INTERNATIONAL

Designation: ~~B215 – 15~~ B215 – 20

Standard Practices for Sampling Metal Powders[1]

This standard is issued under the fixed designation B215; 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 These practices cover sampling methods used to collect a small quantity of metal powder that is as representative of the entire starting material as possible, and ~~details~~detail the procedures that are recommended for reducing this quantity into smaller test portions on which chemical, physical, and mechanical property data may be determined.

1.2 Several sampling practices are described, depending on their applicability to the conditions of storage and transport of the sampled powders:

1.2.1 *Practice 1A (Described in Section 6)*—Applicable to sampling moving powders, as when being transferred from one container to another or to a process stream; or when falling from a conveyor; or in a moving process stream. This is the preferred practice for obtaining the several increments that are combined to form the gross sample.

1.2.2 *Practice 1B (Described in Section 7)*—Applicable to sampling powders that have already been packaged for transport, as in a bag or drum. A hollow tubular slot sampler is the recommended way to sample these packaged powders to obtain the increments (7.1.1). Alternatively, when other methods are not possible or available, a procedure specified here (7.1.2) may be used to randomly scoop samples from the powder, using a scoop of specified material and configuration.

1.2.3 *Practice 2 (Described in Section 8)*—Applicable to obtaining test portions from the composite sample. For larger quantities of powder, a chute splitter is generally used, while a spinning riffler is used for smaller quantities.

1.3 These practices apply to particulate materials or mixtures of particulates with particle sizes generally less than one millimetre and include mixtures containing lubricant, with or without other non-metallic additives, that are ready for compacting.

1.4 These practices do not cover the sampling of flake powders or pastes. For procedures on the sampling and testing of flake metal powders and pastes, refer to Test Methods D480.

1.5 *Units*—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 establish appropriate ~~safety~~ safety, health, and ~~health~~environmental practices and determine the applicability of regulatory limitations prior to use.*

[1] These practices are under the jurisdiction of ASTM Committee B09 on Metal Powders and Metal Powder Products and are the direct responsibility of Subcommittee B09.02 on Base Metal Powders.

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

1.7 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 *ASTM Standards:*[2]

B243 Terminology of Powder Metallurgy

D480 Test Methods for Sampling and Testing of Flaked Aluminum Powders and Pastes

3. Terminology

3.1 *Definitions*—Definitions of powder metallurgy terms can be found in Terminology B243. Additional descriptive information is available in the Related Materials section of Vol 02.05 of the *Annual Book of ASTM Standards*.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 See Fig. 1 for the terms hereinafter defined.

3.2.2 *composite ~~sample—~~sample, n—*blended entire gross sample.

3.2.3 *~~increment—~~increment, n—*quantity of powder obtained by a sampling device at one time from a larger quantity of powder.

