



## Standard Specification for General Requirements for Zinc and Zinc Alloy Products<sup>1</sup>

This standard is issued under the fixed designation B 949; 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 establishes general requirements, unless otherwise specified in the specific product specification, for ordering information, marking, and sampling for chemical analysis common to zinc and zinc alloy products and shall apply to Specifications **B 6**, **B 69**, **B 86**, **B 240**, **B 327**, **B 418**, **B 750**, **B 792**, **B 793**, **B 833**, **B 852**, **B 860**, **B 892**, **B 894**, **B 897**, **B 907**, and **B 943** to the extent referenced therein.

1.2 Although this specification establishes general requirements, it does not restrict that, by agreement between customer and supplier, these requirements may be altered by a customer to suit individual need.

1.3 The chemical composition, physical and mechanical properties, and all other requirements not included in this specification shall be prescribed in the product specification.

1.4 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. This applies except where SI units only are specified.

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 Material 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 ASTM Standards:<sup>2</sup>

**B 6** Specification for Zinc

**B 69** Specification for Rolled Zinc

**B 86** Specification for Zinc and Zinc-Aluminum (ZA) Alloy Foundry and Die Castings

**B 240** Specification for Zinc and Zinc-Aluminum (ZA) Alloys in Ingot Form for Foundry and Die Castings

**B 327** Specification for Master Alloys Used in Making Zinc Die Casting Alloys

**B 418** Specification for Cast and Wrought Galvanic Zinc Anodes

**B 750** Specification for GALFAN (Zinc-5 % Aluminum-Mischmetal) Alloy in Ingot Form for Hot-Dip Coatings

**B 792** Specification for Zinc Alloys in Ingot Form for Slush Casting

**B 793** Specification for Zinc Casting Alloy Ingot for Sheet Metal Forming Dies and Plastic Injection Molds

**B 833** Specification for Zinc and Zinc Alloy Wire for Thermal Spraying (Metallizing) for the Corrosion Protection of Steel

**B 852** Specification for Continuous Galvanizing Grade (CGG) Zinc Alloys for Hot-Dip Galvanizing of Sheet Steel

**B 860** Specification for Zinc Master Alloys for Use in Hot Dip Galvanizing

**B 892** Specification for ACuZinc5 (Zinc-Copper-Aluminum) Alloy in Ingot Form for Die Castings

**B 894** Specification for ACuZinc5 (Zinc-Copper-Aluminum) Alloy Die Castings

**B 897** Specification for the Configuration of Zinc and Zinc Alloy Jumbo and Block Ingot

**B 899** Terminology Relating to Non-ferrous Metals and Alloys

**B 907** Specification for Zinc, Tin and Cadmium Base Alloys Used as Solders

**B 908** Practice for the Use of Color Codes for Zinc Casting Alloy Ingot

**B 914** Practice for Color Codes on Zinc and Zinc Alloy Ingot for Use in Hot-Dip Galvanizing of Steel

**B 943** Specification for Zinc and Tin Alloy Wire Used in Thermal Spraying for Electronic Applications

**E 55** Practice for Sampling Wrought Nonferrous Metals and Alloys for Determination of Chemical Composition

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

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<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.

## E 634 Practice for Sampling of Zinc and Zinc Alloys for Optical Emission Spectrometric Analysis

### 3. Terminology

3.1 For terms related to non-ferrous metals and alloys, refer to Terminology B 899.

### 4. Ordering Information

4.1 Where applicable include the following minimum information when placing orders for zinc and zinc alloy products under this specification:

4.1.1 ASTM designation and latest year of issue (see Scope),

4.1.2 Quantity (weight),

4.1.3 Alloy or grade, or both, (when applicable),

4.1.4 Size,

4.1.4.1 For zinc metal and alloy ingot, if not the manufacturer's standard,:

a) Zinc metal slabs varying in weight from 40 to 60 lb (18 to 27 kg) are all considered standard slabs.

b) Zinc metal may also be ordered in jumbos, blocks, anodes, or other shapes (as per Specification B 897).

4.1.4.2 For castings and other zinc alloy products, see the specific product specification for size requirement information.

4.1.5 Delivery schedule,

4.1.6 Marking (Section 10),

4.1.7 Whether certification is required (Section 9),

4.1.8 Appearance—the product shall be reasonably free from surface corrosion and adhering foreign matter, and

4.1.9 Source inspection must be specified at the time of order (Section 7).

4.2 Additional ordering information for specific zinc and zinc alloy products:

4.2.1 There may be additional information required when ordering specific products. These may be found in the product specifications listed in 2.1 (Specifications B 6 through B 897 and B 907 and B 943).

