Designation: C370 – 12 (Reapproved 2020)

Standard Test Method for Moisture Expansion of Fired Whiteware Products[1]

This standard is issued under the fixed designation C370; 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 determination of the elongation of whiteware bodies caused by rehydration as a result of autoclave treatment.

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.3 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Significance and Use

2.1 This test method provides means to determine increases in physical dimension of fired whiteware materials which develop from the reaction of water and water vapor at elevated pressures and temperatures. These reactions can occur in time at normal atmospheric pressures and temperatures; changes in physical dimensions from water can influence the integrity and stability of an installation. In the case of glazed ware, moisture expansion can lead to crazing.

3. Apparatus

3.1 *Autoclave,* that can safely be operated at 150 psi (1 MPa), and that has sufficient capacity to contain at least five specimens. The apparatus shall be equipped with a safety valve, a pressure gage accurate within 2 % of the scale range, and a source of heat of sufficient capacity to ensure a constant steam pressure within the autoclave.

3.2 *Micrometer,* at least 3 to 4 in. (76 to 102 mm), reading to 0.0001 in. (0.003 mm), or a dial indicator graduated in 0.0001-in. increments.

3.3 *Fixture,* for mounting the micrometer or dial indicator and for holding the specimen in such a manner that reproducible results can be obtained. A fused silica reference shall be used to calibrate the fixture before each measurement.

4. Test Specimen

4.1 The specimens shall be unglazed, rod-like in shape, about 3 to 4 in. (76 to 102 mm) long, and preferably cut from the center of production pieces of ware. The greatest thickness shall not exceed 0.75 in. (19 mm), and the least dimension shall be not less than 0.10 in. (2.5 mm).

4.2 The specimens shall be cut to size and measured immediately after coming from the kiln or shall be stored in a desiccator until they can be cut and measured.

4.3 The ends of the specimens shall be cut perpendicular to the length and parallel to each other. They then shall be smoothed with emery cloth and, finally, with jeweler's rouge.

4.4 At least five specimens shall be tested.

5. Procedure

5.1 Mark the specimens for identification and measure them with the micrometer or the dial indicator to the nearest 0.0001 in. (0.003 mm). Apply a reference mark to the specimens for orientation in the measuring fixture.

5.2 Locate the specimens above the water in the autoclave and subject them to 150-psi (1 MPa) steam pressure for 5 h. Maximum pressure shall be reached in not less than 45 min nor more than 1 h. After the 5-h treatment, immediately release the steam pressure by opening the blow-off valve.

5.3 After removal from the autoclave, dry the specimens to constant weight at a temperature not exceeding 110 °C and cool them to room temperature.

5.4 Measure the dry specimens to the nearest 0.0001 in. (0.003 mm) on the micrometer or dial indicator. To minimize errors of measurement caused by the expansion of the specimen, the temperature of the specimen should be approximately the same for initial and final measurements.

[1] This test method is under the jurisdiction of ASTM Committee C21 on Ceramic Whitewares and Related Products and is the direct responsibility of Subcommittee C21.03 on Methods for Whitewares and Environmental Concerns.

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6. Calculation

6.1 Calculate the percent of moisture expansion, based on the original length of the specimens, as follows:

$$O = (\Delta L/L_1) \times 100 \quad (1)$$

where:

O = moisture expansion, percent,
ΔL = difference between final and original length of the specimen ($L_2 - L_1$), in. (mm),
L_1 = original length of specimen, in. (mm), and
L_2 = length of specimen after autoclave treatment, in. (mm).

7. Report

7.1 Report the following information:

7.1.1 General description of the material being tested,

7.1.2 The average percentage moisture expansion of the lot, and

7.1.3 Individual values of moisture expansion for each specimen.

8. Precision and Bias

8.1 Precision depends on the precision of the micrometer used. A bias statement cannot be made due to lack of recognized standards.

9. Keywords

9.1 fired whiteware products; moisture expansion