



DETERMINING MOISTURE CONTENT OF SOILS

SCOPE

This method describes several field procedures for determining moisture content of soil. The sampling procedure to obtain soils used for this test is given in [IM 312](#).

PROCEDURE A – DETERMINATION OF MOISTURE CONTENT OF SOIL BY DIRECT HEAT

A. Apparatus

1. Balance having a capacity of at least 5,000 grams accurate to at least 0.5 grams.
2. Direct heat source – hot plate, electric or gas stove or burner, or other heat source. Direct application of heat by open flame to specimen is not appropriate.
3. Containers – suitable container made of material resistant to corrosion and not subject to change in mass or disintegration upon repeated heating, cooling, or cleaning.
4. Miscellaneous (as needed) – Mixing tools such as spatula, spoons, etc. for cutting and stirring the specimen.

B. Preparation of Test Sample

1. Obtain a test sample of at least 500 grams.
2. To avoid moisture loss due to evaporation, the weighing should be done immediately after obtaining the test sample. Also avoid any excessive manipulation of the soil, prior to weighing, which could cause a loss of moisture.

C. Test Procedure

1. Weigh a clean, dry container, and record mass.
2. Place the moisture content sample in the container, and immediately determine and record the mass of soil and container.
3. Apply heat to the soil specimen and container, taking care to avoid localized overheating. Continue heating while stirring and breaking up the specimen to obtain even heat distribution. Continue application of heat until the specimen first appears dry. (Note: A piece of dry, light-weight paper or tissue placed on the surface of the apparently dry soil will curl or ripple if the soil still contains significant water or a mirror will fog up when placed over the sample.)
4. After initial heating period has been completed and soil appears dry, remove the container and soil from the heat source. Determine and record the mass of the soil and container.

5. Return the container and soil to the heat source for an additional application of heat.
6. With a small spatula or knife, continue to carefully stir and mix the soil, taking care not to lose any soil.
7. Repeat above steps 3 to 6 until the change between the two consecutive mass determinations would have an insignificant effect on the calculated water content. A change of 0.1% or less of the initial wet mass of the soil should be acceptable for most specimens.
8. Use the final dry mass determination in calculating water content.

D. Calculation

1. Calculate the moisture content, to the nearest 0.1 percent as follows:

$$\% \text{ Moisture} = \frac{(\text{Wet soil} + \text{pan}) - (\text{Dry soil} + \text{pan})}{(\text{Dry soil} + \text{pan}) - (\text{pan})} (100)$$

PROCEDURE B – DETERMINATION OF MOISTURE CONTENT BY MICROWAVE

A. Apparatus

1. Balance having a capacity of at least 5,000 grams accurate to at least 0.5 grams.
2. Microwave oven.
3. Containers – suitable container made of nonmetallic, nonabsorbent material resistant to thermal shock, and not subject to changes in mass or disintegration upon repeated heating, cooling, or cleaning. Porcelain evaporating dishes and standard borosilicate glass dishes perform satisfactorily.
4. Heat Sink – a material or liquid placed in the microwave to absorb energy and avoid overheating the specimen after the moisture has been driven from test specimen (e.g. glass beaker filled with water).
5. Miscellaneous (as needed) – Mixing tools such as spatula, spoons, etc. for cutting and stirring the test specimen. Glass rods have been found useful for stirring and may be left in specimen container during the testing, reducing the possibility of specimen loss due to adhesion to stirring tool.

B. Preparation of Test Sample

1. Obtain a test sample of at least 500 grams mass.
2. To avoid moisture loss due to evaporation, the weighing should be done immediately after

obtaining the test sample. Also avoid any excessive manipulation of the soil, prior to weighing, which could cause a loss of moisture.

C. Test Procedure

1. Weigh a clean, dry container, and record mass.
2. Place the moisture content sample in the container, and immediately determine and record the mass of soil and container.
3. Place the soil and container in a microwave oven with the heat sink and turn the oven on for 3 minutes. If experience with a particular soil type, specimen size, or microwave oven indicates shorter or longer initial drying times can be used without overheating, the initial and subsequent drying times may be adjusted.
4. After the set time has elapsed, remove the container and soil from the microwave oven. Determine and record the mass of the soil and container.
5. With a small spatula or knife or glass rod, carefully stir and mix the soil, taking care not to lose any soil.
6. Return the container and soil to the microwave oven and reheat for 1 minute.
7. Repeat above steps 4 to 6 until the change between the two consecutive mass determinations would have an insignificant effect on the calculated water content. A change of 0.1% or less of the initial wet mass of the soil should be acceptable for most specimens.
8. Use the final dry mass determination in calculating water content

D. Calculation

1. Calculate the moisture content, to the nearest 0.1 percent as follows:

$$\% \text{ Moisture} = \frac{(\text{Wet soil} + \text{pan}) - (\text{Dry soil} + \text{pan})}{(\text{Dry soil} + \text{pan}) - (\text{pan})} (100)$$

PROCEDURE C – DETERMINATION OF MOISTURE CONTENT BY DRYING OVEN

A. Apparatus

1. Balance having a capacity of at least 5,000 grams accurate to at least 0.5 grams
2. Drying oven – thermostatically controlled, capable of being heated continuously at a temperature of 230°F ± 9°F (110 °C ± 5°C).
3. Containers – suitable container made of material resistant to corrosion, and not subject to change in mass or disintegration upon repeated heating, cooling, or cleaning.

B. Preparation of Test Sample

1. Obtain a test sample of at least 500 grams.
2. To avoid moisture loss due to evaporation the weighing should be done immediately after obtaining the test sample. Also avoid any excessive manipulation of the soil, prior to weighing, which could cause a loss of moisture.

C. Test Procedure

1. Weigh a clean, dry container, and record mass.
2. Place the moisture content sample in the container, and immediately determine and record the mass of soil and container.
3. Place the soil and container in a drying oven overnight (at least 16 hours).
4. Remove the container and soil from the oven. Determine and record the mass of the soil and container.
5. Use the final dry mass determination in calculating water content.

D. Calculation

1. Calculate the moisture content, to the nearest 0.1 percent as follows:

$$\% \text{ Moisture} = \frac{(\text{Wet soil + pan}) - (\text{Dry soil + pan})}{(\text{Dry soil + pan}) - (\text{pan})} (100)$$