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Standard Performance Specification for Hydraulic Cement¹

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1. Scope*

1.1 This performance specification covers hydraulic cements for both general and special applications. There are no restrictions on the composition of the cement or its constituents (See [Note 1](#)).

NOTE 1—There are two related hydraulic cement standards, Specification [C150](#) for portland cement and Specifications [C595](#) for blended cements, both of which contain prescriptive and performance requirements

1.2 This performance specification classifies cements based on specific requirements for general use, high early strength, resistance to attack by sulfates, and heat of hydration. Optional requirements are provided for the property of low reactivity with alkali-silica-reactive aggregates.

1.3 The values stated in either SI units or inch-pound units are to be regarded separately as standard. 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. Values in SI units [or inch-pound units] shall be obtained by measurement in SI units [or inch-pound units] or by appropriate conversion, using the Rules for Conversion and Rounding given in [IEEE/ASTM SI 10](#), of measurements made in other units [or SI units]. Values are stated in only SI units when inch-pound units are not used in practice.

1.4 The text of this standard refers to notes and footnotes that provide explanatory material. These notes and footnotes (excluding those in tables and figures) are not requirements of the standard.

1.5 *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.*

¹ This performance specification is under the jurisdiction of ASTM Committee C01 on Cement and is the direct responsibility of Subcommittee C01.10 on Hydraulic Cements for General Concrete Construction.

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2. Referenced Documents

2.1 *ASTM Standards*:²

- [C109/C109M](#) Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens)
- [C114](#) Test Methods for Chemical Analysis of Hydraulic Cement
- [C150](#) Specification for Portland Cement
- [C151](#) Test Method for Autoclave Expansion of Hydraulic Cement
- [C183](#) Practice for Sampling and the Amount of Testing of Hydraulic Cement
- [C185](#) Test Method for Air Content of Hydraulic Cement Mortar
- [C186](#) Test Method for Heat of Hydration of Hydraulic Cement
- [C188](#) Test Method for Density of Hydraulic Cement
- [C191](#) Test Methods for Time of Setting of Hydraulic Cement by Vicat Needle
- [C204](#) Test Methods for Fineness of Hydraulic Cement by Air-Permeability Apparatus
- [C219](#) Terminology Relating to Hydraulic Cement
- [C227](#) Test Method for Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar-Bar Method)
- [C359](#) Test Method for Early Stiffening of Hydraulic Cement (Mortar Method)
- [C430](#) Test Method for Fineness of Hydraulic Cement by the 45- μ m (No. 325) Sieve
- [C441](#) Test Method for Effectiveness of Pozzolans or Ground Blast-Furnace Slag in Preventing Excessive Expansion of Concrete Due to the Alkali-Silica Reaction
- [C451](#) Test Method for Early Stiffening of Hydraulic Cement (Paste Method)
- [C595](#) Specification for Blended Hydraulic Cements
- [C596](#) Test Method for Drying Shrinkage of Mortar Containing Hydraulic Cement

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.

C1012 Test Method for Length Change of Hydraulic-Cement Mortars Exposed to a Sulfate Solution

C1038 Test Method for Expansion of Hydraulic Cement Mortar Bars Stored in Water

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

environmental conditions. For performance properties of concrete, including permeability, resistance to freeze-thaw cycles and deicer salt scaling, additional information may be obtained through the use of comparative testing of concretes.

4.2 Cements conforming to this specification shall be designated in accordance with the nomenclature with special characteristics indicated by type in accordance with the types in 4.2.1-4.2.6. When the type is not specified, the requirements of type GU shall apply.

4.2.1 *Type GU*—Hydraulic cement for general construction. Use when one or more of the special types are not required.

4.2.2 *Type HE*—High Early-Strength.

4.2.3 *Type MS*—Moderate Sulfate Resistance.

4.2.4 *Type HS*—High Sulfate Resistance.

4.2.5 *Type MH*—Moderate Heat of Hydration.

4.2.6 *Type LH*—Low Heat of Hydration.

