



Designation: ~~C 1157-08a~~ Designation: **C1157/C1157M – 09**

Standard Performance Specification for Hydraulic Cement¹

This standard is issued under the fixed designation ~~C 1157/C1157M~~; 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 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~~C150 for portland cement and Specifications ~~C 595~~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 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~~

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. , 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.*

2. Referenced Documents

- <https://www.astm.org/catalog/standards/sist/8536ef5b-2958-4ede-a8ef-c36ae108645c/astm-c1157-c1157m-09>
- 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

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.

Current edition approved Dec. 15, 2008; July 1, 2009. Published January/August 2009. Originally approved in 1992. Last previous edition approved in 2008 as C1157 – 08a. DOI: 10.1520/C1157_C1157M-09.

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.

- 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
- 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

3. Terminology

3.1 Definitions:

- 3.1.1 Terms used in this specification are defined in Terminology C-219C219.

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.

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 immediately after the respective letter designation and title of the principal type (for example, Type MS(R)).

4.3.1 *Option R*—Low Reactivity with alkali-silica-reactive aggregates. When tested for potential activity with reactive aggregates, the cement shall meet the requirements of Table 1 for Option R.

5. Ordering Information

5.1 Orders for cement meeting the requirements of this specification shall include:

5.1.1 The specification designation ASTM C1157, and date,

5.1.2 The type of cement required. If no type is specified, Type GU shall be supplied.

5.1.3 A statement that an option is invoked, when such is desired, and

5.1.4 Manufacturer's certification, if required.

6. Chemical Composition

6.1 The chemical composition for the cement is not specified. However, the cement shall be analyzed for informational purposes.

7. Physical Properties

7.1 Cement of the type specified shall conform to all of the applicable standard physical requirements of Table 1.

7.2 When optional requirements are specified, the cement shall conform to the applicable optional limits of Table 1.

8. Sampling

8.1 When the purchaser requires that the cement be sampled and tested to verify compliance with this specification, sample in accordance with Practice C-183C183. Provide adequate facilities for sampling the finished cement. Sample the finished cement at the mill or at the site of transfer of ownership as may be specified by the purchaser.

8.2 ~~Practice C-183~~

8.2 Practice C183 is not designed for manufacturing quality control and is not required for manufacturer's certification.

9. Test Methods

9.1 When testing a cement for compliance with this specification, or for general characterization, use the following methods,



TABLE 1 Standard Physical Requirements

Cement Type	Applicable Test Method	GU	HE	MS	HS	MH	LH
Fineness	C-204C204	A	A	A	A	A	A
Fineness	C204	A	A	A	A	A	A
Autoclave length change, max, %	C-151C151	0.80	0.80	0.80	0.80	0.80	0.80
Autoclave length change, max, %	C151	0.80	0.80	0.80	0.80	0.80	0.80
Time of setting, vicat test ^B	C-191C191						
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, %	C-185C185	e	e	e	e	e	e
Air content of mortar volume, %	C185	c	c	c	c	c	c
Compressive strength minimum, MPa (psi) ^D	C-109/C-109MC109/ C109M						
Compressive strength minimum, MPa (psi) ^D	C109/C109M						
— 1 day		...	10 (1450)	...	...	...	...
1 day		...	12 [1740]	...	...	...	...
— 3 days		13 (1890)	17 (2470)	11 (1600)	11 (1600)	5 (725)	...
3 days		13 [1890]	24 [3480]	11 [1600]	11 [1600]	5 [725]	...
— 7 days		20 (2900)	...	18 (2610)	18 (2610)	11 (1600)	11 (1600)
7 days		20 [2900]	...	18 [2610]	18 [2610]	11 [1600]	11 [1600]
— 28 days		28 (4060)	...	...	25 (3620)	...	21 (3050)
28 days		28 [4060]	...	...	25 [3620]	...	21 [3050]
Heat of hydration	C-186C186						
Heat of hydration	C186						
— 7 days, max, kJ/kg (kcal/kg)		...	...	...	...	290 (70)	250 (60)
— 28 days, max, kJ/kg (kcal/kg)		...	...	...	...	...	290 (70)
7 days, max, kJ/kg [kcal/kg]		...	...	...	...	290 [70]	250 [60]
28 days, max, kJ/kg [kcal/kg]		...	...	...	...	...	290 [70]
Mortar bar expansion	C-1038C1038						
Mortar bar expansion	C1038						
14 days, % max		0.020	0.020	0.020	0.020	0.020	0.020
Sulfate expansion (sulfate resistance) ^E	C-1012C1012						
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	C-227C227						
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, %	C-451C451	50	50	50	50	50	50
Early stiffening, final penetration, min, %	C451	50	50	50	50	50	50
Compressive strength, ^D	C-109/C-109MC109/ C109M	...	...	28.0	...	22.0	...
— 28 days, min, MPa	C109/C109M	...	...	28.0	...	22.0	...
Compressive strength, ^D							
28 days, min, MPa							
Drying Shrinkage, %	C-596C596	... ^G	... ^G	... ^G	... ^G	... ^G	... ^G
Drying Shrinkage, %	C596	... ^G	... ^G	... ^G	... ^G	... ^G	... ^G

^A Both amount retained when wet sieved on the 45- μm (No. 325) sieve and specific surface area by air permeability apparatus in m^2/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 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.

with modifications or exceptions as indicated.

9.2 *Chemical Analysis*—Chemically analyze the cement using Test Methods C-114C114 for major and minor oxides present in greatest quantity that together, including loss-on-ignition, constitute at least 98 % of the total mass of the cement.

9.3 *Fineness*: