Designation: C 149 – 86 (Reapproved 2005)

Standard Test Method for Thermal Shock Resistance of Glass Containers[1]

This standard is issued under the fixed designation C 149; 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.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This test method covers the determination of the relative resistance of commercial glass containers (bottles and jars) to thermal shock and is intended to apply to all types of glass containers that are required to withstand sudden temperature changes (thermal shock) in service such as in washing, pasteurization, or hot pack processes, or in being transferred from a warm to a colder medium or *vice versa*.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

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.*

2. Referenced Documents

2.1 *ASTM Standards:* [2]

C 224 Practice for Sampling Glass Containers

2.2 *ASTM Adjuncts:*

ADJC0149 Apparatus for thermal shock test of glass containers (6 Drawings)[3]

3. Apparatus

3.1 The apparatus shall consist essentially of a basket for holding the glassware upright, two tanks, one containing hot water and one containing cold water, and an automatically timed means for immersing and transferring the basket of bottles from the hot to the cold bath. A suitable type of apparatus is illustrated in Fig. 1.[3]

3.2 A device shall be provided to maintain the temperature of the baths within ±1.1°C (2°F) of the specified temperatures. Indicating controllers that control the heating of the hot water and the cooling of the cold water are recommended. Otherwise dial thermometers should be attached and the temperatures controlled manually.

3.3 The capacity of each tank shall be at least 3.8 L (1 gal) for each 0.45 kg (1 lb) of glass tested.

4. Sampling

4.1 Methods of sampling a minimum lot from a group of containers of a given type are given in Practice C 224, for the various situations to which it may apply.

5. Procedure

5.1 Adjust the temperatures of the baths so that the cold bath is at 21°C (70°F) and the hot bath is at a temperature hotter than the cold bath by a specified differential. (In most cases this differential will be 42°C (75°F) for the first immersion (Note 1). Fill, or partially fill, the basket, with empty bottles, and when the temperatures of the baths are within ± 1.1°C (2°F) of those specified immerse the basket in the hot bath in such a manner that the bottles become completely filled with hot water, allow to soak for 5 min, transfer to the cold bath, and immerse for 30 s, and then remove from the cold bath. Control the 5-min immersion in the hot bath within 10 s, and the time of transfer from the hot to the cold bath shall be 15 ± 1 s. During the test, protect the apparatus from drafts in a sheltered area. Observe the number of containers failing in the test by individual inspection of each.

NOTE 1—If a cold bath temperature other than 21°C (70°F) is used, the specified differential may be decreased (increased) by 0.5°C (1°F) for each increase (decrease) of 5.6°C (10°F) above (below) the recommended cold bath temperature.

5.2 Use one of the following test procedures depending upon the purpose of the test.

5.2.1 *Pass Test*—Apply the test at a predetermined differential. This pass test is sufficient for the routine testing of samples from continuous production in a manufacturer's plant.

5.2.2 *Progressive Test (to a Predetermined Percent of Breakage)*—Where it may be desirable to conduct the test as a measurement test, the test described in 5.1 may be repeated, the

[1] This method is under the jurisdiction of ASTM Committee C14 on Glass and Glass Products and is the direct responsibility of Subcommittee C14.07 on Glass Containers.

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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.

[3] Detailed drawings are available from ASTM International Headquarters. Order Adjunct No. ADJC0149.

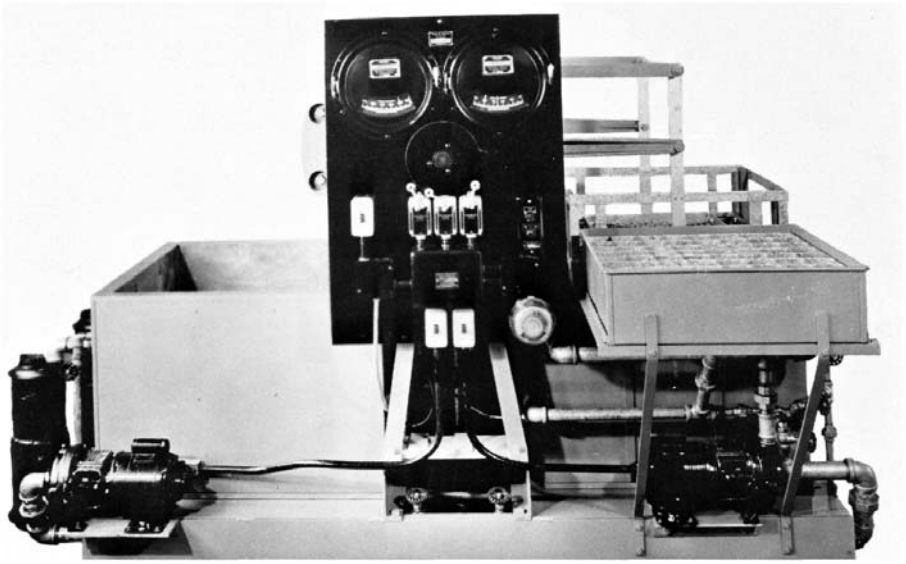

FIG. 1 Automatic Thermal Shock Testing Machine

temperature differential being increased, stepwise, by uniform increments (usually 2.8 or 5.6°C (5 or 10°F) each step) by increasing the temperature of the hot water bath, until the predetermined percent of containers is broken.

5.2.3 *Progressive Test (Total)*—As an alternative to the progressive test described in 5.2.2, the progressive test may be continued until all of the containers fail.

5.2.4 *High-Level Test*—A single test at a predetermined differential sufficiently high to break a portion of the sample may be made.

6. Report

6.1 Report the following information:

6.1.1 Report of method of sampling (see Practice C 224),

6.1.2 Number of containers from each mold included in the sample,

6.1.3 Time of transfer used,

6.1.4 Results of test (use one of the following depending on the kind of test):

6.1.4.1 For the pass test in accordance with 5.2.1: *(1)* temperature differential used, and *(2)* number of containers that failed in the test.

6.1.4.2 For the progressive test in accordance with 5.2.2: (*1*) differential at which the first failure occurred and number of containers that failed at that differential, and (*2*) differential required to cause failure of the predetermined percent of the sample, interpolated to the nearest 0.5°C (1°F).

6.1.4.3 For the progressive test in accordance with 5.2.3: (*1*) differentials used in test and number of containers that failed at each differential, and (*2*) average differential of failure (corrected for the size of the temperature increment or step used by subtracting one half of the increment; for example, 1.4°C (2.5°F) for a 3°C (5°F) increment).

6.1.4.4 For the high-level test in accordance with 5.2.4: (*1*) differential used in the test, and (*2*) number of containers that failed at that differential.

7. Precision and Bias

7.1 Statements regarding either precision or bias of the thermal shock test results are not possible because suitable thermal shock reference test materials are not available.

7.2 Test method precision is within ±1.11°C (±2°F). Test method bias is within ±1.11°C (±2°F).

8. Keywords

8.1 glass containers; thermal shock