



Designation: D 2937 – 00

## Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method<sup>1</sup>

This standard is issued under the fixed designation D 2937; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope\*

1.1 This test method covers the determination of in-place density of soil by the drive-cylinder method. The test method involves obtaining a relatively undisturbed soil sample by driving a thin-walled cylinder and the subsequent activities for the determination of in-place density. When sampling or in-place density is required at depth, Test Method D 1587 should be used.

1.2 This test method is not appropriate for sampling organic soils which can compress upon sampling, very hard natural soils and heavily compacted soils which cannot be easily penetrated by the drive sampler, soils of low plasticity which will not be readily retained in the cylinder, or soils which contain appreciable amounts of gravel (particles coarser than 4.75 mm ( $\frac{3}{16}$  in.)). The presence of particles coarser than 4.75 mm ( $\frac{3}{16}$  in.) may introduce significant errors in density measurements by causing voids along the wall of the cylinder during driving, and when coarse materials have to be dislodged by the trimming of the sample obtained by the cylinder.

1.3 This test method is limited to the procedures necessary for obtaining specimens suitable for determining the in-place density and water content of certain soils. The procedures and precautions necessary for selecting locations and obtaining undisturbed samples suitable for laboratory testing or otherwise determining engineering properties is beyond the scope of this test method.

1.4 It is common practice in the engineering profession to concurrently use pounds to represent both a unit of mass (lbm) and a unit of force (lbf). This implicitly combines two separate systems of units, that is, the absolute system and the gravitational system. It is scientifically undesirable to combine the use of two separate sets of inch-pound units within a single standard. This test method has been written using the gravitational system of units when dealing with the inch-pound system. In this system the pound (lbf) represents a unit of force (weight). However, the use of balances or scales recording pounds of mass (lbm), or the recording of density in lbm/ft<sup>3</sup> should not be regarded as nonconformance with this test method.

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.08 on Special and Construction Control Tests.

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1.5 The standard values stated in SI units are to be regarded as the standard. The values in parentheses are provided for information purposes only.

1.6 *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:

D 653 Terminology Relating to Soil, Rock, and Contained Fluids<sup>2</sup>

D 698 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,000 ft-lbf/ft (600 kN-m/m))<sup>2</sup>

D 1557 Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft (2700 kN-m/m))<sup>2</sup>

D 1587 Practice for Thin-Walled Tube Sampling of Soils<sup>2</sup>

D 2216 Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock<sup>2</sup>

D 2488 Practice for Description and Identification of Soils for Engineering Practices (Visual-Manual Procedure)<sup>2</sup>

D 3740 Practice for the Evaluation of Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction<sup>2</sup>

D 4643 Test Method for Determination of Water (Moisture) Content of Soil by the Microwave Oven Method<sup>2</sup>

D 4753 Specification for Evaluating Selecting, and Specifying Balances and Scales for Use in Soil, Rock, and Construction Materials Testing<sup>2</sup>

D 4944 Test Method for Field Determination of Water (Moisture) Content of Soil by the Calcium Carbide Gas Pressure Tester Method<sup>3</sup>

D 4959 Test Method for Determination of Water (Moisture) Content of Soil by Direct Heating Method<sup>2</sup>

### 3. Terminology

3.1 *Definitions*—All definitions are in accordance with Terminology D 653.

<sup>2</sup> Annual Book of ASTM Standards, Vol 04.08.

<sup>3</sup> Annual Book of ASTM Standards, Vol 04.09.

