



## Standard Specification for White Metal Bearing Alloys (Known Commercially as “Babbitt Metal”)<sup>1</sup>

This standard is issued under the fixed designation B 23; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

*This standard has been approved for use by agencies of the Department of Defense.*

### 1. Scope

1.1 This specification covers eight typical white metal bearing alloys, in bar or ingot form, known commercially as “babbitt metal.” The alloys are specified, covering the range commercially used, and are designated by the alloy numbers shown in [Table 1](#).

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to become familiar with all hazards including those identified in the appropriate Material Safety Data Sheet (MSDS) for this product/material as provided by the manufacturer; to establish appropriate safety and health practices, and determine the applicability of regulatory limitations prior to use.*

### 2. Referenced Documents

2.1 *ASTM Standards:*<sup>2</sup>

[E 29](#) Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

[E 57](#) Methods for Chemical Analysis of White Metal Bearing Alloys<sup>3</sup>

### 3. Ordering Information

3.1 Orders for materials under this specification shall include the following information:

3.1.1 Name of material (white metal bearing alloy),

3.1.2 Form and nominal weight of individual bars,

3.1.3 Quantity,

3.1.4 Alloy number,

3.1.5 Inspection required ([Section 9](#)),

3.1.6 Certification required ([Section 10](#)),

3.1.7 Marking required ([Section 11](#)), and

3.1.8 ASTM designation and year of issue.

### 4. Materials and Manufacture

4.1 The bars or ingots shall be made in accordance with such practice as to obtain the chemical composition, weight, and dimensions as prescribed in this specification.

4.2 The bars or ingots shall be as uniform in quality as practicable.

### 5. Chemical Composition

5.1 The alloys covered by this specification shall conform to the requirements for chemical composition prescribed in [Table 1](#).

5.2 By agreement between manufacturer and purchaser, analysis may be required and limits established for elements not specified in [Table 1](#).

### 6. Dimensions and Weights

6.1 The babbitt shall be furnished in bars of a convenient weight and size for handling. Unless otherwise agreed upon, no unnotched bar shall exceed 10 lb (4.5 kg) in weight, nor notched bar exceed 15 lb (6.8 kg).

6.2 By mutual agreement, babbitt may be furnished in small round bars about 3.5 in. (90 mm) in diameter.

### 7. Sampling

7.1 Three bars shall be selected to represent a shipment of less than 1000 lb (450 kg), five bars to represent a shipment of 1000 lb to 10 000 lb (4500 kg) inclusive, and ten bars to represent a shipment of over 10 000 lb to one carload.

7.2 Saw cuts shall be made at points in the bars as indicated in [Fig. 1](#). No lubricants shall be used for sawing. The sawings shall be carefully treated with a magnet to remove any particles of steel introduced in taking the sample.

7.3 When babbitt is furnished in bars under 5 lb (2.3 kg) in weight, three bars shall be considered the equivalent of one bar ([6.1](#)) for sampling purposes. These may be remelted in a clean

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

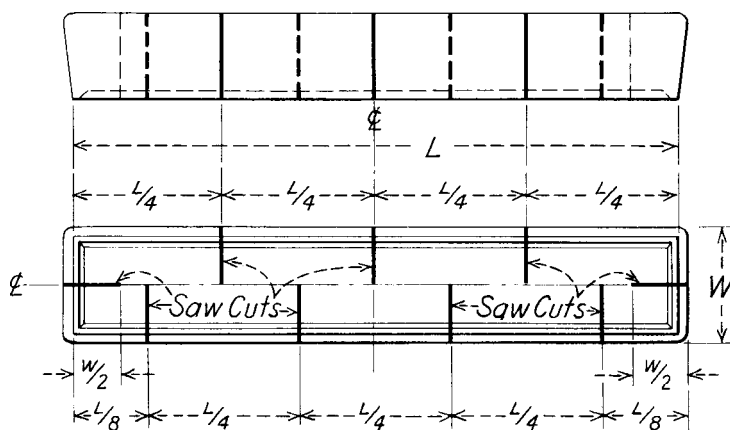
<sup>3</sup> Withdrawn.

TABLE 1 Chemical Composition<sup>A</sup> —wt% (range or maximum)

