Designation: D4336 – 05 (Reapproved 2010)

Standard Test Methods for Determination of the Output Per Stroke of a Mechanical Pump Dispenser[1]

This standard is issued under the fixed designation D4336; 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 These test methods cover the measurement of the mean quantity-by-weight of liquids dispensed from a mechanical pump dispenser (spray or flow type) with a consumer-type product on each actuation.

1.2 *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.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

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

3. Significance and Use

3.1 This test method can be used to compare the output per stroke of different pump dispensers for the purpose of establishing dosage and use instructions for products of consumer usage.

3.2 This test method is suitable for establishing specifications for both the pump dispenser and the final package.

4. Sampling

4.1 Select an appropriate number of pump dispensers at random for the precision and accuracy desired. A number of ten test specimens are recommended, but a minimum of three is acceptable.

5. Test Specimens

5.1 Test specimens shall be clean pump dispensers with dip tubes assembled in the same manner as in production.

6. Conditioning

6.1 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 12.1.

6.2 If the test specimens have been newly-made at the time of the test, it is recommended that the test specimens age at 23 ± 3°C (73 ± 5.4°F) for 24 h before beginning the test. If the test specimens are not allowed to age for 24 h, then it should be noted in the test report as discussed in 12.1.

GRAVIMETRIC METHOD #1

This method is to be used when taring of the package weight is wanted or possible.

7. Apparatus

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

NOTE 1—For applications requiring greater accuracy, a top-loading or analytical style balance with direct reading to 0.001 g is recommended.

7.2 *Container,* an appropriate container for the pump dispenser under test; however, the actual container to be used on the final package is recommended.

8. Procedure

8.1 Fill the container with product to the level to be seen in the final package and secure the mechanical pump dispenser to the container.

8.2 If the pump dispenser is equipped with an overcap or locking feature, remove or release to permit the pump dispenser to be in the operable mode.

8.3 If the pump dispenser has a variable dosage feature, make an appropriate adjustment to the desired dosage at this time.

8.4 Prime the pump dispenser in accordance with Test Method D3890 by actuating it until a full discharge of product occurs.

8.5 Place the package on the balance and tare the weight to zero.

[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.

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[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.

8.6 Actuate the pump dispenser ten times by hand at the rate of 60 to 120 (90 ± 15 preferred) strokes per minute.

NOTE 2—Care must be taken to use the full stroke on each actuation.

8.7 Reweigh the package and record the value to the nearest 0.01 or 0.001 g as appropriate for the balance used and record the weight on the data sheet.

8.8 Repeat 8.1-8.7 for each pump dispenser selected for testing in accordance with 5.1.

GRAVIMETRIC METHOD #2

This method is to be used when taring of the package weight is not wanted or not possible.

9. Apparatus

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

NOTE 3—For applications requiring greater accuracy, a top-loading or analytical style balance with direct reading to 0.001 g is recommended.

9.2 *Container,* an appropriate container for the pump dispenser under test; however, the actual container to be used on the final package is recommended.

10. Procedure

10.1 Fill the container with product to the level to be seen in the final package and secure the mechanical pump dispenser to the container.

10.2 If the pump dispenser is equipped with an overcap or locking feature, remove or release to permit the pump dispenser to be in the operable mode.

10.3 If the pump dispenser has a variable dosage feature, make an appropriate adjustment to the desired dosage to be tested.

10.4 Prime the pump dispenser in accordance with Test Method D3890 by actuation until a full discharge of product occurs.

10.5 Weigh the filled package with the pump dispenser installed to the nearest 0.01 or 0.001 g as appropriate for the balance used and record the "Initial Weight" on the data sheet as "W1".

10.6 Actuate the pump dispenser ten times by hand at the rate of 60 to 120 (90 ± 15 preferred) strokes per minute.

NOTE 4—Care must be taken to use the full stroke on each actuation.

10.7 Reweigh the package and record the differences to the nearest 0.01 or 0.001g as appropriate for the balance used and record the "New Weight" on the data sheet as "W2".

10.8 Repeat 10.1-10.7 for each pump dispenser selected for testing in accordance with 5.1.

11. Calculation for Gravimetric Method #2

11.1 After each series of weighings, calculate the following:

$$\frac{(W1 - W2)}{10} = output\ per\ stroke\ (average)$$

where:

W1 = initial weight, and
W2 = new weight.

12. Report

12.1 Report the following information:

12.1.1 Description of the mechanical pump dispenser and product tested.

12.1.2 Number of specimens tested.

12.1.3 Mean, maximum, and minimum values of the weight per pump stroke for all test specimens tested, and

12.1.4 For pumps with an adjustable dispensing feature, the mean, maximum, and minimum values of the weight per pump stroke for all specimens tested.

13. Precision and Bias

13.1 *Precision*—The precision of Test Methods D4336 is highly dependent on the particular pump tested. One laboratory has investigated one particular fine mist pump and a hair spray with three replicate tests using Gravimetric Method #1, yielding an average output per stroke of 0.174 gr. with a range of 0.177 to 0.172 gr. and a standard deviation of 0.0026 gr. Other mechanical pump dispensers will have other averages of output per stroke 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 for an estimate of within laboratory repeatability. The committee believes that because of this varying pump style dependency, further investigation of repeatability and reproducibility is not practicable.

13.2 *Bias*—Test Methods D4336 has no bias because an accepted reference or referee value is not available.

14. Keywords

14.1 dosage; mechanical pump dispenser; output-per-stroke