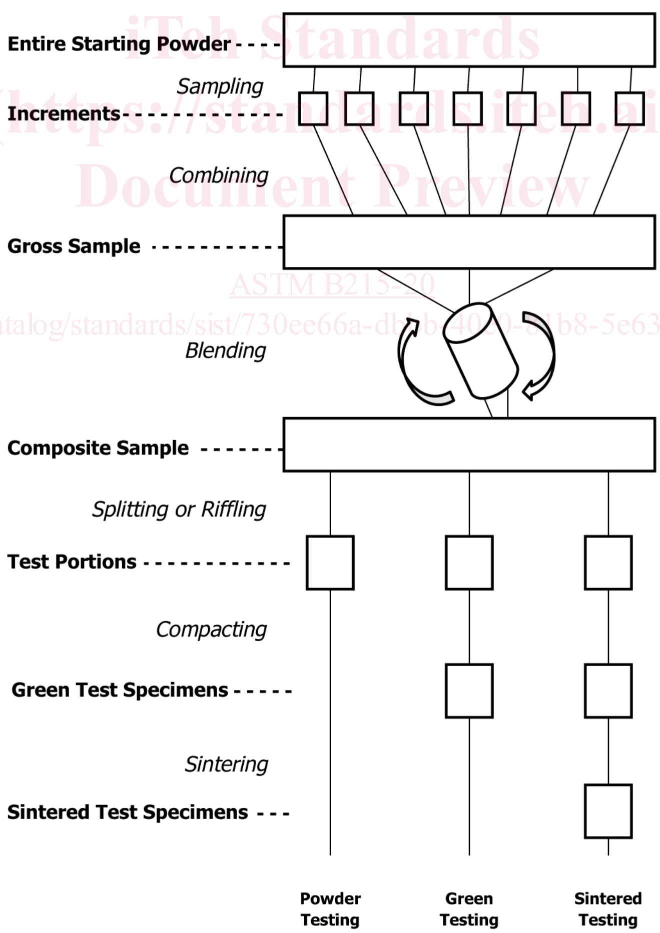

FIG. 1 Scheme of Sampling

[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.

3.2.4 *gross ~~sample—~~sample, n—*total quantity of powder adequate for the intended purpose(s), consisting of all the increments combined.

3.2.5 *test ~~portion—~~portion, n—*quantity of powder (generally taken from the composite sample) on which the test is performed, or from which a test piece is produced.

4. Significance and Use

4.1 Specifications and test methods for metal powders and metal powder products require the sampling, testing, and performance evaluation of small samples taken from large quantities of powder. The sampling procedure is equally as important as the testing and evaluation; the sampling methods used must include every precaution to ensure that the samples obtained will show the true nature and condition of the large powder quantity that they represent.

4.2 The primary objective of any sampling procedure is to obtain a small quantity of material that is truly representative of the larger amount from which it is taken, a condition that is readily comprehended but difficult to define, quantify, and prove. Certain criteria are desirable to meet this condition:[3]

4.2.1 Every sampling increment should have a *non-zero probability* of being selected.

4.2.2 All increments should have an *equal probability* of being selected.

4.2.3 The sampling procedure *should not alter* the material (for example, by changing the particle size or chemical composition).

4.3 Sampling a *moving* powder helps to satisfy these criteria; therefore, Practice 1A should be used whenever possible to obtain the composite sample. Similarly, Practice 2 should be used to obtain the test portions; use of a spinning riffler is preferred when possible and practicable.

4.4 Although not always meeting all the criteria of 4.2.1 – 4.2.3, the other sampling practices described in this standard are based on time-proven experience in the PM industry in sampling granular metal powders. These practices have been shown to produce samples that give reliable and representative evaluation data.

4.5 Since many tests are performed using very small amounts of powder meant to represent much larger quantities, it is most important that the test portions be obtained in a standardized manner. The practices described here take into account the possibility of segregation of the metal powder during and after filling of containers.

4.6 Sample quantities of metal powder are used for chemical analysis and to determine the physical characteristics of the powder. These data are used for production control and quality inspection of finished lots.

4.7 Green compacts produced from powder samples are used to evaluate the compactability properties of metal powders, information that is important to the use of these powders in the manufacture of PM bearings and structural parts.

4.8 Test specimens produced from metal powder samples are compacted and sintered and used to measure physical and mechanical properties of solid PM materials. The data obtained are included in PM material specifications to assist with material selection for PM applications.

4.9 Solid PM articles—structural parts, bearings, etc.—are produced from metal powder samples to evaluate powder performance in the manufacturing and end use of such articles.

[3] Gy, ~~Pierre~~P. M., *Sampling of Heterogeneous and Dynamic Material Systems*, Elsevier: New York, NY, 1992.

5. Apparatus

5.1 *Rectangular Receptacle,* capable of being moved completely across a stream of flowing powder at a constant speed and having a length and width greater than the stream of powder. It must be large enough so that no overflow of powder occurs when collecting the sample.

5.2 *Small ~~Blender—~~Blender,* ~~Of~~of sufficient capacity to blend the entire gross sample, consisting of all the increments combined.

5.3 *Commercial Sampling Device*—Many powder transfer systems are closed for dust control, but there are commercial devices available that can be inserted into a section of a pipe to collect powder increments while maintaining the flowing stream.

5.4 *Powder Sampler*—A slot or tube sampler with an auger point that can be screwed to the bottom of a filled container and is designed to collect powder at one (single-level) or more (multi-level) ~~depths,~~depths; see Fig. 2 and Fig. 3.

