



Standard Specification for Lead- and Tin-Alloy Die Castings¹

This standard is issued under the fixed designation B 102; 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 die castings produced from five alloys whose primary metal is either lead or tin. **Table 1** lists the designations for these alloys as well as their chemical compositions.

1.2 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the 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 The following documents of the issue in effect on date of order acceptance form a part of this specification to the extent referenced herein.

2.2 ASTM Standards:²

B 23 Specification for White Metal Bearing Alloys (Known Commercially as “Babbitt Metal”)

B 275 Practice for Codification of Certain Nonferrous Metals and Alloys, Cast and Wrought

E 8 Test Methods for Tension Testing of Metallic Materials

E 23 Test Methods for Notched Bar Impact Testing of Metallic Materials

E 29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

E 46 Test Methods for Chemical Analysis of Lead- and Tin-Base Solder³

E 88 Practice for Sampling Nonferrous Metals and Alloys in Cast Form for Determination of Chemical Composition

2.3 *Federal Standards:*⁴

Fed. Std. No. 123 Marking for Shipment (Civil Agencies)

2.4 *Military Standards:*⁴

MIL-STD-129 Marking for Shipment and Storage (Military Agencies)

MIL-P-116 Methods of Preservation

3. Terminology

3.1 Definitions:

3.1.1 *die casting, n*—a metal object produced by the introduction of molten metal under substantial pressure into a metal die and characterized by a high degree of fidelity to the die cavity.

4. Ordering Information

4.1 Orders for die castings shall include the following basic information:

4.1.1 This specification number and date,

4.1.2 Quantity and delivery schedule, as required,

4.1.3 Part name and number,

4.1.4 Alloy (**Table 1**), and

4.1.5 Drawings of die casting, when required, giving all necessary dimensions and showing latest revisions and allowances for machining, if any. Location of ejector pin marks or parting lines shall be at the option of the producer, unless specifically designated on the drawing.

4.2 Additional tests, options and special inspection requirements as provided below shall be specified in the contract or purchase order, as additional procedures. Extended delivery time may be involved.

4.2.1 Chemical analysis (**9.1.1**),

4.2.2 Quality assurance (**Section 9**),

4.2.3 Special proof tests or mechanical properties (**Section 7**),

³ Withdrawn.

⁴ Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098.

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.

Current edition approved Nov. 1, 2005. Published November 2005. Originally approved in 1936. Last previous edition approved in 2000 as B 102 - 00

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.

TABLE 1 Chemical Requirements^A

Alloy ^{B,C}	Composition, %															
	Tin			Antimony			Lead			Copper			Other Elements, max			
	Min	Desired	Max	Min	Desired	Max	Min	Desired	Max	Min	Desired	Max	Iron	Arsenic	Zinc	Aluminum
CY44A ^D	90	91	92	4	4.5	5	...	...	0.35	4	4.5	5	0.08	0.08	0.01	0.01
YC135A	80	82	84	12	13	14	...	...	0.35	4	5	6	0.08	0.08	0.01	0.01
PY1815A ^D	64	65	66	14	15	16	17	18	19	1.5	2	2.5	0.08	0.15	0.01	0.01
YT155A ^D	4	5	6	14	15	16	79	80	81	...	...	0.50	...	0.15	0.01	0.01
Y10A ^D	...	...	...	9.25	10	10.75	89	90	91	...	...	0.50	...	0.15	0.01	

^A For purposes of acceptance and rejection, the observed value or calculated value obtained from analysis should be rounded off to the nearest unit in the last right-hand place of figures, used in expressing the specified limit, in accordance with the rounding procedure prescribed in Section 3 of Recommended Practice E 29.

^B These alloy designations were established in accordance with Recommended Practice B 275.

^C Prior to 1952 these alloys were designated as No. 1, No. 2, No.3, No. 4, and No. 5, respectively.

^D These alloys are similar to grades Nos.1, 5, 8 and 12, respectively, of Specification B 23.

