



Standard Specification for Zinc Master Alloys for Use in Hot Dip Galvanizing¹

This standard is issued under the fixed designation B860; 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.

1. Scope*

1.1 This specification covers zinc master alloys which are used in hot dip galvanizing for the purpose of adjusting the concentration of certain alloying elements in the molten zinc bath. **Table 1** covers the chemical composition of these materials which include six master alloys of zinc-aluminum (brightener) and one master alloy of zinc-antimony.

ASTM	Common	UNS
Type A-1	90/10 Zn/Al High Purity	Z30750
Type A-2	90/10 Zn/Al Low Purity	Z31710
Type A-3	95/5 Zn/Al High Purity	Z30503
Type A-4	95/5 Zn/Al Low Purity	Z31510
Type A-5	96/4 Zn/Al High Purity	Z31520
Type A-6	96/4 Zn/Al Low Purity	Z30504
Type S-1	90/10 Zn/Sb	Z55710

NOTE 1—The master alloys in Specification B860 are intended to be used primarily in hot-dip galvanizing to adjust the concentration of certain elements in a molten zinc bath, and differ from the zinc-aluminum alloys in Specification B997 which are intended to be used primarily in molten zinc-aluminum.

1.2 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.

1.3 *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:

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 Oct. 1, 2015. Published October 2015. Originally approved in 1995. Last previous edition approved in 2013 as B860 – 13. DOI: 10.1520/B0860-15.

2.2 ASTM Standards:²

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

B997 Specification for Zinc-Aluminum Alloys in Ingot Form for Hot-Dip Coatings

E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

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

2.3 ISO Standards:³

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 defined in Terminology B899 shall apply unless defined otherwise in this standard.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *brightener bar, n*—brightener bar is a zinc alloy containing aluminum which is added to the galvanizing bath to adjust the aluminum content of the bath to: suppress the formation of iron-zinc alloy layers, increase the brightness and ductility of the galvanized coating, and improve the drainage of zinc from the work as it exits the bath; also called brightener.

4. Ordering Information

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

4.1.1 Quantity, lb,

4.1.2 Alloy type (see **Table 1**),

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 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 Composition, % (Range or Maximum Value)^A

Type A-1	90 % Zinc–10 % Aluminum (90/10 Zn/Al)					High Purity	
Type A-2	90 % Zinc–10 % Aluminum (90/10 Zn/Al)					Low Purity	
Type A-3	95 % Zinc–5 % Aluminum (95/5 Zn/Al)					High Purity	
Type A-4	95 % Zinc–5 % Aluminum (95/5 Zn/Al)					Low Purity	
Type A-5	96 % Zinc–4 % Aluminum (96/4 Zn/Al)					High Purity	
Type A-6	96 % Zinc–4 % Aluminum (96/4 Zn/Al)					Low Purity	
Type S-1	90 % Zinc–10 % Antimony (90/10 Zn/Sb)						
UNS ^B	Type A-1 90/10 Zn/Al Z30750	Type A-2 90/10 Zn/Al Z31710	Type A-3 95/5 Zn/Al Z30503	Type A-4 95/5 Zn/Al Z31510	Type A-5 96/4 Zn/Al Z31520	Type A-6 96/4 Zn/Al Z30504	Type S-1 90/10 Zn/Sb Z55710
Fe	0.05 max	0.15 max	0.05 max	0.15 max	0.05 max	0.15 max	0.03 max
Pb	0.005 max	0.4 max	0.005 max	0.4 max	0.005 max	0.4 max	0.015 max
Cd	0.004 max	...	0.004 max	...	0.004 max	...	0.003 max
Cu	0.035 max	0.5 max	0.035 max	0.5 max	0.035 max	0.5 max	0.003 max
Mg	...	...	...	...	0.06 max	0.06 max	...
Sn	0.003 max	...	0.003 max	...	0.003 max	...	0.01 max
As	...	...	...	...	...	...	0.015 max
Al	9.5–10.5	9.5–10.5	4.5–5.5	4.5–5.5	4.0–4.5	4.0–4.5	...
Sb ^C	...	...	...	...	...	...	9.5–10.5
Others, Total	0.01 max	0.25 max	0.01 max	0.25 max	0.01 max	0.25 max	0.03 max
Zn ^D	Remainder	Remainder	Remainder	Remainder	Remainder	Remainder	Remainder

^A The following applies to all specified limits in this table: For purposes of determining conformance with this specification, an observed value obtained from analysis shall be rounded off to the nearest unit in the last right-hand place of figures used in expressing the limiting value, in accordance with the rounding method of Practice E29.

