Designation: C 1707 – 09

Standard Specification for Specification for Pozzolanic Hydraulic Lime for Structural Purposes [1]

This standard is issued under the fixed designation C 1707; 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 standard covers four types of pozzolanic hydraulic lime for structural purposes which include use in mortar, scratch, brown, and finish (stucco) coats of interior or exterior plaster.

1.1.1 *PHL*—Pozzolanic hydraulic lime for use in mortar, scratch, brown, and finish (stucco) coats of interior or exterior plaster.

1.1.2 PHL_c—PHL with a maximum 20 % binder weight of hydraulic cement.

1.1.3 *PHL-A*—Air-entrained PHL.

1.1.4 PHL_c-*A*—Air-entrained PHL_c.

1.2 This specification classifies pozzolanic hydraulic lime by minimum hydrated lime content, maximum hydraulic cement content, and specific performance requirements.

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard. Appropriate conversion can be done using IEEE/ASTM SI 10.

1.4 *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 25 Test Methods for Chemical Analysis of Limestone, Quicklime, and Hydrated Lime

C 50 Practice for Sampling, Sample Preparation, Packaging, and Marking of Lime and Limestone Products

C 51 Terminology Relating to Lime and Limestone (as used by the Industry)

C 109/C 109M Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens)

C 110 Test Methods for Physical Testing of Quicklime, Hydrated Lime, and Limestone

C 114 Test Methods for Chemical Analysis of Hydraulic Cement

C 150 Specification for Portland Cement

C 207 Specification for Hydrated Lime for Masonry Purposes

C 266 Test Method for Time of Setting of Hydraulic-Cement Paste by Gillmore Needles

C 270 Specification for Mortar for Unit Masonry

C 305 Practice for Mechanical Mixing of Hydraulic Cement Pastes and Mortars of Plastic Consistency

C 511 Specification for Mixing Rooms, Moist Cabinets, Moist Rooms, and Water Storage Tanks Used in the Testing of Hydraulic Cements and Concretes

C 595 Specification for Blended Hydraulic Cements

C 778 Specification for Standard Sand

C 1157 Performance Specification for Hydraulic Cement

IEEE/ASTM SI 10 Standard for use of the International System of Units (SI): (the Modern Metric System)

3. Terminology

3.1 *Definitions:*

3.1.1 Unless otherwise specified, for definitions of terms used in this standard see Terminology C 51.

3.1.2 *air entraining pozzolanic hydraulic lime (PHL-A), n*—as PHL with the exception that Type SA hydrated lime of Specification C 207, or Type NA of Specification C 207 shall

[1] This test method is under the jurisdiction of ASTM Committee C07 on Lime and is the direct responsibility of Subcommittee C07.02 on Specifications and Guidelines.

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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.

be used if shown not detrimental to the soundness of the material. If Type SA or Type NA hydrated limes are used, an additional air entraining agent shall not be used.

3.1.3 *air entraining pozzolanic hydraulic lime with hydraulic cement (PHL$_c$-A), n*—as PHL$_c$ with exception that Type SA hydrated lime of Specification C 207 shall be used, or Type NA of Specification C 207 shall be used if shown not detrimental to the soundness of the material. If Type SA or Type NA hydrated limes are used, an additional air entraining agent shall not be used.

3.1.4 *pozzolanic hydraulic lime (PHL), n*—a powder produced by the blending or intergrinding of not less than 25 % by binder weight of Specification C 207 Type S hydrated lime with one or more pozzolan and inert filler. Type N hydrated lime of Specification C 207 shall be used if shown not detrimental to the soundness of the material.

3.1.5 *pozzolanic hydraulic lime with hydraulic cement (PHL$_c$), n*—as PHL with not more than 20 % by binder weight of hydraulic cement of Specification C 150, Specification C 595, or Performance Specification C 1157 blended or interground.

4. Requirements

4.1 PHL, PHL$_c$ PHL-A and PHL$_c$-A shall conform to the requirements prescribed in Table 1.

5. Test Methods

5.1 *Water Soluble Alkali*—Water soluble alkali shall be tested according to the procedure in Test Methods C 114, Section 17.2.

5.2 *SO_3*—Sulfur trioxide content shall be tested according to the procedure of Test Methods C 25, Section 23.

5.3 *CO_2*—Carbon dioxide content shall be tested according to the procedure of Test Methods C 25, Section 22.

5.4 *Fineness*—Fineness shall be tested according to the wet sieve method of Test Methods C 110, Section 5.

