Designation: C 786 – 96

Standard Test Method for Fineness of Hydraulic Cement and Raw Materials by the 300-µm (No. 50), 150-µm (No. 100), and 75-µm (No. 200) Sieves by Wet Methods[1]

This standard is issued under the fixed designation C 786; 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.

1. Scope

1.1 This test method covers wet sieving techniques for determination of fineness of hydraulic cement and raw materials by means of the 300-µm (No. 50), the 150-µm (No. 100), and the 75-µm (No. 200) sieves.

1.2 The values stated in SI units are to be regarded as the 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:*

C 114 Test Methods for Chemical Analysis of Hydraulic Cement[2]

C 184 Test Method for Fineness of Hydraulic Cement by the 150-µm (No. 100) and 75-µm (No. 200) Sieves[2]

C 430 Test Method for Fineness of Hydraulic Cement by the 45-µm (No. 325) Sieve[2]

E 11 Specification for Wire-Cloth Sieves for Testing Purposes[3]

3. Apparatus

3.1 *Wet Test Sieves*—Standard 300-µm (No. 50), 150-µm (No. 100), or 75-µm (No. 200) sieve cloth conforming to the requirements of Specification E 11, for standard sieves shall be woven from AISI Type 304 wire. The cloth shall be mounted in the frame without distortion, looseness, or wrinkling. Sieve frames are designated as 3 or 4-in. (76.2 or 101.6-mm) diameter type, as follows:

Sieves	76 mm (3-in.) mm (in.)	102 mm (4-in.) mm (in.)
Diameter of frame	76 ± 6 (3.0 ± 0.25)	102 ± 6 (4.0 ± 0.25)
Depth of sieve from top of frame	83 ± 6 (3.25 ± 0.25)	108 ± 6 (4.25 ± 0.25)
Overall height	102 ± 6 (4.0 ± 0.25)	127 ± 6 (5.0 ± 0.25)

3.1.1 For a sieve fabricated by soldering the cloth to the frame, the joint shall be made smooth to prevent material from lodging in the joints between the sieve cloth and the frame. Two-piece sieves shall clamp tightly on the cloth to prevent particles from lodging in the joints between the sieve cloth and the frame, and shall have legs of sufficient length, 19-mm (0.75-in.) minimum, to allow air circulation beneath the sieve cloth.

3.2 *Spray Nozzle*, conforming to the requirements of Test Method C 430. Nozzles having an alternative design are acceptable if the sieve test results agree with those performed using a nozzle conforming to Test Method C 430.

3.3 *Pressure Gage*, conforming to the requirements of Test Method C 430.

3.4 *Balance*, analytical, accurate to within 0.005 g.

3.5 *Weights*—The weights used in fineness determinations shall conform to the requirements of Test Methods C 114.

3.6 *Brush*—A nylon or pure bristle brush will be required for use in cleaning the sieves. A13-mm (0.5-in.) diameter round-style brush with a 229-mm (9-in.) handle is a convenient size.

NOTE 1—**Caution:** Do not use brass or steel-bristle brushes for cleaning sieves due to the possibility that the stiff bristle will part the wire weave, thereby altering the size of the openings and rendering the sieve useless. A13-mm (½-in.) hog bristle stencil brush is also satisfactory for brushing sieves.

3.7 *Dry Test Sieves*—The standard samples for calibrating the wet test sieves must be standardized on 203-mm (8-in.) diameter sieves meeting the requirements of Test Method C 184. The 300-µm (No. 50) sieve shall meet the same requirements.

[1] This test method is under the jurisdiction of ASTM Committee C-1 on Cement and is the direct responsibility of Subcommittee C01.25 on Fineness.

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[2] *Annual Book of ASTM Standards*, Vol 04.01.

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

3.8 *NBS SRM No. 1004*—Glass Bead Standard.

4. Dry Sieve Standardization

4.1 *Correction Factors*:

4.1.1 Correction of the residues obtained on the 203-mm (8-in.) diameter 300-µm (No. 50) and 150-µm (No. 100) dry testing sieves is not required.

4.1.2 Where applicable, a correction factor for a 75-µm (No. 200) sieve shall be determined using the instructions given in Annex A1. A correction factor should be determined when accuracy is desired in order to compare results between laboratories.

