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

This standard is issued under the fixed designation E 389; 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 of metal-bearing ores and related materials at No. 4 (4.75-mm) sieve and coarser.

~~1.2*This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*~~

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 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]

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

E 135 Terminology Relating to Analytical Chemistry for Metals, Ores, and Related Materials

E 276 Test Method for Particle Size or Screen Analysis at No. 4 (4.75-mm) Sieve and Finer for Metal-Bearing Ores and Related Materials

E 882 Guide for Accountability and Quality Control in the Chemical Analysis Laboratory

3. Terminology

~~3.1*Definitions:*~~

~~3.1.1*particle size*—in screen testing, the smallest sieve aperture through which the particle has passed and the size of the following aperture through which the particle fails to pass.~~

~~3.1.2*sieve or screen*—a plate, sheet, or woven wire cloth, or other device, with regularly spaced square apertures of uniform size, mounted in a suitable frame or holder, for use in separating material according to size. The term sieve or screen can be used interchangeably throughout.~~

3.1 *Definitions:*

3.1.1 For definitions of terms in this test method, refer to Terminology E 135.

4. Summary of Test Method

4.1 The sample is passed through a bank of standard sieves by agitation. The screening technique described in this procedure may be used on any solid particles that can be dried so that sieve blinding does not occur.

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

[1] This test method is under the jurisdiction of ASTM Committee ~~E-1~~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.

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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* ~~, Vol 14.02.~~volume information, refer to the standard's Document Summary page on the ASTM website.

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 E 882.

6. Apparatus and Materials

6.1 *U.S. Standard Sieves*, conforming to the requirements of Specification E 11.
6.2 *Sieve Shaker*, mechanical or manual.
6.3 *Drying Oven*, of approximate size and capable of maintaining a uniform temperature at 110 °C ± 5 °C.
6.4 *Sample Splitter or Riffle*, with openings not less than three times the size of the largest particle.
6.5 *Scales and Weights*, of adequate accuracy.
6.6 *Pans*, for holding samples.
6.7 *Brushes*, for cleaning sieves and pans.

7. Sample Preparation

7.1 If necessary, reduce the sample by means of a sample splitter or riffle, or by coning and quartering, or by the alternate-shovel method. Dry at 110 °C ± 5 °C to constant weight.

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 passing the sieve and, if desired, screen in accordance with Test Method E 276.

8. Procedure

8.1 Clean the sieves and apparatus by brushing.
8.2 Nest the selected sieves and fit a pan to the bottom sieve. Place the material which was retained on the No. 4 (4.75-mm) sieve from 7.2 in the top sieve. Cover and clamp in the mechanical shaker and shake for the length of time as specified in 8.3.
8.3 *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 %. For highly friable material the 0.3 % specification may be meaningless and an acceptable end point shall be determined experimentally.
8.4 *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 (Note 2). Record the weight of each sieve fraction.

NOTE 2—For sieves 2 in. (50 mm) and larger, the probability of a piece of material passing through the sieve is related to its shape. Retained particles approximating the size of the sieve openings should be adjusted by hand to see if they will pass through. For sieves smaller than 2 in., gently shake by hand to determine if screening is complete.

9. Calculation

9.1 Sum the weights of each sieve fraction including the weight of the material passing the No. 4 sieve in 7.2. The total shall be within 1 % of the weight of the original test sample or the analysis must be repeated from 7.1 with another test sample. The weight 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:

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

where:
W_p = mass passing the finest sieve, retained on a pan or filter, and
W_t = total mass of all sieve fractions.

Obtain the percent cumulative by adding each percent retained on each sieve as the series progresses.

10. Report

10.1 Report the following data: sieve size, weight retained on or passing through sieve, percent retained on sieve, and percent cumulative.
10.2 Present the data of a screen analysis graphically as a cumulative direct plot or a cumulative logarithmic plot. From the plots, the percentages remaining on any set of openings other than those of the testing sieves used, can be found by interpolation and in this way redistribution of the same material by any assumed set of openings can be determined.