| Chemical Composition, %   | Alloy Number           |                        |                        |                        |                        |                        |                        |                        |
|---------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
|                           | Tin Base               |                        |                        |                        | Lead Base              |                        |                        |                        |
|                           | 1                      | 2                      | 3                      | 11                     | 7                      | 8                      | 13                     | 15                     |
|                           | UNS—L13910             | UNS—L13890             | UNS—L13840             | UNS—L13870             | UNS—L53585             | UNS—L53565             | UNS—L53346             | UNS—L53620             |
| Tin                       | remainder <sup>B</sup> | remainder <sup>B</sup> | remainder <sup>B</sup> | remainder <sup>B</sup> | 9.3–10.7               | 4.5–5.5                | 5.5–6.5                | 0.8–1.2                |
| Antimony                  | 4.0–5.0                | 7.0–8.0                | 7.5–8.5                | 6.0–7.5                | 14.0–16.0              | 14.0–16.0              | 9.5–10.5               | 14.5–17.5              |
| Lead                      | 0.35                   | 0.35                   | 0.35                   | 0.50                   | remainder <sup>B</sup> | remainder <sup>B</sup> | remainder <sup>B</sup> | remainder <sup>B</sup> |
| Copper                    | 4.0–5.0                | 3.0–4.0                | 7.5–8.5                | 5.0–6.5                | 0.50                   | 0.50                   | 0.50                   | 0.6                    |
| Iron                      | 0.08                   | 0.08                   | 0.08                   | 0.08                   | 0.10                   | 0.10                   | 0.10                   | 0.10                   |
| Arsenic                   | 0.10                   | 0.10                   | 0.10                   | 0.10                   | 0.30–0.60              | 0.30–0.60              | 0.25                   | 0.8–1.4                |
| Bismuth                   | 0.08                   | 0.08                   | 0.08                   | 0.08                   | 0.10                   | 0.10                   | 0.10                   | 0.10                   |
| Zinc                      | 0.005                  | 0.005                  | 0.005                  | 0.005                  | 0.005                  | 0.005                  | 0.005                  | 0.005                  |
| Aluminum                  | 0.005                  | 0.005                  | 0.005                  | 0.005                  | 0.005                  | 0.005                  | 0.005                  | 0.005                  |
| Cadmium                   | 0.05                   | 0.05                   | 0.05                   | 0.05                   | 0.05                   | 0.05                   | 0.05                   | 0.05                   |
| Total named elements, min | 99.80                  | 99.80                  | 99.80                  | 99.80                  |                        |                        |                        |                        |

<sup>A</sup> Alloy Number 9 was discontinued in 1946 and numbers 4, 5, 6, 10, 11, 12, 16, and 19 were discontinued in 1959. A new number 11, similar to SAE Grade 11, was added in 1966.

<sup>B</sup> To be determined by difference.



NOTE 1—With notched bars the saw cuts shall be distributed along the bar in a similar manner, avoiding if possible, saw cuts directly through a notch.

FIG. 1 Method of Sampling Unnotched Bar

utensil at a temperature slightly above the liquidus point of the alloy, mixed thoroughly, poured into a cold mold forming a convenient size bar, and then handled in accordance with 6.2.

7.4 Sawings, thoroughly mixed, shall be separated into three equal portions, each of which shall be placed in a sealed package, one for the manufacturer, one for the purchaser, and one for an umpire, if necessary. Each portion should exceed 0.74 oz (21 g) in weight.

7.5 When bars, by agreement, exceed 15 lb (6.8 kg) in weight, the number of sample bars taken and the sampling procedure shall be by agreement between the manufacturer and the purchaser.

## 8. Test Methods

8.1 In case of dispute, the chemical analysis shall be made in accordance with Methods E 57.

8.2 The method of analysis for cadmium and aluminum in case of dispute shall be as agreed upon between manufacturer and purchaser.

8.3 For purposes of compliance with the specified chemical composition limits, the reported analysis shall be rounded to the nearest unit in the right hand place of figures used in

expressing the limiting value, in accordance with the rounding method of Practice E 29.

## 9. Inspection

9.1 Inspection of the material shall be made as agreed upon by the manufacturer and the purchaser as part of the purchase contract.

## 10. Rejection and Rehearing

10.1 Material that fails to conform to the requirements of this specification may be rejected. Rejection should be reported to the producer or supplier promptly and in writing. In case of dissatisfaction with the results of the test, the producer or supplier may make claim for a rehearing.

## 11. Certification

11.1 When specified in the purchase order or contract, a producer's or supplier's certification shall be furnished to the purchaser that the material was manufactured, sampled, tested, and inspected in accordance with this specification and has

been found to meet the requirements. When specified in the purchase order or contract, a report of the test results shall be furnished.

## 12. Product Marking

12.1 The name or trademark of the manufacturer shall be cast on each bar. The numerical designation of the alloy supplied shall be stamped or cast on each bar for identification.

## 13. Keywords

13.1 Babbitt metal; bar; bearing alloys; chemical composition; ingot; lead–tin–antimony alloys; physical properties; tin–antimony–copper alloys

## APPENDIX

### (Nonmandatory Information)

#### X1. PROPERTIES OF WHITE METAL BEARING ALLOYS

X1.1 The data in Table X1.1 do not constitute a part of this specification. They are given merely to indicate to the purchaser the physical properties of the various alloys specified which can be expected of carefully manufactured alloys of the formulas indicated, and to constitute a guide to the purchaser in selecting the grade best suited for meeting the service condition for which the babbitt metal is to be used. Alloys 1 to 8 were

prepared at the National Bureau of Standards from pure Banca tin, high grade “Star” antimony, and a commercially pure lead (99.94 % Pb), and the values given are the results of tests made in the Bureau laboratories. Data on alloy 15 and the liquidus temperature of alloy 1 have been added, based on work at other laboratories. All figures are subject to revision.