4.3 Specifications for material may be altered by agreement between customer and supplier to suit individual need. If the agreed upon chemistry falls outside the limits of the appropriate standard, then the material does not meet all requirements of the standard.

### 5. Chemical Requirements

5.1 Final product (ingots, slabs, jumbos, etc.) shall conform to the chemical composition requirements prescribed in the applicable product specification (see 2.1: Specifications B 6 through B 897, B 907, and B 943).

5.2 Conformance shall be determined by the manufacturer by analyzing samples taken at the time the final product is poured or samples taken from the ingots.

5.2.1 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.

5.2.2 *Method of Analysis*—At the discretion of the producer, the determination of chemical composition shall be made in accordance with suitable spectrochemical or chemical methods.

### 6. Sampling for Determination of Chemical Composition

6.1 *Samples for Spectrochemical and Other Methods of Analysis*—Samples for spectrochemical and other methods of analysis shall be suitable for the form of material being analyzed and the type of analytical method used.

6.2 *Sampling During Production of Ingots, Slabs, Blocks or Jumbos, and Wrought Products*:

6.2.1 *Sampling During Casting*—Samples may be taken from the pour during the casting of zinc and zinc alloys.

6.2.1.1 Samples for spectrochemical methods may be cast as pins or discs in accordance with Practice E 634 for spectrochemical analyses or may be cast in a form or by a method the producer has determined will generate a homogeneous and representative sample.

6.2.1.2 The producer should determine the sampling regimen that will efficiently result in samples that are representative of the product. As a suggested minimum, at least two samples sets shall be taken for batches of 25 tons (22.7 mTons) or less. At least three sample sets shall be taken for batches up to 150 tons (136 mTons). The average chemical analyses shall be determined from these samples. Unless otherwise agreed in the contract or purchase order, sampling procedure will be the manufacturer's choice.

6.2.2 Samples held at the producer's plant shall be retained for not less than 90 days.

6.3 *Sampling of Ingot, Slabs, or Blocks and Jumbos and Wrought Product in the Event of a Dispute or if the Alloy is at the Customer's Plant*—The sample for chemical analysis shall be taken based on the form of the product.

6.3.1 *Ingot, Slabs, or Product in an Easily Sampled Form*—If the alloy is in the form of standard ingots, slabs, etc. at the customer's plant, the sample for chemical analysis shall be taken in accordance with 6.3.1.1 through 6.3.1.6, inclusive.

6.3.1.1 *Selection of Portion*—A portion representative of the total shipment or order shall be selected at random for the final sample. The portion preferably shall be taken during loading or unloading. Not less than five ingots shall be taken at random from each car or truckload of the same alloy for sampling. Each heat in the shipment shall be represented. If the shipment is less than a carload lot, one sample ingot shall be taken for each 10 000 lb (4540 kg) or fraction thereof. When it is deemed necessary, a sample may be taken from each melt of 1000 lb (454 kg) or more.

6.3.1.2 *Preparation of Sample*—The product shall be cleaned thoroughly to rid the surface of extraneous material. Then the samples for chemical analysis shall be taken by sawing, milling, or drilling in such a manner as to be representative of the average cross section of the ingot. The weight of a prepared sample shall be not less than 300 g.

6.3.1.3 The saw drill, or cutter used for taking the sample shall be thoroughly cleaned. No lubricant shall be used in the operation, and the sawings or metal chips shall be carefully treated with a magnet to remove any particles or iron introduced in taking the sample.

NOTE 1—Sampling by sawing is not recommended for Special High Grade zinc because complete removal of the final traces of adventitious iron from sawings is difficult.

6.3.1.4 *Drilling*—Two holes shall be drilled, preferably from the bottom or brand side of each ingot or slab, at two points located along one diagonal of the slab so that each point is halfway between the center and one extremity of the diagonal. If two holes from each ingot or slab do not yield the weight of sample prescribed in 6.3.1.6, a third hole shall be drilled at the center of each. Each hole shall be bored completely through, care being taken to avoid starting the drill in a depression and to adjust the feed to give drillings 0.010 to 0.020 in. (0.25 to 0.51 mm) in thickness. The drill used preferably shall be non-ferrous tipped (such as carbide, Ti-N, etc.) The diameter of the drill shall be 1/2 in. (12.7 mm) for Special High Grade zinc, and shall be 5/16 in. (7.9 mm) for other grades of zinc. The drillings shall be broken or cut with clean shears into pieces not over 1/2 in. in length and mixed thoroughly.

