



Standard Test Method for Alkali Resistance of Ceramic Decorations on Returnable Beverage Glass Containers¹

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1. Scope

1.1 This test method covers determination of the alkali resistance of ceramic labels (hereafter referred to as ACL (Applied Color Label)) on returnable beverage bottles (hereafter referred to as ware) to ensure the necessary durability of the label. A number of states require the cleaning and sanitizing of this ware by washing in hot alkali solutions. Accelerated tests are needed to ensure that the ACL will withstand the anticipated number of washings and still present an acceptable ware identification and appearance.

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. Summary of Method

2.1 The time required for destruction of ACL on exposure to alkali solutions is roughly proportional to the label thickness. A thin coating of good alkali-resistant enamel will fail in a relatively short time, while an extremely heavy coating of a poor alkali-resistant enamel will look reasonably good. A qualitative procedure is described. Any plant or laboratory using this procedure should establish its own standards.

2.1.1 This test method is a qualitative method and determines the time required for 90 % destruction of any ACL exposed to an alkali solution by visual inspection. This test method requires a minimum of skill and experience by the operator.

3. Significance and Use

3.1 This test method provides a means for determining the durability of decorated returnable glass beverage containers which may be a prerequisite in product specifications.

4. Interferences

4.1 Prepare fresh alkali solution for each set of ware and do not use the solution more than 24 h because of carbon dioxide

(CO₂) absorption and the inhibiting action of boron compounds dissolved from the ACL.

4.2 Do not use borosilicate glass containers for test solutions.

5. Apparatus

5.1 *Tank*, steel or stainless steel, equipped with a thermostatically controlled means of heating, and a solution level control, to prevent variations in solution concentration and temperature. The tank should be equipped with a coarsescreen mesh shelf on which ware being tested is placed to avoid sludge build-up around the ware.

5.2 *Bottle Saw or Hot Wire Cutter*—Either a hot wire or an abrasive wheel saw can be used to cut ware. If an abrasive wheel is used, the abrasive and glass sludge should be rinsed off the ware to avoid excessive depletion of the alkali solution.

6. Reagents

6.1 Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society,² where such specifications are available. Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

6.2 *Alkali Solution*—Prepare the alkali solution by mixing the following reagents:

	weight%
Sodium hydroxide (NaOH)	9.1
Trisodium phosphate (Na ₃ PO ₄ ·12H ₂ O)	0.9
Tap water	90.0

7. Test Specimens

7.1 The test ware should be representative of the lot or run and should have good application and fire. Tests should be run on ware with bottoms removed. The bottoms can be easily

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² *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 *Analar 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.

removed with a hot wire cutter or a water-cooled abrasive wheel cut-off saw. It is also convenient to simultaneously cut a ring section for fit determination from the same ware. If an abrasive saw is used, the glass and abrasive sludge should be rinsed from the ware before testing.

8. Procedure

8.1 After the alkali solution has reached an equilibrium temperature of $88 \pm 1^\circ\text{C}$, place the test ware in the solution (on the shelf) and allow it to remain for 2 h. The level of the alkali solution should be such that approximately the lower half of the label will be immersed in the solution and the upper half is not attacked, and can be used for comparison. At the end of the 2-h period, remove the test ware, rinse in warm water, wipe dry, and observe for decoration removal. After recording observations of attack, put the ware back in the solution for another 2-h period. Remove the ware again, rinse, dry, and record observations. Repeat this procedure at 2-h intervals until the decoration is 90 % removed.

8.2 The end point of this test for 90 % destruction is the point at which just enough label remains for bare identification. In the early part of the test it is difficult to be accurate in the amount removed. After approximately 50 % removal, it is much easier to make an accurate observation on percent destruction, and the 90 % removal is a fairly accurate end point for the same observer or a different observer with a reasonable amount of training.

8.3 The ACL must withstand at least three to four 2-h test periods. This means that it must have a reasonable degree of alkali resistance and be reasonably well applied and fired. Where possible, some standard ACL should be included in the test to check the equipment, solution, and operator running the test. Record results as hours to 90 % destruction.

9. Precision and Bias

9.1 No justifiable statements can be made regarding the precision and bias of this test method for determining the alkali resistance of ceramic decorations on glass since the test results are interpreted using a subjective grading system.

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