Designation: B 907 – 00a

Standard Specification for Zinc, Tin and Cadmium Base Solders[1]

This standard is issued under the fixed designation B 907; 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 solder metal alloys (commonly known as soft solders), including zinc-aluminum, zinc-aluminum-copper, zinc-tin, zinc-tin-copper, zinc-cadmium-tin, zinc-cadmium, tin-zinc, cadmium-zinc, cadmium-zinc-silver, and cadmium-silver, used for the purpose of joining together two or more metals at temperatures below their melting points.

1.1.1 Certain alloys are also used in Thermal Spray Wire by the electronics industry (as noted in the Annex part of this specification). B 833 covers Zinc and Zinc Alloy Wire for Thermal Spraying (Metallizing) used primarily for the corrosion protection of steel (as noted in the Annex part of this specification).

1.1.2 Tin base alloys are included in this specification because their use in the electronics industry is different than the major use of the tin and lead solder compositions specified in B 32.

1.1.3 These solders include alloys having a nominal liquidus temperature not exceeding 850°F (455°C).

1.1.4 This specification includes solder in the form of solid bars, ingots, powder and special forms, and in the form of solid wire, and solder paste.

1.2 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

1.3 *Toxicity*—Warning: Soluble and respirable forms of cadmium may be harmful to human health and the environment in certain forms and concentrations. Therefore, ingestion and inhalation of cadmium should be controlled under the appropriate regulations of the U.S. Occupational Safety and Health Administration (OSHA). Cadmium-containing alloys and coatings should not be used on articles that will contact food or beverages, or for dental and other equipment that is normally inserted in the mouth. Similarly, if articles using cadmium-containing alloys or coatings are welded, soldered, brazed, ground, flame-cut, or otherwise heated during fabrication, adequate ventilation must be provided to maintain occupational cadmium exposure below the OSHA Permissible Exposure Level (PEL).

1.4 *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 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:*

B 32 Specification for Solder Metal[2]

B 833 Specification for Zinc and Zinc Alloy Wire for Thermal Spraying (Metallizing)[2]

B 899 Terminology Relating to Non-ferrous Metals and Alloys[2]

E 29 Practice for using Significant Digits in Test Data to Determine Conformance with Specifications.[3]

E 46 Test Methods for Chemical Analysis of Lead and Tin-Base Solder; discontinued 1994

E 47 Test Methods for Chemical Analysis of Zinc Die Casting Alloys

E 51 Method for Spectrographic Analysis of Tin-based Alloys by the Powder Technique; discontinued 1984

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

E 87 Methods for Chemical Analysis of Lead, Tin, Antimony, and Their Alloys (Photometry Method); discontinued 1984

E 88 Practice for Sampling Nonferrous Metals and Alloys in Cast Form for Determination of Chemical Composition[4]

E 527 Practice for Numbering Metals and Alloys

E 536 Test Method for Chemical Analysis of Zinc and Zinc Alloys

2.2 *Federal Standard:*

Fed. Std. No. 123 Marking for Shipment (Civil Agencies)[5]

[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 Zinc and Cadmium.

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[2] *Annual Book of ASTM Standards*, Vol 02.04.

[3] *Annual Book of ASTM Standards*, Vol 14.02.

[4] *Annual Book of ASTM Standards*, Vol 03.05.

[5] Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

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

2.3 *Military Standard:*

Mil-Std-129 Marking for Shipment and Storage[5]

3. Terminology

3.1 Terms shall be defined in accordance with Terminology B 899.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *lot, n*—The term "lot" as used in this specification is defined as follows:

3.2.1.1 *Discussion*—For solid solder metal, a lot consists of all solder of the same type designation, produced from the same batch of raw materials under essentially the same conditions, and offered for inspection at one time.

3.2.2 *lot number, n*—The term "lot number" as used in this specification refers to a numerical designation for a lot which is traceable to a date of manufacture.

4. Classification

4.1 *Type Designation*—The type designation uses the following symbols to properly identify the material:

4.1.1 *Alloy Composition*—The composition is identified by a two or four-letter symbol and a number. The letters typically indicate the chemical symbol for the critical element in the solder and the number indicates the nominal percentage, by weight, of the critical element in the solder (see Table 1).

4.1.2 *Form*—The form is indicated by a single letter in accordance with Table 2.

4.1.3 *Powder Mesh Size (applicable only to solder paste)*—The powder mesh size is identified by a single letter in accordance with Table 3.

5. Ordering Information

5.1 Orders for material under this specification indicate the following information, as required, to adequately describe the desired material.

