



Designation: D2488 – 17<sup>e1</sup>

## Standard Practice for Description and Identification of Soils (Visual-Manual Procedures)<sup>1</sup>

This standard is issued under the fixed designation D2488; 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 reaffirmation. A superscript epsilon (ε) indicates an editorial change since the last revision or reaffirmation.

*This standard has been approved for use by agencies of the U.S. Department of Defense.*

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<sup>e1</sup> NOTE—Editorially corrected Fig. 2 in March 2018.

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### 1. Scope\*

1.1 This practice covers procedures for the description of soils for engineering purposes.

1.2 This practice also describes a procedure for identifying soils, at the option of the user, based on the classification system described in Test Method D2487. The identification is based on visual examination and manual tests. It shall be clearly stated in reporting, the soil identification is based on visual-manual procedures.

1.2.1 When precise classification of soils for engineering purposes is required, the procedures outlined in Test Method D2487 shall be used.

1.2.2 In this practice, the identification procedures assigning a group symbol and name are limited to soil particles smaller than 3 in. (75 mm).

1.2.3 The identification portion of this practice is limited to naturally occurring soils. Specimens used for identification may be either intact or disturbed.

NOTE 1—This practice may be used as a descriptive system applied to such materials as shale, claystone, shells, crushed rock, etc. (see Appendix X2).

1.3 The descriptive information in this practice may be used with other soil classification systems or for materials other than naturally occurring soils.

1.4 *Units*—The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are rationalized conversions to SI units that are provided for information only and are not considered standard. The sieve designations are identified using the “alternative” system in accordance with Practice E11.

1.5 *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 precautionary statements see Section 8.*

*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 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:<sup>2</sup>

[D653 Terminology Relating to Soil, Rock, and Contained Fluids](#)

[D1452 Practice for Soil Exploration and Sampling by Auger Borings](#)

[D1586 Test Method for Standard Penetration Test \(SPT\) and Split-Barrel Sampling of Soils](#)

[D1587 Practice for Thin-Walled Tube Sampling of Fine-Grained Soils for Geotechnical Purposes](#)

[D2113 Practice for Rock Core Drilling and Sampling of Rock for Site Exploration](#)

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<sup>1</sup> This practice is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.07 on Identification and Classification of Soils.

Current edition approved July 15, 2017. Published August 2017. Originally approved in 1966. Last previous edition approved in 2009 as D2488 – 09a. DOI: 10.1520/D2488-17E01.

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto: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



**D2487** Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)

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

**D4083** Practice for Description of Frozen Soils (Visual-Manual Procedure)

**D4427** Classification of Peat Samples by Laboratory Testing

**E11** Specification for Woven Wire Test Sieve Cloth and Test Sieves

### 3. Terminology

#### 3.1 Definitions:

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

3.1.2 *cobbles*—particles of rock that will pass a 12-in. (300-mm) square opening and be retained on a 3-in. (75-mm) sieve.

3.1.3 *boulders*—particles of rock that will not pass a 12-in. (300-mm) square opening.

3.1.4 *clay*—soil passing a No. 200 (75- $\mu\text{m}$ ) sieve that can be made to exhibit plasticity (putty-like properties) within a range of water contents, and that exhibits considerable strength when air-dried. For classification, a clay is a fine-grained soil, or the fine-grained portion of a soil, with a plasticity index equal to or greater than 4, and the plot of plasticity index versus liquid limit falls on or above the “A” line (see Fig. 4 of Test Method **D2487**).

3.1.5 *gravel*—particles of rock that will pass a 3-in. (75-mm) sieve and be retained on a No. 4 (4.75-mm) sieve with the following subdivisions:

3.1.5.1 *coarse*—passes a 3-in. (75-mm) sieve and is retained on a  $\frac{3}{4}$ -in. (19-mm) sieve.

3.1.5.2 *fine*—passes a  $\frac{3}{4}$ -in. (19-mm) sieve and is retained on a No. 4 (4.75-mm) sieve.

