



Designation: C141/C141M – 09

Standard Specification for Hydrated Hydraulic Lime for Structural Purposes¹

This standard is issued under the fixed designation C141/C141M; 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 hydrated hydraulic lime for structural purposes.

1.2 Hydrated hydraulic lime may be used in the scratch or brown coat of plaster, stucco, mortar, or in portland-cement concrete either as blend, amendment, or admixture.

1.3 The values stated in either SI units or inch-pound units are to be regarded separately as standard. Within the text, the inch-pound units are shown in brackets. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.4 The following precautionary caveat pertains only to the test method portion, Section 11 of this specification: *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
- C25 Test Methods for Chemical Analysis of Limestone, Quicklime, and Hydrated Lime
 - C50 Practice for Sampling, Sample Preparation, Packaging, and Marking of Lime and Limestone Products
 - C51 Terminology Relating to Lime and Limestone (as used by the Industry)
 - C109/C109M Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens)
 - C110 Test Methods for Physical Testing of Quicklime,

- Hydrated Lime, and Limestone
- C187 Test Method for Amount of Water Required for Normal Consistency of Hydraulic Cement Paste
- C191 Test Methods for Time of Setting of Hydraulic Cement by Vicat Needle
- C230/C230M Specification for Flow Table for Use in Tests of Hydraulic Cement
- C270 Specification for Mortar for Unit Masonry
- C305 Practice for Mechanical Mixing of Hydraulic Cement Pastes and Mortars of Plastic Consistency
- C778 Specification for Sand

3. Terminology

3.1 For definitions of terms related to this specification, see Terminology C51.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *hydrated hydraulic lime, n*—the product resulting from the slaking of hydraulic quicklime generally to a powder, without any addition, and with or without grinding. It has the property of setting and hardening under water and by reaction of carbon dioxide from the air. The hydraulic properties of this material comes only from the composition of the raw materials.

3.2.2 *hydraulic quicklime, n*—a cementitious product obtained by calcining argillaceous or siliceous limestone, or a mixture of similar composition to form sufficient free lime to permit hydration by slaking.

3.2.3 *reworkability, n*—the ability of a material which has setting and hardening properties to be remixed after a given period without significantly compromising the final hardened properties of the material.

3.2.4 *period of reworkability*—the length of time a material can be reworked after initial mixing; it shall be expressed in hours.

NOTE 1—Hydrated hydraulic limes have a long working time lasting up to 24 h. The user should seek advice from the producer as to maximum working time.

4. Chemical Composition

4.1 The hydrated hydraulic lime shall conform to the following requirements as to chemical composition, calculated to the nonvolatile basis:

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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.

*A Summary of Changes section appears at the end of this standard



	Min	Max
Calcium and magnesium oxides (CaO and MgO calculated to the nonvolatile basis), %	50	75
Silica (SiO ₂ calculated to the nonvolatile basis), %	4	20
Iron and aluminum oxides (Fe ₂ O ₃ and Al ₂ O ₃ calculated to the nonvolatile basis), %	...	7
Carbon dioxide (CO ₂ on an as received basis), %	...	16
Available lime (CaO calculated with Test Methods C25 Section 28), %	16	...

5. Fineness

5.1 The sample shall leave a residue of not more than 0.5 % on a 600- μ m [No. 30] sieve and not more than 10 % on a 75- μ m [No. 200] sieve when tested as described in 11.2.

6. Time of Setting

6.1 The neat lime paste mixed to normal consistency shall not develop an initial set in less than 2 h as determined by the Vicat needle method (see 11.4). Final set shall be attained within 48 h at 100 % RH.

7. Reworkability

7.1 Test for reworkability as described in section 11.7.1. The average compressive strength value of the second set of cubes (set B) shall not be less than 30 % of the first set (set A).

8. Soundness

8.1 The samples when made, stored, and autoclaved as described in 11.5 shall not have an expansion of more than 1.0 %.

9. Compressive Strength

9.1 The average compressive strength of at least three 50-mm [2-in.] cubes, made, stored, and tested in accordance with 11.6, shall be not less than 1.7 N/mm² [250 psi] and no more than 10.3 N/mm² [1500 psi] at the age of 28 days.

9.2 The producer shall state the compressive strength, when tested in accordance with 11.6, at the age of 28 days.

9.3 The product shall be reworkable at 24 h as tested in accordance with 11.7.

NOTE 2—For quality control convenience, compressive strengths are tested at 28 days. Hydrated hydraulic limes will gain considerably in strength over time (up to 90 % of final strength being realized at 12 months).

10. Sampling

10.1 Each sample selected for purpose of tests shall weigh at least 2.3 kg [5 lb] and shall represent not more than 22 680 kg [50 000 lb]. If only one sample is taken, it shall weigh at least 4.5 kg [10 lb].

10.2 The sample shall be given a preliminary sieving by being passed through a 850- μ m [No. 20] sieve in order to thoroughly mix the sample and break up lumps.

10.3 Samples shall be shipped and stored in airtight, moistureproof containers.

10.4 The sampling, inspection, rejection, retesting, packaging, and marking shall be conducted in accordance with Practice C50.

11. Test Methods:

11.1 Chemical Analysis:

11.1.1 Analyses for chemical composition shall be carried out in accordance with Test Methods C25.

11.2 Fineness:

11.2.1 Wet sieve testing should be determined by Test Methods C110 paragraph 15.4.

11.3 Normal Consistency:

11.3.1 Determine normal consistency by the Vicat apparatus in accordance with Test Method C187.

11.4 Time of Setting:

11.4.1 Determine time of setting by the Vicat needle method in accordance with Test Method C191. The test will be done on a sample kept at 100 % RH. It will only be removed for measuring.

11.5 Autoclave Expansion:

11.5.1 Determine autoclave expansion in accordance with Test Methods C110 paragraph 9.3, with the following modifications:

11.5.1.1 Weigh 25 ± 0.1 g of HHL. Add 3 ± 1 ml of 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 a complete state as possible. Press to 5.0 ± 1.5 N/mm² [725 ± 218 psi] for 10 s and demold specimen and autoclave as described.

11.6 Compressive Strength:

11.6.1 Apparatus:

11.6.1.1 Scales and Weights, Sieves, Glass Graduates, Specimen Molds, Tamper, Trowel, and Testing Machine, in accordance with Test Method C109/C109M.

11.6.1.2 Flow Table, conforming to the requirements of Specification C230/C230M.

11.6.1.3 Mixing Apparatus, conforming to the requirements of Practice C305.

11.6.2 Standard Sand—Use 20–30 sand meeting the requirements of Specification C778.

11.6.3 Proportions for Standard Mortar—The mortar shall consist of 1 part of hydrated hydraulic lime to 3 parts of Specification C778 sand, by weight. The quantity of water measured in millilitres shall be such as to produce a flow of 100 to 115 % as determined by the flow table in 11.6.5.

NOTE 3—This proportion is by weight and differs from Specification C270, which is by volume.

11.6.4 Preparation of Standard Mortar—Mix the mortar in accordance with Section 7 of Practice C305, using 500 g of hydrated hydraulic lime and 1500 g of Specification C778 sand with the necessary water to give the desired flow.

11.6.5 Determination of Flow—Determine the flow in accordance with Section 8.3 of Test Method C109/C109M.

11.6.6 Molding of Test Specimens:

11.6.6.1 Prepare molds in accordance with Section 9 of Test Method C109/C109M.

11.6.6.2 The temperature of the air in the vicinity of the mixing slab and of the dry materials, molds, base plates, and mixing bowl, shall be maintained between 20 and 27.5 °C [68