5.5 *Powder Scoop*—A non-magnetic stainless steel scoop with a sharp edge and high sides, of a size and capacity capable of obtaining the desired powder increment. See Fig. 4.

5.6 *Chute ~~Splitter—~~Splitter,* ~~Of~~of sufficient size and capacity to split the required amount of powder into two approximately-equal ~~portions, see~~ portions. A lever-operated gate-type splitter is recommended, so that the entire sample may be distributed evenly across the width of the splitter and poured in one continuous motion. See Fig. 5. Several different sizes of splitter may be necessary throughout the sampling process, depending on the sample size at each step. The size of the chute openings should be at least three times the largest particle size to be sampled, and the chute angle should be at least 45°. The smallest of the chute splitters are often referred to as "micro splitters."

5.7 *Charging ~~Pan—~~Pan or Hopper (*Fig. 5*)*—A pan or hopper that is the same width as the chute splitter and ~~large enough to contain~~ of a size such that the sample to be ~~split.~~split occupies at least 20 % of its volume.

5.8 *Spinning ~~Riffler—~~Riffler,* ~~Of~~of sufficient size and capacity to split the required amount of powder into at least eight

FIG. 2 Multi-Level Slot Sampler with Auger Point (Keystone Sampler)

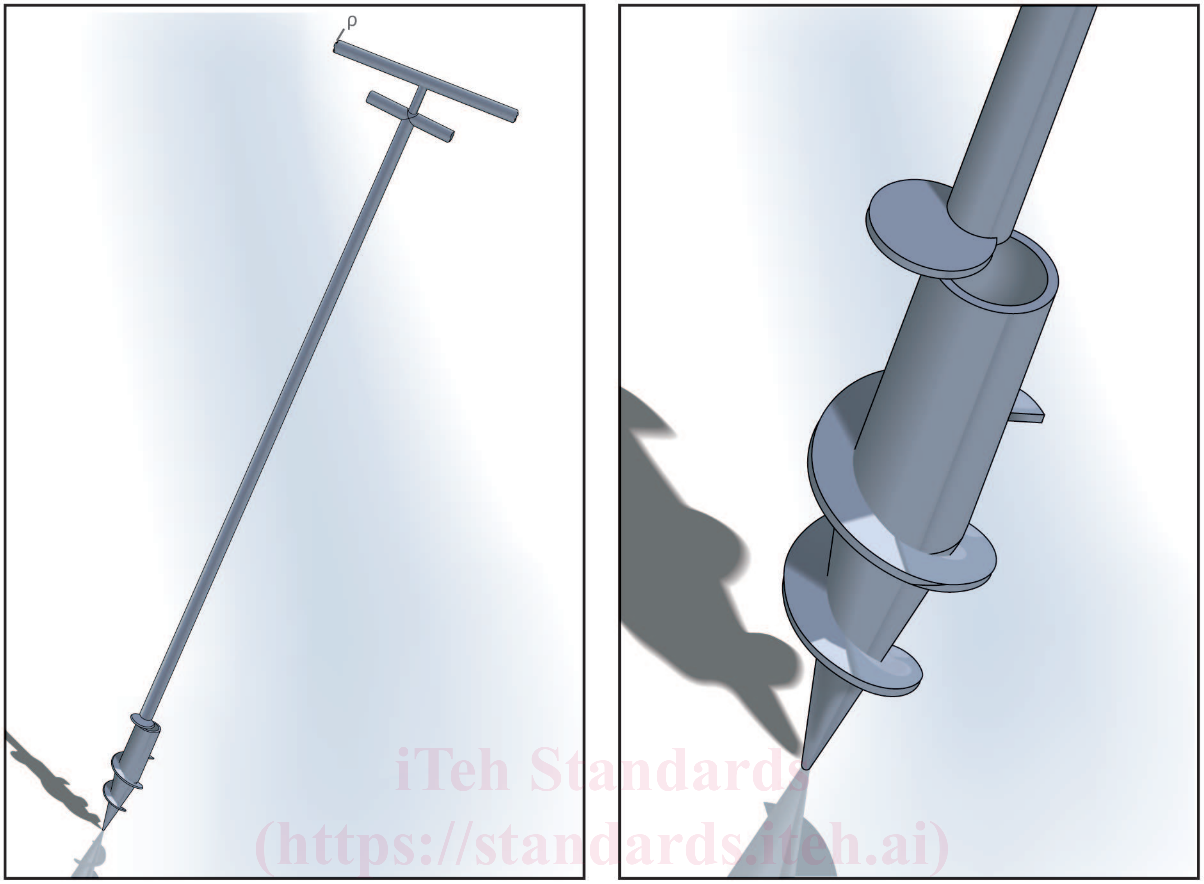

FIG. 3 Single-Level Tube Sampler with Auger Point (Full View and Close-Up of Point) — Schematic