4.3 *Additional Option*—The following additional purchase option applies for any of the principal types listed. When this option is invoked, its letter designation and title shall follow

3. Terminology

3.1 Definitions:

3.1.1 Terms used in this specification are defined in Terminology C219.

4. Classification and Use

4.1 The types of hydraulic cement covered by this specification are given in 4.2.1-4.2.6 and are classified in accordance with specific properties defined in Table 1 (See Note 2).

NOTE 2—This specification is based on hydraulic cement attributes related to concrete performance, including strength development, sulfate resistance, heat of hydration, and resistance to alkali-silica reactivity. Concrete performance is dependent on many factors such as characteristics of other concrete materials, mix design, production, handling, and

TABLE 1 Standard Physical Requirements

| Cement Type | Applicable Test Method | GU | HE | MS | HS | MH | LH |
|---|------------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| Fineness | C204 | A | A | A | A | A | A |
| Autoclave length change, max, % | C151 | 0.80 | 0.80 | 0.80 | 0.80 | 0.80 | 0.80 |
| Time of setting, vicat test ^B | C191 | | | | | | |
| Initial, not less than, minutes | | 45 | 45 | 45 | 45 | 45 | 45 |
| Initial, not more than, minutes | | 420 | 420 | 420 | 420 | 420 | 420 |
| Air content of mortar volume, % | C185 | C | C | C | C | C | C |
| Compressive strength minimum, MPa [psi] ^D | C109/C109M | | | | | | |
| 1 day | | ... | 12 [1740] | ... | ... | ... | ... |
| 3 days | | 13 [1890] | 24 [3480] | 11 [1600] | 11 [1600] | 5 [725] | ... |
| 7 days | | 20 [2900] | ... | 18 [2610] | 18 [2610] | 11 [1600] | 11 [1600] |
| 28 days | | 28 [4060] | ... | ... | 25 [3620] | ... | 21 [3050] |
| Heat of hydration | C186 | | | | | | |
| 7 days, max, kJ/kg [kcal/kg] | | ... | ... | ... | ... | 290 [70] | 250 [60] |
| 28 days, max, kJ/kg [kcal/kg] | | ... | ... | ... | ... | ... | 290 [70] |
| Mortar bar expansion | C1038 | | | | | | |
| 14 days, % max | | 0.020 | 0.020 | 0.020 | 0.020 | 0.020 | 0.020 |
| Sulfate expansion (sulfate resistance) ^E | C1012 | | | | | | |
| 6 months, max, % | | ... | ... | 0.10 | 0.05 | ... | ... |
| 1 year, max, % | | ... | ... | ... | 0.10 | ... | ... |
| Optional Physical Requirements | | | | | | | |
| Option R—Low reactivity with alkali-silica-reactive aggregates ^F | C227 | | | | | | |
| Expansion at | | | | | | | |
| 14 days, max, % | | 0.020 | 0.020 | 0.020 | 0.020 | 0.020 | 0.020 |
| 56 days, max, % | | 0.060 | 0.060 | 0.060 | 0.060 | 0.060 | 0.060 |
| Early stiffening, final penetration, min, % | C451 | 50 | 50 | 50 | 50 | 50 | 50 |
| Compressive strength, ^D 28 days, min, MPa | C109/C109M | ... | ... | 28.0 | ... | 22.0 | ... |
| Drying Shrinkage, % | C596 | ... ^G | ... ^G | ... ^G | ... ^G | ... ^G | ... ^G |

^A Both amount retained when wet sieved on the 45- μ m (No. 325) sieve and specific surface area by air permeability apparatus in m²/kg shall be reported on all certificates of test results requested from the manufacturer.

^B Time of setting refers to initial setting time in Test Method C191.

^C Air content shall be reported on all certificates of test results requested from the manufacturer. A given value in mortar does not necessarily assure that the desired air content will be obtained in concrete.

^D Cements may be shipped prior to later-age test data being available. In such cases, the test value may be left blank. Alternatively, the manufacturer can generally provide estimates based on historical production data. The report shall indicate if such estimates are provided.

^E In the testing of HS cement, testing at one year shall not be required when the cement meets the 6 month limit. An HS cement failing the 6 month limit shall not be rejected unless it also fails the one year limit.

^F Compliance with this requirement shall not be requested unless the cement will be used with alkali-reactive aggregate.

^G At the request of the purchaser, data on drying shrinkage shall be supplied.