

---

# **Standard Specification for Blended Hydraulic Cement**

---

**AASHTO Designation: M 240M/M 240-24<sup>1</sup>**

Technically Revised: 2024

**Technical Subcommittee: 3a, Cement, Lime, and Concrete Materials**

**ASTM Designation: C595/C595M-24**



**American Association of State Highway and Transportation Officials  
555 12<sup>th</sup> Street NW, Suite 1000  
Washington, DC 20004**

Standard Specification for

Blended Hydraulic Cement

AASHTO Designation: M 240M/M 240-24<sup>1</sup>



Technically Revised: 2024

Technical Subcommittee: 3a, Cement, Lime, and Concrete Materials

ASTM Designation: C595/C595M-24

1.

SCOPE

- 1.1. This specification pertains to blended hydraulic cements for both general and special applications using slag, pozzolan, limestone, or some combination thereof, with portland cement or portland cement clinker, or slag with lime (see Note 1).  
**Note 1**—This specification prescribes ingredients and proportions with some performance requirements, whereas ASTM 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 nonconformance 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 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.

2.

REFERENCED DOCUMENTS

- 2.1. *AASHTO Standards:*
  - M 85, Portland Cement
  - M 201, Mixing Rooms, Moist Cabinets, Moist Rooms, and Water Storage Tanks Used in the Testing of Hydraulic Cements and Concretes
  - M 327, Processing Additions for Use in the Manufacture of Hydraulic Cements
  - R 71, Sampling and Amount of Testing of Hydraulic Cement
  - R 80, Determining the Reactivity of Concrete Aggregates and Selecting Appropriate Measures for Preventing Deleterious Expansion in New Concrete Construction
  - T 105, Chemical Analysis of Hydraulic Cement
  - T 106M/T 106, Compressive Strength of Hydraulic Cement Mortar (Using 50-mm or 2-in. Cube Specimens)
  - T 129, Amount of Water Required for Normal Consistency of Hydraulic Cement Paste
  - T 131, Time of Setting of Hydraulic Cement by Vicat Needle
  - T 133, Density of Hydraulic Cement
  - T 137, Air Content of Hydraulic Cement Mortar

- T 153, Fineness of Hydraulic Cement by Air Permeability Apparatus
- T 192, Fineness of Hydraulic Cement by the 45- $\mu\text{m}$  (No. 325) Sieve

2.2. *ASTM Standards:*

- C51, Standard Terminology Relating to Lime and Limestone (as used by the Industry)
- C219, Standard Terminology Relating to Hydraulic and Other Inorganic Cements
- C226, Standard Specification for Air-Entraining Additions for Use in the Manufacture of Air-Entraining Hydraulic Cement
- C311/C311M, Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland-Cement Concrete
- C563, Standard Guide for Approximation of Optimum  $\text{SO}_3$  in Hydraulic Cement
- C688, Standard Specification for Functional Additions for Use in Hydraulic Cements
- C821, Standard Specification for Lime for Use with Pozzolans
- C1012/C1012M, Standard Test Method for Length Change of Hydraulic-Cement Mortars Exposed to a Sulfate Solution
- C1038/C1038M, Standard Test Method for Expansion of Hydraulic Cement Mortar Bars Stored in Water
- C1157/C1157M, Standard Performance Specification for Hydraulic Cement
- C1702, Standard Test Method for Measurement of Heat of Hydration of Hydraulic Cementitious Materials Using Isothermal Conduction Calorimetry
- C1891, Standard Test Method for Fineness of Hydraulic Cement by Air Jet Sieving at 45- $\mu\text{m}$  (No. 325)
- *Manual of Cement Testing, Annual Book of ASTM Standards, Volume 04.01*

2.3. *IEEE/ASTM Standard:*

- SI10, American National Standard for Metric Practice

---

### 3. TERMINOLOGY

3.1. *Definitions*—The terms used in this specification are defined in ASTM C219 (see Note 2), except for the following terms:

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

3.1.2. *limestone, n*—either limestone, as defined according to ASTM C51, or manufactured mineral forms of calcium carbonate for use in blended cements are referred to as limestone.

3.1.3. *slag, n*—the term “slag” is used within this standard to denote either slag cement or granulated blast-furnace slag.

3.1.4. *ternary blended cement*—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 ASTM C219 applicable to this standard include portland cement, portland cement clinker, hydraulic cement, slag cement, granulated blast-furnace slag, pozzolan, and calcium sulfate.

**Note 3**—Manufactured mineral forms of calcium carbonate are any calcium carbonate that is not formed from geological processes. Although there are numerous manufacturing processes that could produce mineral forms of calcium carbonate, the specific chemical reactions are commonly

either precipitation of calcium carbonate from a solution or reacting carbon dioxide fluids with calcium oxide-bearing solid waste.

