



Designation: D 4373 – 96

Standard Test Method for Calcium Carbonate Content of Soils¹

This standard is issued under the fixed designation D 4373; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method covers the quantitative determination of the calcium carbonate (CaCO_3) content of soils. It is a gasometric method that utilizes a simple portable apparatus. The test method is quickly performed for soils containing calcium carbonate.

NOTE 1—The presence of dolomite $\text{CaMg}(\text{CO}_3)_2$ and reducing minerals such as sulfide and sulfate in the soil will interfere with the determination of the amount of CaCO_3 present. Therefore, this test method is an approximate method that determines the calcium carbonate equivalent.

1.2 The values stated in SI units are to be regarded as the standard.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* For specific precaution statements, see Section 6.

2. Summary of Test Method

2.1 The calcium carbonate content of soil is determined by treating a 1-g dried soil specimen with hydrochloric acid (HCl) in an enclosed reactor vessel. Carbon dioxide gas is evolved during the reaction between the acid and carbonate fraction of the specimen. The resulting pressure generated in the closed reactor is proportional (see Fig. 1) to the carbonate content of the specimen. This pressure is measured with a bourdon tube pressure gage, or equivalent pressure-measuring device, that is precalibrated with reagent grade calcium carbonate.

3. Significance and Use

3.1 This test method is used to determine the presence and quantity of calcium carbonate in a soil specimen. Calcium carbonates are known cementing agents, are water soluble at $\text{pH} < 7$, and are soft on the Mohs' scale compared to other soil minerals.

¹ This test method is under the jurisdiction of ASTM Committee D-18 on Soil and Rock and is the direct responsibility of Subcommittee D18.13 on Marine Geotechnics.

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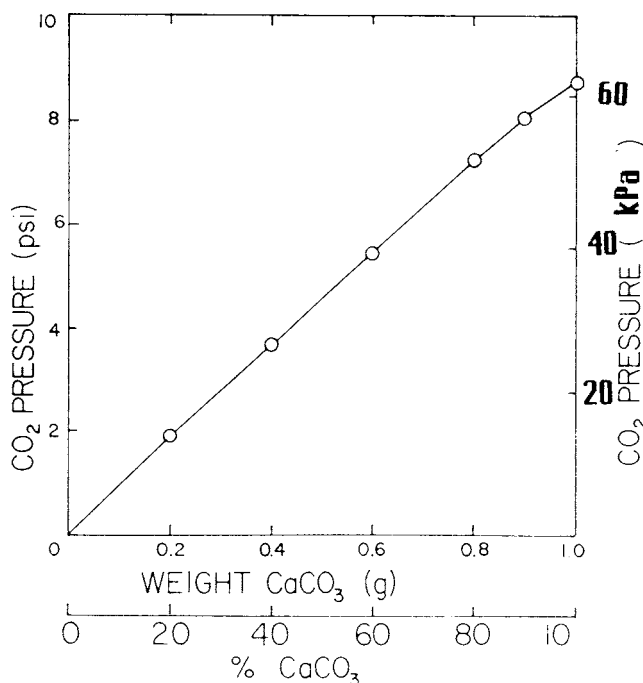


FIG. 1 Typical Calibration Curve for 0.374L Test Cell and 10 psi (69 kPa) Pressure Gage

4. Apparatus

4.1 *Rapid Carbonate Analyzer*—A schematic drawing of the rapid carbonate analyzer is shown in Fig. 2. The basic components of this apparatus include:

4.1.1 *Reaction Cylinder*, with threaded cap and O-ring seal to enclose the cylinder. A clear plastic cylinder allows viewing of effervescent reaction.

4.1.2 *Pressure Gage*, 10 ± 0.1 psi ($70 \pm \text{kPa}$).

4.1.3 *Container*, of clear plastic with a bail handle to hold 20 mL of acid.

4.1.4 *Pressure Relief Valve*, for safe release of CO_2 gas pressure.

4.2 *Balance*, with a sensitivity of 0.01 g.

