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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 C 150 for portland cement and Specifications C 595 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 For properties where values are given in both SI and inch-pound units, the values in SI units are to be regarded as the standard. Values in SI units shall be obtained by measurement in SI units or by appropriate conversion, using the Rules for Conversion and Rounding given in IEEE/ASTM SI 10, of measurements made in other units.

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.*

2. Referenced Documents

2.1 ASTM Standards:²

- C 109/C 109M Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens)
- C 114 Test Methods for Chemical Analysis of Hydraulic Cement
- C 150 Specification for Portland Cement
- C 151 Test Method for Autoclave Expansion of Hydraulic Cement
- C 183 Practice for Sampling and the Amount of Testing of Hydraulic Cement
- C 185 Test Method for Air Content of Hydraulic Cement Mortar
- C 186 Test Method for Heat of Hydration of Hydraulic Cement
- C 188 Test Method for Density of Hydraulic Cement
- C 191 Test Methods for Time of Setting of Hydraulic Cement by Vicat Needle
- C 204 Test Methods for Fineness of Hydraulic Cement by Air-Permeability Apparatus
- C 219 Terminology Relating to Hydraulic Cement
- C 227 Test Method for Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar-Bar Method)
- C 359 Test Method for Early Stiffening of Hydraulic Cement (Mortar Method)
- C 430 Test Method for Fineness of Hydraulic Cement by the 45- μ (No. 325) Sieve
- C 441 Test Method for Effectiveness of Pozzolans or Ground Blast-Furnace Slag in Preventing Excessive Expansion of Concrete Due to the Alkali-Silica Reaction
- C 451 Test Method for Early Stiffening of Hydraulic Cement (Paste Method)
- C 595 Specification for Blended Hydraulic Cements
- C 596 Test Method for Drying Shrinkage of Mortar Containing Hydraulic Cement
- C 1012 Test Method for Length Change of Hydraulic-Cement Mortars Exposed to a Sulfate Solution

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 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.

3. Terminology

3.1 Definitions:

3.1.1 Terms used in this specification are defined in Terminology C 219.

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 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.

TABLE 1 Standard Physical Requirements

Cement Type	Applicable Test Method	GU	HE	MS	HS	MH	LH
Fineness	C 204	A	A	A	A	A	A
Autoclave length change, max, %	C 151	0.80	0.80	0.80	0.80	0.80	0.80
Time of setting, vicat test ^B	C 191						
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, %	C 185	C	C	C	C	C	C
Compressive strength minimum, MPa (psi) ^D	C 109/C 109M						
1 day		...	10 (1450)	...	...	...	...
—3 days		10 (1450)	17 (2470)	10 (1450)	5 (725)	5 (725)	...
3 days		13 (1890)	17 (2470)	11 (1600)	11 (1600)	5 (725)	...
—7 days		17 (2470)	...	17 (2470)	10 (1450)	10 (1450)	5 (725)
7 days		20 (2900)	...	18 (2610)	18 (2610)	11 (1600)	11 (1600)
—28 days		28 (4060)	...	...	17 (2470)	...	17 (2470)
28 days		28 (4060)	...	...	25 (3620)	...	21 (3050)
Heat of hydration	C 186						
7 days, max, kJ/kg (kcal/kg)		...	...	...	...	290 (70)	250 (60)
28 days, max, kJ/kg (kcal/kg)		...	...	...	...	...	290 (70)
Mortar bar expansion	C 1038						
14 days, % max		0.020	0.020	0.020	0.020	0.020	0.020
Sulfate expansion (sulfate resistance) ^E	C 1012						
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	C 227						
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, %	C 451	50	50	50	50	50	50
Compressive strength, ^D 28 days, min, MPa	C 109/C 109M	...	...	28.0	...	22.0	...
Drying Shrinkage, %	C 596	... ^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 C 191.

^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.