



Designation: D8249 – 19 (Reapproved 2024)

Standard Practice for Use of Rotary Kiln Produced Porous Ceramic as a Mineral Amendment in Topsoil Used for Landscaping and Related Purposes¹

This standard is issued under the fixed designation D8249; 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 practice covers the material characteristics, physical requirements, and sampling appropriate for the designation of the rotary kiln produced porous ceramic material as a mineral amendment. The porous ceramic material can be used to replace the sand content of a topsoil or it can be blended into an existing topsoil. Typically 5-20 % by mass of porous ceramics are used when blending with or adding to a topsoil.

1.2 The potential/success of a topsoil amendment is measured/determined by its ability to provide or enhance some or all of the desired properties/characteristics of the topsoil that may be deficient in the unamended topsoil.

1.3 Soils typically consist of three components: water, air and solids. Solids can be further divided into two sub-components: organic matter, such as peat, muck or other decayed matter, and inorganic mineral matter, such as clay, silt and sand. Porous ceramic falls into the inorganic mineral matter sub-component and is generally used in horticultural topsoil applications as a substitute/alternative or addition for the sand component of soil. See Specification **D5268**, Table 1.

1.4 *Units*—The values stated in SI units are to be regarded as the standard. The values given in parentheses are provided for information only and are not considered standard. Reporting of test results in units other than SI shall not be regarded as nonconformance with this standard.

1.5 All observed and calculated values shall conform to the guidelines for significant digits and rounding established in Practice **D6026**, unless superseded by this test method.

1.5.1 The procedures used to specify how data are collected/recorded and calculated in the standard are regarded as the industry standard. In addition, they are representative of the significant digits that generally should be retained. The procedures used do not consider material variation, purpose for

obtaining the data, special purpose studies, or any considerations for the user's objectives; and it is common practice to increase or reduce significant digits of reported data to be commensurate with these considerations. It is beyond the scope of these test methods to consider significant digits used in analysis methods for engineering data.

1.6 *This practice offers a set of instructions for performing one or more specific operations. This document cannot replace education or experience and should be used in conjunction with professional judgment. Not all aspects of this practice may be applicable in all circumstances. This ASTM standard is not intended to represent or replace the standard of care by which the adequacy of a given professional service must be judged, nor should this document be applied without consideration of a project's many unique aspects. The word "Standard" in the title of this document means only that the document has been approved through the ASTM consensus process.*

1.7 *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.*

1.8 *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

C29/C29M Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate

C566 Test Method for Total Evaporable Moisture Content of Aggregate by Drying

D75/D75M Practice for Sampling Aggregates

¹ This test method is under the jurisdiction of ASTM Committee **D18** on Soil and Rock and is the direct responsibility of Subcommittee **D18.22** on Media for Plant Growth.

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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.

D653 Terminology Relating to Soil, Rock, and Contained Fluids

D3740 Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction

D5268 Specification for Topsoil Used for Landscaping and Construction Purposes

D6026 Practice for Using Significant Digits and Data Records in Geotechnical Data

D6913/D6913M Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis

3. Terminology

3.1 Definitions:

3.1.1 For definitions of common technical terms used in this standard, refer to Terminology **D653**.

3.1.2 *topsoil, n—in soil horizons*, the naturally formed top horizon often designated as “A horizon” consisting of soils and materials which supports the growth of plants and normally has a greater degree of weathering and greater accumulations of organic matter than underlying soil horizons or soil parent material.

4. Summary of Practice

4.1 When blending the porous ceramic material into the original topsoil as either a replacement of the sand content or as an addition, the loose bulk density, absorption, and particle size distribution (gradation) of the porous ceramic material are determined in order to calculate and evaluate the amount of porous ceramic material is to be used. A representative sample of both the topsoil and porous ceramic material is obtained. Test specimens are then obtained from both of the representative samples. Testing, as given in Specification **D5268** and in this practice, is done to make sure the amended/alterd topsoil meets the requirements given in Table 1 of Specification **D5268**. Several blends of topsoil using porous ceramic material may be needed for evaluation.

5. Significance and Use

5.1 Landscaping and construction professionals and golf course designers are a few of the typical users of this standard. When physically evaluating a soil, relative to its suitability to support plant growth (primarily grasses), tests must be performed to determine the presence and amount of solid matter compatibility that is then used to determine potential air-void content, water-holding ability, and deleterious materials. Rotary kiln produced porous ceramic material is a mineral amendment that can be added to a topsoil to increase its suitability to support plant growth.

5.2 Typical general ranges of soil content for suitable topsoils are presented in Specification **D5268**. It should be recognized, however, that in some geographic regions, concurrence with the values in the referenced table could be difficult. In such situations, locally acceptable specifications need to be developed.

NOTE 1—The quality of the result produced by this standard is dependent on the competence of the personnel performing it and the suitability of the equipment and facility used. Agencies that meet the

criteria of Practice **D3740** are generally considered capable of competent and objective testing/sampling/inspection. Reliable results depend on many factors; Practice **D3740** provides a means of evaluating some, but not all of those factors.

6. Materials

6.1 Porous ceramic is a rotary kiln produced vesicular amorphous silicate particulate material. It is a highly porous, low density material with a dry/loose bulk density of 510 to 800 kg/m³, (32 to 50 lb/ft³). The pre-sized raw clay used to produce porous ceramic is fired in the kiln at a temperature between 315 and 815°C (600 and 1500°F). As it exits the kiln the material is sterile, inert, and ceramic. Some crushing may be performed to facilitate final sizing in a screening system. Porous ceramic is generally neutral in pH, although the pH can vary somewhat depending on raw material and the fuel used to fire the kiln.

7. Sampling and Test Specimens

7.1 Obtain a sample of the rotary kiln produced porous ceramic according to Practice **D75/D75M**. Then, obtain a representative sample following Test Methods **D6913/D6913M**, Annex A2.

7.2 Obtain a representative sample of the topsoil following Test Methods **D6913/D6913M**, Annex A2.

7.3 The total amount of representative sample of each material needed will vary based on the maximum particle size of the porous ceramic material and topsoil under evaluation. Each test method typically specifies a minimum dry mass required to perform the test; therefore, the representative sample shall be of such quantity that the needed amount of material for each of the test specimens is obtained.

7.4 Thoroughly mix each of the representative samples to make sure each of the test specimens are representative of the porous ceramic material and topsoil.

7.5 Select the test specimens to be tested following the specimen mass requirements given in the individual test methods listed in Section 9.

8. Procedure

8.1 The characteristics of the original/unaltered topsoil planned for use are determined, recorded, and evaluated in accordance with Specification **D5268**.

8.2 Using three test specimens, determine and record the loose bulk density, absorption, and the particle-size distribution (gradation) of the porous ceramic material according to the test methods listed in Section 9.

8.2.1 The oven-dry or saturated surface dry loose bulk density test is performed to establish the mass-volume relationship. A correction for the mass and volume relationship of porous ceramic fines is needed since porous ceramic material has a different specific gravity than silicon dioxide sand, that is, the minus 4.75 mm (No. 4) sieve size to a similar size of sand.

8.3 Where amendment is indicated or desired, determine and record the amount and the particle-size distribution of the porous ceramic material needed to alter the topsoil characteristics. Include in the record the calculation to support the