4.2 *Standard Samples*—Each laboratory must prepare its own standard samples for wet-sieve tests for each of the sieve sizes used. Select standard samples at a level of fineness in the same range as that used in routine work. After the selected material is reserved, uniformly mix the gross sample by placing it on a sheet of rubber, oil cloth, or heavy wrapping paper, depending on the sample size, and raising first one corner of the sheet and then the other so as to roll the sample over and over at least 100 times. Temporarily seal the prepared standard material in airtight containers during the standardization procedure prior to sealing small portions as standard samples in vials. Using the 203-mm (8-in.) diameter sieves from 3.7, perform the dry sieving tests, following the procedure of Test Method C 184. Repeat the test three times and use the average of the amounts passing, expressed as percent, as the standard value of the sample. Use this standard sample to calibrate the wet sieves. Place the entire sample in airtight vials as soon as possible to prevent changes due to humidity. Vials shall be prepared in denominations such as to contain approximately 50 g for standardizing the 300-µm (No. 50); 25 g for the 150-µm (No. 100); or 10 g for the 75-µm (No. 200) sieve.

5. Wet Sieve Calibration

5.1 Weigh the contents of the applicable size standard sample vial for the desired sieve determination on a balance of appropriate sensitivity to the nearest 0.01 g. Record the weight and transfer the sample quantitatively to a clean dry wet test 300-µm (No. 50), 150-µm (No. 100), or 75-µm (No. 200) sieve and proceed as directed in Section 6. The sieve correction factor is the difference between the test residue obtained and the residue value indicated by the standardization tests of Section 4, expressed as a percentage of the test residue. This factor is expressed as follows:

$$C = \frac{(Rs \times Wt/100) - Rt}{Rt} \times 100 \qquad (1)$$

where:

C = sieve correction factor (which may be either plus or minus), %,
R_t = test residue from sample retained on sieve, g,
R_s = standard residue retained on sieve, %, and
W_t = weight of test sample, g.

5.1.1 Example of Determination of Wet Sieve Calibration:

% Residue on 150-µm (No. 100) sieve for standard sample, R_s	= 5.40%
Residue from test sample, R_t	= 1.25 g
Weight of sample, W_t	= 25.5 g

$$\text{Correction factor, C, \%} = \frac{(5.40 \times 25.5/100) - 1.25}{1.25} \times 100 = \pm 10.2 \qquad (2)$$

NOTE 2—The sieve correction is specified as a factor to be multiplied by the residue obtained, and therefore the amount to be added to or subtracted from the test residue in any given instance is proportional to the amount of the residue.

6. Procedure for Wet Sieving

6.1 Weigh the sample to the nearest 0.01 g using approximately 50 g for a 300-µm (No. 50), 25 g for a 150-µm (No. 100), or 10 g for a 75-µm (No. 200) determination. Record the weight and transfer the sample quantitatively to a clean dry sieve. Wet the sample thoroughly with a gentle stream of water. Remove the sieve from under the nozzle and adjust the pressure on the spray nozzle to 69 ± 4 kPa (10 ± 0.5 psi). Return the sieve to its position under the nozzle and wash for 1½ min, moving the sieve in the spray with a circular motion in a horizontal plane at the rate of one motion per second. Every portion of the screen should be sprayed during each circular motion of the sieve. Hold the sieve so that the bottom of the spray nozzle extends 13 mm (0.5 in.) below the top of the sieve frame. Immediately after removing the sieve from the spray, rinse once with about 50 cm^3 of distilled or deionized water using caution not to lose any of the residue. Gently blot the lower surface of the screen cloth with a damp, clean cloth. Dry the sieve and residue in an oven or over a hot plate (see Note 3), supporting the sieve in such a manner that air may pass freely beneath it. Cool the sieve; then brush the residue from the sieve, and weigh on a balance to the nearest 0.01 g (see Note 4).

NOTE 3—Care should be taken when heating the sieve, so that any solder that may have been used in assembling the sieve does not soften.

NOTE 4—Prior to each use, dip the sieve in dilute acetic acid (1+6) or dilute HCl (1+10) and immediately rinse it with distilled or deionized water to remove particles lodged in the meshes. Recalibrate the sieve after 25 determinations.