**TABLE X1.1 Composition and Physical Properties<sup>A</sup> of White Metal Bearing Alloys**

| Alloy Number <sup>B</sup> | Specified Nominal Composition of Alloys, % |          |           |        |         | Specific Gravity <sup>C</sup> | Composition of Alloys Tested, % |          |      |        | Yield Point, psi <sup>D</sup> (MPa) |               |
|---------------------------|--------------------------------------------|----------|-----------|--------|---------|-------------------------------|---------------------------------|----------|------|--------|-------------------------------------|---------------|
|                           | Tin                                        | Antimony | Lead      | Copper | Arsenic |                               | Tin                             | Antimony | Lead | Copper | 68°F (20°C)                         | 212°F (100°C) |
| 1                         | 91.0                                       | 4.5      |           | 4.5    |         | 7.34                          | 90.9                            | 4.52     | none | 4.56   | 4400 (30.3)                         | 2650 (18.3)   |
| 2                         | 89.0                                       | 7.5      |           | 3.5    |         | 7.39                          | 89.2                            | 7.4      | 0.03 | 3.1    | 6100 (42.0)                         | 3000 (20.6)   |
| 3                         | 84.0                                       | 8.0      |           | 8.0    |         | 7.46                          | 83.4                            | 8.2      | 0.03 | 8.3    | 6600 (45.5)                         | 3150 (21.7)   |
| 7                         | 10.0                                       | 15.0     | remainder |        | .45     | 9.73                          | 10.0                            | 14.5     | 75.0 | 0.11   | 3550 (24.5)                         | 1600 (11.0)   |
| 8                         | 5.0                                        | 15.0     | remainder |        | .45     | 10.04                         | 5.2                             | 14.9     | 79.4 | 0.14   | 3400 (23.4)                         | 1750 (12.1)   |
| 15                        | 1.0                                        | 16.0     | remainder |        | 1.0     | 10.05                         |                                 |          |      |        |                                     |               |

| Alloy Number <sup>B</sup> | Johnson's Apparent Elastic Limit, psi (MPa) <sup>E</sup> |               | Ultimate Strength in Compression <sup>F</sup> |               | Brinell Hardness <sup>G</sup> |               | Melting Point, ° F (°C) | Temperature of Complete Liquefaction, °F (°C) | Proper Pouring Temperature, ° F (°C) |
|---------------------------|----------------------------------------------------------|---------------|-----------------------------------------------|---------------|-------------------------------|---------------|-------------------------|-----------------------------------------------|--------------------------------------|
|                           | 68°F (20°C)                                              | 212°F (100°C) | 68°F (20°C)                                   | 212°F (100°C) | 68°F (20°C)                   | 212°F (100°C) |                         |                                               |                                      |
| 1                         | 2450 (16.9)                                              | 1050 (7.2)    | 12 850 (88.6)                                 | 6950 (47.9)   | 17.0                          | 8.0           | 433 (223)               | 700 (371)                                     | 825 (441)                            |
| 2                         | 3350 (23.1)                                              | 1100 (7.6)    | 14 900 (102.7)                                | 8700 (60.0)   | 24.5                          | 12.0          | 466 (241)               | 669 (354)                                     | 795 (424)                            |
| 3                         | 5350 (36.9)                                              | 1300 (9.0)    | 17 600 (121.3)                                | 9900 (68.3)   | 27.0                          | 14.5          | 464 (240)               | 792 (422)                                     | 915 (491)                            |
| 7                         | 2500 (17.2)                                              | 1350 (9.3)    | 15 650 (107.9)                                | 6150 (42.4)   | 22.5                          | 10.5          | 464 (240)               | 514 (268)                                     | 640 (338)                            |
| 8                         | 2650 (18.3)                                              | 1200 (8.3)    | 15 600 (107.6)                                | 6150 (42.4)   | 20.0                          | 9.5           | 459 (237)               | 522 (272)                                     | 645 (341)                            |
| 15                        |                                                          |               |                                               |               | 21.0                          | 13.0          | 479 (248)               | 538 (281)                                     | 662 (350)                            |

<sup>A</sup> The compression test specimens were cylinders 1.5 in. (38 mm) in length and 0.5 in. (13 mm) in diameter, machined from chill castings 2 in. (51 mm) in length and 0.75 in. (19 mm) in diameter. The Brinell tests were made on the bottom of parallel machined specimens cast in a mold 2 in. (51 mm) in diameter and 0.625 in. (16 mm) deep at room temperature.

<sup>B</sup> Data not available on Alloy Numbers 11 and 13.

<sup>C</sup> The specific gravity multiplied by 0.0361 equals the density in pounds per cubic inch.

<sup>D</sup> The values for yield point were taken from stress-strain curves at a deformation of 0.125 % of gage length.

<sup>E</sup> Johnson's apparent elastic limit is taken as the unit stress at the point where the slope of the tangent to the curve is  $\frac{2}{3}$  times its slope at the origin.

<sup>F</sup> The ultimate strength values were taken as the unit load necessary to produce a deformation of 25 % of the length of the specimen.

<sup>G</sup> These values are the average Brinell number of three impressions on each alloy using a 10-mm ball and a 500-kg load applied for 30 s.



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