



Designation: **E1109–18** **E1109 – 19**

Standard Test Method for Determining the Bulk Density of Solid Waste Fractions¹

This standard is issued under the fixed designation E1109; 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 may be used to determine the bulk density of various fractions from the resource recovery processing of municipal solid waste. It is intended as a means of characterizing such fractions and for providing data useful to designers of solid waste processing plants.

1.2 The values stated in SI units are to be regarded as standard. The values given in parentheses are 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, 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

[C702/C702M Practice for Reducing Samples of Aggregate to Testing Size](#)

[D75/D75M Practice for Sampling Aggregates](#)

[D2216 Test Methods for Laboratory Determination of Water \(Moisture\) Content of Soil and Rock by Mass](#)

[D5681 Terminology for Waste and Waste Management](#)

[E689 Reference Radiographs for Ductile Iron Castings](#)

[E1107 Test Method for Measuring the Throughput of Resource-Recovery Unit Operations](#)

3. Terminology

3.1 *Definitions*—For definitions of terms common to waste and waste management used in this test method, refer to Terminology [D5681](#).

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *bulk density*—the mass per unit volume of particulate matter. ~~Bulk density is not an absolute material property as is the density of individual particles of a material. The bulk density depends on the size of the container and how the material is loaded into the container. For example, the bulk density of material placed loosely in a container will be less than that of material tamped into a container. Also, some materials placed loosely in a container will settle with time due to its own weight; thus, its bulk density will increase.~~ matter or material.

4. Summary of Test Method

4.1 A sample of a solid waste stream is tamped in a cubical container of known volume and then weighed. Bulk density is calculated from the weight of the contents and volume of the container.

5. Significance and Use

5.1 This test method describes a physical property of solid waste in processing facilities, a property that characterizes the solid waste streams and hence the operation of resource recovery separators and processors.

¹ This test method is under the jurisdiction of ASTM Committee [D34](#) on Waste Management and is the direct responsibility of Subcommittee [D34.03](#) on Treatment, Recovery and Reuse.

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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.

5.2 The bulk density is an important property for the design of materials handling equipment, separators, and processors.

5.3 In this test method, bulk density is not considered an absolute material property as is the density of individual particles of a material. The measured bulk density here depends on the size of the container, the moisture content of the “as tested” material, and how the material is loaded into the container. For example, the bulk density of material placed loosely in a container will be less than that of material tamped into a container. Also, some materials placed loosely in a container will settle with time due to its own weight; thus, its bulk density will increase. As written, the “as tested” waste sample may or may not be dried prior to testing, so that calculated bulk density includes the moisture associated with the “as tested” material.

6. Apparatus

6.1 *Balance*—A balance or scale accurate to within 0.1 % of the test load at any point within the range of use. The range of use shall be considered to extend from the weight of the measure empty to the weight of the measure plus its contents.

6.2 *Cubical Measure*, with internal dimensions approximately 60 by 60 by 60 cm (24 by 24 by 24 in.), provided with handles. The interior surfaces of the measure shall be nonabsorbent to moisture.

NOTE 1—A satisfactory weigh box has been constructed of ~~2.0 cm (18-mm)~~ (18-mm (nominal ¾-in.)) exterior grade plywood with the finished surface on the inside. Reinforcing strips approximately 5 cm (2 in.) wide and 1.3 cm (~~½ in.~~) (½ in.) thick were fastened to the outside walls, two of them in a way to provide handles.

6.3 Larger cubical weigh boxes shall be used as necessary to accommodate large particles of material. No particle larger than two-thirds the length, height, or width of the weigh box shall be put into the weigh box in determining the bulk density.

7. Sampling

7.1 Samples shall be obtained from the processor streams or separator output streams in accordance with 11.1 of Test Method E1107, and shall constitute the gross sample.

7.2 The amount of material in each sample shall conform to the requirements of Table 1 of Practice D75/D75M, except that samples of material with greater than 90 mm (3½ in.) maximum nominal size shall weigh not less than 250 kg (550 lb).

8. Sample Preparation

8.1 Prepare and test the samples as soon as practicable with due precaution that they neither gain nor lose weight from natural drying or being left uncovered in wet or dusty areas, as described in Section 11 of Test Method E1107.

8.2 Weigh the gross samples before being subdivided. Drain wet samples in accordance with 11.g of Reference Radiographs E689 before weighing and report the test results as “per drained weight.”

8.3 Subdivide gross samples in accordance with Practice C702/C702M to form four test specimens. If the cone and quartering method of Practice C702/C702M is used, take special care to include the fine particulate material that may sift to the bottom of the pile. Keep the test specimens in moisture barrier containers until tested or discarded.

8.4 Bulk density is calculated on a dry weight basis by determining the moisture content of the sample following a method appropriate for the material type, such as Test Methods D2216, for soils and similar particulate wastes.

9. Procedure

9.1 Measure the internal dimensions of the weight box to ± 1 mm (0.05 ~~in.~~ in.). Then calculate and record the volume to ± 0.1 %.

9.2 Determine the weight of the weigh box to ± 0.1 %.

9.3 Select a test specimen at random from the four prepared in 8.3 and fill the weigh box to overflowing, taking special care to avoid segregation, compaction, or spillage, especially loss of the fine particulate material. Then tamp the box three times by lifting it 6 cm (2½ in.) above the ground and dropping squarely. After tamping, draw a rigid straightedge across the top of the box to level the contents. Some agitation of the straightedge may be necessary to force particulate either in or out of the box. If the contents remain below the top of the box, empty the box and start the test again using another specimen.

9.4 Weigh the filled box ± 0.1 % and calculate the bulk density to three significant figures.

9.5 Repeat the procedures of 9.3 and 9.4 with another test specimen selected at random from the remaining three.

9.6 Calculate the average of the two bulk densities. If the densities are more than 10 % different, select at random another specimen from the remaining two specimens and make a third bulk density determination. If the third density is more than 5 % above or below the average of the first two, discard all four test specimens, obtain another gross sample, and repeat the test procedure using a larger weigh box. If the third determination is within 5 % of the average of the first two, report the average of the three determinations.