4.2.4 General quality options for internal soundness or for finish (Section 11),

4.2.5 Source inspection (Section 11),

4.2.6 Certification (Section 12),

4.2.7 Marking for identification (Section 13), and

4.2.8 Special packaging (Section 14).

5. Quality Assurance

5.1 *Responsibility for Inspection*—When specified in the contract or purchase order, the producer or supplier is responsible for the performance of all inspection and test requirements specified herein. Except as otherwise specified in the contract or order, the producer or supplier may use his own or any other suitable facilities for the performance of the inspection and test requirements specified herein, unless disapproved by the purchaser. The purchaser shall have the right to perform any of the inspections and tests set forth in this specification. Quality assurance standards shall be agreed upon between the producer or supplier and purchaser at the time a contract or order is placed.

5.2 *Lot Definition*— An inspection lot shall be defined as follows:

5.2.1 An inspection lot shall consist of the production from each die or compound die on each machine for each 24 h during the first week of normal operation and the production for each 48 h thereafter of normal operation. Any significant change in the machine, composition, die or continuity of operation shall be considered as the start of a new lot. Die castings inspected by this method shall be so marked or handled during the finishing operations as not to lose their identity.

5.2.2 Each die casting of a randomly selected sample shall be examined to determine conformance to the requirements with respect to general quality, dimensions, and identification marking. The producer or supplier may use a system of statistical quality control for such examinations.

6. Mechanical Properties and Tests

6.1 Unless specified in the contract or purchase order or specifically guaranteed by the manufacturer, acceptance of die castings under this specification shall not depend on mechanical properties determined by tension or impact tests. The appendix contains a reference to a source of information on properties. When tension or impact tests are made, the tension

test specimen shown in Fig. 18 of Test Methods E 8, and the impact test specimen shown in Fig. 6 of Test Method E 23 shall be used.

6.2 When specified in the contract or purchase order, die castings shall withstand proof tests without failure as defined by agreement between the purchaser and the producer or supplier.

7. Permissible Variations in Dimensions

7.1 Permissible variations in dimensions shall be within the limits specified on the drawings or in the contract or purchase order.

7.2 Dimensional tolerance deviations waived by the purchaser shall be confirmed in writing to the producer or supplier.

8. General Quality

8.1 *Internal Soundness*—When specified, the soundness of die castings shall conform to standards or requirements agreed upon between the producer or supplier and the purchaser. The number and extent of imperfections shall not exceed those specified by the purchaser. The standards or requirements may consist of radiographs, photographs, or sectioned die castings.

8.2 Imperfections inherent in die castings shall not be cause for rejection provided it is demonstrated that the die castings are in accordance with the requirements and standards agreed upon.

8.3 *Workmanship*— Die castings shall be of uniform quality free of injurious discontinuities that will adversely affect their serviceability.

8.4 *Finish*—When specified in the contract or purchase order the as-cast surface finish required shall conform to standards agreed upon between the purchaser and the producer or supplier.

8.5 *Pressure Tightness*—When specified in the contract or purchase order the pressure tightness of die castings shall conform to standards agreed upon between the purchaser and the producer or supplier.

9. Chemical Requirements

9.1 *Limits*—The die casting shall conform to the requirements as to chemical composition prescribed in Table 1. Conformance shall be determined by the producer by analyzing samples taken at the time castings are made. If the producer has determined the chemical composition of the metal during the

course of manufacture, he shall not be required to sample and analyze the finished product.

9.1.1 When a detailed chemical analysis is required with a shipment, it shall be called for in the contract or purchase order.

9.1.2 If the producer's or supplier's method of composition control is acceptable, sampling for chemical analysis may be waived at the discretion of the purchaser.

9.2 *Number of Samples*—When required, samples for determination of chemical composition shall be taken to represent the following:

9.2.1 A sample shall be taken from each of two representative castings selected from each lot defined in 5.2.1.

9.3 *Methods of Sampling*—Samples from die castings for determination of chemical composition shall be taken in accordance with one of the following methods:

9.3.1 Samples for chemical analysis shall be taken from the material by drilling, sawing, milling, turning, or clipping a representative piece or pieces to obtain a weight of prepared sample not less than 75 g. Sampling shall be in accordance with Practice E 88.

