Designation: B240 – 21

Standard Specification for Zinc and Zinc-Aluminum (ZA) Alloys in Ingot Form for Foundry and Die Castings[1]

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 U.S. 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
ACuZinc5[2]	ACuZinc5	...	Z46540

[A] See Table 1, footnote B.

1.2 Zinc alloys Z33524, Z33526, Z35532, Z46540, 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 responsibility of the user of this standard to become familiar with all hazards including those identified in the appropriate Safety Data Sheet (SDS) for this product/material as provided by the manufacturer, to establish appropriate safety, health, and environmental practices, and determine the applicability of regulatory limitations prior to use.*

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 The following documents of the issue in effect on data of order acceptance form a part of this specification to the extent referenced herein:

2.2 *ASTM Standards:*[3]

B86 Specification for Zinc and Zinc-Aluminum (ZA) Alloy Foundry and Die Castings

B275 Practice for Codification of Certain Zinc, Tin and Lead Die Castings (Withdrawn 2020)[4]

B897 Specification for Configuration of Zinc and Zinc Alloy Jumbo, Block, Half Block, and Slab 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)

[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.

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[2] ACuZinc and ACuZinc5 are registered trade names of the General Motors Corporation.

[3] 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.

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

***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,G] Zamak 3 (AG40A) (Z33524)	Alloy 7[A,B,C,D,G] Zamak 7 (AG40B) (Z33526)	Alloy 5[A,B,C,D,G] Zamak 5 (AC41A) (Z35532)	Alloy 2[A,B,C,D,G] Zamak 2 (AC43A) (Z35544)	ZA-8[B,C,E,G] ZA-8 (Z35637)	ZA-12[B,C,E,G] ZA-12 (Z35632)	ZA-27[B,C,E,G] ZA-27 (Z35842)	ACuZinc5[B,C,G] ACuZinc5 (Z46540)
Color Code[F]	None	Brown	Black	Green	Blue	Orange	Purple	Red
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	2.8-3.3
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	0.035-0.050
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	5.2-6.0
Iron, Max	0.035	0.035	0.035	0.035	0.035	0.05	0.07	0.05
Lead, Max	0.0040	0.0030	0.0040	0.0040	0.005	0.005	0.005	0.004
Cadmium, Max	0.0030	0.0020	0.0030	0.0030	0.005	0.005	0.005	0.003
Tin, Max	0.0015	0.0010	0.0015	0.0015	0.002	0.002	0.002	0.002
Nickel	- - -	0.005-0.020	- - -	- - -	- - -	- - -	- - -	- - -
Zinc[G]	Remainder	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 detrimental effects on alloy performance 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 assignations 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 detrimental effects on alloy performance 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.

E536 Test Methods for Chemical Analysis of Zinc and Zinc Alloys

2.3 *ISO Standards:*[5]

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.

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.

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.

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.

9. Methods for Chemical Analysis

9.1 At the discretion of the producer, the determination of chemical composition shall be made in accordance with suitable spectrochemical or chemical methods.

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

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 spectrochemical 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.

11. Rejection and Rehearing

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

12. Identification Marking

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

13. Certification

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

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 ACuZinc5; 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 that 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 kopper (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

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
ACuZinc5	ACuZinc5	...	Z46540