

- There is often no single 'right' alloy for a given application
- Usually, more than one grade of bronze will perform satisfactorily in a given application
- Selection often depends on past experience, cost, availability and local engineering practices
- Always remember that when metal runs on metal, wear will occur
- Bronze bushes are used to minimise, control or isolate that wear.

When selecting a material, consideration should be given to, but not limited to:

- Relative cost of shaft and bushing – including replacement downtime
- Lubrication and the surface finish of the mating items
- Mechanical service conditions – e.g. load, alignment, speed etc
- Environmental conditions – presenece of corrosive atmospheres, ingress of dirt, grit etc

The detailed selection of a bearing material and design is beyond the scope of this note. Further information is available from Austral Wright Metals, or from a textbook on design of bearings, or from an engineers design handbook.

Table 1: Guide to the relative performance of Bearing Materials

Bearing alloy	Load Capacity and Fatigue	Maximum Operating Temperature	Conformability and Embeddability	Resistance to Seizure	Hardness and Wear Resistance
Tin bronze	High	High	Moderate	Moderate	High
Phosphor bronze	Very High	High	Poor	Moderate	Very High
Leaded bronze	Moderate/ high	High	Good	Good	High
Copper lead	Moderate	High	Very Good	Very Good	Moderate
Aluminium bronze	Very High	Very High	Poor	Moderate	Very High
Gunmetal	Moderate/High	High	Good	Moderate	High
Brass	Moderate	Moderate	Poor	Moderate	High
Copper beryllium	Very High	Very High	Poor	Good	Very High
Tin based whitemetal	Moderate	Moderate	Excellent	Excellent	Low
Lead based whitemetal	Moderate	Moderate	Excellent	Excellent	Low
Aluminium – low tin	High	High	Good	Moderate/Good	Moderate
Aluminium - high tin	Moderate/High	High	Good	Good	Moderate

Table 2: Properties and availability of the most common bronzes used for bearings

Alloy	Type	Tensile Strength Mpa	Yield Strength MPa	Elongation %	Hardness Brinell	Availability Class†
LG2	Leaded Gunmetal	200 – 340	100 – 140	6 – 30	65 – 95	A
General purpose alloy – lightly stressed bearings, water fittings, miscellaneous castings.						
SAE 660	Leaded Gunmetal	205 – 300	100 – 170	8 – 20	90 – 100	B
Widely used for medium duty bronze bushes						
C86300	Manganese Bronze	740 – 930	400 – 500	11 – 21	150 – 230	B
Rolling mill housing nuts & slippers, heavily loaded slow moving gears. Sometimes used for heavily load bushes. Applications where high strength or resistance to fatigue are critical. Highly stressed components at normal temperatures. Note that aluminium bronzes have better corrosion & wear resistance.						
C86500	Manganese Bronze	450 – 600	170 – 280	11 – 21	110 – 150	B
Similar to C86300, with lower tensile properties. Automotive gear shift forks, brackets, gears, bushes, marine fittings etc						
AB1	Aluminium Bronze	500 – 650	170 – 270	12 – 40	50 – 100	B
Applications requiring high strength, resistance to fatigue, wear & shock loading, resistance to erosion & corrosion, e.g. ships propellers, impellor castings etc, gears & bushes where loads are heavy & speeds are slow. AB2 is superior to AB1 in these applications. AB2 has better strength, including high temperature strength, and better corrosion resistance than AB1.						
AB2	Aluminium Bronze	640 – 740	250 – 310	13 – 20	140 – 190	B
PB1	Phosphor Bronze	220 – 420	130 – 230	2 – 25	70 – 150	A
Used for bearings and bushings in heavy duty situations. Good lubrication & shaft alignment is essential. Has good corrosion resistance.						
PB2	Phosphor Bronze	220 – 430	130 – 250	3 - 15	75 – 150	B
Typically used for heavily loaded gears and screw nuts.						

† : A = stock item, B = readily obtainable for sufficient quantity

Figure 1: Guide to the choice of bearing types