



Standard Specification for Zinc and Zinc-Aluminum (ZA) Alloys in Ingot Form for Foundry and Die Castings¹

This standard is issued under the fixed designation B240; 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 commercial zinc and zinc-aluminum (ZA) alloys in ingot form for remelting for the manufacture of pressure die castings, foundry castings and continuous cast bar stock as designated and specified in **Table 1**. Seven alloy compositions are specified, designated as follows:

Common	Traditional	ASTM ^A	UNS ^A
Alloy 3	Zamak 3	AG 40A	Z33524
Alloy 7	Zamak 7	AG 40B	Z33526
Alloy 5	Zamak 5	AC 41A	Z35532
Alloy 2	Zamak 2	AC 43A	Z35544
ZA-8	ZA-8	...	Z35637
ZA-12	ZA-12	...	Z35632
ZA-27	ZA-27	...	Z35842

^A See **Table 1**, footnote B.

1.2 Zinc alloys Z33524, Z33526, Z35532, and Z35544 are used primarily for remelting in the manufacture of pressure die castings. Zinc-aluminum alloys Z35637, Z35632, and Z35842 are used for remelting in the manufacture of both foundry and pressure die castings. Castings made from these ingots are specified in Specification **B86**, Standard Specification for Zinc and Zinc-Aluminum Alloys for Foundry and Die Castings.

1.3 The values stated in inch-pound units are to be regarded as standard. No other units of measurement are included in this standard.

1.4 Systems of nomenclature used to designate zinc and zinc-aluminum (ZA) alloys used for casting are described in **Appendix X1**.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the*

¹ This specification is under the jurisdiction of ASTM Committee **B02** on Nonferrous Metals and Alloys and is the direct responsibility of Subcommittee **B02.04** on Zinc and Cadmium.

Current edition approved Feb. 1, 2013. Published March 2013. Originally approved in 1949. Last previous edition approved in 2010 as B240 – 10. DOI: 10.1520/B0240-13.

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

- B86** Specification for Zinc and Zinc-Aluminum (ZA) Alloy Foundry and Die Castings
- B275** Practice for Codification of Certain Nonferrous Metals and Alloys, Cast and Wrought
- B897** Specification for Configuration of Zinc and Zinc Alloy Jumbo Block and Half Block Ingot
- B899** Terminology Relating to Non-ferrous Metals and Alloys
- B908** Practice for the Use of Color Codes for Zinc Casting Alloy Ingot
- B949** Specification for General Requirements for Zinc and Zinc Alloy Products
- E29** Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
- E527** Practice for Numbering Metals and Alloys in the Unified Numbering System (UNS)
- E536** Test Methods for Chemical Analysis of Zinc and Zinc Alloys

2.3 Other ASTM Document:

- Methods for Emission Spectrochemical Analysis³**

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 *Methods for Emission Spectrochemical Analysis: General Practices, Nomenclature, Standard Methods, Proposed Methods, Suggested Methods*, ASTM International, 1982.

***A Summary of Changes section appears at the end of this standard**

TABLE 1 Chemical and North American Color Code Requirements

	Alloy 3 ^{A,B,C,D}	Alloy 7 ^{A,B,C,D}	Alloy 5 ^{A,B,C,D}	Alloy 2 ^{A,B,C,D}	ZA-8 ^{B,C,E}	ZA-12 ^{B,C,E}	ZA-27 ^{B,C,E}
	Zamak 3 (AG40A) (Z33524)	Zamak 7 (AG40B) (Z33526)	Zamak 5 (AC41A) (Z35532)	Zamak 2 (AC43A) (Z35544)	ZA-8 (Z35637)	ZA-12 (Z35632)	ZA-27 (Z35842)
Color Code ^F	None	Brown	Black	Green	Blue	Orange	Purple
Element							
Aluminum	3.9-4.3	3.9-4.3	3.9-4.3	3.9-4.3	8.2-8.8	10.8-11.5	25.5-28.0
Magnesium	0.03-0.06	0.010-0.020	0.03-0.06	0.025-0.05	0.02-0.03	0.02-0.03	0.012-0.020
Copper	0.10 max	0.10 max	0.7-1.1	2.7-3.3	0.9-1.3	0.5-1.2	2.0-2.5
Iron, Max	0.035	0.035	0.035	0.035	0.035	0.05	0.07
Lead, Max	0.0040	0.0030	0.0040	0.0040	0.005	0.005	0.005
Cadmium, Max	0.0030	0.0020	0.0030	0.0030	0.005	0.005	0.005
Tin, Max	0.0015	0.0010	0.0015	0.0015	0.002	0.002	0.002
Nickel	---	0.005-0.020	---	---	---	---	---
Zinc ^G	Remainder	Remainder	Remainder	Remainder	Remainder	Remainder	Remainder

