Designation: ~~E276 – 03 (Reapproved 2008)$^{\varepsilon 1}$~~ E276 – 13

Standard Test Method for Particle Size or Screen Analysis at No. 4 (4.75-mm) Sieve and Finer for Metal-Bearing Ores and Related Materials[1]

This standard is issued under the fixed designation E276; 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.

~~ε^1 NOTE—Editorial corrections were made throughout in September 2008.~~

1. Scope

1.1 This test method covers the determination of the size distribution by screen analysis, dry or wet, of metal-bearing ores and related materials at No. 4 (4.75-mm) sieve and finer.

1.2 The values stated in inch-pound units are to be regarded as standard. The SI values given in parentheses 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 establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves

E135 Terminology Relating to Analytical Chemistry for Metals, Ores, and Related Materials

E882 Guide for Accountability and Quality Control in the Chemical Analysis Laboratory

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of terms used in this test method, refer to Terminology E135.

4. Summary of Test Method

4.1 The sample is passed through a bank of standard sieves by agitation. The dry screening technique described in this test method may be used on any solid particles that can be dried so that sieve blinding does not occur. The wet screening technique using liquid media may be used on any insoluble solids.

5. Significance and Use

5.1 This test method is intended to be used for compliance with compositional specifications for particle size distribution. It is assumed that all who use this procedure will be trained analysts capable of performing common laboratory practices skillfully and safely. It is expected that work will be performed in a properly equipped laboratory and that proper waste disposal procedures will be followed. Follow appropriate quality control practices such as those described in Guide E882.

6. Apparatus and Materials

6.1 *U.S. Standard Sieves,* conforming to the requirements of Specification E11.

6.2 *Mechanical Sieve Shaker.*

6.3 *Drying Oven,* of appropriate size and capable of maintaining a uniform temperature at ~~110 °C ± 5 °C.~~110 °C ± 5 °C.

[1] This test method is under the jurisdiction of ASTM Committee E01 on Analytical Chemistry for Metals, Ores, and Related Materials and is the direct responsibility of Subcommittee E01.02 on Ores, Concentrates, and Related Metallurgical Materials.

Current edition approved ~~Sept. 1, 2008~~Oct. 1, 2013. Published ~~September 2008~~November 2013. Originally approved in 1965. Last previous edition approved in ~~2003~~2008 as ~~E276 – 03.~~E276 – 03 (2008)$^{\varepsilon 1}$. DOI: ~~10.1520/E0276-03R08E01.~~10.1520/E0276-13.

[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.

6.4 *Sample Splitter or Riffle* with 1-in. (25.4-mm) opening.

6.5 *Scales and Weights,* of adequate accuracy.

6.6 *Pans,* for holding samples.

6.7 *Brass and Fiber Bristle Brushes,* for cleaning sieves and pans.

6.8 *Special Apparatus,* for wet screening, including deep-frame sieves.

6.9 *Water* or other liquid, for wet screening.

7. Sample Preparation

7.1 If necessary, reduce the sample by riffling or other suitable means to obtain a test sample that will not overload the sieves, and dry at ~~110 °C ± 5 °C to constant weight.~~ 110 °C ± 5 °C to constant mass. Constant mass is obtained when an additional hour drying at 110 °C ± 5 °C does not cause a change greater than 0.05 % mass.

NOTE 1—The size of the sample is very important in sieve analysis because the number of particles on a sieve surface affects the probability of any one particle passing through the sieve at a given time. The more particles there are on a sieve, the greater probability that any one particle is hindered from getting into a position to pass through the opening. Avoid overloading the sieves.

7.2 Screen the test sample from 7.1 on a No. 4 (4.75-mm) sieve. Weigh the material retained on the No. 4 sieve. Record mass.

8. Preparation of Apparatus

8.1 Clean coarse sieves up to No. 80 (180 µm) with a soft brass wire brush and clean the finer sieves with a fiber brush. Clean by brushing the under side of the sieves. Gently tap the brass frame to aid in freeing trapped particles. At times, it may be necessary to wash the sieves in a warm soap and water solution. After washing, dry the sieves thoroughly. If wet screening is to be used, nest selected special deep-frame sieves after cleaning as described.

NOTE 2—As an alternative, ultrasonic cleaning of sieves is recommended.

9. Standardization of Sieves

9.1 Calibrate the sieves by use of calibrated glass spheres. Standard glass spheres are available through the National Institute of Standards and Technology (NIST) and other international standardization organizations.

9.2 Use of the microscopic method in the appendix of Specification E11 is also permissible to assure that the sieves meet specification.

10. Procedure

10.1 *Dry Screening:*

10.1.1 *For Samples Containing Less than ~~10 %~~ 10 % Passing a No. 200 (75-µm) Sieve*—Nest the selected sieves and fit a pan below the bottom sieve. Place the material which passed the No. 4 (4.75-mm) sieve from 7.2, in the top sieve. Cover and clamp the nested sieves in the mechanical shaker and shake for the time interval specified in 10.1.3.

10.1.2 *For Samples Containing More than ~~10 %~~ 10 % Passing a No. 200 (75-µm) Sieve*—Wash the material which passed the No. 4 (4.75-mm) sieve from 7.2 on a No. 200 (75-µm) sieve until the solution passing through the sieve is clear (see 10.2). Save the material passing the sieve. Dry the sieve fractions in accordance with 10.2.4.2 and process the retained fraction in accordance with 10.1.1.

10.1.3 *Length of Screening Time or End Point*—The screening time or end point is when additional periods of shaking fail to change the results on any sieve used in the test by more than 0.3 %. The screening time may vary from 3 min to 30 min or more depending on the type of material. Determine the exact time for each material experimentally.

10.1.4 *Weighing*—Remove the clamp and cover. Transfer the contents of each sieve to a tared pan, tapping and brushing the sieves to remove any lodged particles. Record the ~~weight~~mass of each sieve fraction.

10.1.4.1 Weigh and record the mass of the material washed on a No. 200 (75-µm) sieve, as described in 10.1.2 and submitted to wet screening as described in 10.2, the same as in the other sieves.

10.1.5 *Calculation*—Sum the ~~weights~~masses of each of the sieve fractions. The total shall be within 1 % of the ~~weight~~mass of the original test sample or the analysis must be repeated from 7.1 with another test sample. The ~~weight~~mass of the test sample used for calculation is the total of the sieve fractions. Calculate the percent retained on each sieve as follows:

$$\text{Material retained}, \% = (W_r/W_t) \times 100 \quad (1)$$

where:

W_r = mass retained on each sieve, and
W_t = total mass of all sieve fractions.

Calculate the percent passing the finest sieve as follows:

$$\text{Material passing}, \% = (W_p/W_t) \times 100 \quad (2)$$