



Designation: B 85 - 84

Standard Specification for ALUMINUM-ALLOY DIE CASTINGS¹

This standard is issued under the fixed designation B 85; 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 specification has been approved for use by agencies of the Department of Defense and for listing in the DoD Index of Specifications and Standards.

1. Scope

1.1 This specification covers aluminum-alloy die castings. Ten alloy compositions are specified, designated as shown in Table 1.

1.2 The values stated in inch-pound units are the standard. The SI values in parentheses are for information only.

2. Applicable 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:*

B 179 Specification for Aluminum Alloys in Ingot Form for Sand Castings, Permanent Mold Castings, and Die Castings²

B 275 Practice for Codification of Certain Nonferrous Metals and Alloys, Cast and Wrought³

E 8 Methods of Tension Testing of Metallic Materials³

E 23 Methods for Notched-Bar Impact Testing of Metallic Materials³

E 29 Recommended Practice for Indicating Which Places of Figures Are to Be Considered Significant in Specified Limiting Values⁴

E 34 Methods for Chemical Analysis of Aluminum and Aluminum Alloys⁵

E 88 Practice for Sampling Nonferrous Metals and Alloys in Cast Form for Determination of Chemical Composition⁶

E 101 Method for Spectrographic Analysis of Aluminum and Aluminum Alloys by the Point-to-Plane Technique⁶

E 227 Method for Spectrometric Analysis of

Aluminum and Aluminum Alloys by the Point-to-Plane Technique, Optical Emission Spectrometric⁶

E 505 Reference Radiographs for Inspection of Aluminum and Magnesium Die Castings⁷

E 527 Practice for Numbering Metals and Alloys (UNS)⁸

2.3 *American National Standards Institute:*
H35.1 Alloy and Temper Designation Systems for Aluminum²

2.4 *American Die Casting Institute:*
"E" Series Product Standards for Die Castings²

2.5 *Federal Standards:*
Fed. Std. No. 123 Marking for Shipment (Civil Agencies)⁸

Fed. Std. No. 184 Identification Marking of Aluminum, Magnesium and Titanium⁸

2.6 *Military Standards:*
MIL-STD-129 Marking for Shipment and Storage (Military Agencies)⁸

MIL-STD-649 Preparation for Storage and Shipment of Aluminum and Magnesium Products⁸

¹ This specification is under the jurisdiction of ASTM Committee B-6 on Die-Cast Metals and Alloys, and is the direct responsibility of Subcommittee B06.01 on Aluminum Die Castings.

Current edition approved March 30, 1984. Published May 1984. Originally published as B 85 - 31 T. Last previous edition B 85 - 82a.

² *Annual Book of ASTM Standards*, Vol 02.02.

³ *Annual Book of ASTM Standards*, Vol 03.01.

⁴ *Annual Book of ASTM Standards*, Vol 14.02.

⁵ *Annual Book of ASTM Standards*, Vol 03.05.

⁶ *Annual Book of ASTM Standards*, Vol 03.06.

⁷ *Annual Book of ASTM Standards*, Vol 03.03.

⁸ Available from Naval Publications and Forms Center, 5801 Tabor Ave., Philadelphia, Pa. 19120.



3. Definitions

3.1 *die casting*—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 Drawing 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 should be justified only on the basis of need. These shall be specified in the contract or purchase order, as additional procedures and extended delivery time may be involved.

- 4.2.1 Chemical analysis (7.1.1),
- 4.2.2 Quality assurance (Section 6),
- 4.2.3 Special proof tests or mechanical properties (Section 8),
- 4.2.4 General quality options for internal soundness or for finish (Section 10),
- 4.2.5 Source inspection (Section 11),
- 4.2.6 Certification (Section 12),
- 4.2.7 Marking for identification (Section 14), and
- 4.2.8 Special packaging (Section 15).

5. Materials

5.1 The aluminum alloys used for the manufacture of die castings shall be such that the die castings produced will conform to the chemical composition requirements of this specification.

6. Quality Assurance

6.1 *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.

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

6.2.1 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.

6.2.2 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.

7. Chemical Requirements

7.1 *Limits*—The die castings 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.

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

7.1.2 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.

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

7.2.1 A sample shall be taken from each of



two representative castings selected from each lot defined in 6.2.1.

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

7.3.1 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.

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

7.3.3 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.

7.4 Method of Analysis—The determination of chemical composition shall be made in accordance with suitable chemical (Methods E 34), spectrochemical (Method E 101 or E 227), or other methods. In case of dispute, the results secured by Methods E 34 shall be the basis of acceptance.

8. Mechanical Properties and Tests

8.1 Unless specified in the contract or purchase order or specifically guaranteed by the manufacturer, acceptance of die castings under these specifications shall not depend on mechanical properties determined by tension or impact tests. Table X1.1 shows typical mechanical properties. When tension or impact tests are made, the tension test specimen shown in Fig. 18 of Methods E 8 and the impact test specimen shown in Fig. 6 of Methods E 23 shall be used.

8.2 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.

9. Permissible Variations in Dimensions

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

9.1.1 Any dimensions for which a tolerance is not specified shall be in accordance with ADCI Product Standard Series E 1 to E 16

inclusive.

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

10. General Quality

10.1 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 in accordance with Method E 505, photographs or sectioned die castings.

10.2 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.

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

10.4 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, or as prescribed in ADCI Product Standard E 18.

10.5 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, or as prescribed in ADCI Product Standard E 17.

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. Rejection and Retest

13.1 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 13.2.

13.2 Lots rejected for failure to meet the requirements of this specification may be re-submitted for test provided:

13.2.1 The producer has removed the non-conforming material or the producer has re-worked the rejected lot as necessary to correct the deficiencies.

13.3 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.

14. Identification Marking

14.1 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. Government applications shall be marked in accordance with Fed. Std. No. 184.

15. Preparation for Delivery

15.1 *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.

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

15.3 *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-STD-649. The applicable levels shall be as specified in the contract or order.

16. Characteristics of Die Casting Alloys

16.1 Table X1.1 shows certain casting and other outstanding characteristics which are usually considered in selecting a die-casting alloy for a specific application. The characteristics are rated from (1) to (5), (1) being the best and (5) being the least desirable alloy. In applying these ratings, it should be noted that all the alloys have sufficiently good characteristics to be accepted by users and producers of die castings. Hence a rating of (5) indicates a commercial alloy, although in certain cases its application may be limited or its manufacture may be restricted to relatively simple castings.