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Standard Specification for Modern Pewter Alloys[1]

This standard is issued under the fixed designation B560; 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.

1. Scope

1.1 This specification covers three alloy types, made from tin, antimony, and copper, used in the fabrication of pewter articles by casting, spinning, drawing, or forming. The metal may be supplied in the form of bars, ingots, rolled sheet, and circles.

1.2 Pewter alloy shall be defined as having a composition within the range from 90 to 98 % tin, 1 to 8 % antimony, and 0.25 to 3 % copper. Compositions are given in Table 1.

1.3 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.

1.4 *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:*[2]

E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

E51 Method for Spectrographic Analysis of Tin Alloys by the Powder Technique (Withdrawn 1983)[3]

E57 Methods for Chemical Analysis of White Metal Bearing Alloys (Withdrawn 1986)[3]

E88 Practice for Sampling Nonferrous Metals and Alloys in Cast Form for Determination of Chemical Composition

3. Classification

3.1 The hardness and workability of pewter varies with the amount of antimony and copper alloyed with the tin. Casting alloys generally contain less copper and a slightly higher tin content than sheet alloys. The composition for castings (Type 1) and sheet (Type 2) are shown in Table 1 , but individual fabricators may choose compositions in the range given for each type. A special-purpose alloy (Type 3), high in tin, is used for articles requiring a softer metal. All types must conform to the impurity limits shown in Table 1.

3.2 The following applies to all specified limits in this standard: For purposes of determining conformance with these specifications an observed value or a calculated value shall be rounded "to the nearest unit" in the last right-hand place of figures used in expressing the limiting value, in accordance with the rounding method of Practice E29.

4. Ordering Information

4.1 Orders for material under this specification should include the following:

4.1.1 Quantity,

4.1.2 Form—bars, sheet, or circles,

4.1.3 Type and composition (Table 1),

4.1.4 Size (sheet—thickness, width and length; circles—thickness and diameter), and

4.1.5 Marking.

5. Materials and Manufacture

5.1 The manufacturer shall use care to have each shipment of each form as uniform in quality and composition as possible and of a commercially satisfactory appearance.

6. Chemical Composition

6.1 The material shall conform to the requirements as to chemical composition specified in Table 1. Nominal compositions, agreed upon by the manufacturer and purchaser, may be prescribed under this specification.

7. Dimensions, Mass, and Permissible Variations

7.1 Sheet pewter is commercially available in thicknesses from 0.031 to 0.064 ± 0.002 in. (0.79 to 1.63 mm) (Table 2). Thinner sheet down to a thickness of 0.010 in. (0.25 mm) can be supplied to special order. Sheet can be supplied in widths up to 2 ft (0.6 m) and lengths up to 4 ft (1.2 m).

[1] This specification is under the jurisdiction of ASTM Committee B02 on Nonferrous Metals and Alloys and is the direct responsibility of Subcommittee B02.02 on Refined Lead, Tin, Antimony, and Their Alloys.

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

[3] The last approved version of this historical standard is referenced on www.astm.org.

TABLE 1 Chemical Requirements

Element	Composition, -wt%		
	Type 1 Casting Alloy[A]	Type 2 Sheet Alloy[B]	Type 3 Special Purpose Alloys
UNS Number	L13911	L13912	L13963
Tin	90–93	90–93	95–98
Antimony	6–8	5–7.5	1.0–3.0
Copper	0.25–2.0	1.5–3.0	1.0–2.0
Lead, max	0.05	0.05	0.05
Arsenic, max	0.05	0.05	0.05
Iron, max	0.015	0.015	0.015
Zinc, max	0.005	0.005	0.005

[A] Nominal Type 1 alloy composition: 92 Sn, 7.5 Sb, and 0.5 Cu.
[B] Nominal Type 2 alloy composition: 91 Sn, 7 Sb, and 2 Cu.

7.2 Circles are available in diameters from 2 to 20 in. (50.8 to 508 mm) and in thicknesses from 0.031 to 0.064 ± 0.002 in. (Table 2).

7.3 Bars or ingots are nominally 5 lb (2.27 kg) in mass.

8. Workmanship, Finish, and Appearance

8.1 Surface defects in bars or ingots are of no importance. Surface defects in sheet pewter or circles may be a cause for rejection if the defects (pits or dents) cannot be removed to the total satisfaction of the purchaser by polishing. Rejection of an entire shipment should be made only if the surface defects are present on a substantial percentage of the shipment.

9. Sampling

9.1 Unless otherwise agreed upon by the manufacturer and the purchaser, heat (ladle) analyses furnished by the manufacturer shall be accepted as defining the composition of the material furnished.

9.2 If samples for check analyses are desired, they shall be so specified by the purchaser at the time of placement of the order.

9.3 Check analyses samples shall consist of three bars or ingots selected to represent a shipment of less than 1000 lb (454 kg) and five bars or ingots to represent a shipment of over 1000 lb (454 kg). The bars shall be selected at random, preferably under such conditions that every piece in the lot is accessible for selection (for example, while shipment is being loaded or unloaded). A saw cut shall be made entirely through the piece on its long axis and the saw chips collected. Sawings thoroughly mixed and split into three parts shall constitute the samples for chemical analysis (Practice E88).

