EXPERIMENT 1

DETERMINATION OF WATER CONTENT

Purpose:

This test is performed to determine the water (moisture) content of soils.

The water content is the ratio, expressed as a percentage, of the mass of "pore" or "free" water in a given mass of soil to the mass of the dry soil solids.

The Theoretical Part:

For many soils, the water content may be an extremely important index used for establishing the relationship between the way a soil behaves and its properties. The consistency of a fine-grained soil largely depends on its water content. The water content is also used in expressing the phase relationships of air, water, and solids in a given volume of soil.

- Most laboratory tests in soil mechanics require the determination of water content. Water content is defined as

$$W = \frac{\text{weight of water present in a given soil mass}}{\text{weight of dry soil}}$$

- Water content is usually expressed in percent.

❖ For better results, the *minimum* size of the most soil specimens should be approximately as given in **Table 2-1**.

Maximum Particle Size in the Soil (mm)	U.S Sieve No.	Minimum Mass of Soil Sample (g)
0.425	40	20
2.0	10	50
4.75	4	100
9.5	3/8 in.	500
19.0	3/4 in.	2500

Table 1-1. Minimum Size of Moist Soil Samples to Determine Water Content

Equipment And Tools:

1. Moisture can(s).

Moisture cans are available in various sizes [for example, 2-in. (50,S mm) diameter and $^{7}/_{8}$ in. (22.2 mm) high, 3.5-in. (S8.9 mm) diameter and 2 in. (50.S mm) high).

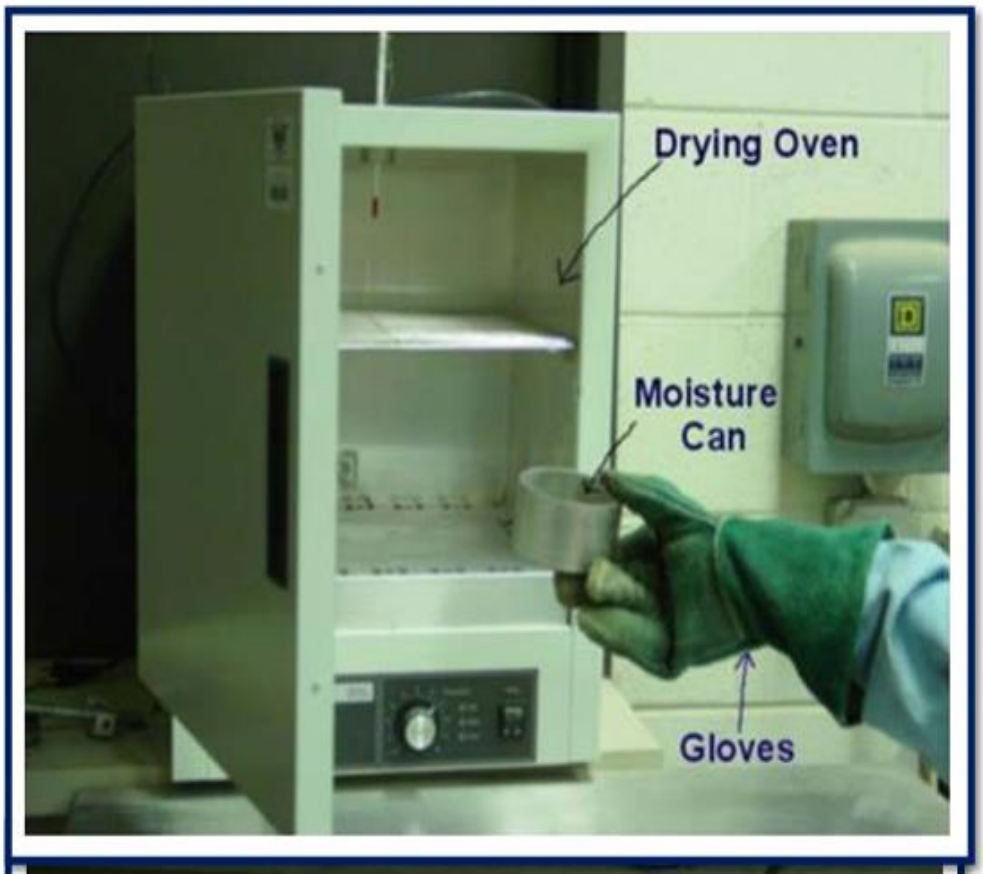
2. Oven with temperature control.

