



Designation: B86 – 23

Standard Specification for Zinc and Zinc-Aluminum (ZA) Alloy Foundry and Die Castings¹

This standard is issued under the fixed designation B86; 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 reappraisal. A superscript epsilon (ε) indicates an editorial change since the last revision or reappraisal.

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, zinc-aluminum castings and continuous cast bar stock, as designated and specified in **Table 1**. Eight alloy compositions are specified and designated as follows:

Common	Traditional	ASTM ^A	UNS
Alloy 3	Zamak 3	AG 40A ^B	Z33525
Alloy 7	Zamak 7	AG 40B	Z33527
Alloy 5	Zamak 5	AC 41A ^B	Z35533
Alloy 2	Zamak 2	AC 43A	Z35545
ZA-8	ZA-8	...	Z35638
ZA-12	ZA-12	...	Z35633
ZA-27	ZA-27	...	Z35841
ACuZinc 5 ^C		...	Z46541

^A See **Table 1**, Footnote C.

^B SAE Specification, Nos. 903 and 925 conform to the requirements for alloys AG40A and AC41A, respectively.

^C ACuZinc and ACuZinc5 are registered trade names of the General Motors Corporation.

1.2 Zinc Alloys Z33525, Z33527, Z35533, and Z35545 are used primarily in the manufacture of pressure die castings. Zinc-Aluminum Alloys Z35638, Z35633, and Z35841 are used in the manufacture of both foundry and pressure die castings. These alloys are also fabricated into continuous cast bar stock used for prototyping and screw machine stock.

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 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 date of order acceptance form a part of this specification to the extent referenced herein:

2.2 ASTM Standards:²

- B240** Specification for Zinc and Zinc-Aluminum (ZA) Alloys in Ingot Form for Foundry and Die Castings
- B275** Practice for Codification of Certain Zinc, Tin and Lead Die Castings (Withdrawn 2020)³
- B557** Test Methods for Tension Testing Wrought and Cast Aluminum- and Magnesium-Alloy Products
- B899** Terminology Relating to Non-ferrous Metals and Alloys
- B949** Specification for General Requirements for Zinc and Zinc Alloy Products
- E8/E8M** Test Methods for Tension Testing of Metallic Materials
- E23** Test Methods for Notched Bar Impact Testing of Metallic Materials
- E29** Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
- E527** Practice for Numbering Metals and Alloys in 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 Nov. 1, 2023. Published November 2023. Originally approved in 1931. Last previous edition approved in 2022 as B86 – 22. DOI: 10.1520/B0086-23.

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.

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



TABLE 1 Chemical Requirements

Common Name	Traditional Name	ASTM Designation	UNS	Composition % max, except as indicated ^{A, B, C}						
				Al	Mg	Cu	Fe	Pb	Cd	Sn
Alloy 3 ^{A,B,C,D,G,H,I}	Zamak 3	(AG40A)	Z33525	3.7-4.3	0.02-0.06	0.10	0.05	0.0050	0.0040	0.002
Alloy 7 ^{A,B,C,D,E,I}	Zamak 7	(AG40B)	Z33527	3.7-4.3	0.005-0.020	0.10	0.05	0.0030	0.0020	0.0010
Alloy 5 ^{A,B,C,D,I}	Zamak 5	(AC41A)	Z35533	3.7-4.3	0.02-0.06	0.7-1.2	0.05	0.0050	0.0040	0.002
Alloy 2 ^{A,C,D,I}	Zamak 2	(AC43A)	Z35545	3.7-4.3	0.02-0.05	2.6-3.3	0.05	0.0050	0.0040	0.002
ZA-8 ^{A,C,F,I}	ZA-8		Z35638	8.0-8.8	0.01-0.03	0.8-1.3	0.075	0.006	0.006	0.003
ZA-12 ^{A,C,F,I}	ZA-12		Z35633	10.5-11.5	0.01-0.03	0.5-1.2	0.075	0.006	0.006	0.003
ZA-27 ^{A,C,F,I}	ZA-27		Z35841	25.0-28.0	0.01-0.020	2.0-2.5	0.075	0.006	0.006	0.003
ACuZinc5 ^{A,C,F,I}	ACuZinc5		Z46541	2.5-3.3	0.025-0.05	5.0-6.0	0.075	0.005	0.004	0.003

^A 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. Note: Elements with a single value are considered maximum allowed concentrations.

^B Zinc alloy castings may contain nickel, chromium, silicon, and manganese in amounts of 0.02 %, 0.02 %, 0.035 %, and 0.06 %, respectively. No deleterious effects on alloy performance have ever been noted due to the presence of these elements in these concentrations and, therefore, analyses are not required for these elements, with the exception of nickel analysis for Z33527.

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

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

^E For the majority of commercial applications, a copper content up to 0.25 % will not adversely affect the serviceability of these die castings and should not serve as a basis for rejection, unless otherwise specified in the contract or purchase order between the producer and user.

^F Zinc-aluminum casting for foundry and pressure die casting may contain chrome, manganese, or nickel in amounts of up to 0.01 % each or 0.03 % total. No deleterious 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.

^G For the majority of commercial applications, a copper content of up to 0.7 % will not adversely affect the serviceability of die castings and should not serve as a basis for rejection, unless otherwise specified in the contract or purchase order between the producer and user, such as to meet the requirements of ISO 15201.

^H Magnesium may be as low as 0.015 % provided that the lead, cadmium, and tin do not exceed 0.003 %, 0.003 %, and 0.001 %, respectively.

^I Remainder Zn, determined arithmetically by difference.