



Designation: D3512/D3512M – 22

Standard Test Method for Pilling Resistance and Other Related Surface Changes of Textile Fabrics: Random Tumble Pilling Tester¹

This standard is issued under the fixed designation D3512/D3512M; 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 propensity of a fabric to form pills and other related surface changes on textiles using the random tumble pilling tester. The procedure is generally applicable to all types of woven and knitted apparel fabrics.

NOTE 1—For other test methods for the pilling resistance of textiles, refer to Test Methods [D3511/D3511M](#), [D3514/D3514M](#), and [D4970/D4970M](#).

1.2 Some fabrics that have been treated with a silicone resin may not be satisfactorily tested by this procedure because the silicone resin may transfer onto the cork liners in the test chamber and cause erroneous results.

1.3 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 non-conformance with the standard.

1.4 *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.*

1.5 *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.*

¹ This test method is under the jurisdiction of ASTM Committee [D13](#) on Textiles and is the direct responsibility of Subcommittee [D13.60](#) on Fabric Physical Test Methods B.

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2. Referenced Documents

2.1 ASTM Standards:²

[D123](#) Terminology Relating to Textiles

[D1776/D1776M](#) Practice for Conditioning and Testing Textiles

[D3511/D3511M](#) Test Method for Pilling Resistance and Other Related Surface Changes of Textile Fabrics: Brush Pilling Tester

[D3514/D3514M](#) Test Method for Pilling Resistance and Other Related Surface Changes of Textile Fabrics: Elastomeric Pad

[D4850](#) Terminology Relating to Fabrics and Fabric Test Methods

[D4970/D4970M](#) Test Method for Pilling Resistance and Other Related Surface Changes of Textile Fabrics: Martindale Tester

[F104](#) Classification System for Nonmetallic Gasket Materials

2.2 ASTM Adjuncts:

12-435120-00 Set of 5 Photographic Standards for Random Tumble Pilling Test³

3. Terminology

3.1 For all terminology related to [D13.59](#), Fabric Test Methods, General, see Terminology [D4850](#).

3.1.1 The following terms are relevant to this standard: fuzz, pilling resistance, pills.

3.2 For all other terminology related to textiles, see Terminology [D123](#).

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.

³ Available from ASTM International Headquarters. Order Adjunct No. [ADJD3512](#).



4. Summary of Test Method

4.1 Pilling and other changes in surface appearance, such as fuzzing, that occur in normal wear are simulated on a laboratory testing machine. Pills are caused to form on fabric by a random rubbing action produced by tumbling specimens in a cylindrical test chamber lined with a mildly abrasive material. To form pills with appearance and structure that resemble those produced in actual wear, small amounts of short-length gray cotton fiber are added to each test chamber with the specimens. The degree of fabric pilling is evaluated by comparison of the tested specimens with visual standards that may be actual fabrics, or photographs of fabrics, showing a range of pilling resistance. The observed resistance to pilling is reported using an arbitrary rating scale.

5. Significance and Use

5.1 *Acceptance Testing*—This method of testing fabrics for resistance to pilling is not recommended for acceptance testing. If it is used for acceptance testing, it should be used with caution because the between-laboratory precision is poor. In some cases the purchaser and the supplier may have to test a commercial shipment of one or more specific materials by the best available test method, even though the test method is not recommended for acceptance testing.

5.1.1 If there are differences or practical significance between reported test results for two laboratories (or more), comparative tests should be performed to determine if there is a statistical bias between them, using competent statistical assistance. As a minimum, the test samples should be used that are as homogeneous as possible, drawn from the material from which the disparate test results were obtained, and randomly assigned in equal numbers to each laboratory for testing. Other materials with established test values may be used for this purpose. The test results from the two laboratories should be compared using a statistical test for unpaired data, at a probability level chosen prior to the testing series. If a bias is found, either its cause must be found and corrected, or future test results must be adjusted in consideration of the known bias.

5.2 The pilling of textile fabrics is a very complex property because it is affected by many factors which may include type of fiber or blends, fiber dimensions, yarn and fabric construction, fabric finishing treatments and refurbishing method. Testing before refurbishing may be adviseable. The pilling resistance of a specific fabric in actual wear varies more with general conditions of use and individual wearers than in replicate fabric specimens subjected to controlled laboratory tests. This experience should be borne in mind when adopting levels of acceptability for any series of standards.

5.3 Pills vary appreciably in size and appearance and depend on the presence of lint and degree of color contrast. These factors are not evaluated when pilling is rated solely on the number of pills. The development of pills may be accompanied by other surface phenomena such as loss of cover, color change, or the development of fuzz. Since the overall acceptability of a specific fabric is dependent on both the characteristics of the pills and the other factors affecting surface

appearance, it is suggested that fabrics tested in the laboratory be evaluated subjectively with regard to their acceptability and not rated solely on the number of pills developed. A series of standards, based on graduated degrees of surface change of the fabric type being tested, may be set up to provide a basis for subjective ratings. The visual standards are most advantageous when the laboratory test specimens correlate closely in appearance with worn fabrics and show a similar ratio of pills to fuzz. Counting the pills and weighing their number with respect to their size and contrast, as a combined measure of pilling resistance, is not recommended because of the excessive time required for counting, sizing, and calculating.

5.4 The degree of fabric pilling is evaluated by comparing the tested specimens with visual standards, which may be actual fabrics or photographs of fabrics, showing a range of pilling resistance. The observed resistance to pilling is reported on an arbitrary scale ranging from 5 (no pilling) to 1 (very severe pilling).

5.5 This test method is applicable to a wide variety of woven and knitted fabrics that vary in pilling propensity as a result of variations in fiber, yarn and fabric structure, and finish.

6. Apparatus and Materials

6.1 *Random Tumble Pilling Tester*⁴(Fig. 1):

6.1.1 *Cork Cylinder Liners*, about 146 mm [5.75 in.] wide by 452 mm [17.81 in] long cut from 1.5-mm [.063-in.] thick flat sheets of Type P2117A material conforming to Classification System F104, Appendix X1. The original surface of the liner, produced by slicing the material, should be used without any further treatment such as sanding. Store liners in original packaging in a cool, dry place.

6.1.2 *Air Injection Device* to give 14-21 kPa [2-3 psi] air pressure in each test chamber, either included in new testers or a modification to older testers.

6.2 *Adhesive*⁴, white all-purpose, for sealing edges of specimens (see 7.1).

6.3 *Plastic Bottle*, with dispensing spout and cap, for use with diluted adhesive.

6.4 *Vacuum Cleaner*, home canister type, to clean specimens after testing.

6.5 *Cotton Sliver*⁵, 4301 tex [approximately 73 Grain Count], U.S. upland cotton with a micronaire range of 3.8-4.2 with a minimum staple length range of 1.08-1.10 in. (or 35/32 in., no metric conversion) measured by USDA High Volume Instrument Classification.

6.6 *Apparatus for Fabric Evaluation*—Facilities for illumination (cool white fluorescent tube) and simultaneous viewing of test specimen and fabric or photograph rating standards. Apparatus and options for visual evaluation are listed in Table 1.

⁴ Apparatus and accessories are commercially available.

⁵ Cotton dyed to a medium gray shade before carding using a colorfast reactive black dye and standard reactive dyeing procedure. Cotton sliver is available commercially.