



# Standard Specification for Master Alloys Used in Making Zinc Die Casting Alloys<sup>1</sup>

This standard is issued under the fixed designation B327; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope\*

1.1 This specification covers aluminum–base and zinc–base master alloys used to make zinc die-casting alloys. Alloy compositions specified for aluminum–base master alloys (hardeners) are designated as shown in [Table 1](#). Alloy compositions specified for the zinc-base master alloys are designated as shown in [Table 2](#).

1.2 Aluminum alloy hardeners are added to Special High Grade zinc (per Specification [B6](#)) in the proper alloying ratios, as shown in [Table 1](#), to produce zinc alloys for die casting.

1.3 Zinc-base master alloy is added to Special High Grade zinc (per Specification [B6](#)) in the proper alloying ratio, as shown in [Table 3](#), to produce zinc alloy for die casting.

1.4 Master alloys may be supplied in the form of shot, bar, ingot or jumbo ingot as specified by the purchaser.

1.5 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.

1.6 *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 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:

<sup>1</sup> 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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## 2.2 ASTM Standards:<sup>2</sup>

### B6 Specification for Zinc

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

[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

[E34](#) Test Methods for Chemical Analysis of Aluminum and Aluminum-Base Alloys

[E88](#) Practice for Sampling Nonferrous Metals and Alloys in Cast Form for Determination of Chemical Composition

[E527](#) Practice for Numbering Metals and Alloys in the Unified Numbering System (UNS)

[E536](#) Test Methods for Chemical Analysis of Zinc and Zinc Alloys

[E1251](#) Test Method for Analysis of Aluminum and Aluminum Alloys by Spark Atomic Emission Spectrometry

## 2.3 ISO Standards:<sup>3</sup>

[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 *hardener, n*—an aluminum-base master alloy added to Special High Grade Zinc (SHG) to produce a zinc alloy for die casting.

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

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

**TABLE 1 Chemical Requirements for Aluminum-Base Master Alloys**

NOTE 1—The following applies to all specified limits in this table: For purposes of determining conformance with this specification, the observed value or calculated value obtained from analysis shall 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 method of Practice E29.

ASTM Alloy	Composition, percent											Usage	
	Aluminum, min	Copper	Iron, max	Silicon, max	Manganese, max	Magnesium <sup>A</sup>	Zinc	Chromium, max	Nickel, max	Tin, max	Lead, max <sup>A</sup>		Cadmium, max <sup>A</sup>
ZG71A <sup>B</sup>	87.0	1.7 max	0.8	0.7	0.50	0.65–1.05	6.5–7.5	0.20	0.20	0.02	0.020	0.010	1 part by weight of ZG71A, <sup>B</sup> 21 parts by weight of Special High Grade zinc <sup>C</sup> to make ASTM zinc alloy Z33524 (AG40A <sup>B</sup> )

<sup>A</sup> Carried to one additional decimal place to ensure proper control in the final alloy.

<sup>B</sup> ASTM alloy designations were established in accordance with Practice B275.

<sup>C</sup> ASTM Specification B6, for Zinc.

**TABLE 2 Chemical and Color Code Requirements for Zinc-Base Master Alloys<sup>A,B,C</sup>**

Common (UNS)	Color Code <sup>D</sup>	Aluminum	Magnesium	Iron max	Copper max	Lead max	Cadmium max	Tin max	Zinc
V12-3 (Z33730)	Pink	11.7–12.6	0.090–0.16	0.070	0.25	0.005	0.004	0.003	Remainder
V12-5 (Z35740)	Pink/Black	11.7–12.6	0.090–0.16	0.070	2.1–3.3	0.005	0.004	0.003	Remainder

<sup>A</sup> Zinc-base master alloys V12-3 (Z33730) and V12-5 (Z35740) used for producing die casting alloys may contain nickel, chromium, silicon, and manganese 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 in die casting alloys and, therefore, analyses are not required for these elements, except that nickel analysis is required when producing die casting alloy Z33526.

