Designation: C 566 – 97

Standard Test Method for Total Evaporable Moisture Content of Aggregate by Drying[1]

This standard is issued under the fixed designation C 566; 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 test method covers the determination of the percentage of evaporable moisture in a sample of aggregate by drying, both surface moisture and moisture in the pores of the aggregate. Some aggregate may contain water that is chemically combined with the minerals in the aggregate. Such water is not evaporable and is not included in the percentage determined by this test method.

1.2 The values stated in SI units are to be regarded as the standard. The values stated in parentheses are provided for information only.

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.* For specific precautionary statements, see 5.3.1, 7.2.1, and 7.3.1.

2. Referenced Documents

2.1 *ASTM Standards:*

C 29/C 29M Test Method for Unit Weight and Voids in Aggregate[2]

C 125 Terminology Relating to Concrete and Concrete Aggregates[2]

C 127 Test Method for Specific Gravity and Absorption of Coarse Aggregate[2]

C 128 Test Method for Specific Gravity and Absorption of Fine Aggregate[2]

C 670 Practice for Preparing Precision Statements for Test Methods for Construction Materials[2]

D 75 Practice for Sampling Aggregates[3]

E 11 Specification for Wire Cloth and Sieves for Testing Purposes[2]

2.2 *Other Document:*

National Research Council Report SHRP-P-619[4]

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of terms used in this test method, refer to Terminology C 125.

4. Significance and Use

4.1 This test method is sufficiently accurate for usual purposes, such as adjusting batch quantities of ingredients for concrete. It will generally measure the moisture in the test sample more reliably than the sample can be made to represent the aggregate supply. In cases where the aggregate itself is altered by heat, or where more refined measurement is required, the test should be conducted using a ventilated, controlled temperature oven.

4.2 Large particles of coarse aggregate, especially those larger than 50 mm (2 in.), will require greater time for the moisture to travel from the interior of the particle to the surface. The user of this test method should determine by trial if rapid drying methods provide sufficient accuracy for the intended use when drying large size particles.

5. Apparatus

5.1 *Balance*—A balance or scale accurate, readable, and sensitive to within 0.1 % of the test load at any point within the range of use. Within any interval equal to 10 % of the capacity of the balance or scale used to determine mass, the load indication shall be accurate within 0.1 % of the difference in masses.

5.2 *Source of Heat*—A ventilated oven capable of maintaining the temperature surrounding the sample at 110 ± 5°C (230 ± 9°F). Where close control of the temperature is not required (see 4.1), other suitable sources of heat may be used, such as an electric or gas hot plate, electric heat lamps, or a ventilated microwave oven.

5.3 *Sample Container*—A container not affected by the heat, and of sufficient volume to contain the sample without danger

[1] This test method is under the jurisdiction of ASTM Committee C-9 on Concrete and Concrete Aggregatesand is the direct responsibility of Subcommittee C09.20on Normal Weight Aggregates.

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

[3] *Annual Book of ASTM Standards*, Vol 04.03.

[4] Available from the National Research Council, 2101 Constitution Ave., N.W., Washington, DC 20418.

of spilling, and of such shape that the depth of sample will not exceed one fifth of the least lateral dimension.

5.3.1 **Precaution**—When a microwave oven is used, the container shall be nonmetallic.

NOTE 1—Except for testing large samples, an ordinary frying pan is suitable for use with a hot plate, or any shallow flat-bottomed metal pan is suitable with heat lamps or oven. Note precaution in 5.3.1.

5.4 *Stirrer*—A metal spoon or spatula of convenient size.

6. Sampling

6.1 Sample in accordance with Practice D 75, except for the sample size.

6.2 Secure a sample of the aggregate representative of the moisture content in the supply being tested and having a mass not less than the amount listed in Table 1. Protect the sample against loss of moisture prior to determining the mass.

7. Procedure

7.1 Determine the mass of the sample to the nearest 0.1 %.

7.2 Dry the sample thoroughly in the sample container by means of the selected source of heat, exercising care to avoid loss of any particles. Very rapid heating may cause some particles to explode, resulting in loss of particles. Use a controlled temperature oven when excessive heat may alter the character of the aggregate, or where more precise measurement is required. If a source of heat other than the controlled temperature oven is used, stir the sample during drying to accelerate the operation and avoid localized overheating. When using a microwave oven, stirring of the sample is optional.

