



Designation: E3162 – 18

Standard Practice Measuring the Durability of Antibacterial Agents Applied to Textiles under Simulated Home Laundering Conditions¹

This standard is issued under the fixed designation E3162; 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 To determine the durability of standard antibacterial treatments on textile products such as apparel, piece goods, household articles, hereinafter referred to as “textile” or “textile products” to multiple home launderings.

1.2 This practice subjects textile products treated with antimicrobial agents to multiple simulated and accelerated home launderings under defined parameters such that reproducible and reliable antimicrobial analysis can be performed using standard industry accepted protocols.

1.3 For some antimicrobial agents, the durability of antibacterial properties resulting from exposure to detergent solution and abrasive action of multiple home launderings has been shown to be approximated by one 45-minute laundering cycle. The exact correlation between expressed laundry care instructions and exposure conditions identified in the practice should be determined separately for every antimicrobial agent.

1.4 The subsequent microbiological methods shall be performed by individuals experienced and adept in microbiological procedures and in facilities suitable for the handling of the microorganisms under test.

1.5 This standard may involve hazardous materials, operation, and equipment. *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.*

1.6 *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.*

¹ This practice is under the jurisdiction of ASTM Committee E35 on Pesticides, Antimicrobials, and Alternative Control Agents and is the direct responsibility of Subcommittee E35.15 on Antimicrobial Agents.

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2. Referenced Documents

2.1 ASTM Standards:²

D123 Terminology Relating to Textiles

E2756 Terminology Relating to Antimicrobial and Antiviral Agents

E2922 Guide for The Use of Standard Test Methods and Practices for Evaluating Antibacterial Activity on Textiles

2.2 AATCC Standards:³

AATCC TM 61 : Colorfastness to Laundering: Accelerated
AATCC TM135 : Dimensional Changes of Fabrics after Home Laundering

AATCC Monograph M6 : Standardization of Home Laundry Test Conditions

2.3 ISO Standard:⁴

ISO 6330 Textiles – Domestic washing and drying procedures for textile testing

3. Terminology

3.1 *Definitions*—For definition of terms used in this test method, refer to: E2756 Standard Terminology Relating to Antimicrobial and Antiviral Agents and D123: Standard Terminology Relating to Textiles.

4. Summary of Practice

4.1 Fabrics are washed under conditions of temperature, detergent solution, and abrasive action similar to that occurring in standard home laundering conditions using industry standard equipment and parameters.

4.2 Singular samples are placed in defined canisters with detergents and steel balls to represent typical exposures, liquor to goods ratios and abrasions experienced in the home laundering situation. The abrasive action is the result of steel balls

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 American Association of Textile Chemists and Colorists (AATCC), P.O. Box 12215, Research Triangle Park, NC 27709-2215, <http://www.aatcc.org>.

⁴ Available from International Organization for Standardization (ISO), ISO Central Secretariat, BIBC II, Chemin de Blandinnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, <http://www.iso.org>.

which, together with the aggressive agitation of fixed canisters, simulate the abrasive action of multiple fabrics in a single load.

4.3 After each cycle, samples are removed, rinsed thoroughly by hand in water and returned to a fresh solution of detergents and steel balls.

4.4 After the final cycle, samples are removed, thoroughly rinsed and dried prior to microbiological testing.

4.5 The use of single canisters during wash allows one to measure the durability of an antimicrobial finish without possible interferences that could occur due to contaminated ballast, cross contamination of active ingredients from other treated articles or from residual solid detergents. These interferences are often seen with other standards that are not designed specifically for measuring antimicrobial properties.

5. Significance and Use

5.1 The durability of antimicrobial agents applied to textiles is an important attribute for many of the available technologies on the market. Antimicrobial agents that claim durability are typically fixed ionically, covalently or physically, or both, to a textile surface and are expected to retain their antimicrobial functionality after 5, 25 or 50 washes.

