
Standard Method of Test for Triaxial Compressive Strength of Undrained Rock Core Specimens without Pore Pressure Measurements

AASHTO Designation: T 226-22

Technically Revised: 2022

Technical Subcommittee: 1a, Soil and Unbound Recycled Materials



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1. SCOPE

- 1.1. This test method covers the determination of the strength of cylindrical rock specimens in an undrained state under triaxial compression loading. The test provides data useful in determining the strength of rock, namely: shear strengths at various lateral pressures, angle of internal friction (angle of shearing resistance), and cohesion intercept. It should be observed that this method makes no provision for pore pressure measurements. Thus, the strength values determined are in terms of total stress that is not corrected for pore pressures.
- 1.2. The values stated in inch-pound units are to be regarded as the standard.
- 1.3. *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety concerns 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.*
- 1.4. *The quality of the results produced by this standard are dependent on the competence of the personnel performing the procedure and the capability, calibration, and maintenance of the equipment used. Agencies that meet the criteria of R 18 are generally considered capable of competent and objective testing/sampling/inspection/etc. Users of this standard are cautioned that compliance with R 18 alone does not completely assure reliable results. Reliable results depend on many factors; following the suggestions of R 18 or some similar acceptable guideline provides a means of evaluating and controlling some of those factors.*

2. REFERENCED DOCUMENTS

- 2.1. *AASHTO Standard:*
 - R 18, Establishing and Implementing a Quality Management System for Construction Materials Testing Laboratories
- 2.2. *ASTM Standards:*
 - D653, Standard Terminology Relating to Soil, Rock, and Contained Fluids
 - D2216, Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
 - D4543, Standard Practices for Preparing Rock Core as Cylindrical Test Specimens and Verifying Conformance to Dimensional and Shape Tolerances

- E4, Standard Practices for Force Verification of Testing Machines
- E122, Standard Practice for Calculating Sample Size to Estimate, with Specified Precision, the Average for a Characteristic of a Lot or Process
- E691, Standard Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

2.3. *Other Document:*

- ISR Research Report “Interlaboratory Testing Program for Rock Properties (ITP/RP) Round Two,” 1994

3. SIGNIFICANCE AND USE

- 3.1. Rock is known to behave as a function of the confining pressure. The triaxial compression test is commonly used to stimulate the stress conditions under which most underground rock masses exist.
- 3.2. The deformation and strength properties of rock cores measured in the laboratory usually do not accurately reflect large-scale *in situ* properties because the latter are strongly influenced by joints, faults, inhomogeneity, weakness planes, and other factors. Therefore, laboratory values for intact specimens must be employed with proper judgment in engineering applications.

4. APPARATUS

- 4.1. *Loading Device*—A suitable device for applying axial load to the specimen. It shall be of sufficient capacity to apply load at a rate conforming to the requirements set forth in Section 7.2. It shall be verified at suitable time intervals in accordance with the procedures given in ASTM E4, Verification of Testing Machines, and comply with the requirements prescribed therein.
- 4.2. *Pressure-Maintaining Device*—A hydraulic pump, pressure intensifier,¹ or other system of sufficient capacity to maintain constant the desired lateral pressure, σ_3 , to within ± 1 percent throughout the test. The confining pressure shall be measured with a hydraulic pressure gauge or electronic transducer having an accuracy of at least ± 1 percent of the confining pressure, including errors due to readout equipment, and a resolution of at least 0.5 percent of the confining pressure.
- 4.3. *Triaxial Compression Chamber*²—An apparatus in which the test specimen may be enclosed in an impermeable flexible membrane; placed between two hardened platens, one of which shall be spherically seated; subjected to a constant lateral fluid pressure; and then loaded axially to failure. The platens shall be made of tool steel hardened to a minimum of Rockwell 58 HRC, the bearing faces of which shall not depart from plane surfaces by more than 0.0005 in. (0.013 mm) when the platens are new, and which shall be maintained within a permissible variation of 0.001 in. (0.025 mm). The diameter of the spherical seat shall be at least as large as that of the test specimen but shall not exceed twice the diameter of the test specimen. The center of the sphere in the spherical seat shall coincide with that of the bearing face of the specimen. The spherical seat shall be properly lubricated to allow free movement. The movable portion of the platen shall be held closely in the spherical seat, but the design shall be such that the bearing face can be rotated and tilted through small angles in any direction. The top platen diameter shall be at least as great as that of the specimen and have a thickness-to-diameter ratio of at least 1:2. In addition to the platens and membrane, the apparatus shall consist of a high-pressure cylinder with overflow valve, a base, suitable entry ports for filling the cylinder with hydraulic fluid and applying the lateral pressure, and hoses, gauges, and valves as needed.
- 4.4. *Deformation Measuring Device*—High-grade dial micrometers or other measuring devices graduated to read to 0.0001 in. (0.0025 mm); and accurate within 0.0001 in. (0.0025 mm); in any