7.2.1 **Caution:** When using a microwave oven, occasionally minerals are present in aggregates that may cause the material to overheat and explode. If this occurs it can damage the microwave oven.

7.3 When a hot plate is used, drying can be expedited by the following procedure. Add sufficient anhydrous denatured alcohol to cover the moist sample. Stir and allow suspended material to settle. Decant as much of the alcohol as possible without losing any of the sample. Ignite the remaining alcohol and allow it to burn off during drying over the hot plate.

7.3.1 **Warning**—Exercise care to control the ignition operation to prevent injury or damage from the burning alcohol.

TABLE 1 Sample Size for Aggregate

Nominal Maximum Size of Aggregate, mm (in.)[A]	Mass of Normal Weight Aggregate Sample, min, kg[B]
4.75 (0.187) (No. 4)	0.5
9.5 (⅜)	1.5
12.5 (½)	2
19.0 (¾)	3
25.0 (1)	4
37.5 (1½)	6
50 (2)	8
63 (2½)	10
75 (3)	13
90 (3½)	16
100 (4)	25
150 (6)	50

[A] Based on sieves meeting Specification E 11.

[B] Determine the minimum sample mass for lightweight aggregate by multiplying the value listed by the dry-loose unit mass of the aggregate in kg/m^3(determined using Test Method C 29/C 29M) and dividing by 1600.

7.4 The sample is thoroughly dry when further heating causes, or would cause, less than 0.1 % additional loss in mass.

7.5 Determine the mass of the dried sample to the nearest 0.1 % after it has cooled sufficiently not to damage the balance.

8. Calculation

8.1 Calculate total evaporable moisture content as follows:

$$p = 100\,(W - D)/D \quad (1)$$

where:

p = total evaporable moisture content of sample, percent,
W = mass of original sample, g, and
D = mass of dried sample, g.

8.2 Surface moisture content is equal to the difference between the total evaporable moisture content and the absorption, with all values based on the mass of a dry sample. Absorption may be determined in accordance with Test Method C 127 or Test Method C 128.

9. Precision and Bias

9.1 *Precision*:

9.1.1 The within-laboratory single operator standard deviation for moisture content of aggregates has been found to be 0.28 % (Note 2). Therefore, results of two properly conducted tests by the same operator in the same laboratory on the same type of aggregate sample should not differ by more than 0.79 % (Note 2) from each other.

9.1.2 The between-laboratory standard deviation for moisture content of aggregates has been found to be 0.28 % (Note 2). Therefore, results of properly conducted tests from two laboratories on the same aggregate sample should not differ by more than 0.79 % (Note 2) from each other.

9.1.3 Test data used to derive the above precision indices were obtained from samples dried to a constant mass in a drying oven maintained at 110 ± 5°C. When other drying procedures are used, the precision of the results may be significantly different than that indicated above.

NOTE 2—These numbers represent, respectively, the 1s and d2s limits as described in Practice C 670.

9.2 *Bias*:

9.2.1 When experimental results are compared with known values from accurately compounded specimens, the following has been derived.

9.2.1.1 The bias of moisture tests on one aggregate material has been found to have a mean of +0.06 %. The bias of individual test values from the same aggregate material has been found with 95 % confidence to lie between −0.07 % and +0.20 %.

9.2.1.2 The bias of moisture tests on a second aggregate material has been found to have a mean of < +0.01 %. The bias of individual test values from the same aggregate material has been found with 95 % confidence to lie between −0.14 % and +0.14 %.

9.2.1.3 The bias of moisture tests overall on both aggregate materials has been found to have a mean of +0.03 %. The bias of individual test values overall from both aggregate materials has been found with 95 % confidence to lie between −0.12 % and +0.18 %.

9.2.2 Test data used to derive the above bias statements were obtained from samples dried to a constant mass in a drying oven maintained at 110 ± 5°C. When other drying procedures are used, the bias of the results may be significantly different than that indicated above.

NOTE 3—These precision and bias statements were derived from aggregate moisture data provided by 17 laboratories participating in the SHRP Soil Moisture Proficiency Sample Program which is fully described in the National Research Council Report SHRP-P-619. The samples tested which relate to these statements were well-graded mixtures of fine and coarse aggregate with moisture contents ranging from air dry to saturated surface dry.

10. Keywords

10.1 aggregate; drying; moisture content