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.

Designation: B29 – 19

Standard Specification for Refined Lead[1]

This standard is issued under the fixed designation B29; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope

1.1 This specification covers refined lead in pig, block, or hog form.

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, health, and environmental practices, and determine the applicability of regulatory limitations prior to use.*

1.4 *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 the date of material purchase form a part of this specification to the extent referenced herein.

2.2 *ASTM Standards:*[2]

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

E37 Test Methods for Chemical Analysis of Pig Lead

E88 Practice for Sampling Nonferrous Metals and Alloys in Cast Form for Determination of Chemical Composition

3. Ordering Information

3.1 Orders for refined lead under this specification shall include the following information:

3.1.1 ASTM designation and year of issue,

3.1.2 Quantity (weight),

3.1.3 Name of material (for example, pure lead),

3.1.4 Size and shape (see Section 6),

3.1.5 Grade (see Table 1 and accompanying notes), and

3.1.6 Certification or test report if specified (Section 13).

4. Materials and Manufacture

4.1 Lead shall be supplied in commercial standard forms or shapes requested by the purchaser in the following grades:

4.1.1 Low bismuth low silver pure lead,

4.1.2 Extra refined pure lead,

4.1.3 Refined pure lead,

4.1.4 Pure lead, and

4.1.5 Chemical copper lead.

4.2 The grades of lead listed in 4.1.1 – 4.1.5 shall be produced by any smelting and refining process from ore or recycled materials to meet the chemical requirements of this specification.

5. Composition

5.1 The lead shall conform to the requirements prescribed in Table 1 and accompanying notes.

6. Sizes and Shapes

6.1 Pigs shall weigh up to a nominal 110 lb (50 kg).

6.2 Blocks or hogs shall be square or oblong and weigh up to 2530 lb (1150 kg).

7. Appearance

7.1 The lead shall be reasonably free from surface corrosion and adhering foreign material.

8. Lot

8.1 All lead of the same type produced and cast at one time shall constitute a lot for chemical analysis. Each pig or block of the lot shall bear a single identifying number that can be related to the manufacturing lot.

[1] This specification is under the jurisdiction of ASTM Committee B02 on Nonferrous Metals and Alloys and is the direct responsibility of Subcommittee B02.02 on Refined Lead, Tin, Antimony, and Their Alloys.

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[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.

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TABLE 1 Chemical Requirements[A,B]

Grade	Composition (Weight Percent)				
	Low Bismuth Low Silver Pure Lead, max[C]	Extra Refined Pure Lead, max[D]	Refined Pure Lead, max[E]	Pure Lead, max	Chemical-Copper Lead[F]
Sb	0.0005	0.0005	0.0005	0.001	0.001 max
As	0.0005	0.0005	0.0005	0.001	0.001 max
Sn	0.0005	0.0005	0.0005	0.001	0.001 max
Sb As and Sn	...	...	...	0.002	0.002 max
Cu	0.0010	0.0005	0.0010	0.0015	0.040–0.080
Ag	0.0010	0.0015	0.0075	0.010	0.020 max
Bi	0.0015	0.0075	0.025	0.05	0.025 max
Zn	0.0005	0.0002	0.001	0.001	0.001 max
Te	0.0001	0.0001	0.0002	...	...
Ni	0.0002	0.0002	0.0002	0.0005	0.002 max
Fe	0.0002	0.0005	0.001	0.001	0.002 max
Se	...	0.0005	0.0005	0.001	0.001 max
S	...	0.0005	0.001	0.002	0.001 max
Al	...	0.0005	0.0005	0.0005	0.0005 max
Cd	...	0.0002	0.0005	0.0005	0.0003 max
Lead (min) by difference	99.995	99.990	99.97	99.94	99.90
UNS Number	L50006	L50008	L50021	L50049	L51121

[A] The following applies to all specified limits in Table 1: For the purpose of determining conformance with this specification, an observed value obtained from the 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] By agreement between the purchaser and the supplier, analyses may be required and limits established for elements or compounds not specified in Table 1.
[C] This grade is intended for chemical applications where low silver and low bismuth contents are required. This is a common primary standard.
[D] This grade is intended for use where a 99.990 refined lead purity is required. It meets the requirements of BS/EN PB990R.
[E] This grade is intended for lead acid battery applications.
[F] This grade is intended for applications requiring corrosion protection and formability.

9. Sampling for Chemical Analysis

9.1 The sample for chemical analysis shall be selected by one of the following methods:

9.1.1 Test samples taken from the lot during casting, or

9.1.2 Test samples taken from the final solidified cast product.

9.2 *Sampling for Lot Analysis*—The supplier may obtain samples from the lot of molten metal during casting. All or part of these samples may be cast into shapes suitable for use in spectrographic analytical methods. This is the preferred method for determining lot chemistry. The samples should be taken in such a way that they are representative of the material cast.

9.3 *Sampling of Cast Product:*

9.3.1 If the lead is in the form of standard pigs (Fig. 1), the sample for chemical analysis shall be taken in accordance with 9.3.3.1, 9.3.3.2, or 9.3.3.3. The method of sampling in 9.3 does not apply to alloys that exhibit segregation of alloy agents during casting. This means the calcium aluminum alloy are not to be sampled according to this procedure. The preferred method of determining lot chemistry for calcium aluminum lots is suppler sampling of quick frozen wafers during casting.