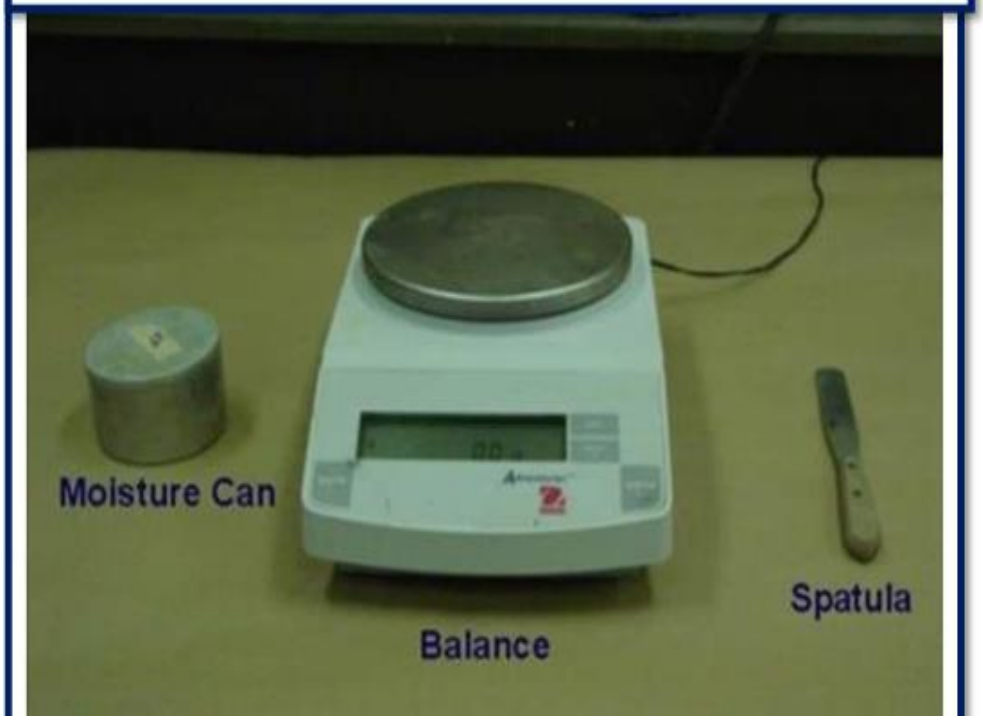
For drying, the temperature of oven is generally kept between 105°C to 110°C.

higher temperature should be avoided to prevent the burning of organic matter in the soil.

3. Balance.

The balance should have a readability of 0.01 g for specimens having amass of200 g or less. If the specimen has a mass of over 200 g, the readability should be 0.1 g.





Procedure:

1. Determine the mass (g) of the empty moisture can plus its cap (W1)' and also record the number.

2. Place a sample of representative moist soil in the can. Close the can with its cap toavoid loss of moisture.

3. Determine the combined mass (g) ofthe closed can and moist soil (W2).

4. Remove the cap from the top of the can and place it on the bottom (of the can).

5. Put the can (Step 4) in the oven to dry the soil to a constant weight. In most cases,24 hours of drying is enough.

6. Determine the combined mass (g) of the dry soil sample plus the can and its cap (W3).

Calculation:

1. Calculate the mass of moisture = *W2 - W3*

2. Calculate the mass of dry soil = *W3 - WI*

3. Calculate the water content

$$W\,(\%) = \frac{W_2 - W_3}{W_3 - W_1} \times 100$$

Standard Results:

Typical values of water content for various types of natural soils in a saturated state are shown in **Table 1-2.**

Standard Reference:

ASTM D 2216 - Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures

Soil	Natural Water Content in a Saturated State (%)
Loose uniform sand	25–30
Dense uniform sand	12–16
Loose angular-grained silty sand	25
Dense angular-grained silty sand	15
Stiff clay	20
Soft clay	30–50
Soft organic clay	80–130
Glacial till	10

Table 1-2. Typical Values of Water Content in a ,Saturated State

Discussion and Conclusions:

a. Most natural soils, which are sandy and gravelly in nature, may have water contents up to about 15 to 20%. In natural fine-grained (silty or clayey) soils, water contents up to about 50 to 80% can be found. However, peat and highly organic soils with water contents up to about 500% are not uncommon.

b. Some organic soils may decompose during oven drying at 110°C. An oven drying temperature of 11° may be too high for soils containing gypsum, as this material slowly dehydrates. According to ASTM, 'a drying temperature of 60°C is more appropriate for such soils.

c. Cooling the dry soil after oven drying (Step 5) in a desiccators is recommended. It prevents absorption of moisture from the atmosphere .