5.5 *Time of Set*—Determine the time of initial and final set according to Test Method C 266, the Gilmore needle procedure, with the following changes:

5.5.1 Determine the first penetration value after 1 h of rest, and every 4 ± 2 h after that.

5.6 *Autoclave Expansion*—Autoclave Expansion shall be measured using the method described in Test Methods C 110, Section 9.3, with the following modification:

TABLE 1 Standard Requirements

Properties	PHL, PHL$_c$	PHL-A, PHL$_c$-A
water soluble alkali, max %	0.2	0.2
SO_3, max %	3.0	3.0
CO_2, max % (as produced basis)	16.0	16.0
Fineness		
retained on 30 mesh sieve, max %	<0.5	<0.5
retained on 200 mesh sieve, max %	<15	<15
Time of initial set, max h	24	24
Time of final set, max h	48	48
Autoclave expansion, max %	0.80	0.80
Air content		
max %	7.0	12.0
min %		>7.0
Water retention, min %	70	70
Compressive strength min, N/m^2(psi), 28 days	>2.4 (>350)	>2.4 (>350)

5.6.1 Weigh 25 ± 0.1 g of one of four types of PHL. Add 3.0 ± 1.0 ml water to the weighed sample and mix by hand until wetted. If the balance allows it, work directly in the specimen mold. If this is not possible, work in an intermediate container and transfer the mixture to the specimen mold in as complete a state as possible. Press to 5.0 ± 1.5 N/m^2 (725 ± 218 psi) for 10 s and demold the specimen and autoclave as described.

5.7 *Preparation of Mortar*—Mortar, plasters and grout are specified by volume proportion of the binder materials to the aggregate in a ratio of 1 volume part binder to 3 volume part aggregate or sand. Laboratory mixed mortars used for air entrainment, water retention and compressive strength testing for this specification shall be measured by weight by converting proportions by volume to proportion by weight.

NOTE 1—Appendix X4 of Specification C 270 provides examples of calculating material proportioning.

$$\textit{Batch factor} = \frac{1440}{(80 \times 3\ (\textit{sand volume proportion}))} = 6 \qquad (1)$$

Determine weight one of the four PHL as follows:

$$\textit{Weight of PHL}\ (g) = 1(\textit{PHL Volume Proportion}) \times \textit{Bulk Density}\ (\textit{Packed Density})\ \textit{of PHL} \times \textit{Batch Factor} \qquad (2)$$

Bulk density of PHL will vary and shall be provided by the manufacturer or determined according to Test Methods C 110 Section 20.

Sand will be a 50-50 blend of graded and 20-30 standard sand meeting Specification C 778.

5.8 *Air Content*—Air content shall be measured according to the procedure of:

5.8.1 Test Methods C 110, Section 8. W_1, W_2, S_1, and S_2 are dropped from the equation to be replaced by W_4 (weight of one of four PHL, g) and S_4 (specific gravity of one of four PHL). The specific gravity of the PHL shall be provided by the manufacturer as determined by the method of Test Methods C 110, Section 21, or determined by a gas pychnometer.

NOTE 2—The specific gravity of the four PHL will vary with composition and a single value cannot be recommended.

5.8.2 Test Methods C 110, Section 8.4.3, using the air pail method.

5.9 *Water Retention*—The water retention value shall be measured following Test Methods C 110, Section 7.

5.10 *Compressive Strength*—Prepare the mortar in accordance with Practice C 305 with the exception that the binder and water are initially placed in the mixing bowl together and allowed to wet for 1½ min prior to mixing. Store the mortar in the molds for 60 ± 12 h in sealed plastic bags prior to de-molding. Determine compressive strength in accordance with Test Method C 109/C 109M. A minimum of three 2-in. cubes is required.

5.11 *Specimen Storage*—Test specimens shall be stored at not less than 95 % R.H. in a moist room or cabinet following the requirements of Specification C 511. The storage surface shall be in equilibrium with the space to ensure no moisture loss.

6. Sampling and Inspection

6.1 The sampling, rejection, retesting, packing, and marking shall be conducted in accordance with Practice C 50.

7. Special Package Marking

7.1 When delivered in packages, the name and brand of the manufacturer, the type under this specification, and the words "AIR ENTRAINING" shall be plainly indicated on the package or in the case of bulk shipments, so indicated on shipping notices.

8. Keywords

8.1 hydrated lime; mortar; plaster grout; pozzolan; pozzolanic hydraulic lime