~~Designation:B214–99~~ Designation: B 214 – 07

Standard Test Method for Sieve Analysis of Metal Powders[1]

This standard is issued under the fixed designation B 214; 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 Department of Defense.

1. Scope

~~1.1This test method covers the determination of the dry sieve analysis of metal powders.~~

~~1.2~~

1.1 This test method covers the dry sieve analysis of metal powders or mixed powders, using sieves with openings ranging from 45 to 1000 micrometers.

1.2 This test method is based on a particular type of mechanical sieve shaker (see 5.2). Other types of sieve shakers are also available, but their precision and reproducibility have not been determined.

1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

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 establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:* [2]

B 212 Test Method for Apparent Density of Free-Flowing Metal Powders Using the Hall Flowmeter Funnel

B 215~~Practices for Sampling Finished Lots of Metal Powders~~[2] Practices for Sampling Metal Powders

B 243~~Terminology of Powder Metallurgy~~[2] Terminology of Powder Metallurgy

B 329 Test Method for Apparent Density of Metal Powders and Compounds Using the Scott Volumeter

B 417 Test Method for Apparent Density of Non-Free-Flowing Metal Powders Using the Carney Funnel

B 703 Test Method for Apparent Density of Powders Using Arnold Meter

E 11~~Specification for Wire-Cloth Sieves for Testing Purposes~~ Specification for Wire Cloth and Sieves for Testing Purposes

E 691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

E 1638 Terminology Relating to Sieves, Sieving Methods and Screening Media

2.2 *MPIF Standard:*

MPIF 05 Determination of Sieve Analysis of Metal Powders[3]

3. Terminology

3.1 *Definitions*—~~Useful definitions of terms for metal powders and powder metallurgy are found in Terminology B243~~—Useful definitions of terms relating to powder metallurgy are found in B 243 and those relating to sieve analysis are found in E 1638.

4. Significance and Use

4.1 The particle size distribution of a metal powder affects its behavior in P/M processing and other applications of these materials. The test method may be part of the purchase agreement between powder ~~manufacturer~~supplier and user, or it may be an internal quality control test for either. ~~This test method is appropriate for materials with size distributions typified by metal powders used in powder metallurgy.~~

[1] This test method is under the jurisdiction of ASTM Committee ~~B-9~~B09 on Metal Powders and Metal Powder ~~Products.~~Products and is the direct responsibility of Subcommittee B09.02 on Base Metal Powders.

Current edition approved ~~April 10, 1999.~~Jan. 1, 2007. Published ~~August 1999.~~January 2007. Originally ~~published as B214–46T.~~approved in 1946. Last previous edition approved in 1999 as B 214 – ~~92~~9.

[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* ~~, Vol 02.05~~volume information, refer to the standard's Document Summary page on the ASTM website.

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

[3] Available from Metal Powder Industries Federation (MPIF), 105 College Road East, Princeton, NJ 08540, http://www.mpif.org.

5. Apparatus

5.1 *Sieves*—~~A set of standard sieves selected from Table 1 of Specification E11, or the equivalent Tyler standard sieves. The sieves shall be 8 in. (203.2 mm) in diameter and either 1 or 2 in. (25 or 50 mm) in depth and fitted with bronze, brass, stainless steel, or other suitable wire cloth. The U.S. sieves given in Table 1 of this method shall conform to Specification E11. If Tyler standard sieves are substituted, they shall conform to the permissible variations given in Table 1 of Specification E11~~—Select a set of standard sieves from the table entitled, "Nominal Dimensions, Permissible Variations for Wire Cloth of Standard Test Sieves (U.S.A.) Standard Sieves," of Specification E 11, or the equivalent Tyler standard sieves. The sieves shall be 200 mm (8 in.) in diameter and either 25 or 50 mm (1 or 2 in.) in depth, and fitted with bronze, brass, stainless steel, or other suitable wire cloth. The U.S. sieves given in the table entitled, "U.S. Standard Series Test Sieves and Equivalent Tyler Standard Sieves," of this test method shall conform to Specification E 11. If Tyler standard sieves are substituted, they shall conform to the permissible variations given in the table entitled, "Nominal Dimensions, Permissible Variations for Wire Cloth of Standard Test Sieves (U.S.A.) Standard Sieves" of Specification E 11.

NOTE 1—The new U.S. Series standard sieves, adopted in 1970, are the preferred sieves to use. The old U.S. Series standard sieves and equivalent sieves manufactured by other companies, such as Tyler, may also be used if the new U.S. Series is not available. Care should be taken to make sure that sieve opening sizes are correct when performing standardization work.

5.2 *Sieve Shaker*— A mechanically operated, single eccentric sieve shaker ~~which~~ shall be used that imparts to the set of sieves a rotary motion and a tapping action of uniform ~~speed, shall be used.~~ speed. The number of rotations per minute shall be between 270 and 300. The number of taps per minute shall be between 140 and 160. The hold down arm of the sieve shaker shall be fitted with a shock absorbing plug to receive the impact of the tapping device. The entire apparatus shall be rigidly mounted by bolting to a solid foundation, preferably of concrete. ~~A time switch should be provided to ensure accuracy of duration of the test.~~

NOTE 2—Use of a sound proof enclosure is recommended.

5.3 *Balance*—A balance having a capacity of at least ~~110~~150 g and a sensitivity of 0.01 g.