5.1.1 Type designation (see 4.1),

5.1.2 Detailed requirements for special forms,

5.1.3 Dimensions of ribbon and wire solder (see 9.2),

5.1.4 Unit weight,

TABLE 1 Solder Compositions

Table 1a: Zinc Base Alloys

		Composition %[A,B,C]													Temperature			
	UNS[D]	Cd	Zn	Sn	Pb	Sb	Ag	Cu	Al	Bi	As	Fe	Ni	Mg	Solidus		Liquidus	
															F	C	F	C
Zn 98	Z30402	0.005	REM	0.003	0.005	0.10	0.015	0.005	1.5–2.5	0.02	0.002	0.02	0.005	0.02	720	382	770	410
Zn 97	Z30505	0.005	REM	0.003	0.005	0.10	0.015	0.005	2.5–3.5	0.02	0.002	0.02	0.005	0.02	720	382	743	395
Zn 95	Z30502	0.005	REM	0.003	0.005	0.10	0.015	0.005	4.5–5.5	0.02	0.002	0.02	0.005	0.02	720	382	720	382
Zn 90	Z34550	0.004	88.0–92.0	0.003	0.005	0.10	0.015	3.0–6.0	3.0–6.0	0.02	0.002	0.100	0.005	0.05	720	382	797	425
Zn 87	Z30705	0.005	REM	0.003	0.005	0.10	0.015	0.005	12.5–13.5	0.02	0.002	0.05	0.005	0.02	720	382	815	435
Zn 85	Z30702	0.005	REM	0.003	0.005	0.10	0.015	0.005	14.0–16.0	0.02	0.002	0.06	0.005	0.02	720	382	842	450
Zn 80	Z30800	0.005	REM	0.003	0.005	0.10	0.015	0.005	19.5–20.5	0.02	0.002	0.08	0.005	0.02	720	382	896	480
Zn/Sn 50	Z56900	0.005	REM	49.0–51.0	0.05	0.10	0.015	0.005	0.100	0.02	0.002	0.02	0.005	0.02	388	198	680	360
Zn/Sn 49	Z56930	0.005	REM	47.5–50.5	0.05	0.10	0.015	0.8–1.3	0.100	0.02	0.002	0.02	0.005	0.05	392	200	592	311
Zn/Sn 27		33.0	26.0–28.0	REM	0.05	0.10	0.015	0.05	0.050	0.02	0.020	0.02	0.005	0.05	351	177	500	260
Zn/Cd 90	Z50940	REM	89.0–91.0	0.003	0.05	0.10	0.015	0.05	0.100	0.02	0.002	0.02	0.005	0.05	509	265	738	392
Zn/Cd 60	Z50980	REM	59.0–61.0	0.003	0.05	0.10	0.015	0.05	0.100	0.02	0.002	0.02	0.005	0.05	509	265	648	342

Table 1b: Tin Base Alloys

		Composition %[A,B,C]													Temperature			
	UNS[D]	Cd	Zn	Sn	Pb	Sb	Ag	Cu	Al	Bi	As	Fe	Ni	Mg	Solidus		Liquidus	
															F	C	F	C
Sn/Zn 60		0.005	REM	59.0–61.0	0.05	0.10	0.015	0.01	0.100	0.005	0.002	0.02	0.005	0.05	390	199	666	352
Sn/Zn 70		0.005	REM	69.0–71.0	0.005	0.10	0.015	0.01	0.100	0.005	0.002	0.02	0.005	0.05	390	199	601	316
Sn/Zn 75		0.004	REM	74.0–76.0	0.20	0.10	0.015	0.05	0.050	0.020	0.020	0.02	0.005	0.05	390	199	572	300
Sn/Zn 80		0.005	REM	79.0–81.0	0.05	0.10	0.015	0.01	0.100	0.005	0.002	0.02	0.005	0.05	390	199	536	280
Sn/Zn 91		0.005	REM	90.0–92.0	0.05	0.10	0.015	0.01	0.100	0.005	0.002	0.02	0.005	0.05	390	199	390	199

Table 1c: Cadmium Base Alloys

		Composition %[A,B,C]													Temperature			
	UNS[D]	Cd	Zn	Sn	Pb	Sb	Ag	Cu	Al	Bi	As	Fe	Ni	Mg	Solidus		Liquidus	
															F	C	F	C
Cd 60		REM	39.0–41.0	0.003	0.05	0.10	0.015	0.05	0.100	0.02	0.002	0.02	0.005	0.05	509	265	601	316
Cd 70		REM	29.0–31.0	0.003	0.05	0.10	0.015	0.05	0.100	0.02	0.002	0.02	0.005	0.05	509	265	572	300
Cd 78		REM	11.0–13.0	0.003	0.05	0.10	4.5–5.5	0.05	0.100	0.02	0.002	0.02	0.005	0.05	480	249	601	316
Cd 83		REM	16.0–18.0	0.003	0.05	0.10	0.015	0.05	0.100	0.02	0.002	0.02	0.005	0.05	509	265	509	265
Cd 95		REM	0.007	0.003	0.05	0.10	4.5–5.5	0.05	0.100	0.02	0.002	0.02	0.005	0.05	640	338	739	393

[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 E 29.