FIG. 4 Stainless Steel Scoop for Sampling Metal Powder

approximately-equal ~~portions,~~portions; see Fig. 6. Several different sizes of riffler may be necessary throughout the sampling process, depending on the sample size at each step. The smallest of these are often referred to as "micro rifflers."

PART 1—OBTAINING THE COMPOSITE SAMPLE

6. Practice 1A—Sampling a Moving Powder

6.1 The preferred method for sampling powders is always when the powder is in motion, as, for example, when being transferred from a blender or a storage tank, or falling from a conveyor, or in a moving process stream (pipeline).

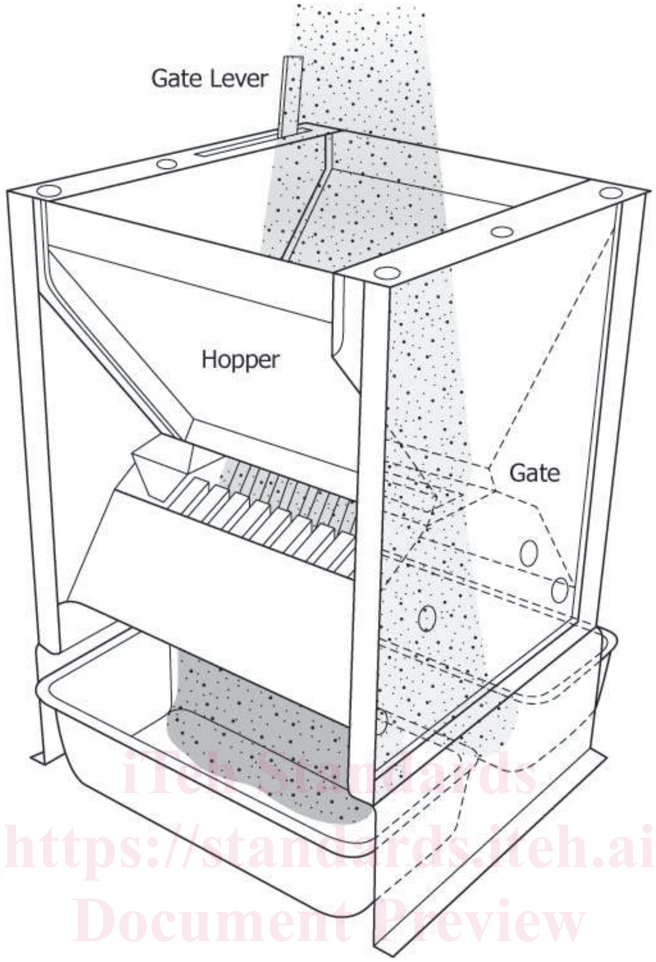

FIG. 5 Gate-Type Chute Splitter — Schematic

6.2 Equal powder increments should be taken at random intervals over the life of the flow.

6.3 The number of increments that make up the gross sample should be agreed upon between the parties concerned.

6.4 Pass the rectangular receptacle at a constant speed completely through the stream of flowing powder, starting immediately upon flow. Repeat at random intervals until the agreed-upon number of increments is obtained, taking the last increment near the end of the flow.

6.5 Alternatively, use a commercial sampling device to collect the agreed-upon number of increments, starting immediately upon flow, and taking the last increment near the end of the flow.