<sup>B</sup> The UNS assignments were established in accordance with Practice E527.

<sup>C</sup> For purposes of determining conformance with this specification, the observed value or calculated value obtained from analysis shall 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 method of Practice E29.

<sup>D</sup> Refer to Practice B908. (Note: Color Codes indicated are for North American applications.)

**TABLE 3 Weight Requirements for Zinc-Base Master Alloy Jumbo Ingots**

NOTE 1—These requirements are based on the use of nominal 2400 lb or 1200 lb jumbo ingots of V12 (Z33730).

Nominal Weight, lb	Weight Range, lb <sup>A</sup>		Usage
	Minimum	Maximum	
2400	2325	2475	1 part by weight of V12-3 (one 2400 lb jumbo ingot), 2 parts by weight (two 2400 lb jumbo ingots) of Special High Grade zinc to make zinc alloy 3 (Zamak 3, UNS Z33524, AG40A <sup>B</sup> ) or 1 part by weight of V12-5 (one 2400 lb jumbo ingot), 2 parts by weight (two 2400 lb jumbo ingots) of Special High Grade zinc to make zinc alloy 5 (Zamak 5, UNS Z35532, AC41A <sup>B</sup> )
1200	1150	1250	1 part by weight of V12-3 (one 1200 lb jumbo ingot), 2 parts by weight (one 2400 lb jumbo ingot) of Special High Grade zinc to make zinc alloy 3 (Zamak 3, UNS Z33524, AG40A <sup>B</sup> ) or 1 part by weight of V12-5 (one 1200 lb jumbo ingot), 2 parts by weight (one 2400 lb jumbo ingot) of Special High Grade zinc to make zinc alloy 5 (Zamak 5, UNS Z35532, AC41A <sup>B</sup> )

<sup>A</sup> Jumbo ingots outside the above weight limits may be acceptable depending upon the chemistry, if mutually agreed upon between the producer and purchaser.

<sup>B</sup> ASTM alloy designations were established in accordance with Practice B275.

#### 4. Ordering Information

4.1 Orders for master alloys under this specification shall include the following information:

4.1.1 Alloy (Table 1 or Table 2),

4.1.2 Form: that is, shot, bar, ingot or jumbo ingot,

4.1.3 Size: that is, maximum shot size or size of bar, ingot, or jumbo ingot,

4.1.4 Unit weight: that is, nominal weight of shot per bag or nominal weight of each bar, ingot, or jumbo ingot,

4.1.5 Markings on shot bags, bars, ingot or jumbo ingot,

4.1.6 Palletizing, if required: means of palletizing and maximum weight per pallet load,

4.1.7 Place of inspection (Section 8), and

4.1.8 For additional information see Specification B949.

#### 5. Materials and Manufacture

5.1 The material may be made by any suitable process.

5.2 The material covered by this specification shall be of uniform quality and shall be free of dross, flux, or other harmful contamination. Also, if the material is in shot form, it shall be sound, uniform in size, and free of a heavily oxidized surface coating, stringers, and moisture.

#### 6. Chemical Requirements

6.1 *Limits*—The material shall conform to the requirements as to chemical composition prescribed in Table 1 or Table 2. In

addition there are weight limits for zinc-base master alloys when supplied in jumbo ingot form. The weight of jumbo ingots shall conform to the requirements as prescribed in [Table 3](#).

6.2 In case of dispute the following requirements shall apply:

6.2.1 *Number of samples*—Samples for verification of chemical composition shall be taken as follows:

6.2.2 If the master alloys are shipped in carload lots of the same alloy, not less than five samples shall be taken at random from the carload for sampling. If the shipment is in less than carload lots, the following shall apply:

6.2.2.1 *Aluminum-base master alloys*—One sample shall be taken for each 6000 lb (2722 kg) or fraction thereof. When it is deemed necessary, a sample may be taken from each melt of 500 lb (227 kg) or more of the alloy.