---

## 4. CLASSIFICATION

- 4.1. This specification applies to the following types of blended cement that generally are intended for use as directed.
- 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 Section 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 Section 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 Section 4.1.1, where:
- 4.2.2.1. A is “S” for slag, “P” for pozzolan, or “L” for limestone, whichever is present in a larger amount by mass;
- 4.2.2.2. X is the targeted percentage by mass of constituent A;
- 4.2.2.3. B is “S” for slag, “P” for pozzolan, or “L” for limestone; and
- 4.2.2.4. Y is the targeted percentage by mass of constituent B.
- 4.2.2.5. 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 Section 15.3. If X and Y are the same, list the two constituents in alphabetical order by constituent type (limestone, pozzolan, or slag).
- Note 4**—Examples of the naming practice per Sections 4.2.1 and 4.3 are shown below (all percentages by mass):
- Binary blended cement with 80 percent portland cement and 20 percent slag = Type IS(20);
  - Binary blended cement with 85 percent portland cement and 15 percent pozzolan = Type IP(15);
  - Binary blended cement with 90 percent portland cement and 10 percent limestone = Type IL(10).
  - Ternary blended cement with 70 percent portland cement, 20 percent slag, and 10 percent pozzolan = Type IT(S20)(P10);
  - Ternary blended cement with 65 percent portland cement, 25 percent of one pozzolan, and 10 percent of another pozzolan = Type IT(P25)(P10);
  - Ternary blended cement with 60 percent portland cement, 20 percent slag, and 20 percent pozzolan = Type IT(P20)(S20);

- Ternary blended cement with 80 percent portland cement, 10 percent limestone, and 10 percent pozzolan = Type IT(L10)(P10); and
- Ternary blended cement with 75 percent portland cement, 15 percent slag, and 10 percent limestone = Type IT(S15)(L10).

4.2.3. A simplified naming practice is used in this standard 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 (percent). (See Note 5.)

**Note 5**—Examples of the simplified naming practices per Section 4.2.3 are shown below:

- An example when requirements are applicable to a range of products can be found in Table 1, where the maximum SO<sub>3</sub> content of 3 percent applies to binary blended cements with slag contents <70 percent, 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 percent, indicated as Type IT(P < S < 70).
- An example when requirements are applicable to only one constituent within a specific range (percent) of that constituent can be found in Section 9.2, where testing is required only when the slag content is <25 percent. Because the requirement is based on the slag content only with no relation to the pozzolan or limestone content, a simplified naming practice is employed and the range of ternary blended cements is indicated as Type IT(S < 25).

4.3. *Special Properties:*

4.3.1. Air-entraining cement, when desired by the purchaser, shall be specified by adding the suffix (A) to the type designation under Section 4.1.1. (See Note 6.)

**Note 6**—A given mass of blended cement has a larger absolute volume than the same mass of portland cement. This should be taken into consideration in purchasing cements and in proportioning concrete mixtures.

4.3.2. Moderate sulfate resistance, when desired by the purchaser, shall be specified by adding the suffix (MS) to the type designation under Section 4.1.1.

4.3.3. High sulfate resistance, when desired by the purchaser, shall be specified by adding the suffix (HS) to the type designation under Section 4.1.1.

**Note 7**—Special properties attributable to slag, pozzolan, or limestone will vary based on quantities contained within the blended cements.

**Note 8**—R 80 provides guidance on use of blended hydraulic cements in concrete mixtures where potential for deleterious alkali-silica reaction is of concern.

4.3.4. High early strength, when desired by the purchaser, shall be specified by adding the suffix (HE) to the type designation under Section 4.1.1.

---

## 5. ORDERING INFORMATION

5.1. *Orders for material under this specification shall include the following:*

5.1.1. Specification number;

5.1.2. Type or types required; and

5.1.2.1. Indicate allowable slag, pozzolan, or limestone maximum or minimum percentage by mass, if required.

- 5.1.3. Optional special properties required (see Section 4.3):
  - 5.1.3.1. MS if moderate sulfate resistance is required;
  - 5.1.3.2. HS if high sulfate resistance is required;
  - 5.1.3.3. HE if high early strength is required;
  - 5.1.3.4. A if air entraining is required;
  - 5.1.3.5. Accelerating addition, if required;
  - 5.1.3.6. Retarding addition, if required;
  - 5.1.3.7. Water-reducing addition, if required;
  - 5.1.3.8. Water-reducing and accelerating addition, if required; and
  - 5.1.3.9. Water-reducing and retarding addition, if required.
- 5.1.4. Certification, if desired. (See Section 15.)

**Note 9**—It is important to check for availability of various options. Some multiple options are mutually incompatible or unattainable.

---

## 6. MATERIALS

- 6.1. Materials permitted to be used as ingredients in cements manufactured to comply with this specification are as follows:
  - 6.1.1. *Portland Cement*—For purposes of this specification, portland cement meeting the requirements of M 85 is suitable.
  - 6.1.2. *Portland Cement Clinker*—Portland cement clinker shall be partially fused clinker consisting primarily of hydraulic calcium silicates.
  - 6.1.3. *Slag*—Slag shall be slag cement or granulated blast-furnace slag and comply with requirements in Section 9.
  - 6.1.4. *Pozzolan*—Pozzolan shall comply with requirements in Section 9.
  - 6.1.5. *Limestone*—Limestone for use in blended cement, shall comply with the requirements indicated in Section 8.2.
  - 6.1.6. *Hydrated Lime*—Hydrated lime used as part of a blended cement shall meet the requirements of ASTM C821, except that when interground in the production process, there shall be no minimum fineness requirement.
  - 6.1.7. *Air-Entraining Addition*—When air-entraining cement is specified, an addition meeting the requirements of ASTM C226 shall be used.
  - 6.1.8. *Inorganic Processing Additions*—When inorganic processing additions are used in the manufacture of cement in amounts exceeding 1.0 percent, they shall have been shown to meet the requirements of M 327 in the amounts used or greater. (See Section 15.2.)