^B UNS numbers in conformance with Practice E527.

^C Chemical method under development.

^D For information only. Quantitative determination of this element is not required. Zinc is assumed to be the difference between 100 % and the sum of those elements listed above.

4.1.3 Size and type of ingot (jumbo, type 1 block, type 2 block, slab or other ingot shape), if not manufacturer's standard,

4.1.4 Specification number and year date,

4.1.5 Source inspection (see Section 8), and

4.1.6 Marking (see Section 10).

5. Materials and Manufacture

5.1 The material covered by this specification shall be of uniform quality and shall be free from harmful contamination. The ingot surface shall contain a minimum of dross and adhering foreign matter.

6. Chemical Requirements

6.1 *Limits*—The alloys shall conform to the requirements as to chemical composition prescribed in Table 1. Conformance shall be determined by the producer by analyzing samples taken at the time the ingots are made. 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.

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:

6.2.1.1 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 *Methods of Sampling*—Samples from ingots 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 weight of prepared sample not less than 100 g. Sampling shall be in accordance with Practice E88.

6.3.2 By agreement, an optional method of sampling would be to select, at random, ingots of the same heat, melt together representative portions of each ingot selected, and cast a disc or suitable sample from the liquid composite for spectrographic or chemical analysis.

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 ingot.

6.3.4 Alternate procedures for sampling and exchange of samples shall be agreed upon between the producer and the customer.

6.4 *Method of Analysis*—The determination of chemical composition shall be made in accordance with suitable chemical Test Methods E536, suitable spectrochemical methods ISO3815-1 and ISO 3815-2, or other methods. In case of dispute, the results should preferably be secured by Test Methods E536, or ISO 3815-1 or ISO 3815-2 and shall be the basis of acceptance.

7. Size and Shape

7.1 Master alloys may be ordered as jumbos, blocks, slabs or other ingot configurations.

7.1.1 *Jumbo*—large casting of zinc or zinc alloy, having through holes for chains, designed for handling by mechanical

equipment, which is also referred to as a jumbo or strip jumbo. See Specification **B897** for additional details.

7.1.2 *Block*—large casting of zinc or zinc alloy, having lift pockets, designed for handling by mechanical equipment, which is also referred to as block. See Specification **B897** for additional details.

7.1.3 *Slab*—smaller casting of zinc or zinc alloy, designed for manual handling. A slab usually weighs about 55 lb (25 kg) but may weigh anywhere from 40 to 60 lb (18 to 27 kg). Slabs are usually shipped in strapped bundles weighing about 2200 lb (one metric ton).

7.1.4 Other shapes and sizes as may be agreed upon between the producer and the customer may be cast to the chemical requirements of this specification.

8. Source Inspection

8.1 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.

8.2 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 in such a manner that there is no unnecessary interference with the producer's operations.

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, it should be rejected and returned to the producer.

10. Identification Marking

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

10.2 Each bundle or skid shall be identified with the bundle weight and the producer's heat number.

11. Packaging

11.1 Unless otherwise specified, the ingot shall be packaged to provide easy access for unloading by overhead crane or forklift. Each package shall contain only one alloy unless otherwise agreed upon.

12. Keywords

12.1 brightener; zinc; zinc alloys; zinc-aluminum alloy; zinc-antimony alloy; zinc master alloys; zinc metal

SUMMARY OF CHANGES

Committee B02 has identified the location of selected changes to this standard since the last issue (B860–13) that may impact the use of this standard. (Approved October 1, 2015.)

(1) A note was added to Section 1, Scope.

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 Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, Tel: (978) 646-2600; <http://www.copyright.com/>