PURITY
CASTING ALLOYS LTD.

Babbitt Alloy Selection

The selection of the right **Babbitt** metal for a given bearing is part science and part art. In the repair and rebuilding of an existing bearing, it is often most important to duplicate the original bearing Babbitt and properly prepare the bearing surface for this new Babbitt coating. Many repair facilities receive bearings with little or no technical documentation. If you need help identifying the original Babbitt, Purity Casting Alloys Ltd. can analyze a sample of the Babbitt material for a nominal charge. Simply melt out a small plug, or send us turnings from the old Babbitt lining. We will analyze them to determine the original formulation of the babbitt lining.

Typical engineering data for several common Babbitt formulations is shown in the table below. It is important to note that changing the Babbitt formula for an existing bearing changes the forces and wear on the entire bearing – shell, lining, lubricant, etc. The discussion on the science of Babbitt selection is meant to educate, but also to emphasize that such changes should not be undertaken lightly. Changing the Babbitt formula in an existing bearing can lead to precisely the bearing failure you are working to avoid.

ASTM Grade	Yield Point, psi[D] (MPa)		Johnson's Apparent Elastic Limit psi (MPa)[E]		Melting Point	Proper Pouring
	68°F(20°C)	212°F(100°C)	68°F(20°C)	212°F(100°C)	°F (°C)	Temp °F (°C)
1	4400 (30.3)	2650 (18.3)	2450 (16.9)	1050 (7.2)	433 (223)	825 (441)
2	6100 (42.0)	3000 (20.6)	3350 (23.1)	1100 (7.6)	466 (241)	795 (424)
3	6600 (45.5)	3150 (21.7)	5350 (36.9)	1300 (9.0)	464 (240)	915 (491)
7	3550 (24.5)	1600 (11.0)	2500 (17.2)	1350 (9.3)	464 (240)	640 (338)
8	3400 (23.4)	1750 (12.1)	2650 (18.3)	1200 (8.3)	459 (237)	645 (341)

[D] The values of yield point were taken from stress-strain curves at deformation of 0.125% of gage length

[E] Johnson's apparent elastic limit is taken as the unit stress at the point where the slope of the tangent to the curve is 2/3 times its slope in origin.

www.purityalloys.com sales@purityalloys.com **604-888-0181**

The Science of Bearing Babbitt Selection

The engineering of a bearing's Babbitt lining is usually completed during the design of the machine. In selecting the proper type of Babbitt for a particular job there are a number of factors to take into consideration, the most important of which are as follows:

1. **Surface speed of the shaft**
2. **Load that the bearing is required to carry**

As most modern equipment and engines operate at high speeds, Tin-Based Babbitt bearings are far more common. Lead-Based Babbitt bearings are encountered most often in the rebuild and restoration of antique engines, motors and compressors. **The chart below lists the most common Tin and Lead-Based Babbitt formulations.**

Industry Names	ASTM Grade	Sn	Pb	Cu	Sb	As
No. 1, ASTM #1	1	90-92	0.35 (max)	4-5	4-5	
Nickel Genuine, ASTM #2	2	88-90	0.35 (max)	3-4	7-8	
Super Tough, ASTM #3	3	83-85	0.35 (max)	7.5-8.5	7.5-8.5	
Grade 4, ASTM #4	4	74-76	9.3-10.7	2.5-3.5	Nov-13	
Imperial Genuine, ASTM #11	11	86-89	0.35 (max)	5-6.5	6-7.5	
Durite, ASTM #15	15	0.8-1.2	79.9-83.9		14.5-17.5	0.8-1.4
Saw Guide, ASTM #8	8	4.5-5.5	77.9-81.2		14-16	0.3-0.6
Mill Anchor, ASTM #13	13	5.5-6.5	82.5-85		9.5-10.5	.25 (max)
Heavy Pressure, HHP, ASTM #7	7	9.3-10.7	72.5-76.5		14-16	0.3-0.6

There is no doubt that if a bearing is to be highly loaded in relation to its size, a high Tin alloy is desirable; whereas for much slower speed work and less heavily loaded bearings, a Lead-Based Babbitt may be employed, and is far more economical.

1. Surface speed of the shaft: (The number of feet traveled per minute by the shaft circumferentially)

Formula: (Pi x D x RPM) / 12 = S

Ex: Determine the surface of a 2 inch diameter shaft going 1,400 RPM (Pi x D x RPM) / 12
= (3.1416 x 2 x 1,400) / 12
= 733.04 Ft/min

Pi = 3.1416
D = Diameter of Shaft
RPM = Revolutions Per Minute
S = Surface speed of the Shaft

2. Load Bearing is required to carry: (The weight which is being exerted through the combined weights of the shaft and any other direct weights on the shaft and measured in pounds per square inch.)

Formula:
W / (I.D x L.O.B.)= L
Example: Determine the load on a bearing of a 2 inch I.D bearing, 5 inches long and carrying a weight of 3,100 lbs
W / (I.D x L.O.B.)
= 3,100 / (2 x 5)
= 310 Lbs/sq.in

W = Total weight carried by bearing
I.D = Inside diameter of bearing
L.O.B = Length of Bearing
L = Load bearing required to carry

The Art of Bearing Babbitt Selection

While not subject to precise calculations, the following considerations must also be taken into account:

- **Continuity of service**
- **Bonding characteristics**
- **Cooling facilities**
- **Lubrication**
- **Cleanliness**
- **Maintenance schedule for the bearing in use**

For example, a bearing in continuous use in a harsh environment without regular maintenance will require different Babbitt and lubrication than a bearing in intermittent use in a clean, light duty environment. This socalled art is really the condensation of the experience of the technician and the experience of the bearing being rebuilt.

If the bearing has performed well in use over many years, the bearing needs simply to be rebuilt to its original specification and formulation. In this case the technician's greatest concerns are:

1. **Bearing shell surface preparation**
2. **Bonding characteristics of the tinning compound and the Babbitt layer and,**
3. **Load bearing surface preparation and finish**

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