Designation: C1891 – 20

Standard Test Method for Fineness of Hydraulic Cement by Air Jet Sieving at 45-µm (No. 325)[1]

This standard is issued under the fixed designation C1891; 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 the determination of the fineness of hydraulic cement by means of air jet sieving using a 45-µm (No. 325) sieve by Air Jet sieving.

1.2 The values stated in SI units are regarded as the standard. The values given in parentheses after SI units 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *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]

C219 Terminology Relating to Hydraulic and Other Inorganic Cements

C430 Test Method for Fineness of Hydraulic Cement by the 45-µm (No. 325) Sieve

C1005 Specification for Reference Masses and Devices for Determining Mass and Volume for Use in the Physical Testing of Hydraulic Cements

E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves

E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

3. Terminology

3.1 *Definitions:*

3.1.1 Terms relating to this test method are defined in Terminology C219.

4. Summary of Test Method

4.1 A known mass of hydraulic cement is placed on a test sieve that is inserted in the sieve holder of the air jet sieve apparatus. Air from a slowly-rotating nozzle located beneath the sieve passes through the sieve to fluidize the sample for a predetermined period of time. The exit air flow removes undersized particles downward through the test sieve to a vacuum canister. The mass of hydraulic cement retained on the test sieve is determined, and the percent passing the test sieve is calculated.

5. Significance and Use

5.1 This test method provides data for assessing compliance where specifications limit the amount of material retained when sieved on a 45-µm (No. 325) sieve.

6. Air Jet Sieving Apparatus

6.1 *Sieve:*

6.1.1 *Sieve Frame*—The sieve frame shall be of a rigid material, preferably bronze or stainless steel, not subject to corrosion (for purposes of the cleaning procedure). The frame shall be circular and it shall be 203 mm (8-in.) in diameter to fit the air jet sieving apparatus.

6.1.2 *Sieve Cloth*—The sieve frame shall be fitted with a 45-µm (No. 325) stainless steel AISI Type 304 woven-wire sieve cloth, conforming to the requirements of Specification E11. The sieve cloth shall be mounted in the frame without distortion, looseness or wrinkling. The joint between the cloth and frame shall be smooth and without holes.

6.2 *Sieve Cover*—A cover made of hard plastic or metal is necessary for covering the sieve and achieving a seal. The seal needs to be such that the apparatus can maintain a vacuum pressure throughout the test period.

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

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

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

6.3 *Seal*—A seal between the sieve frame and its holder to ensure air flow is through and not around the sieve. The seal shall be made of soft, pliable material.

6.4 *Vacuum Device*—A canister type vacuum cleaner that can achieve and maintain at least 2.5 kPa (254 mm or 10-in. water column) vacuum.

6.5 *Timer*—A device capable of timing the test period within 1 s. It can be attached and automatic, or such that it lets the operator know when to start and stop the apparatus.

6.6 *Vacuum Gauge*—A gauge capable of indicating the vacuum pressure below the sieve within 0.1 kPa (12.7 mm or 0.5-in. water column).

6.7 *Brush*—A brush with soft bristles used to brush material off the cover and onto the sieve.

6.8 *Low Power Ultrasonic Bath*—150 W maximum and large enough to allow submersion and cleaning of a 203 mm (8-in.) sieve. A smaller bath is acceptable if the sieve can be partially submerged and rotated such that the entire sieve cloth is cleaned incrementally.

6.9 *Balance*—Conforming to the requirements of Specification C1005 and able to measure a minimum mass of 10 mg.

7. Sieve Standardization

7.1 Place 10.00 g of a certified reference material of a known 45-µm fineness (Note 1) on the sieve and proceed as described in Section 8. The sieve correction factor (Note 2) is the difference between the test residue obtained and the assigned residue value specified for the standard sample, expressed as a percentage of the test residue.

Example of Sieve Correction Factor Determination:

Residue on a 45-µm sieve, sample No. 114, or No. 46h or secondary standard	12.2 %
Residue for a 10.00-g sample	1.22 g
Residue on sieve being calibrated	0.93 g
Difference	+0.29 g
Correction factor = +0.29/0.93 × 100 = +31.18	+31.2 %

NOTE 1—Use of the current lot of National Institute of Standards and Technology Standard Reference Material (SRM) for fineness is recommended. As an alternative, a secondary standard can be developed as described in Appendix X1.

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

8. Procedure

8.1 Place 10.00 g of hydraulic cement on the sieve. Place the sieve on the air jet sieving apparatus. Place the cover on the sieve. Turn the air jet sieving apparatus on and allow it to run for the predetermined time (Note 3). Ensure that at least 2.5 kPa (254 mm or 10-in. water column) of vacuum is reached. If the minimum vacuum is not reached, determine the cause of the problem and correct it.

8.2 Lightly tapping the cover two minutes before the end of the test and again one minute before ending the test can significantly reduce the amount of material sticking to the underside of the cover.

8.3 When the air jet sieve has stopped, remove the cover and gently brush any material off the underside of the cover onto the sieve. Restart the air jet sieve apparatus and run for 30 s.

8.4 If material is still built up on the underside of the cover, repeat step 8.3. Occasionally wiping the underside of the cover with an anti-static dryer cloth has been found to reduce material held by static charges.

8.5 Remove the sieve from the air jet sieve apparatus and carefully transfer the residual material to a weigh paper or pan and determine the mass of the residue to the nearest 0.01 g.

NOTE 3—The ideal time to run the apparatus can be determined by running the same sample several times until a constant mass of residue remains. For hydraulic cement, 180 s has been found to be sufficient in most cases.

9. Cleaning of Sieves

9.1 Frequency of Cleaning and Standardization—Sieves shall be cleaned after no more than five determinations and re-standardized after no more than 100 determinations.

9.2 Place sieve topside down in the ultrasonic bath with water and a laboratory cleaning solution or detergent. Turn the ultrasonic bath on for 10 to 15 min. Rotate the sieve, as necessary, to ensure submersion and cleaning of the entire sieve cloth. Rinse and dry the sieve. When held up to a light, a dirty sieve is very apparent.

10. Calculation

10.1 Calculate the fineness of the cement to the nearest 0.1 % as follows:

$$R_c = (R_s / W) \times (100 + C) \quad (1)$$

$$F = 100 - R_c \quad (2)$$

where:

F = fineness of the cement expressed as the corrected percentage passing the 45-µm (No. 325) sieve,
R_c = corrected residue, %,
R_s = residue from the sample retained on the 45-µm (No. 325) sieve, g,
W = original sample weight, g, and
C = sieve correction factor (determined as prescribed in Section 5) which may be plus or minus.

Example:

Sieve correction factor, C	=	+31.2 %
Residue from sample being tested, R_s	=	0.88 g
Original sample weight, W	=	10.00 g
Corrected residue, R_c	=	(0.88/10) × (100 + 31.2)
	=	11.5 %
Corrected percent passing, F	=	100 – 11.5 = 88.5 %

11. Precision and Bias

11.1 The precision of this test method is based on an interlaboratory study of Test Method C1891, conducted in 2018. 42 laboratories participated in this study, each reporting a single test result for two different hydraulic cements. Every test result reported represents an individual test determination. Except for the lack of replicate data, Practice E691 was