Designation: C 778 – 00

Standard Specification for Standard Sand[1]

This standard is issued under the fixed designation C 778; 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.

This standard has been approved for use by agencies of the 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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

C 109/C 109M Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens)[2]

C 127 Test Method for Specific Gravity and Absorption of Coarse Aggregate[3]

C 136 Test Method for Sieve Analysis of Fine and Coarse Aggregates[3]

C 150 Specification for Portland Cement[2]

C 185 Test Method for Air Content of Hydraulic Cement Mortar[2]

C 595 Specification for Blended Hydraulic Cements[2]

C 1005 Specification for Reference Masses and Devices for Determining Mass for Use in the Physical Testing of Hydraulic Cements[2]

E 11 Specification for Wire-Cloth Sieves for Testing Purposes[4]

IEEE/ASTM SI 10 Standard for Use of the International System of Units (SI): The Modern Metric System[4]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *20–30 sand*, *n*—standard sand, predominantly graded to pass a 850-µm (No. 20) sieve and be retained on a 600-µm (No. 30) sieve.

3.1.2 *graded sand*, *n*—standard sand, predominantly graded between the 600-µm (No. 30) sieve and the 150-µm (No. 100) sieve.

3.1.3 *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 E 11, and of the following sizes:

1.18-mm (No. 16)	425-µm (No. 40)
850-µm (No. 20)	300-µm (No. 50)
600-µm (No. 30)	150-µm (No. 100)

5.2 *Sample Splitter*—The sample splitter shall be of the riffle type and shall have an even number of equal-width chutes that alternately discharge in opposite directions. 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. It shall be equipped with a hopper or straightedged pan by which a sample may be fed to the chutes at a controlled rate, and two receptacles to hold the two halves of the sample following splitting. The length of the hopper or pan shall be approximately equal to the overall width of the assembly of chutes.

5.3 *Reference Masses and Devices for Determining Mass*—Reference masses and devices for determining mass shall

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

[3] *Annual Book of ASTM Standards*, Vol 04.02.

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

TABLE 1 Standard Sand Requirements

Characteristics	20-30 Sand	Graded Sand
Grading, percent passing sieve:		
1.18 mm (No. 16)	100	100
850 µm (No. 20)	85 to 100	
600 µm (No. 30)	0 to 5	96 to 100
425 µm (No. 40)		65 to 75
300 µm (No. 50)		20 to 30
150 µm (No. 100)		0 to 4
Difference in air content of mortars made with washed and unwashed sand, max, % air[A]	2.0	1.5[B]
Source of sand	Ottawa, IL or LeSuer, MN	Ottawa, IL

[A] This determination is needed when contamination of sand is suspected as discussed in 8.1.

[B] Compressive strength of Test Method C 109/C 109M mortar made with Specification C 150 or C 595 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.

conform to the requirements of Specification C 1005 as appropriate for the size of the sample the mass of which is to be determined.

6. Sampling

6.1 *Procedure*—Pour an approximate quantity of sand from the bag or other container into the hopper or pan of the sample splitter, leveling the surface from end to end and from edge to edge so that approximately equal amounts will flow through each chute when the sand is introduced to the chutes. The rate at which the sand is introduced shall be such as to allow free flow through the chutes into the receptacles below. When all of the original material has been divided, the portion in one of the receptacles shall be reintroduced to the hopper. Repeat as many times as necessary to obtain a sample of the desired mass. As appropriate, the portion of the sample collected in the second receptacle each time may either be reserved for testing, for reduction in size for other tests, or discarded.

7. Sieve Analysis

7.1 *General*—Obtain approximately 700 g of sand from a full bag and reduce to approximately 100 g using the procedure described in the section on sampling.

7.2 *Sieving*—Sieve the sand by hand or mechanically as described in Test Method C 136.

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

8. Tests for Air-Entraining Potential of Sand

8.1 Both 20–30 and graded sands may contain small amounts of surfactants or other contaminants that will produce air voids in mortars made with the sand. When contamination is suspected, tests can be made using "washed" and "as received" sand to determine the effect on air content or strength (see Note 1).

NOTE 1—Often 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 water to cover the sand and mix for 2 min. Decant the water over a 75 µm 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 "as received" sand for test following the procedures in Test Method C 185 for 20–30 sand or Test Method C 109/C 109M 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 C 185. 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 C 109/C 109M. When Test Method C 109/C 109M 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 C 127 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^3.

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.

9. Rejection

9.1 *Standard Sand*—A bag of standard sand shall be rejected if the contents fail to meet one or more of the requirements of this specification. A shipment of standard sand shall be sampled by selecting every 15th bag by consecutive number beginning with the 5th bag of the shipment. Bags missing from the sequence shall be counted as if they were there. A shipment of standard sand may be accepted 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 of this specification, the shipment shall be resampled by selecting every 15th bag by consecutive number beginning with the 10th bag of the shipment. A shipment of standard sand may be accepted if the contents of the selected bags on the resampling meet the requirements of this specification. If any of the selected bags in the resampling

fail to meet one or more of the requirements of this specification, and the rejected bag is within a 15-bag sequence of a bag rejected in the first selection of bags, the entire sequence of bags between accepted tests shall be rejected. The entire shipment shall be rejected if half of the number of bags tested fail to meet the requirements of this specification, or if the shipment consists of five bags or less if one randomly selected bag fails the specification.

9.2 Table 2 shows for both sampling and resampling in Column 2 the number of bags to be tested based on the total number of consecutive bags in the shipment. Column 3 shows the identification of the bag to be selected for test based on the consecutive number of the bags.

NOTE 2—If, in a shipment of 30 bags, on first sampling, the 20th bag fails the specification, and on resampling, the 25th bag fails the specification, the entire shipment is rejected. If the shipment were 100 bags and on first sampling only the 20th bag fails, and on resampling only the 25th bag fails, only bags Nos. 11 to 34 would be rejected.

TABLE 2 Sampling and Resampling of Standard Sand

Total No. of Consecutive Bags in Shipment	No. of Bags to Test	Test in Consecutive No., the Following Bags
Sampling:		
less than 5	1	random
5 to 19	1	5th
20 to 34	2	5th and 20th
35 to 49	3	5th, 20th, and 35th
50 to 64	4	5th, 20th, 35th, and 50th
Resampling:		
less than 5	none	reject shipment
5 to 19	1	10th
20 to 34	2	10th and 25th
35 to 49	3	10th, 25th, and 40th
50 to 64	4	10th, 25th, 40th, and 55th

10. Packaging and Package Marking

10.1 *Packaging*—Standard sands shall be delivered in bags with impervious liners made of material that will not contaminate the sand.

10.2 *Marking*—Each bag shall be plainly marked as follows: ASTM C 778 20-30 Sand or ASTM C 778 Graded Sand as the case may be. The source of the sand and the mass of the sand contained therein shall be plainly indicated on each bag.

11. Keywords

11.1 20-30 sand; graded sand; hydraulic cement testing sand; standard sand