6. Test Specimen

6.1 The size of the test specimen shall be 90 to ~~100~~110 g for any metal powder having an apparent density greater than or equal to 1.50 g/cm^3 when determined in accordance with Test Method B 212. ~~A 40 to 60-g specimen shall be used when the apparent density of the powder is less than 1.50 g/cm^3.~~ B 329, B 417, or B 703. A specimen of 40 to 60 g shall be used when the apparent density of the powder is less than 1.50 g/cm^3. The test specimen should be obtained in accordance with Practices B 215.

7. Procedure

~~7.1Assemble the group of sieves selected in consecutive order as to size of openings, with the coarsest sieve at the top, the assembly being completed by a solid collecting pan below the bottom sieve. Place the test specimen on the top sieve and close this sieve with a solid cover. Then fasten the sieve assembly securely in a suitable mechanical sieve shaking device and operate the machine for a period of 15 min.~~

~~7.2Remove the screened fractions from the nest of sieves by removing the coarsest sieve from the nest, gently tapping its contents to one side and pouring them upon a glazed paper. Brush any material adhering to the bottom of the sieve and frame with a soft brush into the next finer sieve. Tap the sieve just removed upside down, on the paper containing the portion that had been retained on it. Weigh this fraction to the nearest 0.1 g and remove it from the balance. Repeat this process for each sieve in the nest and remove the fraction collected in the pan and weigh. The sum of the masses of all the fractions shall be not less than 99% of the mass of the test specimen. Add the difference between this sum and the mass of the test specimen (in accordance with Section~~

7.1 Examine the sieves to make sure that they are not damaged and are clean.

TABLE 1 U.S. Standard Series Test Sieves and Equivalent Tyler Standard Sieves

~~MSiesh Dvesignation~~ Number	Sieve Opening (μm)		
	New U.S. Series	Old U.S. Series	Tyler Series
20	850	841	833
35	—	—	417
40	425	420	—
60	250	250	250
80	180	177	175
100	150	149	147
140	106	105	—
150	—	—	104
200	75	74	74
230	63	63	—
250	—	—	63
325	45	44	45

7.2 Assemble the group of sieves selected in consecutive order by the size of their openings, with the coarsest sieve at the top, the assembly being completed by a solid collecting pan below the bottom sieve. Place the test specimen on the top sieve and close this sieve with a solid cover. Then fasten the sieve assembly securely in the sieve shaker and operate the machine for a period of 15 minutes.

NOTE 3—For some materials, for example brittle and friable materials, the 15 minutes may be too long. Sieving time may be adjusted for such materials, and the actual time used should be reported along with the test data.

7.3 Remove the screened fractions from the nest of sieves by removing the coarsest sieve from the nest, gently tapping its contents to one side and pouring them upon a glazed paper. Brush any material adhering to the bottom surface of the sieve and the lower frame with a soft brush into the next finer sieve. Tap the sieve just removed upside down, on the paper containing the portion that had been retained on it, and brush the back side of the sieve with the flat side of the brush so as to dislodge any particles that may have been wedged in the screen openings, by pushing to the upper side of the screen. Weigh this fraction to the nearest 0.1 g and remove it from the balance. Repeat this process for each sieve in the nest. Remove the fraction collected in the pan and weigh. The sum of the masses of all the fractions shall be not less than 99 % of the mass of the test specimen. Add the difference between this sum and the mass of the test specimen (in accordance with Section 6) to the mass of the fraction collected in the pan.

NOTE~~3—If the sum is less than 99%, check the condition of the screens and pan or possible errors in weighing and repeat the test.~~ 4—If the sum is less than 99 %, check the condition of the screens and the pan and also check for possible errors in weighing. Repeat the test if error persists.

8. Report

8.1 Express the masses of the fractions retained on each sieve, and the mass of the fraction collected in the pan, as percentages of the mass of the test specimen to the nearest 0.1 %, and report them in the form shown in Table 2~~. Report any fraction that is less than 0.1% of the mass of the test specimen as "trace." If a fraction is absent, report it as "0.0".~~. Report any fraction that is less than 0.1 % of the mass of the test specimen as "trace." If a fraction is absent, report it as "0.0". Report the actual time period of sieving, if it is different than 15 minutes.

8.2 Interpretation of this report should be made with reference to Specification E 11 in which the dimensional tolerances of standard sieves are specified.

TABLE 2 Format for Reporting Test Data of a Typical 100-Mesh Powder

Particle Size (μm)	~~Mesh Designation~~ Sieve Number	~~Percentage~~ % By Mass
New U.S. Standard Series		
>180	+ 80	...
≤ 180 > 150	– 80 + 100	...
≤ 150 > 106	– 100 + 140	...
≤ 106 > 75	– 140 + 200	...
≤ 75 > 45	– 200 + 325	...
≤ 45	– 325	...
Old U.S. Standard Series		
~~Particle Size (μm)~~	~~Mesh Designation No.~~	~~Percentage by Mass~~
Particle Size (μm)	Sieve Number	% By Mass
> 177	+ 80	...
≤ 177 > 149	– 80 + 100	...
≤ 149 > 105	– 100 + 140	...
≤ 105 > 74	– 140 + 200	...
≤ 74 > 44	– 200 + 325	...
≤ 44	– 325	...
Tyler Standard Sieve Series		
~~Particle Size (μm)~~	~~Mesh Designation No~~	~~Percentage By Mass~~
Particle Size (μm)	Sieve Number	% By Mass
> 175	+ 80	...
≤ 175 > 147	– 80 + 100	...
≤ 147 > 104	– 100 + 150	...
≤ 104 > 74	– 150 + 200	...
≤ 74 > 45	– 200 + 325	...
≤ 45	– 325	...