



Standard Practice for Evaluation of Laboratories Testing Hydraulic Cement¹

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1. Scope

1.1 This practice covers the technical training and experience of laboratory testing personnel and identifies the minimum technical requirements for laboratory equipment used in testing of hydraulic cement as prescribed by ASTM.

1.2 This practice provides minimum criteria for evaluating the capability of a laboratory to perform chemical or physical tests listed in the various specifications on hydraulic cement (see Note 1).

NOTE 1—Relevant hydraulic cement specifications are C 91, C 150, C 595, C 845, and C 1157.

1.3 The SI units are to be regarded as the standard.

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:

- C 91 Specification for Masonry Cement²
- C 109/C 109M Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens)²
- C 114 Test Methods for Chemical Analysis of Hydraulic Cement²
- C 115 Test Method for Fineness of Portland Cement by the Turbidimeter²
- C 125 Terminology Relating to Concrete and Concrete Aggregates³
- C 150 Specification for Portland Cement²
- C 151 Test Method for Autoclave Expansion of Portland Cement²
- C 185 Test Method for Air Content of Hydraulic Cement Mortar²
- C 187 Test Method for Normal Consistency of Hydraulic Cement²

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² *Annual Book of ASTM Standards*, Vol 04.01.

³ *Annual Book of ASTM Standards*, Vol 04.02.

- C 191 Test Method for Time of Setting of Hydraulic Cement by Vicat Needle²
- C 204 Test Method for Fineness of Hydraulic Cement by Air Permeability Apparatus²
- C 219 Terminology Relating to Hydraulic Cement²
- C 230 Specification for Flow Table for Use in Tests of Hydraulic Cement²
- C 266 Test Method for Time of Setting of Hydraulic-Cement Paste by Gillmore Needles²
- C 305 Practice for Mechanical Mixing of Hydraulic Cement Pastes and Mortars of Plastic Consistency²
- C 451 Test Method for Early Stiffening of Portland Cement (Paste Method)²
- C 595 Specification for Blended Hydraulic Cements²
- C 778 Specification for Standard Sand²
- C 845 Specification for Expansive Hydraulic Cement²
- C 1005 Specification for Weights and Weighing Devices for Use in the Physical Testing of Hydraulic Cements²
- C 1157 Performance Specification for Blended Hydraulic Cement²
- E 4 Practices for Force Verification of Testing Machines⁴

2.2 Other Documents:

- ACI 116R Cement and Concrete Terminology⁵
- ASTM Manual of Cement Testing²

3. Terminology

3.1 Definitions:

3.1.1 *inspection, n*—a process of measuring, examining, testing, gaging, or using other procedures to ascertain the quality or state, detect errors or defects, or otherwise appraise materials, products, services, systems, or environments when compared to preestablished criteria.

3.1.2 Additional definitions may be found in Terminologies C 125 and C 219, Practices E 4, and ACI 116R.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *evaluation authority, n*—an independent entity, apart from the organization being evaluated, that can provide an unbiased evaluation of the organization and shall have the capability to assess the technical activities of testing laboratories (see Discussion).

⁴ *Annual Book of ASTM Standards*, Vol 03.01.

⁵ Available from American Concrete Institute, P.O. Box 19150, Detroit, MI 48219.

3.2.1.1 *Discussion*—One such evaluation authority is the Cement and Concrete Reference Laboratory (CCRL).⁶ Laboratory inspection is broadened into accreditation programs by such independent authorities as the National Voluntary Laboratory Accreditation Program (NVLAP),⁷ American Association for Laboratory Accreditation (A2LA)⁸ AASHTO Accreditation Program (AAP),⁹ and others established.

3.2.2 *laboratory technician, n*—an employee of the laboratory who is assigned to perform the actual testing operations primarily conducted in the laboratory.

3.2.3 *quality systems, n*—those internal procedures and practices that a laboratory utilizes to ensure continued compliance with applicable testing standards.

3.2.4 *subcontracting, n*—employing another organization to provide testing services that the laboratory contracted to provide.

