
Standard Method of Test for Testing Lime for Chemical Constituents and Particle Sizes

AASHTO Designation: T 219-22

Technically Revised: 2022

Technical Subcommittee: 3a, Cement, Lime, and Concrete Materials



**American Association of State Highway and Transportation Officials
555 12th Street NW, Suite 1000
Washington, DC 20004**

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1. SCOPE

- 1.1. This test procedure is intended to serve as a reasonably accurate, fairly rapid means of determining the chemical limits of Type I hydrated lime and the particle size requirements of Types I and II hydrated lime on a routine basis. (See Note 1.)
- Note 1**—The chemical limits of Type II lime shall be determined in accordance with ASTM C25.
- 1.2. The entire procedure and the calculations it involves are based on certain hypothetical assumptions. Lime products by their very nature contain many ingredients other than those mentioned or considered in the test procedure. For our purposes, only the principal constituents usually present are considered. This aids greatly in the simplification of the test procedure to the obvious loss of some degree of accuracy. All test values to be reported shall be rounded off to the first decimal place. *Example:* percent $\text{Ca}(\text{OH})_2 = 95.5$ percent (rather than the 95.53 percent shown on the sample calculation sheets). The inherent accuracy obtainable through the use of this procedure is believed to be adequate for the purpose intended. The limitations of this test procedure, along with the object and intent of this same procedure, should be fully realized so that it may be evaluated as merely one approach to the problem of routine quality control.
- 1.2.1. The following applies to all specified limits in this standard: For the purposes of determining conformance with these specifications, an observed value or a calculated value shall be rounded off “to the nearest unit” in the last right-hand place of figures used in expressing the limiting value, in accordance with ASTM E29.
- 1.3. The values stated in SI units are to be regarded as the standard.
- 1.4. Refer to 29 CFR 1910.1200 for regulatory information for chemicals.
- 1.5. *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety concerns associated with its use. It is the responsibility of the user of the standard to consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*
- 1.6. *The quality of the results produced by this standard are dependent on the competence of the personnel performing the procedure and the capability, calibration, and maintenance of the equipment used. Agencies that meet the criteria of R 18 are generally considered capable of competent and objective testing/sampling/inspection/etc. Users of this standard are cautioned that compliance with R 18 alone does not completely assure reliable results. Reliable results depend on many factors; following the suggestions of R 18 or some similar acceptable guideline provides a means of evaluating and controlling some of those factors.*

2. REFERENCED DOCUMENTS

2.1. *AASHTO Standards:*

- M 231, Weighing Devices Used in the Testing of Materials
- M 339M/M 339, Thermometers Used in the Testing of Construction Materials
- R 18, Establishing and Implementing a Quality Management System for Construction Materials Testing Laboratories
- T 192, Fineness of Hydraulic Cement by the 45- μ m (No. 325) Sieve

2.2. *ASTM Standards:*

- C25, Standard Test Methods for Chemical Analysis of Limestone, Quicklime, and Hydrated Lime
- E1, Standard Specification for ASTM Liquid-in-Glass Thermometers
- E11, Standard Specification for Wire-Cloth Sieves for Testing Purposes
- E29, Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
- E230, Standard Specification for Temperature-Electromotive Force (emf) Tables for Standardized Thermocouples
- E2251, Standard Specification for Liquid-in-Glass ASTM Thermometers with Low-Hazard Precision Liquids
- E2877, Standard Guide for Digital Contact Thermometers

2.3. *Federal Standard:*

- Fed. Std. No. 29, CFR 1910.1200 OSHA Hazard Communication Standard; see also Permissible Exposure Limits—Annotated Tables, available at <https://www.osha.gov/dsg/annotated-pels/>

2.4. *International Electrotechnical Commission Standard:*

- IEC 60584-1:2013 Thermocouples - Part 1: EMF Specifications and Tolerances

3. APPARATUS

3.1. *Electric Muffle Furnace with Temperature Controlling Device*—Capable of sustained operation at a temperature of $1100 \pm 11^\circ\text{C}$ ($2012 \pm 20^\circ\text{F}$).

3.2. *Thermometer*—The thermometer for measuring the temperature of the solution shall meet the requirements of M 339M/M 339 with a temperature range of at least 25 to 28°C (77 to 85°F), and an accuracy of $\pm 0.5^\circ\text{C}$ ($\pm 1.0^\circ\text{F}$) (see Note 2).

Note 2—Thermometer types suitable for use include ASTM E1 mercury thermometers; IEC 60584 thermocouple thermometer Type K, Class 1; or ASTM E230 thermocouple thermometer, Type K, Special.

3.3. *Platinum Crucible*—Low-form, wide-bottom type with reinforced rim and bottom, 30-mL capacity.

3.4. *Metallic Tongs for Muffle Furnace*—750 mm in length.

3.5. *Balances*—A general-purpose balance shall have sufficient capacity, be readable to 0.1 percent of the sample mass or better, and conform to the requirements of M 231. The analytical balance shall conform to M 231, Class A.

- 3.6. *Beakers*—400-mL capacity.
- 3.7. *Buret*—100-mL capacity.
- 3.8. *Buret*—50-mL capacity of alkali-resistant glass and fitted with a Teflon stopcock.
- 3.9. *Magnetic-Type Stirrer*—With stirring bars preferably of the Teflon-covered type.
- 3.10. *Stopwatch*—With 60-s long hand to indicate 0.2 s. The long hand is to complete one turn of the dial in 60 s. The watch should also have a short hand to register up to 30 min. Operation should preferably be by successive depressions of the crown to accomplish starting, stopping, and returning to zero.
- 3.11. *Sieves*—Conforming to ASTM E11 as follows: 3.35, 2.00, 0.600, and 0.075 mm.
- 3.12. *pH Meter*—Having an accuracy of 0.1 pH.
- 3.13. *pH Meter Electrode*—Standard combination.
- 3.14. *Desiccator*.

4. REAGENTS

- 4.1. Reagent grade chemicals shall be used in all tests.
- 4.2. *Acid Potassium Hydrogen Phthalate*—National Institute of Standards and Technology Standard Sample or equal.
- 4.3. *Bromphenol Blue*—Tetrabromophenol sulfonphthalein.
- 4.4. *Hydrochloric Acid*.
- 4.5. *Phenolphthalein Powder*.
- 4.6. *Potassium Biphthalate*—Crystal primary standard. This reagent is satisfactory for use as a pH standard used in Section 5.5.
- 4.7. *Sodium Hydroxide*—50 percent solution.

5. PREPARATION OF SPECIAL SOLUTIONS

- 5.1. *Standardized Sodium Hydroxide Solution*:
- 5.1.1. This solution shall have a normality of 1.000 ± 0.015 when the normality of the solution is accurately determined by direct standardization against a National Institute for Standards and Technology (NIST) Potassium Hydrogen Phthalate acidimetric standard. This acidimetric standard shall be used without prior crushing or drying. Once the standard sample bottle has been opened, it should be restoppered, sealed with plastic tape, and stored in a desiccator pending further use. For the purpose of this standardization, 8.1691 g of the prescribed acid potassium hydrogen phthalate shall be considered as equivalent to 40.00 mL of 1.000 Normal NaOH.
- 5.1.2. Prepare the desired volume of 1.0 Normal NaOH by measuring out 52.3 mL of the 50 percent NaOH solution and dilute with distilled water to 1-L volume.