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Standard Specification for Blended Hydraulic Cements¹

This standard is issued under the fixed designation C595/C595M; 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 pertains to blended hydraulic cements for both general and special applications, using slag, pozzolan, limestone, or some combination of these, with portland cement or portland cement clinker or slag with lime.

NOTE 1—This specification prescribes ingredients and proportions, with some performance requirements, whereas Performance Specification C1157/C1157M is a hydraulic cement specification in which performance criteria alone govern the products and their acceptance.

1.2 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.

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

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

¹ This 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.

- 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)
- C114 Test Methods for Chemical Analysis of Hydraulic Cement
- C150/C150M Specification for Portland Cement
- C183/C183M Practice for Sampling and the Amount of Testing of Hydraulic Cement
- C185 Test Method for Air Content of Hydraulic Cement Mortar
- C187 Test Method for Amount of Water Required for Normal Consistency of Hydraulic Cement Paste
- 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 and Other Inorganic Cements
- C226 Specification for Air-Entraining Additions for Use in the Manufacture of Air-Entraining Hydraulic Cement
- C311/C311M Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland-Cement Concrete
- C430 Test Method for Fineness of Hydraulic Cement by the 45- μ m (No. 325) Sieve
- C465 Specification for Processing Additions for Use in the Manufacture of Hydraulic Cements
- C563 Guide for Approximation of Optimum SO₃ in Hydraulic Cement
- C688 Specification for Functional Additions for Use in Hydraulic Cements
- C821 Specification for Lime for Use with Pozzolans
- C1012/C1012M Test Method for Length Change of Hydraulic-Cement Mortars Exposed to a Sulfate Solution
- C1038/C1038M Test Method for Expansion of Hydraulic Cement Mortar Bars Stored in Water
- C1157/C1157M Performance Specification for Hydraulic Cement
- C1702 Test Method for Measurement of Heat of Hydration of Hydraulic Cementitious Materials Using Isothermal Conduction Calorimetry

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



C1778 Guide for Reducing the Risk of Deleterious Alkali-Aggregate Reaction in Concrete

C1891 Test Method for Fineness of Hydraulic Cement by Air Jet Sieving at 45- μm (No. 325)

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 The terms used in this specification are defined in Terminology **C219**, except for the terms below.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *binary blended cement, n*—a blended hydraulic cement consisting of portland cement with either a slag, a pozzolan, or a limestone.

3.2.2 *slag, n*—the term slag is used within this specification to denote either slag cement or granulated blast-furnace slag.

3.2.3 *ternary blended cement, n*—a blended hydraulic cement consisting of portland cement with either a combination of two different pozzolans, slag and a pozzolan, a pozzolan and a limestone, or a slag and a limestone.

NOTE 2—Relevant terms in Terminology **C219** applicable to this specification include portland cement, portland-cement clinker, hydraulic cement, slag cement, granulated blast-furnace slag, pozzolan, and calcium sulfate. Limestone is defined in Terminology **C51**.

4. Classification

4.1 This specification applies to the following types of blended cement that generally are intended for use as indicated.

4.1.1 Blended hydraulic cements for general concrete construction.

4.1.1.1 *Type IS*—Portland blast-furnace slag cement.

4.1.1.2 *Type IP*—Portland-pozzolan cement.

4.1.1.3 *Type IL*—Portland-limestone cement.

4.1.1.4 *Type IT*—Ternary blended cement.

4.2 Reporting:

4.2.1 The naming practice for blended cements shall be made by adding the suffix (X) to the type designation under 4.1.1, where (X) equals the targeted percentage of slag, pozzolan or limestone, in the product expressed as a whole number by mass of the final blended product, within the allowable variation as stated in 15.3.

4.2.2 The naming practice for ternary blended cements shall be made by adding the suffixes (AX) and (BY) to the Type IT designation under 4.1.1, where:

A is either “S” for slag, “P” for pozzolan, or “L” for limestone, whichever is present in larger amount by mass,

X is the targeted percentage by mass of constituent A,

B is either “S” for slag, “P” for pozzolan, or “L” for limestone, and

Y is the targeted percentage by mass of constituent B.

Both X and Y values are expressed as a whole number by mass of the final blended product, within the allowable variation as stated in 15.3. If X and Y are the same, list the two constituents in alphabetical order by constituent type (limestone, pozzolan, or slag).

NOTE 3—Examples of the naming practice in accordance with 4.2.1 and 4.2.2 are shown below (all percentages by mass):

Binary blended cement with 80 % portland cement and 20 % slag = Type IS(20).

Binary blended cement with 85 % portland cement and 15 % pozzolan = Type IP(15).

Binary blended cement with 90 % portland cement and 10 % limestone = Type IL(10).

Ternary blended cement with 70 % portland cement, 20 % slag and 10 % pozzolan = Type IT(S20)(P10).

Ternary blended cement with 65 % portland cement, 25 % of one pozzolan and 10 % of another pozzolan = Type IT(P25)(P10).

Ternary blended cement with 60 % portland cement and 20 % of slag and 20 % pozzolan = Type IT(P20)(S20).

Ternary blended cement with 80 % portland cement, 10 % limestone and 10 % pozzolan = Type IT(L10)(P10).

Ternary blended cement with 75 % portland cement, 15 % slag and 10 % limestone = Type IT(S15)(L10).

4.2.3 A simplified naming practice is used in this specification for practicality and clarity when referring to specific requirements for binary and ternary blended cements that are applicable to a range of products or in ternary blended cements when requirements are applicable to only one constituent within a specific range (%) (see Note 4).

NOTE 4—Examples of the simplified naming practices in accordance with 4.2.3 are shown below:

(1) An example when requirements are applicable to a range of products can be found in Table 1, where the maximum SO_3 content of 3 % applies to: binary blended cements with slag contents <70 %, indicated as IS(<70); and ternary blended cements with a pozzolan content less than the slag content and the slag content is less than 70 %, indicated as IT($P < S < 70$).

TABLE 1 Chemical Requirements

Cement Type ^A	Applicable Test Method	IS(<70), IT($P < S < 70$), IT($L < S < 70$)	IS(≥ 70), IT($S \geq 70$)	IP, IT($P \geq S$), IT($P \geq L$)	IL, IT($L \geq S$), IT($L \geq P$)
Magnesium oxide (MgO), max, %	C114	...	...	6.0	...
Sulfate reported as SO_3 , max, % ^B	C114	3.0	4.0	4.0	3.0
Sulfide reported as S^{2-} , max, %	C114	2.0	2.0	...	...
Insoluble residue, max, % ^C	C114	1.0	1.0	...	...
Loss on ignition, max, %	C114	3.0 ^D	4.0 ^D	5.0 ^D	10.0

^A The chemical requirements in this table are applicable to all air-entrained cement equivalents.

^B It is permissible to exceed the values in the table for SO_3 content, provided it has been demonstrated by Test Method **C1038/C1038M** that the cement with the increased SO_3 will not develop expansion exceeding 0.020 % at 14 days. When the manufacturer supplies cement under this provision, supporting data shall be supplied to the purchaser (see Note 10).

^C Insoluble residue maximum limit does not apply to ternary blended cements.

^D For ternary blended cements with limestone, loss on ignition is a maximum of 10.0 % by mass.