3.1.6 *organic clay*—a clay with sufficient organic content to influence the soil properties. For classification, an organic clay is a soil that would be classified as a clay, except that its liquid limit value after oven drying is less than 75 % of its liquid limit value before oven drying.

3.1.7 *organic silt*—a silt with sufficient organic content to influence the soil properties. For classification, an organic silt is a soil that would be classified as a silt except that its liquid limit value after oven drying is less than 75 % of its liquid limit value before oven drying.

3.1.8 *peat*—a soil composed primarily of vegetable tissue in various stages of decomposition usually with an organic odor, a dark brown to black color, a spongy consistency, and a texture ranging from fibrous to amorphous.

3.1.9 *sand*—particles of rock that will pass a No. 4 (4.75-mm) sieve and be retained on a No. 200 (75- $\mu\text{m}$ ) sieve with the following subdivisions:

3.1.9.1 *coarse*—passes a No. 4 (4.75-mm) sieve and is retained on a No. 10 (2.00-mm) sieve.

3.1.9.2 *medium*—passes a No. 10 (2.00-mm) sieve and is retained on a No. 40 (425- $\mu\text{m}$ ) sieve.

3.1.9.3 *fine*—passes a No. 40 (425- $\mu\text{m}$ ) sieve and is retained on a No. 200 (75- $\mu\text{m}$ ) sieve.

3.1.10 *silt*—soil passing a No. 200 (75- $\mu\text{m}$ ) sieve that is nonplastic or very slightly plastic and that exhibits little or no strength when air dry. For classification, a silt is a fine-grained soil, or the fine-grained portion of a soil, with a plasticity index less than 4, or the plot of plasticity index versus liquid limit falls below the “A” line (see Fig. 4 of Test Method **D2487**).

3.1.11 *fine-grained soils*—soils that are made up of 50 % or more particles that will pass a No. 200 (75  $\mu\text{m}$ ) sieve.

3.1.12 *coarse-grained soils*—soils that are made up of more than 50 % particles that will be retained on a No. 200 (75  $\mu\text{m}$ ) sieve.

### 4. Summary of Practice

4.1 Using visual examination and simple manual tests, this practice gives standardized criteria and procedures for describing and identifying soils.

4.2 The soil can be given an identification by assigning a group symbol(s) and name. The flow charts, **Fig. 1a** and **Fig. 1b** for fine-grained soils, and **Fig. 2**, for coarse-grained soils, can be used to assign the appropriate group symbol(s) and name. If the soil has properties which do not distinctly place it into a specific group, borderline symbols may be used, see **Appendix X3**.

### 5. Significance and Use

5.1 The descriptive information required in this practice can be used to describe a soil to aid in the evaluation of its significant properties for engineering use.

5.2 The descriptive information required in this practice should be used to supplement the classification of a soil as determined by Test Method **D2487**.

