



Designation: D5240/D5240M – 20

Standard Test Method for Evaluation of the Durability of Rock for Erosion Control Using Sodium Sulfate or Magnesium Sulfate¹

This standard is issued under the fixed designation D5240/D5240M; 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 test procedures for evaluating the soundness of rock for erosion control by the effects of a sodium or magnesium sulfate solution on slabs of rock. It is an accelerated weathering test. The rock slabs, prepared in accordance with procedures in Practice D5121, are intended to be representative of erosion control sized materials and their inherent weaknesses. The test is appropriate for breakwater stone, armor stone, riprap and gabion sized rock materials.

1.1.1 The limitations of this test are twofold. First the test is a simulation of freezing and thawing conditions using accelerated life cycling techniques. The test evaluates the internal expansive force derived from the rehydration of the salt upon re-immersion, an event that may not occur in some natural environments, to simulate the expansion of water rather than the actual freezing of water. Secondly, the size of the cut rock slab specimens may eliminate some of the internal defects present in the rock structure. The test specimens may not be representative of the quality of the larger rock samples used in construction. Careful examination of the rock source and proper sampling are essential in minimizing this limitation.

1.2 The use of reclaimed concrete and other materials for erosion control is beyond the scope of this test method.

1.3 *Units*—The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the standard. Reporting of test results in units other than SI shall not be regarded as nonconformance with this standard.

1.3.1 The gravitational system of inch-pound units is used when dealing with inch-pound units. In this system, the pound (lbf) represents a unit of force (weight), while the unit for mass

is slugs. The slug unit is not given unless dynamic ($F=ma$) calculations are involved.

1.3.2 It is common practice in the engineering/construction profession to concurrently use pounds to represent both a unit of mass (lbm) and of force (lbf). This practice implicitly combines two separate systems of units; the absolute and the gravitational systems. It is scientifically undesirable to combine the use of two separate sets of inch-pound units within a single standard. As stated, this standard includes the gravitational system of inch-pound units and does not use/present the slug unit for mass. However, the use of balances or scales recording pounds of mass (lbm) or recording density in lbm/ft³ shall not be regarded as nonconformance with this standard.

1.3.3 Calculations are done using only one set of units; either SI or gravitational inch-pound. Other units are permissible, provided appropriate conversion factors are used to maintain consistency of units throughout the calculations, and similar significant digits or resolution, or both are maintained.

1.4 All observed and calculated values shall conform to the guidelines for significant digits and rounding established in Practice D6026, unless superseded by this standard.

1.4.1 For purposes of comparing measured or calculated value(s) with specified limits, the measured or calculated value(s) shall be rounded to the nearest decimal or significant digits in the specified limits.

1.4.2 The procedures used to specify how data are collected/recorded or calculated, in this standard are regarded as the industry standard. In addition, they are representative of the significant digits that generally should be retained. The procedures used do not consider material variation, purpose for obtaining the data, special purpose studies, or any considerations for the user's objectives; and it is common practice to increase or reduce significant digits of reported data to be commensurate with these considerations. It is beyond the scope of this standard to consider significant digits used in analytical methods for engineering design.

1.5 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

¹ This test method is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.17 on Rock for Erosion Control.

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

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

- C88/C88M Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
- C295/C295M Guide for Petrographic Examination of Aggregates for Concrete
- D653 Terminology Relating to Soil, Rock, and Contained Fluids
- D2216 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
- D4753 Guide for Evaluating, Selecting, and Specifying Balances and Standard Masses for Use in Soil, Rock, and Construction Materials Testing
- D4992 Practice for Evaluation of Rock to be Used for Erosion Control
- D5121 Practice for Preparation of Rock Slabs for Durability Testing
- D5313/D5313M Test Method for Evaluation of Durability of Rock for Erosion Control Under Wetting and Drying Conditions
- D6026 Practice for Using Significant Digits in Geotechnical Data
- E100 Specification for ASTM Hydrometers
- E145 Specification for Gravity-Convection and Forced-Ventilation Ovens

3. Terminology

3.1 Definitions:

3.1.1 For definitions of common technical terms used in this standard, refer to Terminology **D653**.

3.1.2 *gabion-fill stone, n—in rock*, stone generally less than 22 kg [50 lb] and placed in baskets of wire or other suitable material that is tied together to form an integral structure designed to resist erosion along stream banks and around bridge piers as well as stabilize shorelines, stream banks or slopes as well as retaining walls, noise barriers, temporary flood walls, silt filtration from runoff, for small or temporary/permanent dams, or channel lining. **D5121, D5313/D5313M**

3.1.3 *rock saw, n—in rock*, a saw capable of cutting rock. **D5121, D5313/D5313M**

3.1.3.1 *Discussion*—The term “rock saw” shall include the cutting mechanisms that saw the rock, any components that control or power the sawing process or both, any components

to cool or wash away cuttings from the cutting area, and framework on which the cutting mechanisms and any other associated components are mounted or held. The cutting mechanism can be a blade or a wire, with or without abrasive materials such as diamonds to assist in the cutting process, especially for harder rocks.

3.1.4 *slab, n—in rock*, a section of rock having two smooth, approximately parallel faces, produced by two saw cuts spaced such that the thickness of the slab is generally less than the other dimensions of the rock. **D5121, D5313/D5313M**

3.1.4.1 *Discussion*—The slab will be the rock specimen which will subsequently undergo durability tests. The words “slab” and “specimen” are interchangeable throughout the test method.

4. Summary of Test Method

4.1 Erosion control rock samples are trimmed into saw-cut slab specimens. The trimmed slabs are oven-dried to a constant mass. The specimens are repeatedly immersed in saturated solutions of sodium sulfate or magnesium sulfate followed by oven drying. At the completion of the test, the percent loss by mass for each specimen set is determined. A visual examination of the slabs is performed at the end of testing. The type of deterioration and changes to previously noted planes of weakness are recorded.

5. Significance and Use

5.1 Rock for erosion control consists of individual pieces of natural stone. The ability of these individual pieces of stone to resist deterioration due to weathering action affects the stability of the integral placement of rock for erosion control and hence, the stability of construction projects, structures, shorelines, and stream banks.

5.2 The sodium sulfate or magnesium sulfate soundness test is one method by which to estimate qualitatively the durability of rock under weathering conditions. This test method was developed to be used in conjunction with additional test methods listed in Practice **D4992**. This test method does not provide an absolute value, but rather an indication of the resistance to freezing and thawing; therefore, the results of this test method are not to be used as the sole basis for the determination of rock durability.

5.3 This test method has been used to evaluate many different types of rocks. There have been occasions when test results have provided data that have not agreed with the durability of rock under actual field conditions; samples yielding a low soundness loss have disintegrated in actual usage, and the reverse has been true.

NOTE 1—The quality of results produced by this standard is dependent on the competence of the personnel performing it and suitability of the equipment and facilities used. Agencies that meet the criteria of Practice **D3740** are generally considered capable of competent and objective testing/sampling/inspection/etc. Users of this standard are cautioned that compliance with Practice **D3740** does not in itself assure reliable results. Reliable results depend on many factors and Practice **D3740** provides a means of evaluating some of them.

6. Apparatus

6.1 *Rock Saw*—A laboratory water-cooled diamond saw used to cut geological and concrete specimens, or a diamond

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* volume information, refer to the standard's Document Summary page on the ASTM website.