6.6 The total amount from all increments shall be adequate for the tests or evaluations to be performed.

NOTE 1—To investigate within-lot and sampling variability, individual increments may be tested, rather than being combined to form a composite sample.

6.7 Combine the increments to form the gross sample.

6.8 Blend the gross sample in a small blender to form the composite sample.

7. Practice 1B—Sampling a Stationary Powder

7.1 Although sampling a moving powder is always preferred, it is not always possible to do so with powders that have already

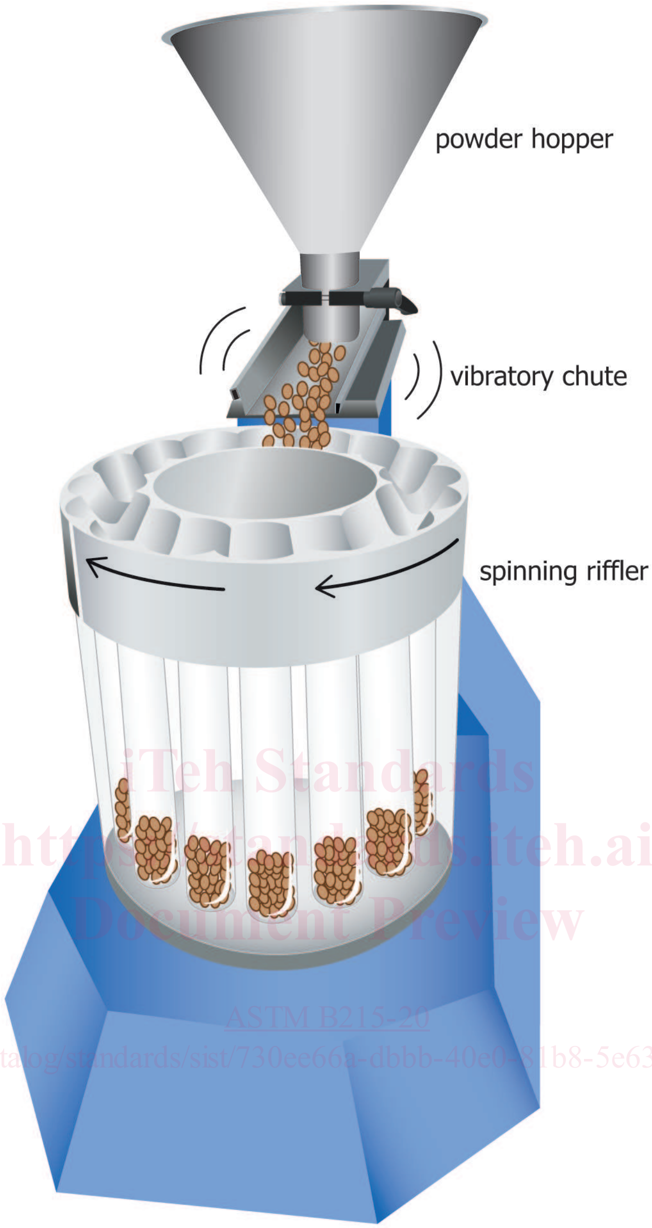

FIG. 6 Spinning Riffler — Schematic

been packaged for shipment (for example, in drums, pails, or bags). Such stationary powders must then be sampled using either a tube (slot) sampler or a simple scoop, as specified in the following sections.

7.1.1 *Sampling a Stationary Powder Using a Slot or Tube Sampler*—Using a hollow tubular multi-level slot sampler (Fig. 2) to remove powder from several depths of the container is the recommended way to sample packaged powder. Alternatively, a single-level tube sampler (Fig. 3) may be used repeatedly to remove powder from several depths of the container.

7.1.1.1 Equal powder increments should be taken at each depth.

7.1.1.2 The number of increments that make up the gross sample and the number of increments taken from each container should be agreed upon between the parties concerned.

7.1.1.3 Consult Table 1, Sampling Schedule, to determine the recommended minimum number of containers, selected at random, from the lot or batch of powder, that are to be sampled.

7.1.1.4 Obtain powder increments from each container using either of the following devices: