



Designation: **C778–17** **C778–21**

## Standard Specification for Standard Sand<sup>1</sup>

This standard is issued under the fixed designation C778; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

*This standard has been approved for use by agencies of the U.S. Department of Defense.*

### 1. Scope\*

1.1 This specification covers standard sand for use in the testing of hydraulic cements.

1.2 The values stated in SI units are to be regarded as the standard.

1.3 Values in SI units shall be obtained by measurement in SI units or by appropriate conversion, using the Rules for Conversion and Rounding given in **IEEE/ASTM SI 10**, of measurements made in other units.

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *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:<sup>2</sup>

- [C109/C109M Test Method for Compressive Strength of Hydraulic Cement Mortars \(Using 2-in. or \[50 mm\] Cube Specimens\)](#)
- [C127 Test Method for Relative Density \(Specific Gravity\) and Absorption of Coarse Aggregate](#)
- [C136 Test Method for Sieve Analysis of Fine and Coarse Aggregates](#)
- [C150 Specification for Portland Cement](#)
- [C185 Test Method for Air Content of Hydraulic Cement Mortar](#)
- [C219 Terminology Relating to Hydraulic and Other Inorganic Cements](#)
- [C595 Specification for Blended Hydraulic Cements](#)
- [C702 Practice for Reducing Samples of Aggregate to Testing Size](#)
- [C1005 Specification for Reference Masses and Devices for Determining Mass and Volume for Use in Physical Testing of Hydraulic Cements](#)
- [E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves](#)
- [IEEE/ASTM SI 10 Standard for Use of the International System of Units \(SI\): The Modern Metric System](#)

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee C01 on Cement and is the direct responsibility of Subcommittee C01.95 on Coordination of Standards. Current edition approved Aug. 1, 2017/Dec. 1, 2021. Published August 2017/December 2021. Originally approved in 1974. Last previous edition approved in 2013/20137 as ~~C778–13~~ C778–17. DOI: ~~10.1520/C0778-17~~ 10.1520/C0778-21.

<sup>2</sup> 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

### 3. Terminology

3.1 For definitions of terms used in this test method, refer to Terminology [C219](#).

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *20-30 sand, n*—standard sand, predominantly graded to pass a 850- $\mu\text{m}$  (No. 20) sieve and be retained on a 600- $\mu\text{m}$  (No. 30) sieve.

3.2.2 *graded sand, n*—standard sand, predominantly graded between the 600- $\mu\text{m}$  (No. 30) sieve and the 150- $\mu\text{m}$  (No. 100) sieve.

3.2.3 *standard sand, n*—silica sand, composed almost entirely of naturally rounded grains of nearly pure quartz, used for preparing mortars in the testing of hydraulic cements.

### 4. Requirements

4.1 Sand shall meet the requirements of [Table 1](#) with respect to grading, source of sand, and absence of undesirable air entraining characteristics.

## METHODS OF SAMPLING AND TESTING STANDARD SANDS

### 5. Apparatus

5.1 *Sieves*—The sieves shall be standard 203-mm (8-in.) diameter, full-height, wire-cloth sieves, conforming to the requirements of Specification [E11](#), and of the following sizes:

1.18-mm (No. 16)	425- $\mu\text{m}$ (No. 40)
850- $\mu\text{m}$ (No. 20)	300- $\mu\text{m}$ (No. 50)
600- $\mu\text{m}$ (No. 30)	150- $\mu\text{m}$ (No. 100)
	75- $\mu\text{m}$ (No. 200)

5.2 *Sample Splitter*—The sample splitter, receptacles, and feeder pan or hopper shall conform to the general design requirements listed in Method A, apparatus section of Practice [C702](#), except that the device shall have no fewer than eight chutes having a maximum opening no greater than 13 mm, and a minimum opening at least three times the diameter of the largest particle of sand in a sample to be split.

5.3 *Scales, Balances, and Reference Masses*—Scales, balances, and reference masses shall conform to the requirements of Specification [C1005](#) as appropriate for the size of the sample the mass of which is to be determined.

### 6. Sampling

6.1 Sample each lot or shipment and test for the grading requirements in [Table 1](#). Determine air entraining characteristics only when contamination of sand is suspected. Sample the shipment in accordance to the procedure listed in [9.1](#).

**TABLE 1 Standard Sand Requirements**

Characteristics	20-30 Sand	Graded Sand
Grading, percent passing sieve:		
1.18 mm (No. 16)	100	100
850 $\mu\text{m}$ (No. 20)	85 to 100	
600 $\mu\text{m}$ (No. 30)	0 to 5	96 to 100
425 $\mu\text{m}$ (No. 40)		60 to 75
300 $\mu\text{m}$ (No. 50)		16 to 30
150 $\mu\text{m}$ (No. 100)		0 to 4
Difference in air content of mortars made with washed and unwashed sand, max, % air <sup>A</sup>	2.0	1.5
Source of sand	Ottawa, IL or LeSuer, MN	Ottawa, IL

<sup>A</sup> This determination is needed when contamination of sand is suspected as discussed in [8.1](#).

6.2 *Procedure*—Using *Method A—Mechanical Splitter* procedure described in Practice **C702**, reduce the entire contents of a bag of standard sand to a testing size of approximately 300 g.

## 7. Sieve Analysis

7.1 *Sieving*—Sieve the sand by hand or mechanically as described in Test Method **C136**.

7.2 *Reporting*—Report the results of the sieve analysis as total percentage passing each sieve.

## 8. Tests for Air-Entraining Potential of Sand

8.1 Small amounts of some surfactants or other contaminants will produce air voids in mortars made with 20-30 sand, graded sands or both. When contamination is suspected, test the sands in accordance with the procedures described in this section to determine the effect on air content or strength (see **Note 1**).

NOTE 1—It may be desirable to wash these sands routinely to avoid potential problems. Additionally, the washing procedure outlined in **8.1.1** will tend to minimize segregation of sand that may occur when the sand is handled in a dry state.

8.1.1 Obtain a sample of at least 2800 g from a full bag of sand. Place the remainder of the sand from the bag in a concrete mixer of the drum type. Add sufficient potable water to cover the sand and mix for 2 min. Decant the water over a 75 μm (No. 200) sieve and drain for 2 min. Repeat the washing and decanting procedure four times. Tilt the mixer and drain the sand for 20 min or longer. Determine the mass of damp sand and place it in approximately batch-sized quantities in separate containers. Dry the sand to constant mass in an oven at 110°C. Cool and adjust the quantity of dry sand to the amount required for a test. Prepare two batches of each of “washed” and “as received” sand for test following the procedures in Test Method **C185** for 20-30 sand or Test Method **C109/C109M** for graded sand.

8.1.2 Tests for air-entraining potential of a standard sand shall be made on a single day by a single operator.

8.2 *20-30 Sand*—Prepare two batches of mortar with washed sand and two with “as received” sand in accordance with Test Method **C185**. Compare the average air content for washed and unwashed sand mortars for compliance with limit in **Table 1**.

8.3 *Graded Sand*—Prepare two batches of mortar with washed sand and two with “as received” sand in accordance with Test Method **C109/C109M**. (See **Note 2**.) When Test Method **C109/C109M** mortar cubes are removed from the molds, determine the density of a group of at least three cubes from each batch by determining the mass of the cubes both in air and immersed in water. Follow procedures outlined in Test Method **C127** for bulk specific gravity (SSD). Determine the mass of the cubes to at least the nearest gram. Calculate the apparent air content as follows:

$$\text{apparent air content} = ((D_t - D_m)/D_t) \times 100 \quad (1)$$

where:

$D_m$  = the measured density (bulk specific gravity (SSD)), and  
 $D_t$  = the theoretical density of air-free mortar, g/cm<sup>3</sup>.

Note that  $D_t$  is calculated as the total mass of the ingredients in a batch of mortar divided by the sum of the absolute volumes of the cement, sand, and water used in the batch. Average the apparent air content of the two batches made with washed sand and compare that average with the similar average for “as received sand” mortar to determine compliance with the limit in **Table 1**.

NOTE 2—Compressive strength of Test Method **C109/C109M** mortar made with Specification **C150** or **C595** cement will be reduced approximately 4 % for each percent of air in the compacted cube. However, as many as three batches of washed and three of unwashed sand may be needed to reliably detect a difference in strength of 7 % between washed and unwashed sand mortars.

## 9. Rejection

9.1 *Standard Sand*—Reject a bag of standard sand if the contents fail to meet one or more of the requirements of this specification. Sample a shipment of standard sand by selecting every 15th bag by consecutive number beginning with the 5th bag of the shipment. Count bags missing from the sequence as if they were there. Accept a shipment of standard sand if the contents of the selected bags meet the requirements of this specification. If any of the selected bags fail to meet one or more of the requirements