9.4 For sheet, circles, and discs, a sample shall consist of clippings from not more than 2 % of the shipment. The minimum mass of sample shall be 250 g.

10. Chemical Analysis

10.1 In case of dispute, the chemical analysis shall be made in accordance with Methods E57 and E51.

11. Rejection and Rehearing

11.1 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.

12. Product Marking

12.1 At the option of the purchaser, the manufacturer's identifying mark shall be cast or stamped on each bar. The numerical designation of the type shall be either cast on each bar for identification or marked on the container. Sheet metal shall be marked on the container as to type, for identification purposes.

13. Keywords

13.1 bar; ingot; pewter; rolled sheet; tin–antimony–copper alloys

TABLE 2 Available Nominal Sizes and Mass of Pewter Metal Sheets

Gage	20	19	18	17	16	15	14
Thickness:							
in.	0.031	0.035	0.040	0.045	0.050	0.057	0.064
mm	0.79	0.89	1.02	1.14	1.27	1.45	1.63
Mass:							
oz/ft^2	19.0	22.0	25.0	28.1	31.3	35.9	40.6
kg/m^2	5.8	6.7	7.6	8.6	9.5	10.9	12.4

Circles														
Gage		20		19		18		17		16		15		14	
Diameter		Nominal Mass													
in.	mm	oz	g	oz	g	oz	g	oz	g	oz	g	oz	g	oz	g
2	5.1	0.33	8.5	0.40	11.3	0.50	14.2	0.60	17.0	0.66	18.7	0.75	21.2	0.80	22.7
3	7.6	1.00	28.4	1.10	31.2	1.25	35.4	1.40	39.7	1.50	42.5	1.75	49.6	2.00	56.7
4	10.2	1.75	49.6	2.00	56.7	2.25	64.2	2.50	74.9	2.88	81.7	3.20	90.7	3.67	104
5	12.7	2.67	75.7	3.00	85.1	3.50	99.2	4.00	113	4.33	123	5.00	142	5.67	161
6	15.2	3.67	104	4.20	119	4.75	135	5.33	151	6.00	170	6.80	193	7.75	220
7	17.8	5.13	144	6.00	170	6.75	191	7.60	216	8.50	241	9.67	274	11.00	312
8	20.3	6.67	189	7.75	220	8.75	248	9.88	280	11.00	312	12.50	354	14.25	404
9	22.9	8.50	241	10.00	284	11.25	319	12.67	359	14.00	397	16.13	457	18.25	515
10	25.4	10.25	291	11.88	337	13.50	383	15.13	429	16.88	479	19.33	479	22.00	624
11	28.0	12.50	354	14.50	411	16.50	468	18.50	525	20.67	586	23.67	671	26.88	762
12	30.5	15.00	425	17.25	489	19.67	558	22.00	624	24.50	695	28.13	797	31.88	904
13	33.0	17.50	496	20.25	574	23.00	652	25.88	734	28.75	815	33.00	936	37.33	1068
14	35.6	20.33	576	23.50	666	26.75	758	30.00	851	33.50	950	38.33	1087	43.50	1233
15	38.1	23.33	661	27.00	766	30.75	872	34.50	978	38.50	1091	44.13	1251	50.00	1418
16	40.6	26.67	756	30.88	886	35.00	992	39.33	1115	43.75	1240	50.20	1424	56.88	1613
17	43.2	29.88	847	34.50	978	39.25	1113	44.13	1261	49.00	1389	56.30	1596	63.75	1807
18	45.7	33.67	955	39.00	1106	44.25	1255	49.75	1410	55.33	1569	63.50	1801	72.00	2041
19	48.3	37.40	1060	43.33	1228	49.25	1396	55.40	1571	61.50	1743	70.67	2003	80.00	2268
20	50.8	41.50	1177	48.00	1361	54.50	1545	61.33	1739	68.13	1931	78.25	2218	88.50	2509

APPENDIX

(Nonmandatory Information)

X1. ADDITIONAL INFORMATION

X1.1 Modern pewter can be fabricated into decorative and utilitarian articles. Articles made from modern pewter have a surface finish which very slowly tarnishes or discolors in the atmosphere. Washing at intervals in soapy water, rinsing, and immediately drying thoroughly removes surface grime and renovates the appearance. Many pewter articles are designed to dispense foods and beverages (mugs, tumblers, vegetable dishes, water pitchers, etc.) and metal meeting this specification is mandatory for these uses.

Pewter in the cast condition is harder than in any other form. Rolling the cast metal alters the crystal structure and the rolled sheet may be half as hard (see values below) as the cast metal, but this is an advantage for spinning and forming. Typical properties of an alloy containing 91 tin, 7 antimony, and 2 copper are:

Density	0.263 $lb/in.^3$ (7.3 mg/m^3)
Liquidus	563°F (295°C)
Solidus	471°F (244°C)
Casting temperature range	600–625°F (316–324°C)
Hardness (HB):	
As cast	23
Cold-rolled sheet	13
Annealed sheet	18
Tensile strength, psi (MPa):	
Chill cast	9800 (67.6)
Cold-rolled sheet	7600 (52.4)
Annealed sheet	8600 (59.3)