White Metal Bearing Alloys (Babbitt Metal) - Lead and Tin Based

**Bar Shape**
- Ingot: 10-3/4" x 2" x 1-1/4" (L x W x H)
- Margash: 26" x 2" x 1-1/2" (L x W x H)
- Pig: 17-1/2" x 4" x 3-1/2" (L x W x H)

**Pure Lead**
- 10 LB
- 25 LB
- 55 LB

**Pure Tin**
- 6-1/2 LB
- 16 LB
- 35 LB

### Tin Based Alloys
- Marine 11D: SNSB5CU4
- No. 1 (ASTM #1): SNSB4.5CU4.5
- Marine 11R: SNSB7.75CU2.75
- Nickel Genuine (ASTM #2): SNSB7.5CU3.5
- Marine 11: SNSB5.75CU5.25
- Diesel Special: SNSB6.75CU5.5
- No. 11 (ASTM #11): SNSB6.75CU5.75
- SAE 11: SNSB7.5CU6.5
- Imperial Genuine: SNSB7CU7
- Turbine: SNSB7CU8
- Royal Amature: SNSB8.25CU8
- Super Tough (ASTM #3): SNSB8CU8

### Lead Based Alloys
- No. 13 (ASTM #13): PBSN6SB10
- Mill Anchor: PBSN5SB12
- Durite (ASTM #15): PBSN1SB16
- Star: PBN5.25SB14
- Silvertone: PBSN2SB18
- Royal (ASTM #8): PBSN5SB15
- Heavy Pressure (ASTM #7): PBSN10SB15
- Special Sawguide: PBSN10SB19

### Tin Based Alloys - Chemical Composition (%) Chart

<table>
<thead>
<tr>
<th>INDUSTRY NAME</th>
<th>ASTM B23</th>
<th>Sn (Tin)</th>
<th>Sb (Antimony)</th>
<th>Cu (Copper)</th>
<th>Pb (Lead)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marine 11D</td>
<td>-</td>
<td>90.0 - 92.0</td>
<td>4.5 - 5.5</td>
<td>3.5 - 4.5</td>
<td>0.35 (Max)</td>
</tr>
<tr>
<td>No. 1 Grade 1</td>
<td></td>
<td>90.0 - 92.0</td>
<td>4.0 - 5.0</td>
<td>4.0 - 5.0</td>
<td>0.35 (Max)</td>
</tr>
<tr>
<td>Marine 11R</td>
<td>-</td>
<td>89.0 - 89.5</td>
<td>7.5 - 8.5</td>
<td>2.5 - 3.0</td>
<td>0.35 (Max)</td>
</tr>
<tr>
<td>Nickel Genuine Grade 2</td>
<td></td>
<td>88.0 - 90.0</td>
<td>7.0 - 8.0</td>
<td>3.0 - 4.0</td>
<td>0.35 (Max)</td>
</tr>
<tr>
<td>Marine 11</td>
<td>-</td>
<td>88.0 - 90.0</td>
<td>5.5 - 6.0</td>
<td>5.0 - 5.5</td>
<td>0.35 (Max)</td>
</tr>
<tr>
<td>4X Royal Nickel Genuine</td>
<td>-</td>
<td>87.5 - 89.5</td>
<td>7.25 - 7.75</td>
<td>3.25 - 3.75</td>
<td>0.35 (Max)</td>
</tr>
<tr>
<td>Diesel Special</td>
<td>-</td>
<td>87.5 - 88.0</td>
<td>6.5 - 7.0</td>
<td>5.0 - 6.0</td>
<td>0.35 (Max)</td>
</tr>
<tr>
<td>No. 11 Grade 11</td>
<td></td>
<td>86.0 - 89.0</td>
<td>6.0 - 7.5</td>
<td>5.0 - 6.5</td>
<td>0.35 (Max)</td>
</tr>
<tr>
<td>SAE 11</td>
<td>-</td>
<td>85.0 - 87.0</td>
<td>7.0 - 8.0</td>
<td>6.0 - 7.0</td>
<td>0.35 (Max)</td>
</tr>
<tr>
<td>Imperial Genuine</td>
<td>-</td>
<td>85.0 - 87.0</td>
<td>6.5 - 7.5</td>
<td>6.5 - 7.5</td>
<td>0.35 (Max)</td>
</tr>
<tr>
<td>Turbine</td>
<td>-</td>
<td>84.0 - 86.0</td>
<td>6.5 - 7.5</td>
<td>7.5 - 8.5</td>
<td>0.35 (Max)</td>
</tr>
<tr>
<td>Royal Amature</td>
<td>-</td>
<td>83.5 - 84.0</td>
<td>8.0 - 8.5</td>
<td>7.5 - 8.5</td>
<td>0.35 (Max)</td>
</tr>
<tr>
<td>Super Tough Grade 3</td>
<td></td>
<td>83.0 - 85.0</td>
<td>7.5 - 8.5</td>
<td>7.5 - 8.5</td>
<td>0.35 (Max)</td>
</tr>
</tbody>
</table>