6.2.2.2 *Zinc-base master alloys*—One sample shall be taken for each 10 000 lb (4536 kg) or fraction thereof. When necessary, a sample may be taken from each melt of 1000 lb (454 kg) or more.

6.2.3 A sample may consist of an ingot or bar. In the case of metal in shot form, a small representative lot of the shot may be melted and poured to form a thin chill-cast bar approximately ¼ in. (6.4 mm) thick or a suitable spectrographic mold sample. In the case of a jumbo ingot, the sample may be a cast spectrographic specimen taken from the same pour used to cast the jumbo ingots.

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

6.3.1 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 100 g. Sampling shall be in accordance with [Practice E88](#).

6.3.2 By agreement between the producer and the purchaser, other methods of sampling cast products for spectrochemical and other methods of analysis may be used. Such methods shall be suitable for the form of material being analyzed and the type of analytical method used.

6.3.2.1 An optional method of sampling for analysis may be to melt together representative portions of each ingot selected, and then sample the liquid composite by casting suitable specimens for spectrographic or chemical analysis, or both.

6.3.2.2 Samples may also be in the form of separately cast spectrographic specimens taken from the same pour used to cast the ingot.

6.3.3 As there is no generally accepted method for obtaining a representative sample from a jumbo ingot, the method of choice will be as described in [6.3.2.2](#).

6.4 *Method of Analysis*—The determination of chemical composition shall be in accordance with suitable methods.

6.4.1 *For aluminum-base master alloys*—The determination of chemical composition shall be in accordance with suitable

chemical (Test Methods [E34](#)), spectrochemical (Test Method [E1251](#)) or other methods. In case of dispute, the results of Test Methods [E34](#) shall be the basis of acceptance.

6.4.2 *For zinc-base master alloys*—The determination of chemical composition shall preferably be in accordance with suitable chemical (Test Method [E536](#)), ISO 3815-1, ISO 3815-2, (note: ISO 3815-2 is not specific for zinc-base master alloy, but may be used in a generic manner with suitable validation), or other methods. Because there is no specific ASTM or ISO method covering the composition of this zinc-base master alloy, the test method used as the basis of acceptance shall be as agreed upon between the producer and purchaser.

## 7. Size and Shape

7.1 Aluminum alloy hardener may be supplied in the form of shot, bar or ingot but typically is supplied as shot.

7.2 Zinc-base master alloy may be supplied as ingot or jumbo ingot but is typically supplied as jumbo ingot.

7.2.1 The weight of zinc master alloy jumbo ingots is important because they are added in a fixed ratio to Special High Grade zinc jumbo ingots. The weight of jumbo ingots shall be  $1200 \pm 50$  lbs or  $2400 \pm 75$  lbs. Other sizes or weight limits, or both, may be as agreed upon by the producer and customer.

## 8. Source Inspection

8.1 See Specification [B949](#).

## 9. Rejection and Rehearing

9.1 Material that fails to conform to the requirements of this specification may be rejected. Rejection should be reported to the producer or supplier promptly and in writing. In case of dissatisfaction with the results of the test, the producer or supplier may make claim for a rehearing. If the rehearing establishes that the material does not conform to the requirements of this specification, as much of the rejected original material as possible shall be returned to the producer or supplier.

9.2 For additional information see Specification [B949](#).

## 10. Identification Marking

10.1 All shot bags, bars, ingots, or jumbo ingots shall be properly marked for identification with the producer's name or brand.

10.2 For additional information see Specification [B949](#).

## 11. Preparation for Delivery

11.1 See Specification [B949](#).

## 12. Keywords

12.1 aluminum alloy hardener; aluminum-base master alloy; master alloy; V12; zinc-base master alloy; zinc die casting alloy

**SUMMARY OF CHANGES**

Committee B02 has identified the location of selected changes to this standard since the last issue (B327–13a) that may impact the use of this standard. (Approved May 1, 2016.)

(1) The references to specific sections in Specification B949 were removed.

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