



# Standard Specification for Lime for Use with Pozzolans<sup>1</sup>

This standard is issued under the fixed designation C 821; 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 specification covers all types of commercial hydrated lime such as: high-calcium, magnesium, or dolomitic-hydrated lime. By-product limes and slaked quick limes in dry, wet, or slurred form are also included.

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 25 Test Methods for Chemical Analysis of Limestone, Quicklime, and Hydrated Lime<sup>2</sup>
- C 50 Practice for Sampling, Inspection, Packaging, and Marking of Lime and Limestone Products<sup>2</sup>
- C 204 Test Method for Fineness of Hydraulic Cement by Air Permeability Apparatus<sup>2</sup>
- C 593 Specification for Fly Ash and Other Pozzolans for Use with Lime<sup>2</sup>

## 3. Terminology

### 3.1 Definitions:

3.1.1 *chemical factor*—a numerical value of the active constituents in the hydrated lime that react chemically with a pozzolan. The value is based on the combined calcium oxide equivalents of free calcium oxide, calcium hydroxide, and magnesium oxide. Calcium carbonate and magnesium hydroxide are excluded, since these compounds have been found to be nonreactive.

3.1.2 *pozzolanic receptivity index*—a performance factor incorporating both chemical quality and fineness, determined by Eq 3.

## 4. Chemical and Physical Requirements

4.1 The lime shall conform to the requirements listed in Table 1, except as noted in Section 5.

TABLE 1 Chemical and Physical Requirements

Chemical factor, min	50
Blaine fineness, min, cm <sup>2</sup> /g	10 000
Pozzolanic receptivity index, min	100

## 5. Performance Requirements

5.1 If the chemical factor, Blaine fineness, or pozzolanic receptivity index is below the limits given in Table 1, the lime shall be required to meet the applicable performance requirements listed in Table 2. Where such lime complies with the limits listed in Table 2, it shall be considered acceptable for use with pozzolans. However, it may be necessary to increase the lime content in the lime-pozzolan mixtures in order to meet minimum design criteria.

## 6. Test Methods

### 6.1 Chemical Factor:

6.1.1 Determine calcium oxide (CaO), magnesium oxide (MgO), and carbon dioxide (CO<sub>2</sub>) contents in accordance with Test Methods C 25. When the magnesium oxide content is greater than 5 %, determine the peak height of magnesium oxide and magnesium hydroxide using standard X-ray diffraction procedures and calculate the ratio (*r*) of magnesium oxide to hydroxide using Eq 1. When the magnesium oxide is less than 5 %, the value of *r* shall be 0.30.

$$r = \frac{\text{cps MgO}}{\text{cps MgO} + 2.0 (\text{cps Mg}(\text{OH})_2)} \quad (1)$$

where:

cps = counts per second of principal peaks corresponding to an interplanar spacing for MgO of 2.106 Å and for Mg(OH)<sub>2</sub> of 2.365 Å.

6.1.2 *Calculation of Chemical Factor*—Using the test results provided by 6.1.1 the chemical factor (C.F.) is determined by Eq 2:

$$\text{C.F.} = (\text{CaO}) - 1.27 (\text{CO}_2) + 1.4 r (\text{MgO}) \quad (2)$$

6.2 *Blaine Fineness*—Calculate in accordance with Method C 204, except use the specific gravity of the lime in calculating the trial weight of the sample, and the weight finally chosen must result in a firm bed as described in Test Method C 204. Use the specific gravity of the lime and finally chosen weight to determine the porosity of the bed in accordance with Eq 2 of Test Method C 204, and use this porosity (as well as specific gravity) in calculating the surface area.

### 6.3 Pozzolanic Receptivity Index (PRI):

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 04.01.

**TABLE 2 Performance Requirements**

<i>Plastic Compositions:</i>		
Lime-pozzolan strength, min, psi (MPa)	600	(4.13)
<i>Nonplastic Compositions:</i>		
Lime-pozzolan-aggregate strength, min, psi (MPa)	400	(2.76)
Vacuum saturation strength, min, psi (MPa)	400	(2.8)

$$\text{PRI} = \frac{\text{chemical factor} \times \text{Blaine fineness}}{10\,000} \quad (3)$$

**6.4 Lime-Pozzolan Strength**—See Specification C 593, Section 7. The pozzolan used shall pass the requirements of Specification C 593 when tested with a lime having a pozzolanic receptivity index of 80 or higher.

**6.5 Lime-Pozzolan-Aggregate Strength, Freeze-Thaw**

*Resistance*—See Specification C 593, Section 8. The pozzolan used shall pass the requirements of Specification C 593 when tested with a lime having a pozzolanic receptivity index of 80 or higher.

## 7. Sampling, Inspection, Packing, and Marking

7.1 The sampling, inspection, rejection, retesting, packing, and marking shall be conducted in accordance with Methods C 50.

## 8. Keywords

8.1 hydrated; lime; pozzolans

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