Maximum Allowable Impurities: Fe=0.08, As=0.10, Bi=0.08, Zn=0.005, Al=0.005, Cd=0.05
**Lead Based Alloys - Chemical Composition (%) Chart**

<table>
<thead>
<tr>
<th>INDUSTRY NAME</th>
<th>ASTM B23</th>
<th>Sn (Tin)</th>
<th>Sb (Antimony)</th>
<th>Pb (Lead)</th>
<th>As (Arsenic)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 13</td>
<td>Grade 13</td>
<td>5.5 - 6.5</td>
<td>9.5 - 10.5</td>
<td>Balance</td>
<td>0.25 (Max)</td>
</tr>
<tr>
<td>Mill Anchor</td>
<td>-</td>
<td>4.0 - 6.0</td>
<td>11.5 - 12.5</td>
<td>Balance</td>
<td>0.25 (Max)</td>
</tr>
<tr>
<td>Durite</td>
<td>Grade 15</td>
<td>0.8 - 1.2</td>
<td>14.5 - 17.5</td>
<td>Balance</td>
<td>0.8 - 1.4</td>
</tr>
<tr>
<td>Star</td>
<td>-</td>
<td>5.0 - 5.5</td>
<td>13.5 - 14.5</td>
<td>Balance</td>
<td>0.30 - 0.60</td>
</tr>
<tr>
<td>Silverstone</td>
<td>-</td>
<td>1.0 - 3.0</td>
<td>17.5 - 18.5</td>
<td>Balance</td>
<td>0.25 (Max)</td>
</tr>
<tr>
<td>Royal</td>
<td>Grade 8</td>
<td>4.5 - 5.5</td>
<td>14.0 - 16.0</td>
<td>Balance</td>
<td>0.30 - 0.60</td>
</tr>
<tr>
<td>Heavy Pressure</td>
<td>Grade 7</td>
<td>9.3 - 10.7</td>
<td>14.0 - 16.0</td>
<td>Balance</td>
<td>0.30 - 0.60</td>
</tr>
<tr>
<td>Special Sawguide</td>
<td>-</td>
<td>9.0 - 11.0</td>
<td>18.5 - 19.5</td>
<td>Balance</td>
<td>0.25 (Max)</td>
</tr>
</tbody>
</table>

Maximum Allowable Impurities: Cu=0.50, Fe=0.10, Bi=0.10, Zn=0.005, Al=0.005, Cd=0.05

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 bearing is required to carry**

Secondly, but no less important, the following points must also be taken into account:

A. **Continuity of service**
B. **Bonding possibilities**
C. **Cooling facilities**
D. **Lubrication**
E. **Cleanliness**
F. **Attention given to the bearings in question**

There is no doubt that if a bearing 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-base one 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.)

   \[
   \text{Formula: } \frac{\pi \times D \times \text{RPM}}{12} = S
   \]

   \[
   \pi = 3.1416
   \]

   \[
   D = \text{Diameter of Shaft}
   \]

   \[
   \text{RPM} = \text{Revolutions Per Minute}
   \]

   \[
   S = \text{Surface speed of the Shaft}
   \]

   **Example:** Determine the surface of a 2 inch diameter shaft going 1,400 RPM

   \[
   \frac{\pi \times D \times \text{RPM}}{12} = \frac{3.1416 \times 2 \times 1,400}{12} = 733.04 \text{ Ft/min}
   \]
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:

\[
\frac{W}{I.D \times L.O.B.} = L
\]

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

**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

\[
\frac{W}{I.D \times L.O.B.} = \frac{3,100}{2 \times 5} = 310 \text{ Lbs/sq.in}
\]

There are many formulas for standard grade babbitts but they fall into two main classifications:

<table>
<thead>
<tr>
<th>Babbitt Classification</th>
<th>LIMITS</th>
<th></th>
<th>LOAD (Lbs/sq.in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Surface Speeds (# of Ft/min)</td>
<td>MIN.</td>
<td>MAX.</td>
</tr>
<tr>
<td>Tin-Based Babbitts</td>
<td></td>
<td>1,000</td>
<td>2,400</td>
</tr>
<tr>
<td>Lead Based Babbitts</td>
<td></td>
<td>100</td>
<td>1,000</td>
</tr>
</tbody>
</table>