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.

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# Standard Test Methods for Determining Bulk Density of Granular Carriers and Granular Pesticides[1]

This standard is issued under the fixed designation E727/E727M; 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 These test methods are used to determine bulk density of granular carriers and granular pesticides by measuring either free-fall bulk density (Test Method A) or loose-fill bulk density (Test Method B).

1.2 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the standard.

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.* For specific hazard statements see Section 4.

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]

E725 Test Method for Sampling Granular Carriers and Granular Pesticides

## 3. Significance and Use

3.1 These test methods were designed principally for clay, corncob, nut shell, paper-based or sand granular carriers, and granular pesticide products, but need not be limited to these materials. There may be more appropriate test methods for other types of granular carriers or pesticide products. The differences in the following test methods are slight, but they offer a choice of a recognized test procedure.

## 4. Hazards

4.1 Before testing granular pesticides, read the precautionary statements on the product label. Take proper precautions to prevent skin contact and inhalation of the fines and vapors. Take care to prevent contamination of the surrounding area. Always wear the appropriate safety equipment and, where indicated, wear respiratory devices approved by NIOSH for the product being tested.

## 5. Summary of Test Method A—Free-Fall Bulk Density

5.1 A tared 500-mL cylinder is filled with the granular carrier or granular pesticide. The weight of the sample is measured and the bulk density calculated in pounds per cubic foot or kilograms per cubic meter.

## 6. Apparatus

6.1 *Balance,* sensitivity of 1 g.

6.2 *Cylinder,* graduated, capacity 500 mL. The cylinder should be calibrated at the 500-mL mark by using 499 g water at 20°C. The cylinder is cut off at the 500-mL mark and ground smooth.

6.3 *Funnel,* powder, 152 mm [6 in.] in diameter at the top, bottom stem opening of 25-mm [1-in.] diameter, and sides having a slope of approximately 60°.

6.4 *Spatula,* large with 51-mm [2-in.] wide blade.

6.5 *Beaker,* glass, metal, or plastic, 600-mL capacity.

6.6 *Pan,* metal or plastic, 203 mm [8 in.] in diameter with 51-mm [2-in.] sides to collect overflow of cylinder.

6.7 *Ring Stand and Ring Clamp.*

## 7. Procedure

7.1 Weigh the 500-mL graduated cylinder and place it in the overflow pan.

7.2 Support the funnel on a ring which is then affixed to a ring stand such that the top of the funnel is horizontal and

[1] These test methods are under the jurisdiction of ASTM Committee E35 on Pesticides, Antimicrobials, and Alternative Control Agents and are the direct responsibility of Subcommittee E35.22 on Pesticide Formulations and Delivery Systems.

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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.

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rigidly in position. Adjust the height of the funnel so that its bottom position is 38 mm [1.5 in.] above the top center of the 500-mL graduated cylinder.

7.3 Hold a piece of flat metal (such as a wide spatula or similar tool) against the bottom of the funnel stem. Fill a 600-mL beaker with a representative sample of the granular carrier as defined in Test Method E725 and pour into the funnel. Quickly remove the metal plate, allowing the granules to fall into the graduate of their own accord.

7.4 Hold the graduate firmly and level off the granules to the top of the graduate with the straight edge of the spatula. Avoid jiggling or vibrating the cylinder.

7.5 Tap the cylinder to tamp the particles into the cylinder away from the top, to avoid spillage losses during handling.

7.6 Reweigh the cylinder and determine the weight of the sample to the nearest 1 g.

7.7 Determine the weight on duplicate samples.

## 8. Calculation

8.1 For the granular carrier or granular pesticide, calculate the free-fall bulk density as follows:

$$\text{Free} - \text{fall density } (\text{kg/m}^3) = \text{grams granular material} \times 2.0 \quad (1)$$

$$\text{Free} - \text{fall density } (\text{lb/ft}^3) = \text{grams granular material} \times 0.125 \quad (2)$$

## 9. Summary of Test Method B—Loose-Fill Bulk Density of Granular Materials

9.1 A tared dry pint cup is filled to overflowing with a granular carrier or granular pesticide. The sample is leveled. The weight of the sample is measured and the bulk density calculated in pounds per cubic foot.

## 10. Apparatus

10.1 *Filling Hopper,* Ohaus Model 150.[3]

10.2 *Cup,* standard dry pint. Note that a standard *dry pint* cup is used in this test, not a wet pint cup.

10.3 *Balance,* sensitivity of 0.1 g.

10.4 *Straightedge.*

10.5 *Catch Pan.*

## 11. Procedure

11.1 Weigh the standard dry pint cup to the nearest 0.1 g ($W_1$).

11.2 Select 400 g of material in accordance with Method E725.

11.3 Close the slide gate on the bottom of the Ohaus filling hopper and pour the 400 g of material into the hopper.

11.4 Position the dry pint cup below the gate so the cup is centered and 2 in. below the gate. Place a catch pan below the cup to catch any sample overflow.

11.5 Open the gate quickly and let the sample fill the cup and overflow. Do not vibrate the cup or close the gate before all of the sample flows out of the hopper.

11.6 Level the material in the cup with a straightedge using a gentle sawing motion.

11.7 Weigh the cup to the nearest 0.1 g ($W_2$).

## 12. Calculation

12.1 For the granular carrier or granular pesticide, calculate the loose-fill bulk density as follows:

$$\text{Bulk density } (\text{kg/m}^3) = (W_1 - W_2) \times 1.82 \quad (3)$$

$$\text{Bulk density } (\text{lb/ft}^3) = (W_2 - W_1) \times 0.113 \quad (4)$$

## 13. Precision and Bias

13.1 These test methods yield comparative data. The pass/fail aspect of these procedures should be determined by applicable specifications.

## 14. Disposal of Samples

14.1 After testing, store all materials in a safe manner and dispose of used material in accordance with product label directions, or material safety data sheets, or both.

## 15. Keywords

15.1 bulk density; free-fall; granule; loose-fill; pesticide

[3] The sole source of supply of the apparatus known to the committee at this time is Ohaus Scales, 29 Hanover Rd., Florham Park, NJ 07932. If you are aware of alternative suppliers, please provide this information to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,[1] which you may attend.

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