Designation: D3472 – 97 (Reapproved 2007)

Standard Test Method for Reverse-Ratchet Torque of Type IA Child-Resistant Closures[1]

This standard is issued under the fixed designation D3472; 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 measurement of the torque developed when Type IA child-resistant closures are rotated in the counter-clockwise direction. Type IA closures are reclosable continuous threaded closures that use a random push down while turning; no orientation of the push down force is necessary.

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]

D3198 Test Method for Application and Removal Torque of Threaded or Lug-Style Closures

D3474 Practice for Calibration and Use of Torque Meters Used in Packaging Applications

D3475 Classification of Child-Resistant Packages

D3810 Test Method for Minimum Application Torque of Type IA Child-Resistant Closures

E105 Practice for Probability Sampling of Materials

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

3. Terminology

3.1 *Definition* (see Classification D3475).

3.1.1 *Type IA child-resistant closure*—a two-piece continuous thread closure requiring a random push down while turning; no orientation of the push down force is necessary.

4. Summary of Test Method

4.1 Representative specimens of child-resistant threaded closures are applied to an appropriate container. A torque-measuring device is used to measure the amount of torque developed when the closure is rotated in the counter-clockwise direction without any vertical force applied. This is reverse-ratchet torque.

5. Significance and Use

5.1 These torque measurements are of value because the reverse-ratchet torque is a torque applied to the closure in the removal direction of the closure. For Type IA closures, it is essential that this torque be significantly lower than some defined level at which the closure might unscrew.

5.2 This test may be used to establish performance specification for this attribute.

6. Apparatus

6.1 *Torque Tester,* (See Note 1.) The model used is determined by the anticipated range of torques to be measured. Reverse-ratchet torques usually fall below 10 lbf·in. (1.1 N·m). An appropriate torque tester range from 0 to 25 lbf·in. (0 to 2.8 N·m) or 0 to 10 lbf·in. (0 to 1.1 N·m) is suggested.

NOTE 1—A digital or automated torque instrument, if used, will have an appropriate design and scale capacity for the container/closure system to be evaluated. Torque results will be available in either electronic display or printout format.

7. Sampling

7.1 The number of samples will depend on the purpose for which this test is being run. For a given set of samples, sufficient measurements should be taken in accordance with established statistical sampling procedures.

7.2 Refer to Practices E105 and E122 for more specific information on statistically valid procedures.

8. Test Specimens

8.1 Unused threaded closures complete with liner, if applicable, and containers with the proper corresponding finish should be used.

[1] This test method is under the jurisdiction of ASTM Committee D10 on Packaging and is the direct responsibility of Subcommittee D10.32 on Consumer, Pharmaceutical and Medical Packaging.

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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.

8.2 If appropriate care is taken to avoid build-up of lubricant or coating from liner facings, the same container may be used for multiple tests in a series.

8.3 If repeated removal and reapplication is being studied as a variable, a separate container should be used for each closure, and the same closure-container combinations used for the duration of the test.

9. Calibration

9.1 Calibrate the torque meter in accordance with Practice D3474.

NOTE 2—Follow calibration procedure of manufacturer if a digital or automated torque instrument is to be used.

10. Conditioning

10.1 Closure application and removal-torque measurements may be influenced by test circumstances such as time, temperature, and humidity conditioning of the closures prior to testing, as well as temperature and humidity at the time of test. When closure-torque tests are repetitive, it is important that these variables and test conditions be controlled so the data may be reasonably comparable or reproducible from one test lot to another.

10.2 If special conditions are not required, store components at 23 ± 2°C (73.4 ± 3.4°F) and 50 ± 5 % relative humidity for a minimum of 24 h.

10.3 The atmosphere conditions in Table 1 may be used when special conditioning is appropriate. Other atmosphere conditions may be used as appropriate.

11. Procedure

11.1 *Reverse-Ratchet Torque:*

TABLE 1 Special Atmospheres

Environment	Temperature, °C (°F)	Relative Humidity, %
Cryogenic	–55 ± 3 (–67 ± 6)	...
Frozen food storage	–18 ± 2 (0 ± 4)	...
Refrigerated storage	5 ± 2 (41 ± 4)	85 ± 5
Temperature high humidity	20 ± 2 (68 ± 4)	85 ± 5
Tropical	40 ± 2 (104 ± 6)	85 ± 5
Desert	60 ± 3 (140 ± 6)	15 ± 2

11.1.1 Apply the closure with the recommended application torque in accordance with Test Methods D3810 and D3198 or as specified by the closure manufacturer.

11.1.2 With the container still in the torque tester, turn the closure counter-clockwise for three or more complete revolutions of the outer cap. Turn the closure slowly and steadily with the same rate for all samples. Exert no vertical force. Avoid excessive squeezing of the outer closure.

11.1.3 The highest reading registered on the instrument is the reverse-ratchet torque.

12. Report

12.1 The report shall include the following:

12.1.1 Thread finish and other designation of the closure,

12.1.2 Materials of construction of the closure, including any liner, and any liner coating,

12.1.3 Material of construction and finish of the container, mold release, surface treatment, or annealing agents such as silicones (where applicable),

12.1.4 Number of replicates,

12.1.5 Preconditioning time, temperature, and humidity of the test,

12.1.6 Temperature and humidity of the test area, with tolerances,

12.1.7 All torques, expressed in pound-force-inch and newton-metre in tabular form, with note on scale range used for torque meter,

NOTE 3—Pound-force-inch × 0.113 = newton-metre.

12.1.8 Average value and range of the torques,

12.1.9 Evaluation of comparative results, if appropriate, and

12.1.10 Statement that this test was made in accordance with ASTM Test Method D3472.

13. Precision and Bias

13.1 *Precision*—The repeatability is about 0.22 in.-lb or 10.6 % of the average. This is based on limited data of one package from a single laboratory. Other packages may have different repeatability values. The reproducibility of this test method is being determined.

13.2 *Bias*—No justifiable statement can be made on the bias of this test method since a true value cannot be established by an accepted referee method.

14. Keywords

14.1 reverse ratchet torque; Type IA child-resistant closure