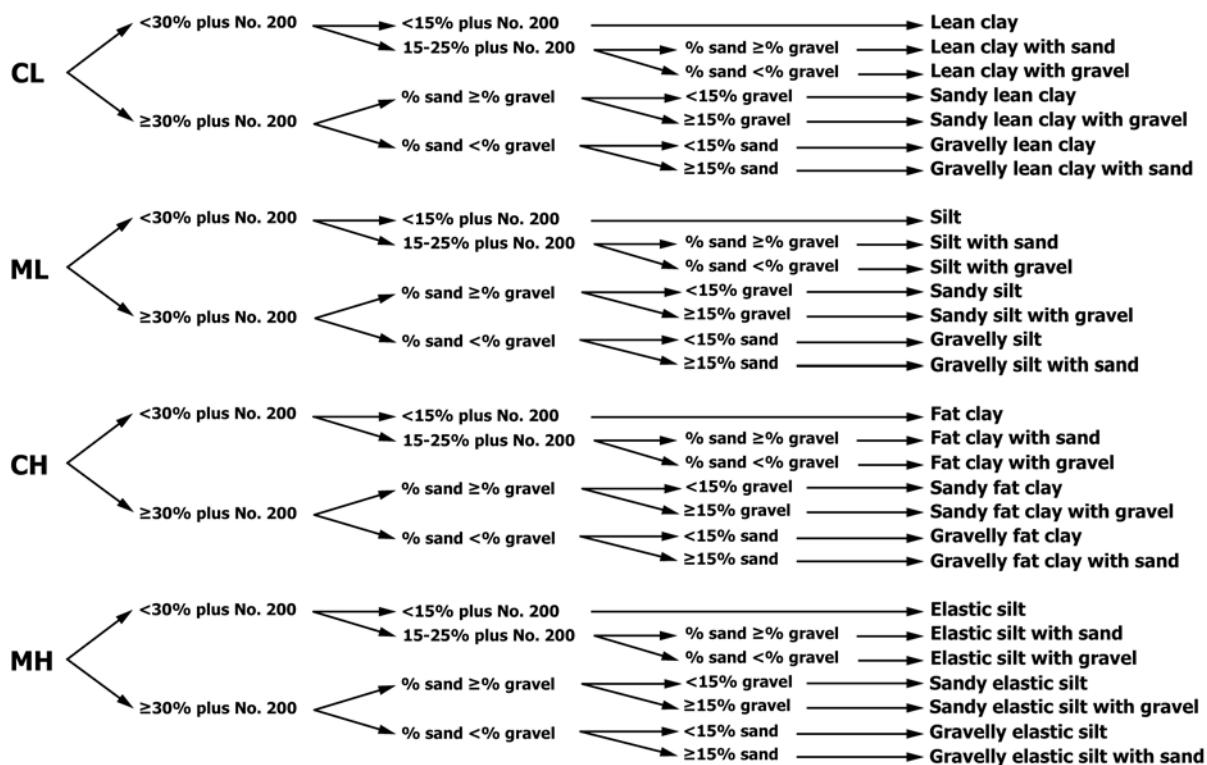
5.3 This practice may be used in identifying soils using the classification group symbols and names as prescribed in Test Method **D2487**. Since the names and symbols used in this practice to identify the soils are the same as those used in Test Method **D2487**, it shall be clearly stated in reports and all other appropriate documents, that the classification symbol and name are based on visual-manual procedures.

5.4 This practice is to be used for identification of soils in the field, laboratory, or any other location where soil samples are inspected and described.

5.5 This practice may be used to group similar soil samples to reduce the number of laboratory tests necessary for positive soil classification.

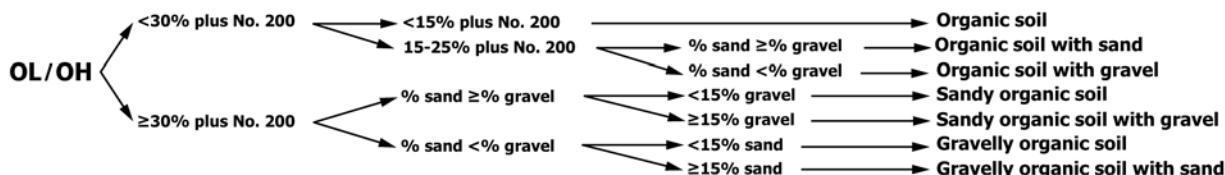
NOTE 2—The ability to describe and identify soils correctly is learned more readily under the guidance of experienced personnel, but it may also be acquired systematically by comparing numerical laboratory test results for typical soils of each type with their visual and manual characteristics.

5.6 Soil samples from a given boring, test pit or location which appear to have similar characteristics are not required to follow all of the procedures in this practice, providing at least one sample is completely described and identified. These samples may follow only the necessary procedures to determine they are “similar” and shall be labeled as such.

**GROUP SYMBOL**
**GROUP NAME**


NOTE—Percentages are based on estimating amounts of fines, sand, and gravel to the closest 5 %.

