



## TEST METHODS MANUAL

Laboratory Services Division  
Bureau of Soils and Water Management  
Department of Agriculture

# TM-LSD-04-11

SECTION : SOIL CHEMISTRY

Issue No.: 3

Effective date: July 1, 2022

SUBJECT : **MOISTURE (WATER) CONTENT (GRAVIMETRIC METHOD)**

Revision No.: 0

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### SCOPE

This method is for the laboratory determination of the moisture (water) content of soils as a percentage of its oven-dried weight. It is applicable to fine, medium and coarse-grained soils for particle size <2 mm.

### PRINCIPLE

Soil moisture is the water present in the space between the soil particles. It influences the physical, chemical, and biological characteristics of the soil. Hence, its availability to support plant growth is a primary factor in agriculture productivity.

The oven-drying technique is probably the most widely used of all gravimetric methods for measuring soil moisture and is the standard for the calibration of all other soil moisture determination techniques. This method consists of oven drying a soil sample at 105 °C until a constant weight is obtained. Usually, this weight is obtained within 12 hours, but for large samples the drying time increases. The wet weight of the soil sample is taken before oven drying. The amount of water in the sample can be determined and the moisture content calculated and expressed as a percentage of the dry soil weight.

### TEST PRECAUTIONS

Checking every moisture content sample to determine that it is dried to a constant weight is impractical. In most cases, drying of a moisture content sample overnight (16 hours) is sufficient. In cases where there is doubt concerning the adequacy of overnight drying, drying should be continued until the difference in weight of the cooled sample after two successive periods does not exceed 0.1% of the original sample weight. Samples of sand may often be dried to constant weight after 7 hours. Since dry soil may absorb moisture from wet samples, dried samples should be removed before placing wet samples in the oven. Drying time should be extended if the oven is full.

### EQUIPMENT

- A thermostatically controlled oven preferably of the forced-draught type, capable of maintaining a temperature between 105 °C and 110 °C.
- Analytical Balance, precision of 0.0001 g


### LABORATORY WARE

- Numbered container with close fitting numbered lids.


Prepared by:

  
**EZRA MAE B. GAMBOA**  
Document Controller

Reviewed by:

  
**FLORINA P. SANCHEZ**  
Head, Soil Chemistry Section

Approved by:

  
**GINA P. NILO, Ph.D.**  
Quality Manager

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- b) A desiccator containing anhydrous self-indicating silica gel.
- c) A scoop.
- d) Heat resistant gloves
- e) Tongs

### HEALTH AND SAFETY

Wearing dust masks and protective gloves when handling soil samples is advised since soils may contain bacteria and/or organisms which can be harmful to one's health.

The use of heat resistant gloves/mitts or pot holders to remove samples from the oven is recommended.

### PROCEDURE (ASTM, 2014)

1. Determine and record the mass of the clean and dry specimen container and its lid, if used along with its identification.
2. Place the moist test specimen in the container and, if used, set the lid securely in position.
3. Determine the mass of the container and moist specimen using a balance selected on the basis of the specimen mass or required significant digits. Record this value.
4. Remove the lid (if used) and place the container with the moist specimen in the drying oven.
5. Dry the specimen to a constant mass. Maintain the drying oven at  $105 \pm 5$  °C.
6. After the specimen has dried to constant mass, remove the container from the oven (and replace the lid if used).
7. Allow the specimen and container to cool in the desiccator for 15 minutes.
8. Determine the mass of the container and oven-dried specimen using the same type/capacity balance used in No. 4.
9. Record this value.

#### Notes:

*Suitable sample containers must be made of material resistant to corrosion and change in mass upon repeated heating, cooling, and exposure to materials of varying pH, and cleaning.*


*The purpose of close-fitting lids is to prevent loss of moisture from samples before initial mass determination, and to prevent absorption of moisture from the atmosphere following drying and before final mass determination.*

*Keep the samples that are stored prior to testing in a desiccator at a room temperature and in an area that prevents direct contact with sunlight. Disturbed samples in containers shall be stored in such a way as to minimize moisture condensation on the insides of the containers.*


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**EZRA MAE B. GAMBOA**  
Document Controller

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Head, Soil Chemistry Section

Approved by:

  
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### CALCULATION

$$w = [(M_{cms} - M_{cds}) / (M_{cds} - M_c)] \times 100 = (M_w / M_s) \times 100$$

where:

w	=	moisture/water content, %
M <sub>cms</sub>	=	mass of container and moist specimen, g
M <sub>cds</sub>	=	mass of container and oven dry specimen, g
M <sub>c</sub>	=	mass of container, g
M <sub>w</sub>	=	mass of water (M <sub>w</sub> = M <sub>cms</sub> - M <sub>cds</sub> ), g and
M <sub>s</sub>	=	mass of oven dry specimen (M <sub>s</sub> = M <sub>cds</sub> - M <sub>c</sub> ), g

Limited Preview

### QUALITY ASSURANCE PROCEDURE

For full access, kindly fill out the Document Request Form.

Google Form link:

<https://forms.gle/RbCgCdA54prTS6oN7>

$$\% RSD = \frac{s}{\bar{x}} \times 100$$

where:

s	=	standard deviation of the triplicate result
$\bar{x}$	=	mean

### 2. Trueness of Result

Thank you!

- Analyze a CRM or a QRM at least once a year.
  - ✓ Acceptance Criteria: Results should be within the confidence interval of the CRM or the Consensus Value of the QRM
- Participate in Interlaboratory Proficiency Testing Program at least once a year.
  - ✓ Acceptance Criteria: z-score is within acceptance criterion as evaluated by the PT scheme provider using its stated protocol.

3. **Control Chart** – Perform triplicate analysis of QCM or QRM for every batch of analysis. Plot the result in the control chart. Monitor for out of control signals. If Out of Control Signal/Trend is observed, identify the root cause and correct the problem. Develop corrective action plan and prepare RFA report as needed.

Prepared by:

*embgambao*  
EZRA MAE B. GAMBOA  
Document Controller

Reviewed by:

*JP Sanchez*  
FLORFINA P. SANCHEZ  
Head, Soil Chemistry Section

Approved by:

*GINA P. NILO*  
GINA P. NILO, Ph.D.  
Quality Manager

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