INTERNATIONAL

~~Designation:D 2936–95~~ Designation: D2936 – 08

Standard Test Method for Direct Tensile Strength of Intact Rock Core Specimens[1]

This standard is issued under the fixed designation D2936; 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 determination of the direct tensile strength of intact cylindrical rock specimens.

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

1.2 The values stated in SI units are to be regarded as standard. The values provided in parenthesis are for information only.

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.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D2216 ~~Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock~~ Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

D3740 Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction

D4543 ~~Practice for Determining Dimensional and Shape Tolerances of Rock Core Specimens[2]~~ Practices for Preparing Rock Core as Cylindrical Test Specimens and Verifying Conformance to Dimensional and Shape Tolerances

E4 Practices ~~of~~for Force Verification of Testing Machines

E122 ~~Practice for Choice of Sample Size to Estimate the Average Quality of a Lot or Process~~ Practice for Calculating Sample Size to Estimate, With Specified Precision, the Average for a Characteristic of a Lot or Process

3. Summary of Test Method

3.1 A rock core sample is cut to length and its ends are cemented to metal caps. The metal caps are attached to a testing machine and the specimen is loaded in tension until it fails.

4. Significance and Use

4.1 Rock is much weaker in tension than in compression. Thus, in determining the failure condition for a rock structure, many investigators employ tensile strength of the component rock as the failure strength for the structure. Direct tensile stressing of rock is the most basic test for determining the tensile strength of rock.

5. Apparatus

5.1 *Loading Device*, to apply and measure axial load on the specimen, of sufficient capacity to apply the load at a rate conforming to the requirements of 8.2. The device shall be verified at suitable time intervals in accordance with the procedures given in Practices ~~E 4~~E4 and shall comply with the requirements prescribed therein.

5.2 *Caps*—Cylindrical metal caps that, when cemented to the specimen ends, provide a means through which the direct tensile load can be applied. The diameter of the metal caps shall not be less than that of the test specimen, nor shall it exceed the test specimen diameter by more than 1.10 times. Caps shall have a thickness of at least 30 mm (1¼ in.). Caps shall be provided with a suitable linkage system for load transfer from the loading device to the test specimen. The linkage system shall be so designed that the load will be transmitted through the axis of the test specimen without the application of bending or torsional stresses. The length of the linkages at each end shall be at least two times the diameter of the metal end caps. One such system is shown in Fig. 1.

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[1] This test method is under the jurisdiction of ASTM Committee ~~D-18~~D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.12 on Rock Mechanics.

~~Current edition approved June 15, 1995. Published August 1995. Originally published as D 2936–71. Last previous edition D 2936–84 (1989)ϵ2.~~

Current edition approved July 1, 2008. Published July 2008. Originally approved in 1971. Last previous edition approved in 2004 as D2936 – 95 (2004)ϵ1. DOI: 10.1520/D2936-08.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* ~~, Vol 04.08.~~volume information, refer to the standard's Document Summary page on the ASTM website.

***A Summary of Changes section appears at the end of this standard.**

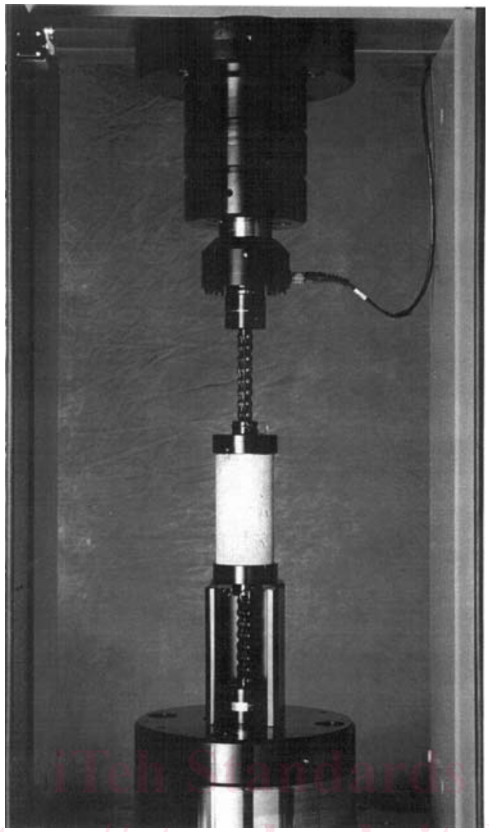

FIG. 1 Direct Tensile-Strength Test Assembly

NOTE 1—Roller of link chain of suitable capacity has been found to perform quite well in this application. Because roller chain flexes in one plane only, the upper and lower segments should be positioned at right angles to each other to effectively reduce bending in the specimen. Ball-and-socket, cable, or similar arrangements have been found to be generally unsuitable as their tendency for bending and twisting makes the assembly unable to transmit a purely direct tensile stress to the test specimen.

6. Sampling

6.1 Select the specimen from the cores to represent a valid average of the type of rock under consideration. This can be achieved by visual observations of mineral constituents, grain sizes and shape, partings, and defects such as pores and fissures, or by other methods such as ultrasonic velocity measurements.

7. Test Specimens

7.1 *Preparation*—Prepare test specimens in accordance with Practice ~~D 4543~~D4543, except that the degree of flatness and smoothness of the specimen ends is not critical. End surfaces, such as result from sawing with a diamond cutoff wheel, are entirely adequate. Grinding, lapping, or polishing beyond this point serves no useful purpose, and in fact, may adversely affect the adhesion of the cementing medium.

7.2 Water content of the specimen at the time of test can have a significant effect upon the deformation of the rock. Good practice generally dictates that laboratory tests be made upon specimens representative of field conditions. Thus, it follows that the field water content of the specimen should be preserved until the time of test. On the other hand, there may be reasons for testing specimens at other water contents, including zero. In any case, the water content of the test specimen should be tailored to the problem at hand and reported in accordance with 10.1.6. If the water content of the specimen is to be determined, follow the procedures given in Test Method ~~D 2216~~D2216.

7.3 If water content is to be maintained, and the elevated temperature enclosure is not equipped with humidity control, seal the specimen using a flexible membrane or apply a plastic or silicone rubber coating to the specimen sides.

8. Procedure

8.1 Cement the metal caps to the test specimen to ensure alignment of the cap axes with the longitudinal axis of the specimen (see Note 2). The thickness of the cement layer should not exceed 1.5 mm ($\frac{1}{16}$ in.) at each end. The cement layer must be of uniform thickness to ensure parallelism between the top surfaces of the metal caps attached to both ends of the specimens. This should be checked before the cement is hardened (see Note ~~2~~1) by measuring the length of the end-cap assembly at three locations 120° apart and near the edge. The maximum difference between these measurements should be less than 0.10 mm (0.005 in.) for