9.3.2 By agreement, an appropriate spectrographic sample may be prepared at time of manufacture.

9.3.3 The method of sampling cast products for spectrochemical and other methods of analysis shall be suitable for the form of material being analyzed and the type of analytical method used.

9.4 *Method of Analysis*—The determination of chemical composition shall be made in accordance with suitable chemical (Test Methods E 46), spectrochemical, or other methods as agreed upon between buyer and seller. In case of dispute, the results secured by Test Methods E 46 shall be the basis of acceptance.

10. Rejection and Retest

10.1 When one or more samples, depending on the approved sampling plan, fail to meet the requirements of this specification, the represented lot is subject to rejection except as otherwise provided in 10.2.

10.2 Lots rejected for failure to meet the requirements of this specification may be resubmitted for test provided:

10.2.1 The producer has removed the nonconforming material or the producer has reworked the rejected lot as necessary to correct the deficiencies.

10.3 Individual castings that show injurious imperfections during subsequent manufacturing operations may be rejected. The producer or supplier shall be responsible only for replacement of the rejected castings to the purchaser. As much of the rejected original material as possible shall be returned to the producer or supplier.

11. Source Inspection

11.1 If the purchaser desires that his representative inspect or witness the inspection and testing of the product prior to shipment, such agreement shall be made by the purchaser and producer or supplier as part of the contract or purchase order.

11.2 When such inspection or witness of inspection and testing is agreed upon, the producer or supplier shall afford the purchaser's representative all reasonable facilities to satisfy him that the product meets the requirements of this specification. Inspection and tests shall be conducted so there is no unnecessary interference with the producer's operations.

12. Certification

12.1 The producer or supplier shall, when called for in the contract or purchase order, furnish to the purchaser a certificate of inspection stating that each lot has been sampled, tested, and inspected in accordance with this specification, and has been found to meet the requirements specified.

13. Identification Marking

13.1 When specified in the contract or purchase order, all castings shall be properly marked for identification with the part number, name or brand of the producer, as agreed upon.

14. Preparation for Delivery

14.1 *Packaging*—Unless otherwise specified, the die castings shall be packaged to provide adequate protection during normal handling and transportation. Each package shall contain only one type of item unless otherwise agreed upon. The type of packaging and gross weight of containers shall, unless otherwise agreed upon, be at the producer's discretion, provided they are such as to ensure acceptance by common or other carriers for safe transportation at the lowest rate to the delivery point.

14.2 *Marking*—Each shipping container shall be legibly marked with the purchase order number, gross and net weights, and the supplier's name or trademark. When required, marking for shipment shall be in accordance with Fed. Std. No. 123 for civil agencies and MIL-STD-129 for Military agencies.

14.3 *Preservation*—Material intended for prolonged storage in unheated locations shall be adequately packed and protected to avoid deterioration and damage. When specified in the contract or purchase order, material shall be preserved, packaged, and packed in accordance with the requirements of MIL-P-116. The applicable levels shall be as specified in the contract or order.

15. Keywords

15.1 antimony alloys; die castings; hot chamber die castings; lead alloys; lead-tin-antimony alloys; pressure die castings; tin alloys

APPENDIX

(Nonmandatory Information)

X1. MECHANICAL PROPERTIES

X1.1 Tension test data do not constitute a part of this specification but mechanical properties for most of these alloys can be found.⁵ This data indicates to the purchaser the mechanical properties that may be expected of these alloys. In the tension testing of die-cast lead- and tin-alloy specimens, the

rate of strain shall be 1/8 in./in.-min measured on the gage length of the specimen. It is to be understood that there may not be exact conformity between the properties of the specimens tested and of commercial die castings. Other information on these die castings will be found in a paper by F. J. Tobias.⁶

⁵ *Proceedings*, Am. Soc. Testing Mats., ASTEA, Vol 39, 1939, p. 283; Vol 46, 1946, p. 233.

⁶ Tobias, F. J., "Lead and Tin Alloys for Die Castings," *Proceedings*, Am. Soc. Testing Mats., ASTEA, Vol 31, Part I, 1931, p. 280.

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