^A Zinc alloy ingot for die casting may contain nickel, chromium, silicon, and manganese in amounts of up to 0.02, 0.02, 0.035 and 0.05 %, respectively. No harmful effects have ever been noted due to the presence of these elements in up to these concentrations and, therefore, analyses are not required for these elements, except that nickel analysis is required for Z33526.

^B ASTM alloy designations were established in accordance with Practice B275. UNS assignments were established in accordance with Practice E527. The last digit of a UNS number differentiates between alloys of similar composition. UNS designations for ingot and casting versions of an alloy were not assigned in the same sequence for all alloys.

^C For purposes of acceptance and rejection, the observed value or calculated value obtained from analysis should be rounded 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 Practice E29.

^D When this material is required to conform to ISO Standard 301, the chemical limits for thallium and indium each shall not exceed 0.001 %.

^E Zinc-aluminum ingot for foundry and pressure die casting may contain nickel, chromium, and manganese in amounts of up to 0.01 % each or 0.03 % total. No harmful effects have ever been noted due to the presence of these elements in up to these concentrations and, therefore, analyses are not required for these elements.

^F Refer to Practice B908. (Note: Colors indicated are for North American applications.)

^G Determined arithmetically by difference.

2.4 ISO Standards:⁴

ISO 301 Zinc Alloy Ingots Intended for Casting

ISO 3815-1 Zinc and zinc alloys — Part 1: Analysis of solid samples by optical emission spectrometry.

ISO 3815-2 Zinc and zinc alloys — Part 2: Analysis by inductively coupled plasma optical emission spectrometry.

3. Terminology

3.1 Terms shall be defined in accordance with Terminology B899.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *continuous casting, n*—a casting technique in which a cast is continuously withdrawn through the bottom of the mold as it solidifies, so that its length is not determined by mold dimensions; used chiefly to produce semifinished mill products such as billets, blooms, ingots, slabs and tubes; also known as concast.

3.2.2 *die casting, n*—a casting process in which molten metal is injected under high velocity and pressure into a metal die and solidified, also a product produced by such a process. Alternately known as pressure die casting.

4. Ordering Information

4.1 Orders for ingot under this specification shall include information as specified in Specification B949, Section 4.

5. Materials and Manufacturer

5.1 The material covered by this specification shall be of uniform quality and reasonably free from dross, adhering foreign matter, and surface oxide.

⁴ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

6. Chemical Requirements

6.1 The ingots shall conform to the requirements as to chemical composition prescribed in Table 1. Conformance shall be determined in accordance with Specification B949, Sections 5.2 and 5.2.1.

7. Ingot Sizes and Shapes

7.1 Zinc casting alloy ingots are typically supplied in ingot bundles weighing 1700 to 2400 lb.

7.2 Ingots and bundles vary in size and weight depending on the alloy and supplier.

7.2.1 Standard ingots have a nominal weight in the range of 17 to 24 lb. and are generally 24 to 26 in. long.

7.2.2 Margash bars or ingots come in two sizes with a nominal weight in the range of either 12 to 14 lb. or 20 to 24 lb.

7.3 Zinc casting alloy ingot may be ordered in jumbos or blocks, as specified in Specification B897.

7.4 Zinc casting alloy ingot may also be ordered in other shapes.

8. Sampling for Determination of Chemical Composition

8.1 Sampling procedures shall be in accordance with appropriate provisions of Specification B949, Section 6.

9. Methods for Chemical Analysis

9.1 The determination of chemical composition shall be made in accordance with Specification B949, Section 5.2.2.

9.2 In case of dispute, the results secured by an approved method (or combination of approved methods), or by a method agreed upon by both parties, shall be the basis of acceptance.

9.2.1 Approved methods include: Test Methods E536, ISO 3815–1, or ISO 3815–2.

NOTE 1—Test Methods E536 is directly applicable, in an unmodified form, only to alloys 3, 5 and 7. ISO 3815–1 and ISO 3815–2 are generic methods applied to zinc and zinc alloys. Each of the methods may be modified and formatted for the alloy to be assayed. An experienced chemist, using suitable and/or traceable standards along with valid quality assurance techniques, will be able to perform and validate the methods and demonstrate acceptable precision and accuracy.

