Designation: ~~C150/C150M – 17~~ C150/C150M – 18

Standard Specification for Portland Cement[1]

This standard is issued under the fixed designation C150/C150M; 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 covers ten types of portland cement, as follows (see Note 2):

1.1.1 *Type I*—For use when the special properties specified for any other type are not required.

1.1.2 *Type IA*—Air-entraining cement for the same uses as Type I, where air-entrainment is desired.

1.1.3 *Type II*—For general use, more especially when moderate sulfate resistance is desired.

1.1.4 *Type IIA*—Air-entraining cement for the same uses as Type II, where air-entrainment is desired.

1.1.5 *Type II(MH)*—For general use, more especially when moderate heat of hydration and moderate sulfate resistance are desired.

1.1.6 *Type II(MH)A*—Air-entraining cement for the same uses as Type II(MH), where air-entrainment is desired.

1.1.7 *Type III*—For use when high early strength is desired.

1.1.8 *Type IIIA*—Air-entraining cement for the same use as Type III, where air-entrainment is desired.

1.1.9 *Type IV*—For use when a low heat of hydration is desired.

1.1.10 *Type V*—For use when high sulfate resistance is desired.

NOTE 1—Some cements are designated with a combined type classification, such as Type I/II, indicating that the cement meets the requirements of the indicated types and is being offered as suitable for use when either type is desired.

NOTE 2—Cement conforming to the requirements for all types are not carried in stock in some areas. In advance of specifying the use of cement other than Type I, determine whether the proposed type of cement is, or can be made, available.

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 standard references notes and footnotes which provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as 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]

C33 Specification for Concrete Aggregates

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

C115 Test Method for Fineness of Portland Cement by the Turbidimeter

C151 Test Method for Autoclave Expansion of Hydraulic Cement

C183 Practice for Sampling and the Amount of Testing of Hydraulic Cement

[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.

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

C185 Test Method for Air Content of Hydraulic Cement Mortar
C186 Test Method for Heat of Hydration 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
C226 Specification for Air-Entraining Additions for Use in the Manufacture of Air-Entraining Hydraulic Cement
C266 Test Method for Time of Setting of Hydraulic-Cement Paste by Gillmore Needles
C451 Test Method for Early Stiffening of Hydraulic Cement (Paste Method)
C452 Test Method for Potential Expansion of Portland-Cement Mortars Exposed to Sulfate
C465 Specification for Processing Additions for Use in the Manufacture of Hydraulic Cements
C563 Guide for Approximation of Optimum SO_3 in Hydraulic Cement
C1038 Test Method for Expansion of Hydraulic Cement Mortar Bars Stored in Water
C1702 Test Method for Measurement of Heat of Hydration of Hydraulic Cementitious Materials Using Isothermal Conduction Calorimetry
E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
IEEE/ASTM SI 10 American National Standard for Use of the International System of Units (SI): The Modern Metric System

3. Terminology

3.1 *Definitions*—See Terminology C219.

4. Ordering Information

4.1 Orders for material under this specification shall include the following:
4.1.1 This specification number and date,
4.1.2 Type or types allowable. If no type is specified, Type I shall be supplied,
4.1.3 Any optional chemical requirements from Table 2, if desired, and
4.1.4 Any optional physical requirements from Table 4, if desired.

5. Ingredients

5.1 The cement covered by this specification shall contain no ingredients except as follows:
5.1.1 Portland cement clinker.
5.1.2 Water or calcium sulfate, or both. The amounts shall be such that the limits shown in Table 1 for sulfur trioxide and loss-on-ignition are not exceeded.

5.1.3 Limestone. The amount shall not be more than 5.0 % by mass such that the chemical and physical requirements of this standard are met (see Note 3). The limestone, defined in Terminology C51, shall be naturally occurring and consist of at least 70 % by mass of one or more of the mineral forms of calcium carbonate. If limestone is used, the manufacturer shall report the amount used, expressed as a percentage of cement mass, as determined using Annex A2, along with the oxide composition of the limestone.

NOTE 3—This standard permits portland cement to contain limestone, but does not require that limestone be an ingredient in the cement. Cement without ground limestone can be specified in the contract or order.

5.1.4 Inorganic processing additions. The amount shall be not more than 5.0 % by mass of cement. Not more than one inorganic processing addition shall be used at a time. For amounts greater than 1.0 %, they shall have been shown to meet the requirements of Specification C465 for the inorganic processing addition in the amount used or greater. If an inorganic processing addition is used, the manufacturer shall report the amount used, expressed as a percentage of cement mass, along with the oxide composition of the processing addition. See Note 4.

