Designation: D6633 – 05 (Reapproved 2010)

Standard Test Method for Basic Functional Stability of a Mechanical Pump Dispenser[1]

This standard is issued under the fixed designation D6633; 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 basic functional stability of a mechanical pump dispenser with a product.

1.2 This test method covers accelerated usage evaluations of mechanical pump dispensers (spray or flow types) with a product.

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.* Specific precautions are given in Section 5.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D2063 Test Methods for Measurement of Torque Retention for Packages with Continuous Thread Closures

D3890 Test Method for Number of Strokes to Prime a Mechanical Pump Dispenser

D4336 Test Methods for Determination of the Output Per Stroke of a Mechanical Pump Dispenser

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

3. Significance and Use

3.1 This test method is used for determining the accelerated usage of a mechanical pump dispenser for consumer usage.

4. Apparatus

4.1 *Containers,* that will allow the mechanical pump dispenser to be affixed to them (Note 1) and also be capable of containing product for a period of time at various environmental conditions (Note 2).

NOTE 1—If possible, the actual container to be marketed should be used.

4.2 *Product,* a sufficient amount to fill the number of containers in accordance with 4.1, reference 10.2.

4.3 *Balance,* with direct reading to 0.01 g. Top loading or analytical style is recommended.

4.4 *Environments,* where the mechanical pump dispenser and product will be kept during the test period.

4.4.1 *Ambient Area,* maintained at 23 ± 3°C (73 ± 5.4°F).

4.4.2 *Oven* (45°C) , maintained at 45 ± 3°C (113 ± 5.4°F).

NOTE 2—The oven temperature can be changed according to product formulation. If different temperatures are used, this should be noted in the test report discussed in 11.

4.4.3 *Cycle Chamber,* optional, alternating 5 to 50°C (41 to 122°F) every 24 h.

4.5 *Oven-Safe Tray,* with absorbent paper towels laid in the tray.

4.6 *Food Coloring or Dye,* optional.

5. Precautions

5.1 Appropriate handling considerations should be given to flammable, toxic, caustic, or other potentially hazardous material used. When testing at any temperature, safety should be the number one consideration and special attention should be used on the flash points of the products tested.

6. Sampling

6.1 Based upon the desired precision, sampling shall be performed in accordance with Practice E122.

6.2 In the absence of any special sampling plan, performance shall be based on not less than the number of representative specimens exposed to any of the environmental conditions as specified in Section 9.

7. Test Specimen

7.1 Test specimens shall be clean, dry and previously unused mechanical pump dispensers.

[1] This test method is under the jurisdiction of ASTM Committee D10 on Packaging and is the direct responsibility of Subcommittee D10.33 on Mechanical Dispensers.

Current edition approved Oct. 1, 2010. Published March 2011. Originally approved in 2001. Last previous edition approved in 2005 as D6633 – 05. DOI: 10.1520/D6633-05R10.

[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.

Copyright © ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959. United States

8. Conditioning

8.1 If possible, condition the test specimens at 23 ± 3°C (73 ± 5.4°F) for not less than 4 h. If the test specimens are not conditioned at the recommended temperature, this should be noted in the test report discussed in 11.

8.2 Test pumps should be tested no sooner than 24 h after assembly when possible. If pumps are not conditioned at the recommended time, this should be noted in the test report discussed in 11.

9. Test Specimen Preparation

9.1 Prepare a minimum of 12 mechanical pump dispensers with product and containers to be used for accelerated usage evaluation.

9.1.1 Affix the mechanical pump dispensers to containers at the minimum recommended torque load in accordance with Test Method D2063.

9.1.2 Label all of the assembled units with the product name, any safety hazards for the product, name of the technician completing the test, and the test number or means of identifying the test along with the following:

9.1.2.1 Minimum 3 units labeled, "Upright, Ambient."

9.1.2.2 Minimum 3 units labeled, "Upright, Oven 45°C."

9.1.2.3 Optional: Minimum 3 units labeled, "Upright, Cycle Chamber."

9.1.2.4 Minimum 3 units labeled "On-Side, Ambient."

9.1.2.5 Minimum 3 units labeled, "On-Side, Oven 45°C)."

9.1.2.6 Optional: Minimum 3 units labeled "On-Side, Cycle Chamber."

10. Procedure

10.1 Test each mechanical pump dispenser for strokes to prime in accordance with Test Method D3890. Report the findings in 11.1.

10.2 Test each mechanical pump dispenser for output per stroke in accordance with Test Methods D4336. Visually inspect the spray or flow of the product to ensure that no obstructions are present.