9.3 For purposes of determining compliance with specified composition limits as given in Table 1, an observed or calculated value shall be rounded to the nearest unit in the last right-hand place of figures shown in Table 1, in accordance with the rounding method of Practice E29.

10. Source Inspection

10.1 Source inspection provisions shall be in accordance with Specification B949, Section 7.

11. Rejection and Rehearing

11.1 Claims for rejection and rehearing shall be in accordance with Specification B949, Section 8.

12. Identification Marking

12.1 All ingots shall be properly marked for identification in accordance with Specification B949, Section 10.

13. Certification

13.1 When specified in the purchase order or contract, certification of the product shall be in accordance with Specification B949, Section 9.

14. Preparation for Delivery

14.1 *Packaging*—Unless otherwise specified, the ingot shall be packaged to provide adequate protection during normal handling and transportation. Each package shall contain only one alloy unless otherwise agreed upon.

15. Keywords

15.1 bar stock; castings; concast; continuous cast bar stock; die castings; foundry castings; permanent mold castings; pressure die castings; prototyping; sand castings; ZA alloys; Zamak; zinc; zinc-aluminum alloys; zinc metal

APPENDIX

(Nonmandatory Information)

X1. NOMENCLATURE SYSTEMS FOR ZINC AND ZINC-ALUMINUM (ZA) ALLOYS

X1.1 The information in this appendix does not constitute a part of this specification but is provided for informational purposes only. The nomenclature covers commercial zinc and zinc-aluminum (ZA) alloys in ingot form for remelting for the manufacture of pressure die castings and foundry castings, as designated and specified in Table 1.

X1.2 Several different systems of nomenclature have evolved over the years to designate the zinc alloys used for casting, as listed in Table X1.1.

X1.2.1 Common names refer to the long established zinc casting alloys by number based their sequential development preceded by the word Alloy. Zinc-aluminum alloys (with a higher aluminum content than the conventional zinc die casting alloys) use the prefix ZA followed by their approximate aluminum content. These terms are in common usage.

X1.2.2 Traditional names for the long established zinc casting alloys use the prefix ZAMAK which was devised based

on the major elements present: zinc, aluminum, magnesium and copper (copper). Zinc-aluminum alloys use the prefix ZA followed by their approximate aluminum content. These terms are in common usage.

X1.2.3 ASTM designations are established in Practice B275 based on alloy chemistry. The first letter, A, refers to the principal alloying element, aluminum. The second letter, G (magnesium) or C (copper), refers to the second most significant alloying element. The first number, 4, refers to the nominal aluminum content. The second number refers to the nominal content to the second most significant alloying element. The last letter, A or B, differentiates between alloys of similar composition. Prior to the adoption of this designation system by ASTM, alloys were identified by Roman numerals, for example, XXI, XXIII and XV designated AC43A, AG40A and AC41A, respectively.

X1.2.4 UNS numbers are established in Practice E527 (SAE J1086) as part of a Unified Numbering System to provide a unique designation for each metal grade and alloy in use worldwide. Zinc alloys start with the prefix “Z” followed by five numbers. The first digit is based on the major alloying element, the second digit provides a further sub-classification based on secondary and tertiary alloying elements, the third digit designates the nominal composition of the of the major alloying element, the fourth digit designates the nominal concentration of the second most important alloying element, and the fifth digit allows a unique number to be established to differentiate between similar compositions.

TABLE X1.1 Nomenclature Systems for Zinc and Zinc-Aluminum (ZA) Alloys

Common	Traditional	ASTM	UNS
Alloy 3	Zamak 3	AG 40A	Z33524
Alloy 7	Zamak 7	AG 40B	Z33526
Alloy 5	Zamak 5	AC 41A	Z35532
Alloy 2	Zamak 2	AC 43A	Z35544
ZA-8	ZA-8	...	Z35637
ZA-12	ZA-12	...	Z35632
ZA-27	ZA-27	...	Z35842

SUMMARY OF CHANGES

Committee B02 has identified the location of selected changes to this standard since the last issue (B240 – 10) that may impact the use of this standard. (Approved February 1, 2013.)

(1) UNS numbers were added.

ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.

This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org). Permission rights to photocopy the standard may also be secured from the ASTM website (www.astm.org/COPYRIGHT/).