6.3.1.5 *Sawing*—Using, preferably, a heat treated high-speed steel saw, make two cuts completely across and through the ingot or slab from one long side to the other. Each cut shall be approximately halfway between the center and each end. The width of the saw cut shall be sufficient to give the weight of sample prescribed in 6.3.1.6, and cuttings from all the slabs shall be mixed thoroughly to form a uniform sample.

6.3.1.6 *Size of Sample and Storage*—The prepared sample shall weigh at least 1600 g for Special High Grade zinc, and at least 300 g for other grades of zinc and zinc alloys. The properly mixed sample shall be split into three equal parts, each of which shall be placed in a sealed package, one for the manufacturer, one for the purchaser, and one for a referee, if necessary. Tight, leak-proof, paper sample envelopes or cardboard cartons may be used to hold the sample.

6.3.2 An optional method of sampling for analysis may be by melting together the representative portions selected and then sampling the liquid composite by casting suitable specimens for either spectrographic or chemical analysis.

6.3.2.1 Care must be taken to ensure that the melt is stirred, homogenous, and representative, since it is possible to alter the composition during remelting.

6.3.3 Samples for chemical analysis may also be in the form of a separately cast spectrographic disc specimen taken from the same pour used to cast the product.

6.3.4 *Sampling of Blocks or Jumbos*—Representative samples cannot be obtained from large castings (except for remelting the entire ingot in a separate furnace and then taking a sample) because of the potential for segregation. Therefore, alloy cast in block form shall be sampled from the pour.

6.3.4.1 *Sampling of Blocks or Jumbos for Nominal Composition*—Drillings taken from the sides of blocks or jumbos may be used to differentiate alloys, however, as noted in 6.3.4 there is no guarantee of obtaining a representative sample for conformance determination.

#### 6.3.5 *Sampling Wrought Product:*

6.3.5.1 The sampling plan for zinc for purposes of chemical analysis or mechanical property testing shall be designed such that any lot of finished product may be adequately described by the results of the tests performed on the samples. Lot or portion size shall be as agreed upon between purchaser and supplier.

6.3.5.2 In general, the steps for sampling wrought product are similar to those for ingot, slab and castings described in 6.3.1.1-6.3.1.6.

6.3.5.3 Matters of sampling and sample preparation of wrought product not covered by this specification shall be in accordance with Practice E 55.

6.4 *Sampling of Zinc Alloy Ingots for Routine Testing, Nominal Quality, Non-Dispute Situations*—It is a common practice to select a sample portion from a single ingot for quality and conformance checking.

6.4.1 In these instances the portion should be cut from a section that is approximately halfway between the center and each end, and avoiding any cast notches, by making two cuts completely across and through the ingot or slab from one long side to the other.

6.4.2 The sample prepared from this portion by milling or drilling should be from the cut faces and be representative of the average cross section of the ingot.

6.4.3 It is also common practice after appropriate surface preparation to use the cut face directly for spectrochemical analysis. In this instance it is important to perform a sufficient number of repetitive tests to ensure that the results represent the average cross section of the ingot. It should be noted that this gives results that only represent the ingot from which the slice is derived and further it does not produce, nor will it yield results that are equivalent to samples produced in accordance with Practice E 634.

6.4.4 When sampling in this way for routine quality checks, it should be noted that sampling only one ingot may not be representative of the entire batch.

#### 6.5 *Sampling of Final Product Castings:*

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

6.5.2 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.

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

6.5.4 A sample shall be taken from each of two representative castings selected from each lot defined as follows:

6.5.5 For normal inspection purposes, an inspection lot shall consist of the production from each die during a single production run, as defined and recorded by the producer, and shipped, or available for shipment, at one time.

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

6.5.7 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 E 88.

6.5.8 By agreement, an appropriate spectrographic sample may be prepared at time of manufacture in accordance with Practice E 634.



6.5.9 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.

6.5.10 *Method of Analysis*—Shall be in accordance with 5.2.2.

6.5.11 Matters of sampling and sample preparation of castings not covered by this specification shall be in accordance with Practice E 88.

6.6 Unless otherwise provided in this section, procedures for sampling, storing, and exchange of samples shall be as agreed upon between the producer and the customer.

## 7. Source Inspection

7.1 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.