10.3 Place all of the test specimens as prepared in 9.1 in their respective environments as indicated by the appropriate label on each unit. Except for trigger sprayers, place specimens labeled "On-Side" with the orifice facing down. Trigger sprayers may have the orifice oriented to the side while in the "on-side" position. If the mechanical pump dispensers use a protective hood or overcap, these test specimens should be stored with their protective devices in place. If the mechanical pump dispensers have a locking feature, these test specimens should be stored in the locked position during storage and unlocked for testing.

10.4 Except for trigger sprayers, remove all of the test samples from their respective environments three times per week, (preferably Monday, Wednesday, and Friday), over a four week period for a total of 12 test days.

10.5 For trigger sprayers, remove all of the test specimens from their respective environments once every two weeks for a duration of 12 weeks for a total of 7 test days.

10.6 Allow the temperature of the test specimens to equilibrate (generally 4 to 6 h) to ambient temperature prior to the actual evaluations.

10.7 Evaluate the primed mechanical pump dispensers for each of the following parameters:

10.7.1 *Leakage*—Visually inspect for the presence of product on the outside of either the mechanical pump dispenser or the container. If any test specimen exhibits a high degree of leakage, discontinue any additional testing with that particular mechanical pump dispenser and report the findings in 11.1.

10.7.2 *Retention of Prime*—Fully stroke each mechanical pump dispenser to determine if the mechanical pump dispenser has retained its prime. If any test specimen has lost prime and it is unable to be reprimed, then discontinue any additional testing with that particular mechanical pump dispenser and report the findings in 11.1.

NOTE 3—If the mechanical pump dispenser fails to re-prime as a result of a clog, then try cleaning in accordance with 10.7.3 before concluding the test.

10.7.3 *Clogging*—Visually inspect the orifice of each mechanical pump dispenser for the presence of product, either as is, or in a dried state and report the findings in 11.1. If the pump exhibits a high degree of clogging, which interferes with the performance of the mechanical pump dispenser, try removing the dried product from off the face of the orifice. If this does not remedy the clog and results in an unusable mechanical pump dispenser, discontinue any additional testing with that particular mechanical pump dispenser and report the findings in 11.1.

10.7.4 *Output per Stroke*—Determine the output per stroke (in accordance with Test Methods D4336) of each mechanical pump dispenser per D4336.

10.7.5 *Spray Quality*—Observe spray quality. Report any leakage and location in 11.1.

10.8 Upon completion of the testing outlined in 10.6, return all functioning test specimens to their respective environments for continued testing at the next scheduled time interval.

10.9 Retain all test specimens that were discontinued from testing because of one or more defects. Save these if future examination is required.

11. Report

11.1 Report the following information:

11.1.1 Description of the mechanical pump dispenser (supplier, type, closure size, diptube length and application torque of closure to bottle),

11.1.2 Identification of the product used,

11.1.3 Statement to the effect that the tests were made in compliance with this test method along with the:

11.1.4 Name of the technician completing the test, and

11.1.5 Date of report along with dates for the test period.

11.1.6 Detailed record of test on each mechanical pump dispenser,

11.1.7 When a mechanical pump dispenser was discontinued from additional testing and the nature of its discontinuance, and

11.1.8 Any observations or recommendations that may assist in correcting the various defects report upon.

11.1.9 Data for each package on strokes to prime and delivery rate. Identify any patterns or trends seen in the delivery ate of the packages during the test.

11.2 Report the overall results of the testing and draw a conclusion as to the acceptability of the mechanical pump dispenser. If the mechanical pump dispenser is acceptable, but with certain limitations, note accordingly.

12. Precision and Bias

12.1 *Precision*—The precision is highly dependent on the particular pump style and contents tested. One laboratory has investigated one particular fine mist pump style and a hair spray product with six replicate tests per temperature variable, yielding no visual product leakage, very minor cloggage, and all specimens retaining prime. For all specimens evaluated for strokes to prime, the test yielded an average of 6.58 strokes with a range of 6 to 7 strokes and a standard deviation of 0.53 strokes. For the 23°C specimens evaluated for output per stroke, the test yielded an average of 0.136 g with a range of 0.130 to 0.142 g and a standard deviation of 0.02 g. For the 45°C specimens evaluated for output per stroke, the test yielded an average of 0.136 g with a range of 0.131 to 0.142 g and a standard deviation of 0.02 g. Other pumps and contents will have other averages and will have more or less variability between replicate tests. Users of this test method are suggested to reference historical files of previous tests of similar pumps and contents for an estimate of within laboratory repeatability. The Committee believes that because of this strong product and pump style dependency, further investigation of repeatability and reproducibility is not practicable.

12.2 *Bias*—This test method has no bias because an accepted reference or referee value is not available.

13. Keywords

13.1 functional stability; mechanical pump dispenser; package

ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.

This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org). Permission rights to photocopy the standard may also be secured from the ASTM website (www.astm.org/COPYRIGHT/).