[B] All values not given as a range are maximum values unless stated otherwise.

[C] Remainder (REM) determined arithmetically by difference.

[D] The USN designations were established in accordance with Practice E 527. The last digit of a UNS number differentiates between alloys of similar composition.

TABLE 2 Form

Symbol	Form
B	Bar
I	Ingot
P	Powder
R	Ribbon
S	Special[A]
W	Wire

[A]Includes pellets, preforms, etc.

TABLE 3 Powder Mesh Size

Size Symbol	Powder Mesh Size
A	<325
B	<200
C	<100
D	<60

5.1.5 Packaging (see Section 18),

5.1.6 Marking (see Section 17),

5.1.7 ASTM Specification number and issue, marked on (a) purchase order and (b) package or spool, and

5.1.8 Special requirements, as agreed upon between supplier and purchaser.

6. Materials and Manufacture

6.1 The producer shall have each lot of solder metal as uniform in quality as practicable and of satisfactory appearance in accordance with best industrial practices. Each bar, ingot, or other form in which the solder is sold must be uniform in composition with the entire lot.

7. Chemical Composition

7.1 *Solder Alloy*—The solder alloy composition is as specified in Table 1.

NOTE 1—By mutual agreement between supplier and purchaser, analysis may be required and limits established for elements or compounds not specified in Table 4.

8. Physical Properties and Performance Requirements

8.1 *Solder Paste*—Solder paste must exhibit smoothness of texture (no lumps) and the absence of caking and drying during storage and application. Some applications may require a fast drying formulation.

8.1.1 *Powder Mesh Size*—The solder powder mesh size shall be as specified (see Section 4.1.3) when the extracted solder powder is tested as agreed upon between supplier and purchaser.

8.1.2 *Viscosity*—The viscosity of solder paste and the method used to determine the viscosity must be agreed upon between the supplier and the purchaser.

TABLE 4 Frequency of Sampling

Size of Lot, lb (kg)	Number of Samples (spools, coils, containers or pieces)
Up to 1000 (450), incl	3
Over 1000 to 10,000 (450 to 4500), incl	5
Over 10,000 (4500)	10

8.2 The following variables must be taken into account when relating one viscosity measurement to another: type of viscometer used, spindle size and shape, speed (r/min), temperature and the recent mixing history of the sample, and the use or non-use of a helipath.

9. Dimensions and Unit Weight

9.1 *Bar and Ingot Solder*—The dimensions and unit weight of bar and ingot solder will be as agreed upon between supplier and purchaser.

9.2 *Wire solder*—The dimensions and unit weight of wire solder are specified in 5.13 and 5.14. The tolerance on specified outside diameter shall be ± 5 % or± 0.002 in. (0.05 mm), whichever is greater.

9.3 Other forms:

9.3.1 Dimension for ribbon and special forms will be agreed upon between supplier and purchaser.

9.3.2 The unit weight of solder paste is specified in 5.1.4.

10. Workmanship, Finish and Appearance

10.1 All forms of solder must be processed in such a manner as to be uniform in quality and free of defects that will affect life, serviceability, or appearance.

11. Sampling

11.1 Care must be taken to ensure that the sample selected for testing is representative of the material. The method for sampling consists of one of the following methods:

11.1.1 Samples taken from the final solidified cast of fabricated product.

11.1.2 Representative samples obtained from the lot of molten metal during casting. The molten sample is poured into a cool mold, forming a bar approximately ¼in (6.4 mm) thick.

11.2 *Frequency of Sampling*—Frequency of sampling for determination of chemical composition shall be in accordance with Table 4. For spools and coils, the sample is obtained by cutting back 6 ft (1.8 m) of wire from the free end and then taking the next 6 ft for test. In other forms, an equivalent sample is selected at random from the container.

11.3 *Other aspects of Sampling*—Other aspects of sampling conforms in the case of bar and ingots, to Practice E 88. For fabricated solders the appropriate reference is Practice E 55.

12. Specimen Preparation

12.1 *Solid Ribbon and Wire Solder*—Each sample of solid ribbon and wire solder is prepared in accordance with 12.1 as applicable.

12.2 *Bar and Ingot solder*—Each sample piece is cut in half and one half marked and held in reserve. The remaining half is melted in a clean container, mixed thoroughly and poured into a cool mold, forming a bar approximately ¼ in (6.4 mm) thick. Sampling is performed by one of the following methods:

12.3 *Sawing*—Saw cuts are made across the bar at equal intervals of not more than 1 in (2.5 cm) throughout its length. If it is impractical to melt the bar or ingot as specified above, saw cuts are made across each piece at equal intervals of not more than 1 in (2.5 cm) throughout its length. No lubricants are used during sawing. The specimen consists of not less than 5 oz (143 g).