7. Calculation

7.1 Calculate the fineness of the material as follows:

$$R_c = (R_t/W) \times (100 + C) \qquad (3)$$

$$F = 100 - R_c \qquad (4)$$

where:

F = fineness expressed as the corrected percentage of sample passing the sieve,
R_c = corrected residue, %,
W = weight of sample used for test, g,
R_t = residue from the sample retained on the sieve, g, and
C = sieve correction factor (determined in accordance with Section 5, which may be either plus or minus), %.

7.1.1 Example for 150-µm (No. 100) Sieve Determination:

Sieve correction factor, C	= ±10.2 %
Exact weight of sample used for test, W	= 25.10 g
Residue from sample retained on sieve, R_t	= 1.42 g
Corrected residue,	
$R_c = (1.42/25.10) \times (100 + 10.2)$	= 6.2 %
$F = 100 - 6.2$	= 93.8 %

8. Precision and Bias

8.1 No precision data are available due to the limited use of this method. Therefore, users are advised to develop their own laboratory precision.

8.2 Since there is no accepted reference material suitable for determining any bias that may be associated with this test method, no statement on bias is being made.

9. Keywords

9.1 fineness; hydraulic cement and raw materials; sieve

ANNEX

(Mandatory Information)

A1. DRY SIEVE CORRECTION FACTORS

A1.1 300-µm (No. 50) and 150-µm (No. 100) 203-mm (8-in.) Diameter Sieves

A1.1.1 The particle size distribution curve of cement at the 300-µm (No. 50) and 150-µm (No. 100) is level in this region, and therefore it is felt that no sieve correction is necessary.

A1.2 75-µm (No. 200) 203-mm (8-in.) Diameter Sieve

A1.2.1 A 75-µm (No. 200) sieve may or may not need to be standardized, depending on the accuracy required. For internal laboratory use where changes in fineness are of more importance than the absolute value, it is not necessary to standardize the dry sieve. The sieve cloth, as a minimum, should conform to Specification E 11. A correction factor should be established where accuracy is desired in order to compare results between laboratories.

A1.2.2 To determine the percentage of test material passing through a nominal 75-µm (No. 200) sieve, two additional sieves are needed: a 90-µm (No. 170) and a 63-µm (No. 230) sieve. Using NBS SRM No 1004 (No. 140-No. 400 sieve), Glass Bead Standard, determine the effective openings of each of the three sieves.

NOTE A1.1—NBS SRM No. 1004 tends to blind the screen during use and the beads lodged in the meshes are difficult to remove. Tapping the frame of the sieve and gentle brushing of the cloth from the underside will aid in recovering all the beads and keep the bead loss down to approximately 50 mg.

A1.2.3 Select a test material. It is important that the sample for calibration be of the same typical fineness as the range in which the sieve is to be used. The use of the same test material selected for the 75-µm (No. 200) dry sieve calibration is encouraged (see 4.2). Determine the percent residue of the test material on each of the three sieves, following the procedure of Test Method C 184. Plot the average percent residues *versus* the effective opening. The percent residue at the nominal opening of the No. 200 sieve can be read off the plot and the difference between the actual obtained residue and the nominal residue at 75 µm may be used algebraically as a sieve correction factor for that sieve, only in the same general fineness area.

A1.3 Example—Determination Of Sieve Correction factor for 75-µm (No. 200) Sieve

A1.3.1 Using the SRM 1004, the following was determined:

(*a*) Effective opening of nominal sieves being corrected:

75-µm (No. 200)	72µ m
90-µm (No. 170)	90 µm
63-µm (No. 230)	65 µm

(*b*) Test sample residue, % (to be plotted on graph paper):

at 90 µm	1.1 %
at 72 µm	2.3 %
at 65 µm	2.8 %

(*c*) From the above plot:

$$\text{Residue at } 75-\mu\text{m} = 2.1\% \qquad \text{(A1.1)}$$

A1.3.2 Since the sieve is woven too tightly and retains more than it should if it were a 75-µm opening, the correction, *C*, to be applied to the residue in percent is − 0.2%.