
Standard Method of Test for Determination of Organic Content in Soils by Loss on Ignition

AASHTO Designation: T 267-22

Technically Revised: 2022

Technical Subcommittee: 1a, Soil and Unbound Recycled Materials



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1. SCOPE

- 1.1. The Loss on Ignition method for the determination of organic content is most applicable to those materials identified as peats, organic mucks, and soils containing relatively undecayed or undecomposed vegetative matter or fresh plant materials such as wood, roots, or grass, or carbonaceous materials such as lignite, coal, etc. This method determines the quantitative oxidation of organic matter in these materials and gives a valid estimate of organic content. The Wet Combustion method (T 194) is recommended when it is desired to determine the percentage of humus-like, easily oxidized organic material to provide information relating to the suitability of a soil for plant growth.
- 1.2. The following applies to all specified limits in this standard: For the purposes of determining conformance with these specifications, an observed value or a calculated value shall be rounded off “to the nearest unit” in the last right-hand place of figures used in expressing the limiting value, in accordance with ASTM E29.
- 1.3. The values stated in SI units are to be regarded as the standard.
- 1.4. *The quality of the results produced by this standard are dependent on the competence of the personnel performing the procedure and the capability, calibration, and maintenance of the equipment used. Agencies that meet the criteria of R 18 are generally considered capable of competent and objective testing/sampling/inspection/etc. Users of this standard are cautioned that compliance with R 18 alone does not completely assure reliable results. Reliable results depend on many factors; following the suggestions of R 18 or some similar acceptable guideline provides a means of evaluating and controlling some of those factors.*

2. REFERENCED DOCUMENTS

- 2.1. *AASHTO Standards:*
 - M 231, Weighing Devices Used in the Testing of Materials
 - M 339M/M 339, Thermometers Used in the Testing of Construction Materials
 - R 18, Establishing and Implementing a Quality Management System for Construction Materials Testing Laboratories
 - R 58, Dry Preparation of Disturbed Soil and Soil–Aggregate Samples for Test
 - T 194, Determination of Organic Matter in Soils by Wet Combustion
- 2.2. *ASTM Standards:*

- E1, Standard Specification for ASTM Liquid-in-Glass Thermometers
- E29, Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
- E230/E230M, Standard Specification for Temperature-Electromotive Force (emf) Tables for Standardized Thermocouples
- E2877, Standard Guide for Digital Contact Thermometers

2.3. *International Electrotechnical Commission Standard:*

- IEC 60584-1: 2013 Thermocouples - Part 1: EMF Specifications and Tolerances

3. APPARATUS

3.1. *Oven*—Drying oven capable of maintaining temperatures of $110 \pm 5^\circ\text{C}$ ($230 \pm 9^\circ\text{F}$). Gravity, instead of blower convection, may be necessary when drying lightweight material. Oven(s) for heating and drying shall be capable of operation at the temperatures required, between 25 to 120°C (77 to 248°F), within $\pm 5^\circ\text{C}$ ($\pm 9^\circ\text{F}$), as corrected, if necessary, by standardization. More than one oven may be used, provided each is used within its proper operating temperature range. The thermometer used for monitoring the temperature of the oven, or for measuring the temperature of materials shall meet the requirements of M 339M/M 339 with a temperature range of at least 0 to 130°C (32 to 266°F), and an accuracy of $\pm 1.25^\circ\text{C}$ ($\pm 2.25^\circ\text{F}$) (see Note 1).

Note 1—Thermometer types suitable for use include ASTM E1 mercury thermometers; ASTM E2877 digital metal stem thermometer; ASTM E230/E230M thermocouple thermometer, Type J or K, Special Class, Type T any Class; IEC 60584 thermocouple thermometer, Type J or K, Class 1, Type T any Class; or dial gauge metal stem (bi-metal) thermometer.

3.2. *Balance*—The balance shall have sufficient capacity and conform to M 231, Class G 1.

3.3. *Muffle Furnace*—The furnace shall be capable of maintaining a continuous temperature of $455 \pm 10^\circ\text{C}$ ($833 \pm 18^\circ\text{F}$) and have a combustion chamber capable of accommodating the designated container and sample. A pyrometer recorder shall indicate the temperature while in use. When measuring temperature during use the thermometer for measuring the temperature of materials shall meet the requirements of M 339M/M 339 with a temperature range of at least 400 to 500°C (752 to 932°F), and an accuracy of $\pm 2.5^\circ\text{C}$ ($\pm 4.5^\circ\text{F}$) (see Note 2).

Note 2—Thermometer types suitable for use include ASTM E1 mercury thermometers; ASTM E230/E230M thermocouple thermometer, Type T, Special Class; or IEC 60584 thermocouple thermometer, Type T, Class 1.

3.4. *Crucibles or Evaporating Dishes*—High silica, alundum, porcelain, or nickel crucibles of 30- to 50-mL capacity or Coors porcelain evaporating dishes, approximately 100-mm top diameter.

3.5. *Desiccator*—A desiccator of sufficient size containing an effective desiccant.

3.6. *Containers*—Suitable rustproof metal, porcelain, glass, or plastic-coated containers.

3.7. *Miscellaneous Supplies*—Asbestos gloves, tongs, spatulas, etc.

4. SAMPLE PREPARATION

4.1. A representative sample with a mass of at least 100 g shall be taken from the thoroughly mixed portion of the material passing the 2.00-mm (No. 10) sieve that has been obtained in accordance with R 58.

- 4.2. Place the sample in a container and dry in the oven at $110 \pm 5^{\circ}\text{C}$ ($230 \pm 9^{\circ}\text{F}$) to constant mass. Remove the sample from the oven, place in the desiccator, and allow to cool.
- Note 3**—This sample can be allowed to remain in the oven until ready to proceed with the remainder of the test.

5. IGNITION PROCEDURE

- 5.1. Select a sample with a mass of approximately 10 to 40 g, place into tared crucibles or porcelain evaporating dishes, and determine the mass to the nearest 0.01 g.
- Note 4**—Sample masses for lightweight materials such as peat may be less than 10 g but should be of sufficient amount to fill the crucible to at least three-quarter depth. A cover may initially be required over the crucible during the initial phase of ignition to decrease the possibility of the sample being “blown out” from the container.
- 5.2. Place the crucible or dish containing the sample into the muffle furnace for 6 h at a temperature of $455 \pm 10^{\circ}\text{C}$ ($833 \pm 18^{\circ}\text{F}$). Remove the sample from the furnace, place into the desiccator, and allow to cool.
- 5.3. Remove the cooled sample from the desiccator and determine the mass to the nearest 0.01 g.

6. CALCULATION

- 6.1. The organic content shall be expressed as a percentage of the mass of the oven-dried soil and shall be calculated as follows:

$$\text{percent organic matter} = \frac{A - B}{A - C} \times 100 \quad (1)$$

where:

- A = mass of crucible or evaporating dish and oven-dried soil, before ignition;
 B = mass of crucible or evaporating dish and oven-dried soil, after ignition; and
 C = mass of crucible or evaporating dish, to the nearest 0.01 g.

- 6.2. Calculate the percentage of organic content to the nearest 0.1 percent.

7. KEYWORDS

- 7.1. Combustion method; organic content; plant growth; topsoil.