FIG. 1a Flow Chart for Identifying Inorganic Fine-Grained Soil (50 % or more fines)

**GROUP SYMBOL**
**GROUP NAME**


NOTE—Percentages are based on estimating amounts of fines, sand, and gravel to the closest 5 %.

FIG. 1 b Flow Chart for Identifying Organic Fine-Grained Soil (50 % or more fines)

5.7 This practice may be used in combination with Practice D4083 when working with frozen soils.

NOTE 3—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/etc. 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.

6.3 *Jar with Lid (optional)*

6.4 *Hand Lens (optional)*

6.5 *Shallow Pan (optional)*

## 7. Reagents

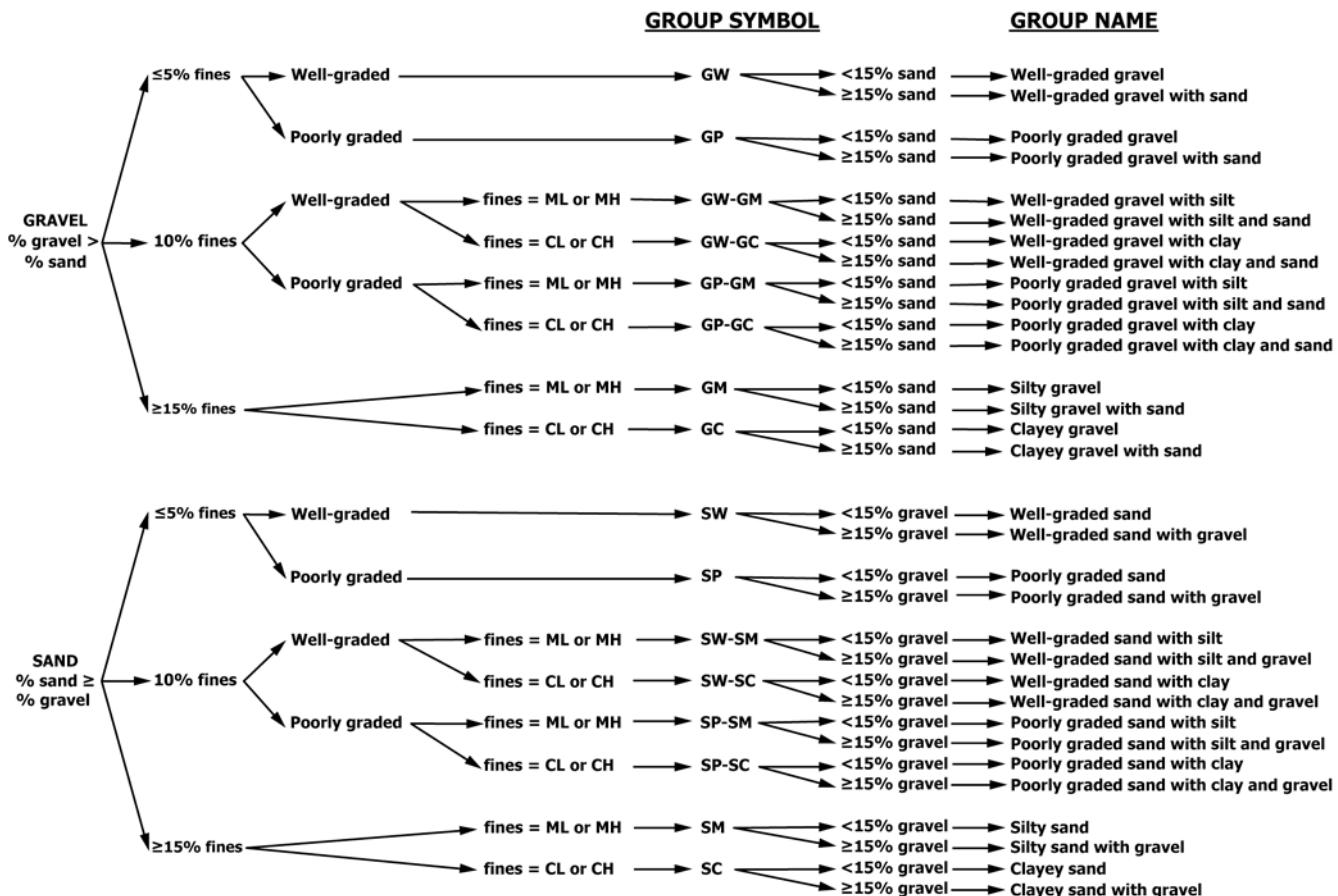
7.1 *Purity of Water*—Unless otherwise indicated, references to water shall be understood to mean water from a city water supply or natural source, including non-potable water.

