Designation: D5883 – 12

# Standard Guide for Use of Rotary Kiln Produced Expanded Shale, Clay or Slate (ESCS) as a Mineral Amendment in Topsoil Used for Landscaping and Related Purposes[1]

This standard is issued under the fixed designation D5883; 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 guide covers the material characteristics, physical requirements, and sampling appropriate for the designation of the material as a mineral amendment.

1.2 The presence in the topsoil of the correct nutrient and pH level is necessary for healthy plant growth. This guide does not, however, cover a determination of the nutrients, nor their availability.[2]

NOTE 1—The nutrient content of topsoil is important and the chemicals usually evaluated are nitrogen, phosphate, and potassium. Nutrient deficiencies may be corrected by using fertilizers. Excess soluble salts should be examined as to their desirability. The acidity or alkalinity of the soil is also important. Excess acidity may be corrected by the application of lime dust. Excess alkalinity may be corrected by the application of sulfur or other suitable acidifying compounds. The latter item, in addition to lowering pH, also could be considered as an aggregate when considering the particle size distribution.

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

1.4 *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.*

1.5 *This guide offers an organized collection of information or a series of options and does not recommend a specific course of action. This document cannot replace education or experience and should be used in conjunction with professional judgment. Not all aspects of this guide 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.*

## 2. Referenced Documents

2.1 *ASTM Standards:*[3]

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 Practice for Sampling Aggregates

D653 Terminology Relating to Soil, Rock, and Contained Fluids

D1140 Test Methods for Amount of Material in Soils Finer than No. 200 (75-μm) Sieve

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

D4972 Test Method for pH of Soils

D5268 Specification for Topsoil Used for Landscaping Purposes

E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves

## 3. Terminology

3.1 *Definitions*—For definitions of general terms used in this guide, refer to Terminology D653.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *amendment, physical*—any substance, such as sand, calcined clay, peat, or sawdust, added to the soil to alter its physical properties.

[1] This guide is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.22 on Soil as a Medium for Plant Growth.

Current edition approved Nov. 1, 2012. Published December 2012. Originally approved in 1995. Last previous edition approved in 2008 as D5883 – 96 (2008). DOI: 10.1520/D5883-12.

[2] Nutrient testing procedures are found in the state Agricultural Experiment Station recommendations from the state within which the landscape is located, "Methods of Soil Analysis" Editor-in-Chief: C. A. Black, *Agronomy No. 9*, Vol 2, American Society of Agronomy, Inc., Madison, WI, and Hesse, P.R., *A Textbook of Soil Chemical Analysis*, Chemical Publishing Co., New York, NY 1972.

[3] 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.

***A Summary of Changes section appears at the end of this standard**

3.2.2 *slit trench drain*—a narrow trench (usually 5 to 10 centimeters wide) back-filled to the surface with a material, such as sand, gravel, or crushed rock, to facilitate surface or substance drainage.

3.2.3 *soil modification, n*—alteration of soil characteristics by addition of physical amendments: commonly used to improve physical conditions of soils.

3.2.4 *topsoil, n*—usually the original surface layer of grassland or cultivated land. Topsoil does not generally include soil from peatlands or other special areas, such as land disturbed by industrial activity. Topsoil is usually a darker shade of brown, gray, or red than the subsoil that lies immediately beneath it, because it contains organic matter intimately mixed with the mineral matter. Topsoil tends to be more friable and pervious than inorganic soils.

## 4. Significance and Use

4.1 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 (organic and inorganic) compatibility that can determine potential air-void content and water-holding ability, and finally, deleterious materials.

4.2 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 would be difficult. In such situations, locally acceptable specifications need to be developed.

NOTE 2—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 facilities used. Agencies that meet the criteria of Practice D3740 are generally considered capable of competent and objective testing/sampling/inspection/ and the like. Users of this standard are cautioned that compliance with Practice D3740 does not in itself assure reliable results. Reliable results depend on many factors; Practice D3740 provides a means of evaluating some of those factors.

## 5. Function and Material

5.1 *Function*—The potential/success of a topsoil amendment is measured/determined by its ability to provide some or all of the desired properties/characteristics of the topsoil that are absent in the unamended topsoil or soil. Soils consist essentially of three space-occupying components: water, air voids, and solid particulate matter. The third component 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. ESCS falls into the latter group of the third component sub-component group, as a better substitute for sand.

5.2 *Material*—ESCS, is a rotary kiln produced vesicular amorphous silicate particulate material. It is a highly porous, low density material with an apparent specific gravity of approximately 0.8 to 2.4, and a dry/loose unit weight of 560 to 1120 kg/m$^3$, (approximately 35 to 70 lb/ft$^3$). The pre-sized raw shale, clay or slate used to produce ESCS is fired in the kiln at a temperature between 1000 °C (1800 °F) and 1200 °C (2200 °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. ESCS in generally neutral in pH although the pH can vary somewhat depending on the raw material and the fuel in the kiln. Density, or loose unit weight, is determined by Test Method C29/C29M. The absorption may be determined by Test Method C566 after soaking the sample a sufficient period of time, usually 3 to 7 days, depending on the source and the grading of the material. The particle distribution may be determined with appropriate sieves as stated in Specification E11. The ESCS may be sampled in accordance with Practice D75.

## 6. Application

6.1 ESCS is generally used in horticultural topsoil applications as a substitute for the sand sub-component of soil (see Specification D5268, Table 1). A correction for the weight and volume relationship of ESCS fines needs to be noted since ESCS 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. The oven-dry or saturated surface dry/loose unit weight tests (see Test Method C29/C29M) can be performed to establish the weight-volume relationship. Typically, a loose cubic foot of ESCS fines will weigh approximately from 560 to 1120 kg/m$^3$ (35 to 70 lb/ft$^3$) depending on the source. Absorption of ESCS varies with the source, but is usually from approximately 18 % to 35 % of the oven-dry loose unit weight. Several blends of topsoil using ESCS with or in place of the sand should be prepared and evaluated with regard to potential for aeration, moisture retention, resistence to compaction, and the other items covered in Specification D5268.

## 7. Keywords

7.1 horticulture; landscaping; mineral amendment; soil; soil amendment; modification; topsoil

## SUMMARY OF CHANGES

Committee D18 has identified the location of selected changes to this guide since the last issue, D5883–96(2008), that may impact the use of this guide. (Approved November 1, 2012)

(*1*) Added new Note 2 with reference to D3740.