



Standard Test Method for Porosity in Vitreous Whitewares by Dye Penetration¹

This standard is issued under the fixed designation C 949; 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 procedures for detecting pores, cracks, or other voids that may be present in otherwise impermeable whiteware ceramics, or as porosity in underfired ware.

NOTE 1—This test method was partially derived from ANSI C29.1.

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:

C 242 Terminology of Ceramic Whitewares and Related Products²

2.2 ANSI Standard:

C 29.1 Test Methods for Electrical Power Insulators³

3. Terminology

3.1 Definitions:

3.1.1 For definitions of terms used in this test method, refer to Terminology C 242.

4. Summary of Test Method

4.1 Randomly selected unglazed fragments of vitreous whiteware products are immersed in a fuchsin dye solution, at one or more pressures for prescribed times. After drying, the specimens are broken and inspected for the extent of dye penetration into the body, or into defects present in the body.

5. Significance and Use

5.1 This test method provides a means for readily determining if a ceramic is properly fired (matured). Penetration of any extent may negate the usefulness of the ceramic, or, arbitrarily, some degree of penetration may be acceptable for the use or commercial quality of the item being tested.

6. Apparatus

6.1 *Vessel*, capable of applying and holding a pressure of 10 000 psi (68.9 MPa).

6.1.1 Fig. 1 illustrates a satisfactory device.

NOTE 2—Fig. 1 does not represent the only possible design or configuration. It is representative of a device that has been successfully used.

6.1.2 Fig. 2 illustrates an actual device and typical examples.

6.1.3 Fig. 3 illustrates an assembled device, including fixture, under pressure.

7. Testing Solution

7.1 Use a solution consisting of 1 g of basic fuchsin dye dissolved in 1 L of 50 % alcohol.

NOTE 3—The alcohol used should not react with the dye to cause fading.

8. Preparation of Test Specimens

8.1 Use freshly broken fragments, approximately ¼ in. (6 mm) in the smallest dimension, up to ¾ in. (19 mm) in the largest dimension, of the whiteware ceramic. At least 75 % of the surface shall be free of glaze or other surface treatment.

9. Procedure

9.1 Immerse the test specimens in the testing solution within the pressure chamber, and

9.2 Apply a minimum pressure of 4000 psi (27.6 MPa) for not less than 5 h, or

9.3 Apply a minimum 10 000 psi (68.9 MPa) for not less than 2 h, or

9.4 Immerse the specimens in the testing solution at atmospheric pressure, in an open vessel, for any period of time appropriate to the needs of the tester.

10. Examination

10.1 After following the procedures in 9.2, 9.3, or 9.4, dry and break the test specimen for examination.

10.2 Porosity is indicated by penetration of the dye into the specimens to an extent visible to the unaided eye.

10.3 Disregard penetration into small fissures formed in preparing the test specimens.

11. Report

11.1 Report the following information:

¹ This test method is under the jurisdiction of ASTM Committee C-21 on Ceramic Whitewares and Related Products and is the direct responsibility of Subcommittee C21.03 on Fundamental Properties.

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² *Annual Book of ASTM Standards*, Vol 15.02.

³ Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

Technical drawing of a plunger assembly, showing a cross-section of the assembly. The drawing includes the following dimensions and callouts:

- Top Dimensions:**
 - Overall width: 1.122"
 - Bore diameter: .376" BORE
- Plunger Assembly:**
 - Top section: 3/8" -16 THRD. 1 1/4" LG.
 - Angle: 15°
 - Radius: 3/16"
 - Length: 3"
 - Bore diameter: .372"
- Gaskets:**
 - 2 SOFT RUBBER GASKETS 1/16" THICK. USE GASKET CUTTER
- Drill and Polish:**
 - DRILL: 1 7/64" - REAM 1.125" D.
 - POLISH 4" OF BORE TO APPROX. 8 MICRO-INCHES
- Other Dimensions:**
 - Overall height: 7 1/4"
 - Section height: 3"
 - Section height: 1"
 - Section height: 1/16"
 - Section height: 1.119"
 - Section height: 1/8"
 - Section height: 9" R. 1/16"
 - Section height: 6" HOLD
 - Overall width: 4"

MATERIAL: VASCA JET #1000 HIGH SPEED STEEL- HARDEN TO
ROCKWELL C-42 TO C-48 BEFORE HONING

NOTE 1—1 in. = 25.4 mm.

FIG. 1 A Typical Pressure Vessel for Dye Penetration Test

- 11.1.1 Whether penetration occurred and to what depth,
- 11.1.2 Pressure used, and
- 11.1.3 Time under pressure.

12. Precision and Bias

12.1 This test method is qualitative and is liable to subjective interpretation. Within a given laboratory, agreement should

be possible between several operators whether penetration exceeds in-house acceptance standards.

13. Keywords

13.1 ceramics; porosity; whitewares



FIG. 2 A Typical Unassembled Pressure Vessel and Samples



FIG. 3 A Typical Assembled Pressure Vessel

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