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

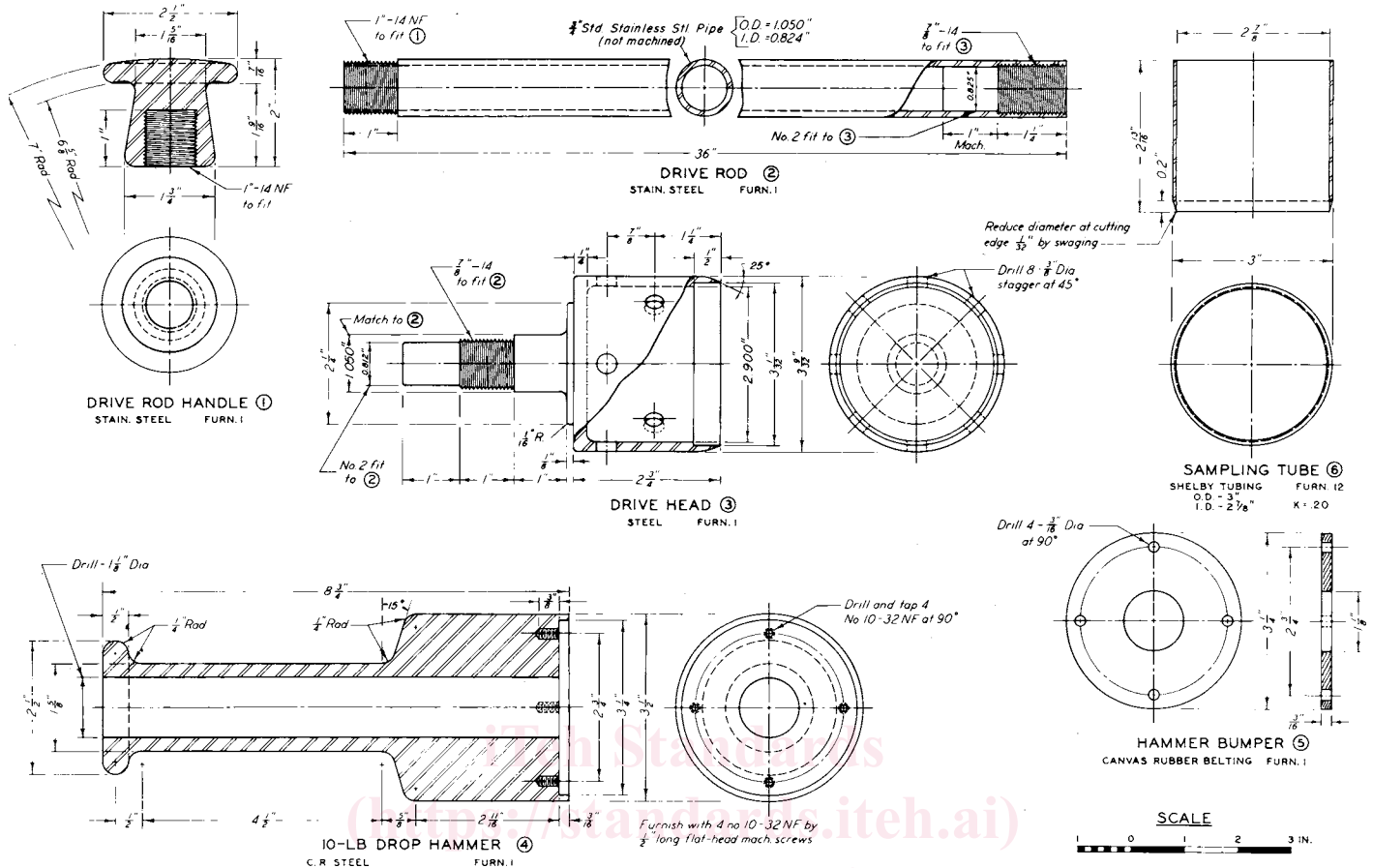


FIG. 1 Typical Design for a Surface Soil Sampler

TABLE 1 Dimensional Equivalent for Fig. 1

mm	in.	mm	in.
2	5/64	101.2	4
3.3	0.13	114.3	4 1/2
4.8	3/16	127.0	5
19	3/4	152.4	6
44.4	1 3/4	212.0	8 1/2
76	3	863.6	34
97.2	3 13/16	1117.6	44

4. Significance and Use

4.1 This test method can be used to determine the in-place density of natural, inorganic soils which do not contain significant amounts of particles coarser than 4.75 mm (3/16 in.), and which can be readily retained in the drive cylinder. This test method may also be used to determine the in-place density of compacted soils used in construction of structural fill, highway embankments, or earth dams. When the in-place density is to be used as a basis for acceptance, the drive cylinder volumes must be as large as practical and not less than 850 cm<sup>3</sup> (.03 ft<sup>3</sup>).

4.2 This test method is not recommended for use in organic or friable soils. This test method may not be applicable for soft, highly plastic, noncohesive, saturated or other soils which are easily deformed, compress during sampling, or which may not be retained in the drive cylinder. The use of this test method in

soils containing particles coarser than 4.75 mm (3/16 in.) may result in damage to the drive cylinder equipment. Soils containing particles coarser than 4.75 mm (3/16 in.) may not yield valid results if voids are created along the wall of cylinder during driving, or if particles are dislodged from the sample ends during trimming.

4.3 The general principles of this test method have been successfully used to obtain samples of some field compacted fine-grained soils having a maximum particle size of 4.75 mm (3/16 in.) for purposes other than density determinations, such as the testing for engineering properties.

NOTE 1—Notwithstanding the statements on precision and bias contained in this standard: The precision of this test method is dependent on the competence of the personnel performing it and the suitability of the equipment and facilities used. Agencies which meet the criteria of Practice D 3740 are generally considered capable of competent and objective