

Calibrated Cylinder Method

Determining the Volume of the Thick or Thin Wall Calibrated Cylinder Compaction Sampler

The calibrated cylinder compaction sampler is subject to a change in volume as a result of wear and damage during normal use and grinding or otherwise dressing the cutting and driving edges. Frequent inspection and calibration of the cylinder is needed to ensure the cylinder volume used in the density determination is accurate.

Frequency of Calibration

The volume of new cylinders shall be determined before they are used on a job.

Other cylinders should be calibrated when one of the following occurs:

- After the cutting or driving edges are dressed
- At the beginning of each new contract
- After 75 soil samples are taken
- Whenever inspection shows wear or damage
- When test results are questionable

Calibrating the Sampler

The following method determines the volume by measuring the length and inside diameter of the cylinder. Inside-outside type calipers shall be used for making the measurements. All measurements are to be read to the nearest .001 inch.

Step 1. Mark a set of quarter points on each end of the cylinder directly opposed.

Step 2. Measure the length of the cylinder at the quarter points (4 lengths).

Step 3. Average the measured lengths by totaling and dividing by 4.

Step 4.

Thick wall - Measure the inside diameter of the cylinder at each end between the quarter points (2 diameters at each end).

Thin wall - Measure the inside diameter of the cylinder at 4 equally spaced points on the shaped end.

Step 5. Average the measured diameters by totaling and dividing by 4.

Step 6. Compute the volume to the nearest .001 cubic foot using the following formula:

$$V = .0004545 D^2L$$

Where: V = Volume of cylinder
D = Average inside diameter (in inches)
L = Average length (in inches)

Moisture Content Tests

Microwave Method

The microwave oven is an available alternative to other quick-dry methods used in the field. It is also acceptable for use in the laboratory determination of water contents for complex test specimens. Procedures for determining the moisture content using a microwave oven are given in American Society for Testing and Materials (ASTM) D 4643, "Determination of Water (Moisture) Content of Soil by the Microwave Oven Heating." The test data and results will be recorded on Form NRCS-ENG-359, [Form KS-ENG-63](#), or a similar worksheet. Care will be exercised during the heating process with the microwave to prevent overheating of the sample and causing damage to the microwave. The use of a firebrick in the oven during the heating process is recommended. As an alternative, a suitable container filled with water can be placed in the oven along with the sample to absorb excess energy.

The following are recommendations when using the microwave for moisture content determinations:

- The soil sample should be a minimum of 100 grams and be placed in a suitable container.
- The sample and container can be covered with a paper towel to minimize the effects of particle shattering during heating.
- Break up the soil into ¼-inch size particles or less to speed the drying time.
- Set the power setting at 50-70% for ovens with a power of 700 watts or more.