9.3.1.1 If the pigs differ in shape from those shown in Fig. 1 or the product is cast into blocks or hogs, the supplier and the purchaser shall agree mutually as to the method to be followed in sampling such shapes.

9.3.2 *Sampling Pig Lead*—A portion representative of the total shipment shall be selected at random for the final sample. For lots containing at least 100 000 lb (45 400 kg) of pig lead, one pig shall be taken from every 20 000 lb (9080 kg). For smaller lots, a total of five pigs shall be taken.

9.3.3 *Sample Preparation*—Each pig shall be cleaned thoroughly to rid the surface of dirt or adhering foreign material prior to sampling by one of the following methods: sawing, drilling, or melting.

9.3.3.1 *Sawing*—The pigs selected shall be sawed completely through as illustrated in Fig. 1. The sawings from the pigs shall be mixed thoroughly and quartered, and the samples for analysis taken from the mixed material. The sawings must be free of extraneous material introduced from the saw blade. All sawings shall be treated with a strong magnet in order to remove iron introduced by sawing.

9.3.3.2 *Drilling*—The pigs shall be drilled at least halfway through from two opposite sides as illustrated in Fig. 2. A drill of about ½ in. (12.7 mm) in diameter shall be used. In drilling, the holes shall be spaced along a diagonal line from one corner of the pig to the other. Holes may be made in a single pig or in each of several pigs placed as illustrated in Fig. 2. The drillings shall be clipped into pieces not over ½ in. (12.7 mm) in length, mixed thoroughly, and treated with a strong magnet to remove iron introduced by drilling.

9.3.3.3 *Melting*—Whole pigs, portions of pigs produced by sawing, drillings, or sawings shall be melted in a clean vessel. The melting temperature must not exceed 685°F (363°C) to prevent excessive drossing. The lead must be stirred immediately prior to sampling. The molten lead shall be cast into shapes suitable for use in spectrographic analysis, cast into thin sample bars not to exceed ⅜ in. (9.5 mm) thick for sawing, or granulated by pouring into distilled water and drying the

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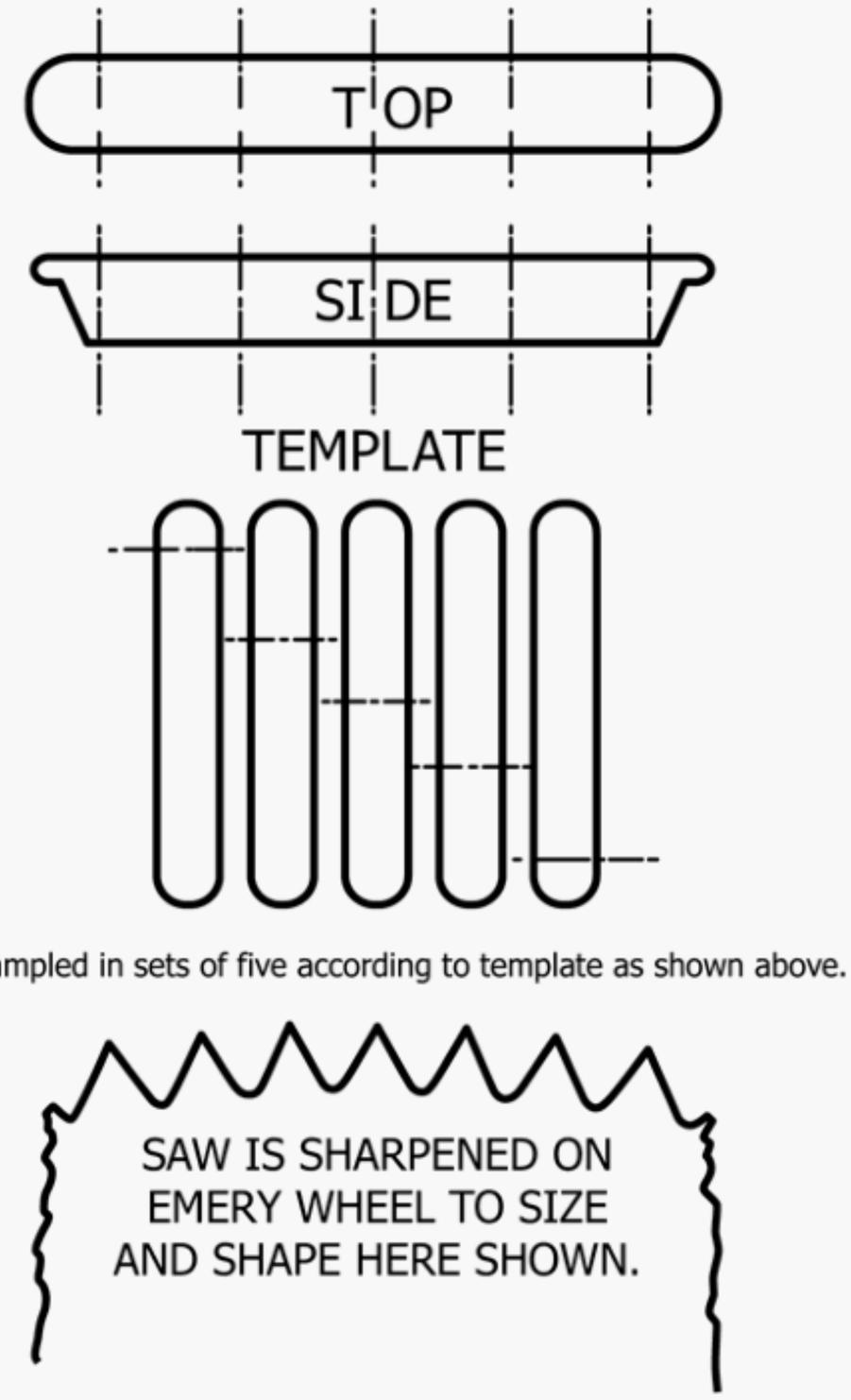
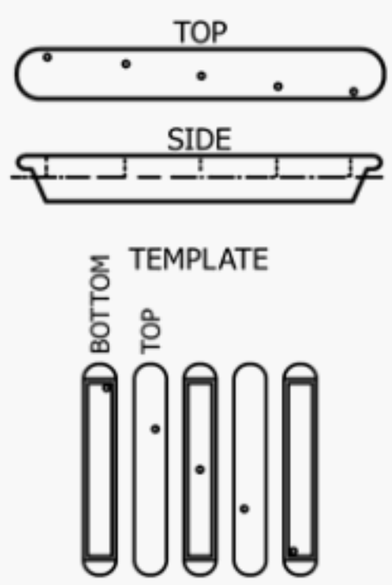