7.2 *Hydrochloric Acid*—A small bottle of dilute hydrochloric acid (HCl) one part HCl (10 N) to three parts distilled water (This reagent is optional for use with this practice). See Section 8.

## 6. Apparatus

6.1 *Small Knife or Spatula*

6.2 *Test Tube and Stopper (optional)*



NOTE—Percentages are based on estimating amounts of fines, sand, and gravel to the closest 5 %.

NOTE—It is suggested that a distinction be made between *dual symbols* and *borderline symbols*.

*Dual Symbol*—A dual symbol is two symbols separated by a hyphen, for example, GP-GM, SW-SC, CL-ML used to indicate that the soil has been identified as having the properties of a classification in accordance with Test Method D2487 where two symbols are required. Two symbols are required when the soil has between 5 and 12 % fines or when the liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart.

*Borderline Symbol*—A borderline symbol is two symbols separated by a slash, for example, CL/CH, GM/SM, CL/ML. A borderline symbol should be used to indicate that the soil has been identified as having properties that do not distinctly place the soil into a specific group (see Appendix X3).

**FIG. 2 Flow Chart for Identifying Coarse-Grained Soils (less than 50 % fines)**

## 8. Safety Precautions

8.1 When preparing the dilute HCl solution of one part concentrated hydrochloric acid (10 N) to three parts of distilled water, slowly add acid into water following necessary safety precautions. Handle with caution, utilize personal protective equipment and store safely. If solution comes into contact with the skin or eyes, rinse thoroughly with water.

8.2 **Caution**—Acid shall be added to the water. Do not add water to the acid as this may cause an adverse reaction.

## 9. Sampling

9.1 The sample shall be considered to be representative of the stratum from which it was obtained by an appropriate, accepted, or standard procedure.

NOTE 4—Preferably, the sampling procedure should be identified as having been conducted in accordance with Practices D1452, D1587, or D2113, or Test Method D1586.

9.2 The sample shall be carefully identified as to origin.

NOTE 5—Remarks as to the origin may take the form of a boring number and sample number in conjunction with a project number, a

geologic stratum, a pedologic horizon or a location description with respect to a permanent monument, a grid system or a station number and offset with respect to a stated centerline and a depth or elevation.

9.3 For accurate description and identification, the minimum amount of the specimen to be examined shall be in accordance with Table 1.

NOTE 6—If random isolated particles are encountered that are significantly larger than the particles in the soil matrix, the soil matrix can be accurately described and identified in accordance with the preceding table.

9.4 If the sample or specimen being examined is smaller than the minimum recommended specimen size, the report shall include a remark stating as such.

**TABLE 1 Minimum Specimen Dry Mass Requirements**

Maximum Particle Size, Sieve Opening	Minimum Specimen Size, by Dry Mass
No. 4 (4.75 mm)	0.25 lb (110 g)
3/8 in. (9.5 mm)	0.5 lb (220 g)
3/4 in. (19.0 mm)	2.2 lb (1.0 kg)
1 1/2 in. (38.1 mm)	18 lb (8.0 kg)
3 in. (75.0 mm)	132 lb (60.0 kg)