7.2 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.

## 8. Claims, Investigation of Claims, and Settlement of Claims

8.1 When one or more samples, depending on the approved sampling plan, fail to meet the requirements of this specification as listed in 2.1 (Specifications B 6 through B 897 and B 907 and B 943), the represented lot is subject to rejection except as otherwise provided in 8.2.

8.2 Lots rejected for failure to meet the requirements of this specification may be resubmitted for test provided:

8.2.1 The producer has removed the nonconforming material or the producer has reworked the rejected lot as necessary to correct the deficiencies.

8.3 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.

8.4 *Claims with Respect to Zinc Metal and Zinc Alloy Ingot:*

8.4.1 *Claims to be Investigated* shall be made in writing to the manufacturer within thirty (30) days of receipt of material at the purchaser's plant and the results of the purchaser's tests shall be given. The manufacturer shall be given two (2) weeks from date of receipt of such claim to investigate their records and then shall agree to either satisfy the claim or send a representative to the facility of the purchaser to investigate the matter further.

8.4.2 *Analysis of Car Lots*—No claims shall be considered unless the minimum samples as specified in Section 6 can be shown to such representative.

8.4.3 *Physical Defects of Individual Pieces*—No claims shall be considered unless the zinc metal in question, unused, can be shown to such representative.

8.4.4 When the zinc metal satisfies the chemical and physical requirements of this specification, it shall not be rejected for defects in manufacturing, for defects of alloys in which it is used, or for defects in the coating of zinc-coated products.

8.5 *Claim Investigation with Respect to Zinc Metal and Zinc Alloy Ingot:*

8.5.1 The inspector representing the manufacturer shall examine all pieces where physical defects are claimed. If agreement is not reached, the question of fact shall be submitted to a mutually agreeable referee, whose decision shall be final.

8.5.2 On a question of metal contents, a sample shall be drawn in the presence of representatives of both the manufacturer and the purchaser as described in Section 6. The manufacturer and the purchaser shall each make an analysis, and if the results do not establish or dismiss the claim to the satisfaction of both parties, the third sample shall be submitted to a mutually agreeable referee, who shall determine the question of quality, and whose determination shall be final.

8.6 *Settlement of Claims with Respect to Zinc Metal and Zinc Alloy Ingot:*

8.6.1 The expenses of the manufacturer's representative and of the referee shall be paid by the loser or divided in proportion to concession made in case of compromise. In case of rejection being established, maximum damages shall be limited to the payment of freight both ways by the manufacturer for substitution of an equivalent weight of zinc metal conforming to this specification.

## 9. Certification

9.1 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.

9.2 Alternatively, the producer or supplier shall, when called for in the contract or purchase order, furnish to the purchaser a chemical analysis of each lot supplied as an indication that the material meets the chemical requirements specified.

## 10. Product Identification Marking and Packaging

10.1 All ingots, slabs, jumbos or blocks shall be properly marked for identification with the producer's name or brand.

10.2 Each bundle, skid, jumbo or block shall be identified with the producer's heat/lot/batch number.

10.3 Each bundle, skid, jumbo or block shall further be marked with the producer's grade identification and the net mass (weight).

10.4 *Color Code for Zinc Alloys*—The purpose of these color codes is to allow for quick grade identification of bundle, skid, jumbo or block of zinc and zinc alloys. Other than jumbos or blocks this standard is not intended to imply that each ingot will be color-coded, but only that each ingot bundle or skid be color coded.

10.4.1 Each bundle, skid, jumbo or block shall be identified with the appropriate color code.

10.4.2 The color will be applied as a stripe, or stripes.

10.4.3 Color codes are listed for each alloy in the appropriate product specification. In addition, more detailed instructions are given in Practices **B 908** and **B 914**.

10.4.4 In the absence of a written agreement to the contrary between the supplier and end user, the North American color code will be the standard for all North American transactions; for all other transactions the International Color Code will be used.

#### 10.5 *Packaging of Zinc and Zinc Alloys:*

10.5.1 The material shall be packaged to ensure adequate protection during normal handling and transportation. For

specific details, the appropriate standard shall be consulted for the material being supplied where packaging is specified (see **2.1**; Specifications **B 6** through **B 897** and **B 907** and **B 943**).

## 11. Keywords

11.1 alloys; anode; block; casting; CGG; chemical analysis; chemical requirements; color code; hot-dip alloys ingot; jumbo; rolled zinc; wire; zinc; zinc alloy

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