5. Reagents

5.1 *Purity of Reagents*—Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that

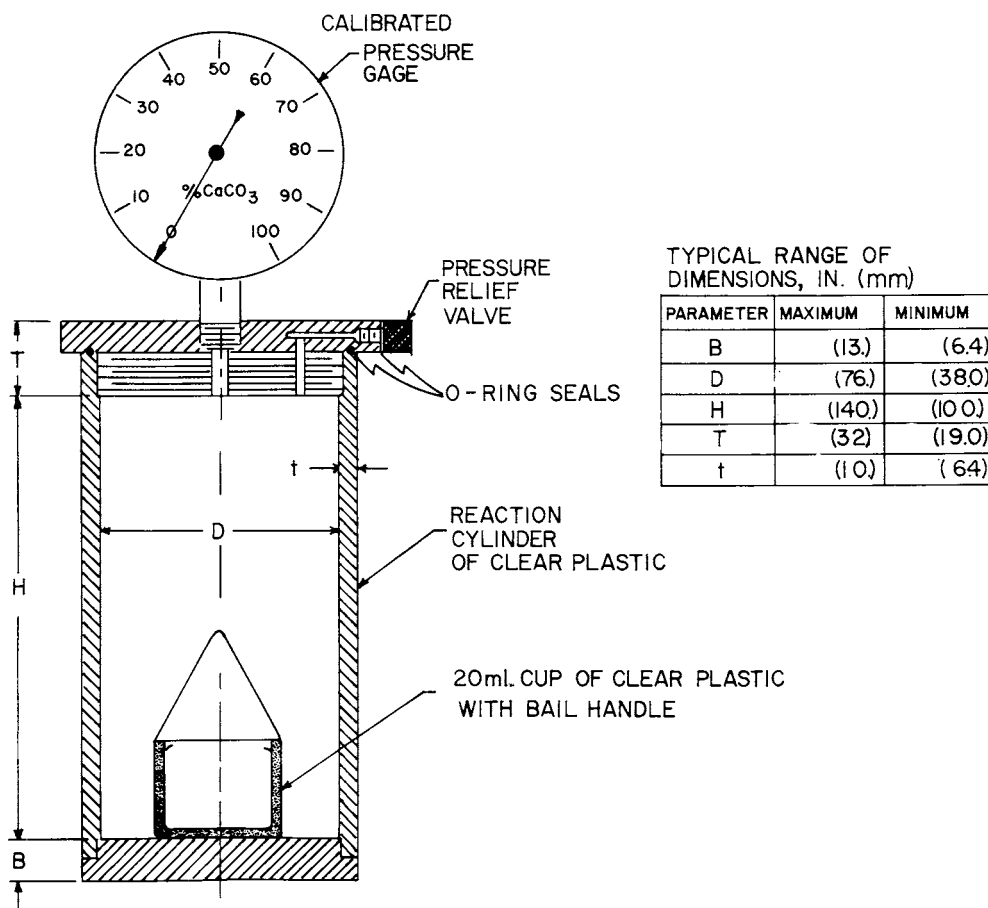


FIG. 2 Schematic Drawing of Rapid Carbonate Analyzer

all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available.² Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

5.2 Calcium Carbonate (CaCO_3).

5.3 *Hydrochloric Acid* (HCl), (in about 1 *N* solution)—Prepare 1 L of about 1 *N* solution by placing 80 mL of concentrated, reagent grade HCl in a 1L volumetric flask and dilute to the mark with distilled or demineralized water. Store in polyethylene bottle.

6. Safety Precautions

6.1 Use care in handling the hydrochloric acid so that no acid is spilled on either skin or clothing. If acid contacts the skin or eyes, immediately flush with large quantities of water. Process concentrated hydrochloric acid beneath a laboratory hood or in a well-ventilated area to reduce the inhalation of fumes.

² *Reagent Chemicals, American Chemical Society Specifications*, American Chemical Society, Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see *Analar Standards for Laboratory Chemicals*, BDH Ltd., Poole, Dorset, U.K., and the *United States Pharmacopeia and National Formulary*, U.S. Pharmacopeial Convention, Inc. (USPC), Rockville, MD.

6.2 The pressure relief valve of the carbonate analyzer should be opened following each test to dissipate gas pressure so that the cap can be safely removed.

7. Test Specimens

7.1 Select 20 or 30-g specimens from a core or surface grab sample. Oven dry at 105°C for a period of 12 to 24 h. Pulverize the entire sample with a mortar and pestle (or hammer) until all of the particles pass a No. 10 (2-mm) sieve. Smaller particles react faster than larger particles when treated with acid.

8. Calibration

8.1 Calibration is accomplished by using reagent grade CaCO_3 to obtain the relationship between the weight of CaCO_3 and the pressure generated in the constant volume reactor. Each carbonate analyzer and pressure gage is individually calibrated. Prepare five sets of duplicate specimens with the following weights of CaCO_3 :

8.1.1 *Set 1*—Two specimens at 0.2 g, that is, analogous to 20 % calcium carbonate for a test specimen of 1 g.

8.1.2 *Set 2*—Two specimens at 0.4 g.

8.1.3 *Set 3*—Two specimens at 0.6 g.

8.1.4 *Set 4*—Two specimens at 0.8 g.

8.1.5 *Set 5*—Two specimens at 1.0 g.