



Designation: C127 – 15

Standard Test Method for Relative Density (Specific Gravity) and Absorption of Coarse Aggregate¹

This standard is issued under the fixed designation C127; 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 U.S. Department of Defense.

1. Scope

1.1 This test method covers the determination of relative density (specific gravity) and the absorption of coarse aggregates. The relative density (specific gravity), a dimensionless quantity, is expressed as oven-dry (OD), saturated-surface-dry (SSD), or as apparent relative density (apparent specific gravity). The OD relative density is determined after drying the aggregate. The SSD relative density and absorption are determined after soaking the aggregate in water for a prescribed duration.

1.2 This test method is not intended to be used with lightweight aggregates that comply with Specification C332 Group I aggregates.

1.3 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.4 The text of this test method references notes and footnotes that provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of this test method.

1.5 *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*:²
C29/C29M Test Method for Bulk Density (“Unit Weight”) and Voids in Aggregate

¹ This test method is under the jurisdiction of ASTM Committee C09 on Concrete and Concrete Aggregates and is the direct responsibility of Subcommittee C09.20 on Normal Weight Aggregates.

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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.

- C125 Terminology Relating to Concrete and Concrete Aggregates
- C128 Test Method for Relative Density (Specific Gravity) and Absorption of Fine Aggregate
- C136 Test Method for Sieve Analysis of Fine and Coarse Aggregates
- C330 Specification for Lightweight Aggregates for Structural Concrete
- C332 Specification for Lightweight Aggregates for Insulating Concrete
- C566 Test Method for Total Evaporable Moisture Content of Aggregate by Drying
- C670 Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials
- C702 Practice for Reducing Samples of Aggregate to Testing Size
- D75 Practice for Sampling Aggregates
- D448 Classification for Sizes of Aggregate for Road and Bridge Construction
- E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves
- 2.2 *AASHTO Standard*:
AASHTO T 85 Specific Gravity and Absorption of Coarse Aggregate³

3. Terminology

3.1 For definition of terms used in this standard, refer to Terminology C125.

4. Summary of Test Method

4.1 A sample of aggregate is immersed in water for 24 ± 4 h to essentially fill the pores. It is then removed from the water, the water dried from the surface of the particles, and the mass determined. Subsequently, the volume of the sample is determined by the displacement of water method. Finally, the sample is oven-dried and the mass determined. Using the mass

³ Available from American Association of State Highway and Transportation Officials (AASHTO), 444 N. Capitol St., NW, Suite 249, Washington, DC 20001, http://www.transportation.org.

values thus obtained and formulas in this test method, it is possible to calculate relative density (specific gravity) and absorption.

5. Significance and Use

5.1 Relative density (specific gravity) is the ratio of mass of an aggregate to the mass of a volume of water equal to the volume of the aggregate particles – also referred to as the absolute volume of the aggregate. It is also expressed as the ratio of the density of the aggregate particles to the density of water. Distinction is made between the density of aggregate particles and the bulk density of aggregates as determined by Test Method **C29/C29M**, which includes the volume of voids between the particles of aggregates.

5.2 Relative density is used to calculate the volume occupied by the aggregate in various mixtures containing aggregate, including hydraulic cement concrete, bituminous concrete, and other mixtures that are proportioned or analyzed on an absolute volume basis. Relative density (specific gravity) is also used in the computation of voids in aggregate in Test Method **C29/C29M**. Relative density (specific gravity) (SSD) is used if the aggregate is in a saturated-surface-dry condition, that is, if its absorption has been satisfied. Alternatively, the relative density (specific gravity) (OD) is used for computations when the aggregate is dry or assumed to be dry.

5.3 Apparent relative density (specific gravity) pertain to the solid material making up the constituent particles not including the pore space within the particles that is accessible to water.