FIG. 1 Method of Sampling Lead by Sawing



NOTE 1—Pigs selected for sampling shall be placed side by side, every other pig bottom side up, and sampled according to template in sets of five pigs each as indicated above. The pigs shall be drilled at least halfway through: when a larger sample is desired, the pigs shall be turned over and sampled on the other diagonal.

FIG. 2 Method of Sampling Lead by Drilling

material thoroughly. For sample bars, saw cuts shall be made halfway across the bar from each side and staggered so that they are about ½ in. (12.7 mm) apart. The sawings so produced are treated in accordance with 9.3.3.1.

9.3.4 *Sample Size:*

9.3.4.1 For spectrographic analysis, three samples shall be prepared of a size and shape satisfactory for use by the laboratory at which the analysis is to be made.

9.3.4.2 For wet chemical analysis, each prepared sample (sawings, drillings, or granules) shall weigh at least 600 g.[3]

9.3.5 Aspects of sampling and sample preparation not specifically covered in this specification shall be carried out in accordance with Practice E88.

10. Methods of Chemical Analyses

10.1 The chemical compositions enumerated in Table 1 of this specification shall, in case of disagreement, be determined by wet chemical or spectrographic methods mutually agreed upon by the supplier and the purchaser.

10.2 By agreement between the purchaser and the supplier, analyses may be required and limits established for elements or compounds not specified in Table 1.

11. Inspection

11.1 Inspection of the material shall be agreed upon between the purchaser and the supplier as part of the purchase contract.

12. Rejection and Rehearing

12.1 Material that fails to conform to the requirements of this specification may be rejected. Rejection should be reported to the supplier promptly and in writing. In case of dissatisfaction with the results of the test, the supplier may make claim for a rehearing.

12.2 Rejection shall be considered as follows:

12.2.1 Variation of weight, quantity, dimensions, or workmanship.

12.2.2 Chemical composition.

12.2.2.1 In case of dispute, the material shall be sampled in the presence of both parties in accordance with 9.3.

12.2.2.2 The resulting sample (at least 1800 g) shall be mixed and separated into three equal parts, each of which shall be placed in a sealed package, one for the supplier, one for the purchaser, and one for the umpire if necessary, and analyzed in accordance with Test Methods E37.

12.3 When the lead metal satisfies the chemical and physical requirements of this specification, it shall not be condemned for defects in manufacturing or for defects of alloys or products in which it is used.

13. Certification

13.1 When specified in the purchase order or contract, the purchaser shall be furnished certification that samples representing each lot have been tested as directed in this specification and the requirements have been met. When specified in the purchase order or contract, a certified report of the test results shall be furnished.

[3] Fox, G. J., "Determination of As, Sb, and Te in Lead and Lead Alloys Using Hydride Generation Atomic Absorption Spectrometry," *Atomic Spectroscopy*, Vol 11, No.1, January 1990, p. 13.

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14. Marking and Special Requirements

14.1 A brand, by which the supplier can be identified, shall be cast or marked legibly upon each pig, block, or hog. In addition, other markings shall identify the material by type and lot number.

14.2 (Any) special marking, color code, and other quality requirements not covered by this specification shall be agreed upon between the supplier and the purchaser.

15. Keywords

15.1 chemical-copper lead; lead; lead metal; pure lead; refined pure lead

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