Designation: C 367 – 99

Standard Test Methods for Strength Properties of Prefabricated Architectural Acoustical Tile or Lay-In Ceiling Panels[1]

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INTRODUCTION

Materials used for absorbing sound generally have a porous, low-density structure. In comparison with many building materials they may be relatively fragile. Materials are available that possess adequate strength and stability and at the same time provide good sound absorption. The test methods described here cover procedures for evaluating those physical properties related to strength. The methods are of use in developing, manufacturing, and selecting acoustical tile or lay-in panels.

It should be kept in mind that a property related to strength is only one of several considerations important in judging the usefulness of an acoustical material. For example, a material judged to be quite weak by one of these tests may still be desired for other reasons, and with adequate precautions, may be shipped and installed successfully.

1. Scope

1.1 These test methods cover the determination of the strength properties of prefabricated architectual acoustical tile or lay-in ceiling panels as follows:

Tests	Sections
Hardness	2 to 7
Friability	8 to 13
Sag	14 to 20
Transverse strength	21 to 26

1.2 Not all of the tests described in these test methods may be necessary to evaluate any particular product for a specific use. In each instance, it will be necessary to determine which properties are required.

1.3 These test methods specify procedures that may be used in product development, manufacturing control, specification acceptance, and service evaluation.

1.4 Properties determined by these test methods reflect the performance of the materials under the specific conditions of the test, and do not necessarily indicate performance under conditions other than those specified herein.

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

HARDNESS

2. Significance and Use

2.1 Knowledge of hardness is useful in the development and the quality control of acoustical tile. Deviation from an established hardness range will assist in pointing out processing errors or defective raw materials, thereby aiding the maintenance of uniform product quality.

2.2 This property is also useful in comparing the relative abilities of materials to resist indentations on the panel surface caused by impacts.

2.3 Since the hardness varies with the thickness, only samples of the same thickness may be directly compared.

3. Apparatus

3.1 *Testing Machine*—Any standard mechanical or hydraulic testing machine capable of applying and measuring the required load within an accuracy of ±1 % may be used. It shall be equipped with a 50.8-mm (2.00-in.) diameter metal ball, or hemispherically shaped penetrator that bears upon the specimen surface.

4. Test Specimens

4.1 Cut five 100 by 100-mm (4 by 4-in.) specimens from a single tile or panel. Cut the five specimens from representative areas of the tile or ceiling panel.

[1] These test methods are under the jurisdiction of ASTM Committee E-33 on Environmental Acoustics and are the direct responsibility of Subcommittee E33.04 on Application of Acoustical Materials and Systems.

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5. Conditioning

5.1 The strength properties of acoustical materials often depend on the moisture content at the time of the test. Therefore, condition materials for test under "room conditions" to constant weight (within ±1 %) in an atmosphere maintained at a relative humidity of 50 ± 2 %, and a temperature of 23 ± 1°C (73 ± 2°F). State in the test report any departure from this recommended condition.

6. Procedure

6.1 Place the specimen in the conditioning chamber and let it remain until equilibrium is obtained.

6.2 Place the specimen on a flat surface under the loading penetrator of the test machine. Force the penetrator into the specimen 6.4± 0.3 mm (0.25 ± 0.01 in.) below the original surface (Note 1) at a rate of 2.5 mm (0.10 in.)/min (Note 2).

NOTE 1—The original surface is defined as the point where the penetrator first contacts the specimen.

NOTE 2—When possible, the penetrator should bear between perforations or fissures when testing perforated or fissured material.

6.3 Record the load shown on the testing machine when the penetrator reaches the specified depression as the hardness of the specimen in newtons or pounds-force.

7. Report

7.1 The report shall include the following:

7.1.1 Identification of the test material,

7.1.2 Method of conditioning including time of conditioning, temperature, °C or °F, and relative humidity, %,

7.1.3 Statement describing whether the finished or unfinished surface was tested,

7.1.4 Average thickness for the five specimens, mm or in.,

7.1.5 Individual thicknesses for each of the five specimens, mm or in.,

7.1.6 Average hardness for the five specimens, N or lbf, and

7.1.7 Individual hardness for each of the five specimens, N or lbf.

FRIABILITY

8. Significance and Use

8.1 The friability test measures the susceptibility of an acoustical product to edge and corner damage that might be sustained during shipping, handling, and installing. Products that are friable and soft may erode considerably when subjected to rough treatment.

9. Apparatus

9.1 *Balance*, accurate to within 0.5 % of the weight of the smallest specimen tested.

9.2 *Testing Container*, consisting of a red oak box with inside dimensions of 200 mm (7¾ in.) square by 190 mm (7½ in.) deep and fitted with a cover on one end for inserting and removing the specimens. The box shall be mounted so that it may be rotated at 60 r/min on a horizontal axis that is perpendicular to its square dimension.

9.3 *Red Oak Cubes*, 24, 19 ± 0.8 mm (¾ ± 1/32 in.) on an edge, having a specific gravity of 0.65 ± 0.02.

9.4 *Timer*, consisting of a watch or clock capable of measuring intervals of 10 min within ± 5.0 s.

10. Test Specimens

10.1 Cut twelve 25 by 25-mm (1 by 1-in.) square specimens from a single tile or panel. The specimen thickness is equal to the tile or panel thickness.

NOTE 3—If the friability of original edges is of importance, separate tests should be run on 25 by 25-mm (1 by 1-in.) specimens having one or two original edges.

11. Conditioning

11.1 Maintain standard conditions as described in 5.1 during preparation and testing of specimens.

12. Procedure

12.1 Weigh the twelve specimens and record the combined weight to the nearest 0.1 g.

12.2 Place the 12 specimens and the 24 oak cubes in the testing container. Close the top of the testing container and rotate the container about its axis at a speed of 60 rpm for two 10-min periods. At the end of each 10-min period, remove the specimens from the box and determine the percentage of loss in weight, due to pulverization and breakage. In the case of badly abraded specimens, remove up to twelve of the largest pieces remaining and weigh these for the determination. In rare cases, no pieces may remain from an individual specimen. In this case, the weight loss shall be reported as 100 %.

13. Report

13.1 The report shall include the following:

13.1.1 Identification of the test material,

13.1.2 Method of conditioning including time of conditioning, temperature, °C or °F, and relative humidity, %, and

13.1.3 Percentage loss in weight for the 10- and 20-min periods.

SAG

14. Significance and Use

14.1 This test method is for the purpose of determining the sag properties of ceiling tile or panels under various conditions of humidity exposure. Tiles or panels of various sizes can be tested by using appropriately sized supporting frames.

14.2 The test method will provide both the initial sag below the plane of the grid system and the total moisture-induced sag.

14.3 This test method is not designed to establish the expected performance of the ceiling panels under field conditions of use, but only the sag properties for the specific temperature, humidity, exposure time, and mounting conditions used in the test.

15. Apparatus

15.1 *Controlled-Atmosphere Chamber*, capable of operating at a dry-bulb temperature of 23 to 32± 1.5°C (73 to 90 ± 3°F), and relative humidities of 50, 60, 70, 80, or 90 ± 2 %. The chamber should be equipped with suitable recording equipment to record wet- and dry-bulb temperatures (or dry bulb and