3.2.5 *testing laboratory, n*—an organization that measures, examines, performs tests, or otherwise determines the characteristics or performance of materials or products. This may include organizations that offer commercial testing services, an in-house quality control function, an academic institution, or any other organization providing the specified testing services.

4. Significance and Use

4.1 The testing of hydraulic cement is an important element in obtaining quality construction. A testing laboratory must be selected with care.

4.2 A testing laboratory shall be deemed qualified to perform and report the results of its tests if the laboratory meets the requirements of this practice.

4.3 This practice provides guidance for evaluating the organization, personnel, facilities, and quality systems of the laboratory. This practice may be supplemented by criteria and requirements for particular projects.

5. Documentation of Organization

5.1 The following information shall be readily available for review:

5.1.1 A description of the organization, including the complete legal name and address of the main office and each laboratory location, names and positions of the principal officers and the individual in charge of the laboratory.

5.1.2 A description of the organization management structure, and

5.1.3 A listing of the range of services offered.

6. Human Resources

6.1 The manager of the laboratory shall be a chemist, materials analyst, or an engineer and a full-time employee of the organization having at least three years supervisory experience

in the testing of hydraulic cement; however, a person with equivalent science-oriented education or experience having satisfactorily directed testing of hydraulic cement is acceptable.

7. Testing and Additional Requirements

7.1 *Testing Requirements*—The organization shall have the capability of performing tests associated with its range of services (see Note 2). The laboratory shall have the facilities and equipment required for preparing, storing, conditioning, and testing specimens.

NOTE 2—The range of services of a testing laboratory may involve either chemical testing or physical testing, or both. The laboratory need not perform all tests listed in the applicable ASTM specification, but rather have the required equipment and demonstrate the ability to perform the procedures within its reported range of services.

7.1.1 The laboratory shall use the latest version of each referenced ASTM standard within one year of its publication in the *Annual Book of ASTM Standards* except where an earlier version is specifically required.

7.1.2 Laboratory personnel shall have convenient access to applicable standards.

7.2 *Additional Requirements*—The following requirements apply to only those tests performed by the laboratory. They are intended to supplement certain provisions of the standard test methods.

7.2.1 Water storage recording thermometers shall be checked for accuracy at least every six months by comparing their output with that of a mercury in glass thermometer, graduated in 0.5°C divisions, placed in the water adjacent to the probe of the recording thermometer. Adjustments shall be made if differences in the observed readings exceed 1°C.

7.2.2 General-purpose weighing devices and weights shall be checked at least annually and shall conform to the requirements of Specification C 1005.

7.2.3 Analytical balances and reference masses shall be checked at least annually and shall conform to the requirements of Test Methods C 114.

7.2.4 The 45- μm (No. 325) sieve fineness nozzles shall be checked at least every six months using the flow rate test procedure described in the *ASTM Manual of Cement Testing*.

7.2.5 Flow tables shall be checked at least every 2½ years using the calibration material described in Specification C 230.

7.2.6 Compression machines shall be verified, in accordance with Practices E 4 at least annually to determine if indicated loads, with and without the maximum load indicator (when so equipped), are accurate to $\pm 1.0\%$.

7.2.7 Compression machine bearing blocks shall be checked for planeness in accordance with the requirements of Test Method C 109/C 109M at least annually using a straightedge and feeler stock and shall be refinished if found to be out of tolerance.

7.2.8 Air content measures (400 mL) shall be calibrated at least every 2½ years following the procedures described in Test Method C 185.

7.2.9 Wagner turbidimeter apparatus shall be calibrated at least every six months using the procedures described in Test Method C 115.

7.2.10 Each lot of standard sand shall be checked upon

⁶ CCRL, National Institute of Standards and Technology, Bldg. 226, Rm. A365, Gaithersburg, MD 20899.

⁷ NVLAP, National Institute of Standards and Technology, Building 411, Room A124, Gaithersburg, MD 20899.

⁸ American Association for Laboratory Accreditation, Quince Orchard, Gaithersburg, MD 20878.

⁹ American Association of State Highway and Transportation Officials (AASHTO), 444 N. Capital St., NW, Suite 225, Washington, DC 20001.