5.2 Textile wash standards do exist that measure features as diverse as colorfastness or softener retention, pilling, or even the appearance of the decorative coatings of a zipper; however, no wash method exists that is specific for measuring the durability of an antimicrobial agent applied directly into or onto a textile surface.

5.3 Current wash standards have been written to either closely simulate (AATCC TM135) or accelerate (AATCC TM61) the laundering conditions that would be experienced during normal home laundering. While shown to be effective when testing physical properties of textiles, these methods introduce variables to the washing protocol that can directly affect the final antimicrobial properties of a fabric. For example, many wash protocols add bleach or softeners which can build up over time and may introduce false positive results in industry standard microbiological tests. Conversely, powdered detergents if not completely rinsed after each wash can leave residual surfactants that can build up over time but are generally removed during wear. These residual detergents can potentially coat an antimicrobial surface and provide false negative results.

5.4 Very specific parameters are identified within this practice to closely replicate home launderings as identified and studied in previous wash protocols (AATCC TM61) and accepted within the textile industry. This practice uses detergents and washing conditions which limit potential cross contamination of samples during washing and unrealistic deposition of residual detergents on the test fabric. These conditions increase the reproducibility and reliability of subsequent microbiological test methods.

5.5 This practice allows for the simple washing of textile fabrics for the subsequent antimicrobial testing. Any industry accepted antimicrobial test standard could be used following this washing protocol.

5.6 This practice is appropriate for porous materials such as textiles or any porous, soft substrate that is intended to withstand multiple home washes. This practice is intended to measure the durable antibacterial properties of such materials. In most instances, further studies will be required to support and substantiate actual claims being made for the performance of treated materials in practice or as part of a regulatory process.

5.7 This standard practice has been shown to be effective at measuring the durability of polymer based antimicrobial agents to home laundering conditions. Particle based or other antimicrobial agents may require modifications of the current methodology to simulate laundering conditions in practice. The exact correlation between expressed laundry care instructions on the antimicrobial treated article and the exposure conditions identified in the standard practice must be determined separately for every antimicrobial active.

6. Apparatus

6.1 *accelerated laundering machine*—a laundering machine for rotating closed canisters in a thermostatically controlled water bath at 40 ± 2 rpm.

6.2 *adapter plates*, stainless-steel plates for holding canisters on laundering machine shaft.

6.3 *analytical balance*, with capacity and precision of $10\text{g} \pm 0.1\text{g}$ to weigh samples for testing.

6.4 *beakers*, capable of holding 1000 ml liquid solution.

6.5 *stainless steel canisters*, lever lock canisters suitable holding 1200 ml, 90×200 mm (3.5×8.0 in.).

6.6 *stainless steel balls*, 6 mm (0.25 in.) in diameter.

6.7 *gaskets*, TFE-fluorocarbon gaskets capable of covering each canister to prevent leakage.

6.8 *graduated cylinder*, for dispensing 500 ml detergents per canister.

6.9 *air-circulating oven*, an oven at $70 \pm 2^\circ\text{C}$ to dry samples after final wash cycle.

6.10 *nitrile rubber gloves*, for handling samples.

7. Reagents and Materials⁵

7.1 *Liquid reference detergents*—Standard liquid reference detergent without optical brighteners, phosphates, bleaches or softeners. The exact liquid detergents used must be referenced in final report.

7.2 *Water*—deionized.

7.3 *Wash solution*—Dilute liquid reference detergent (7.1) with deionized water to a final concentration of 0.23 % v/v. This prepared standard wash solution shall be used for all subsequent washing cycles.

⁵ *Reagent Chemicals, American Chemical Society Specifications*, American Chemical Society, Washington, DC. For Suggestions on the testing of reagents not listed by the American Chemical Society, see *Annual Standards for Laboratory Chemicals*, BDH Ltd., Poole, Dorset, U.K., and the *United States Pharmacopeia and National Formulary*, U.S. Pharmacopeial Convention, Inc. (USPC), Rockville, MD.