5.4 Absorption values are used to calculate the change in the mass of an aggregate due to water absorbed in the pore spaces within the constituent particles, compared to the dry condition, when it is deemed that the aggregate has been in contact with water long enough to satisfy most of the absorption potential. The laboratory standard for absorption is that obtained after submerging dry aggregate for a prescribed period of time. Aggregates mined from below the water table commonly have a moisture content greater than the absorption determined by this test method, if used without opportunity to dry prior to use. Conversely, some aggregates that have not been continuously maintained in a moist condition until used are likely to contain an amount of absorbed moisture less than the 24-h soaked condition. For an aggregate that has been in contact with water and that has free moisture on the particle surfaces, the percentage of free moisture is determined by deducting the absorption from the total moisture content determined by Test Method **C566**.

5.5 The general procedures described in this test method are suitable for determining the absorption of aggregates that have had conditioning other than the 24-h soak, such as boiling water or vacuum saturation. The values obtained for absorption by other test methods will be different than the values obtained by the prescribed soaking, as will the relative density (specific gravity) (SSD).

6. Apparatus

6.1 *Balance*—A device for determining mass that is sensitive, readable, and accurate to 0.05 % of the sample mass

at any point within the range used for this test, or 0.5 g, whichever is greater. The balance shall be equipped with suitable apparatus for suspending the sample container in water from the center of the platform or pan of the balance.

6.2 *Sample Container*—A wire basket of 3.35 mm (No. 6) or finer mesh, or a bucket of approximately equal breadth and height, with a capacity of 4 to 7 L for 37.5-mm (1½-in.) nominal maximum size aggregate or smaller, and a larger container as needed for testing larger maximum size aggregate. The container shall be constructed so as to prevent trapping air when the container is submerged.

6.3 *Water Tank*—A watertight tank into which the sample container is placed while suspended below the balance.

6.4 *Sieves*—A 4.75-mm (No. 4) sieve or other sizes as needed (see 7.2 – 7.4), conforming to Specification **E11**.

6.5 *Oven*—An oven of sufficient size, capable of maintaining a uniform temperature of 110 ± 5 °C (230 ± 9 °F).

7. Sampling

7.1 Sample the aggregate in accordance with Practice **D75**.

7.2 Thoroughly mix the sample of aggregate and reduce it to the approximate quantity needed using the applicable procedures in Practice **C702**. Reject all material passing a 4.75-mm (No. 4) sieve by dry sieving and thoroughly washing to remove dust or other coatings from the surface. If the coarse aggregate contains a substantial quantity of material finer than the 4.75-mm sieve (such as for Size No. 8 and 9 aggregates in Classification **D448**), use the 2.36-mm (No. 8) sieve in place of the 4.75-mm sieve. Alternatively, separate the material finer than the 4.75-mm sieve and test the finer material according to Test Method **C128**.

NOTE 1—If aggregates smaller than 4.75 mm (No. 4) are used in the sample, check to ensure that the size of the openings in the sample container is smaller than the minimum size aggregate.

7.3 The minimum mass of test sample to be used is given as follows. Testing the coarse aggregate in several size fractions is permitted. If the sample contains more than 15 % retained on the 37.5-mm (1½-in.) sieve, test the material larger than 37.5 mm in one or more size fractions separately from the smaller size fractions. When an aggregate is tested in separate size fractions, the minimum mass of test sample for each fraction shall be the difference between the masses prescribed for the maximum and minimum sizes of the fraction.

Nominal Maximum Size, mm (in.)	Minimum Mass of Test Sample, kg (lb)
12.5 (½) or less	2 (4.4)
19.0 (¾)	3 (6.6)
25.0 (1)	4 (8.8)
37.5 (1½)	5 (11)
50 (2)	8 (18)
63 (2½)	12 (26)
75 (3)	18 (40)
90 (3½)	25 (55)
100 (4)	40 (88)
125 (5)	75 (165)

7.4 If the sample is tested in two or more size fractions, determine the grading of the sample in accordance with Test Method **C136**, including the sieves used for separating the size fractions for the determinations in this method. In calculating