Designation: C 866 – 77 (Reapproved 2006)

Standard Test Method for Filtration Rate of Ceramic Whiteware Clays[1]

This standard is issued under the fixed designation C 866; 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 rate at which a layer of clay-water paste is formed from a clay-water slip under pressure filtration. The filtration rate is directly related to such whiteware operations as filter pressing, slip casting, and drying of ware in which water permeability through a clay-water paste is the controlling mechanism.

1.2 A straight-line relationship exists between the time of filter pressing and the square of the thickness of the paste layer. The filtration rate is directly related to the filter press pressure and the void fraction of the paste layer, and is inversely related to the square of the clay surface area, the ratio of solids to liquid in the slip, and the viscosity of water at the testing temperature.

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 324 Test Method for Free Moisture in Ceramic Whiteware Clays

3. Apparatus

3.1 *Balance*, 0.001-g sensitivity.

3.2 *Blender*.

3.3 *Filter Press*, capable of operation at 345 kPa (50 psi).

3.4 *Stop Watch*.

3.5 *Vernier Calipers*, capable of measuring thickness to the nearest 0.1 mm.

4. Procedure

4.1 Weigh 100 g of clay, dried in accordance with Test Method C 324, to the nearest 0.1 g and mix with 300 mL of water measured to the nearest 1.0 mL for 10 min in a blender.

4.2 Store the slip in a closed container for at least 24 h to allow the clay and water to reach equilibrium conditions.

4.3 Remix the clay-water slurry for 5 min in the blender.

4.4 Pour the clay-water slurry into the filter press and apply 345 kPa (50 psi) air pressure for 30 min.

4.5 Relieve the pressure from the filter press and then pour the clay-water slurry from the top of the filter cake that has formed. A sharp movement of the wrist is required to remove all of the remaining slip from the filter press.

4.6 Record the temperature of the filtrate.

4.7 Reapply air pressure to the filter press for 10 min to force some of the water from the cake that has formed.

NOTE 1—Some clays have a fast filtration rate and the air may pass through the cake in less than 10 min. In this case, the air pressure should be relieved as soon as the sound of air emitting from the press is detected.

4.8 Remove the filter cake from the press and measure the thickness to the nearest 0.1 mm with the vernier calipers.

4.9 Place the cake in a drying oven at 100 to 110°C for a period of 24 h. Weigh the dried filter cake to the nearest 0.01 g.

5. Calculations

5.1 Calculate the filtration rate as follows:

$$FR = L^2/T \quad (1)$$

where:

FR = filtration rate, cm^2/s,
L = thickness of the wet filter cake, cm, and
T = filtration time, s.

NOTE 2—The filtration time is based upon the 30-min period during which the clay-water slip is being filter pressed and does not include the additional 10-min period for removal of water from the cake after it has been formed.

5.2 The void fraction in the filter cake varies considerably depending upon ions in the water that modify the packing structure of the clay particles in the filter cake. Water that is normally used for mixing with the clays should be used for the

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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.

test so that interactions between ions in the water with the clay are considered. However, in some cases distilled water may be used for mixing with the clay so that only those ions introduced with the clay are considered in the test. The void fraction is calculated as follows based upon the density of the clay being 2.60 Mg/m^3:

$$VF = 1 - \frac{W}{2.60 \times A \times L} \quad (2)$$

where:

VF = void fraction in the filter cake,
W = dry weight of the filter cake, g,
A = cross-sectional area of the filter press, cm^2, and
L = thickness of the wet filter cake, cm.

6. Precision and Bias

6.1 The experience of several laboratories indicates that this test method is capable of a precision of ±2 % (95 % confidence level).

7. Keywords

7.1 clay; filtration