NOTE 4—These requirements are based on data and recommendations by Taylor.[3]

5.1.5 Organic Processing additions. They shall have been shown to meet the requirements of Specification C465 in the amounts used or greater and the total amount of organic processing additions used shall not exceed 1.0 % by mass of cement.
5.1.6 Air-entraining addition (for air-entraining portland cement only). The interground addition shall conform to the requirements of Specification C226.

6. Chemical Composition

6.1 Portland cement of each of the ten types shown in Section 1 shall conform to the respective standard chemical requirements prescribed in Table 1. In addition, optional chemical requirements are shown in Table 2.

[3] Taylor, P., "Specifications and Protocols for Acceptance Tests on Processing Additions in Cement Manufacturing," *NCHRP Report 607*, Transportation Research 3 Board, Washington, DC 20008, 96 pp. Available at www.trb.org.

TABLE 1 Standard Composition Requirements

~~Cement Type[A]~~	~~Applicable Test Method~~	~~I and IA~~	~~II and IIA~~	~~II(MH) and II(MH)A~~	~~III and IIIA~~	~~IV~~	~~V~~
Cement Type[A]	Applicable Test Method	I and IA	II and IIA	II(MH) and II(MH)A	III and IIIA	IV	V
~~Aluminum oxide (Al_2O_3), max, %~~	~~C114~~	~~...~~	~~6.0~~	~~6.0~~	~~...~~	~~...~~	~~...~~
Aluminum oxide (Al_2O_3), max, %	C114	...	6.0	6.0	...	...	...
~~Ferric oxide (Fe_2O_3), max, %~~	~~C114~~	~~...~~	~~6.0[B]~~	~~6.0[B,C]~~	~~...~~	~~6.5~~	~~...~~
Ferric oxide (Fe_2O_3), max, %	C114	...	6.0[B]	6.0[B,C]	...	6.5	...
~~Magnesium oxide (MgO), max, %~~	~~C114~~	~~6.0~~	~~6.0~~	~~6.0~~	~~6.0~~	~~6.0~~	~~6.0~~
Magnesium oxide (MgO), max, %	C114	6.0	6.0	6.0	6.0	6.0	6.0
Sulfur trioxide (SO_3),[D] max, %	C114						
~~When (C_3A)[E] is 8 % or less~~		~~3.0~~	~~3.0~~	~~3.0~~	~~3.5~~	~~2.3~~	~~2.3~~
When (C_3A)[E] is 8 % or less		3.0	3.0	3.0	3.5	2.3	2.3
~~When (C_3A)[E] is more than 8 %~~		~~3.5~~	~~[F]~~	~~[F]~~	~~4.5~~	~~[F]~~	~~[F]~~
When (C_3A)[E] is more than 8 %		3.5	[F]	[F]	4.5	[F]	[F]
Loss on ignition, max, %	C114						
When limestone is not an ingredient		3.0	3.0	3.0	3.0	2.5	3.0
When limestone is an ingredient		3.5	3.5	3.5	3.5	3.5	3.5
Insoluble residue, max, %	C114	1.5	1.5	1.5	1.5	1.5	1.5
~~Tricalcium silicate (C_3S)[E], max, %~~	~~See Annex A1~~	~~...~~	~~...~~	~~...~~	~~...~~	~~35[C]~~	~~...~~
Tricalcium silicate (C_3S)[E], max, %	See Annex A1	...	...	...	...	35[C]	...
~~Dicalcium silicate (C_2S)[E], min, %~~	~~See Annex A1~~	~~...~~	~~...~~	~~...~~	~~...~~	~~40[C]~~	~~...~~
Dicalcium silicate (C_2S)[E], min, %	See Annex A1	...	...	...	...	40[C]	...
~~Tricalcium aluminate (C_3A)[E], max, %~~	~~See Annex A1~~	~~...~~	~~8~~	~~8~~	~~15~~	~~7[C]~~	~~5[B]~~
Tricalcium aluminate (C_3A)[E], max, %	See Annex A1	...	8	8	15	7[C]	5[B]
~~Sum of C_3S + 4.75C_3A[G], max, %~~	~~See Annex A1~~	~~...~~	~~...~~	~~100[C,H]~~	~~...~~	~~...~~	~~...~~
Sum of C_3S + 4.75C_3A[G], max, %	See Annex A1	...	...	100[C,H]	...	...	...
~~Tetracalcium aluminoferrite plus twice the tricalcium aluminate (C_4AF + 2(C_3A)), or solid solution (C_4AF + C_2F), as applicable, max, %~~	~~See Annex A1~~	~~...~~	~~...~~	~~...~~	~~...~~	~~...~~	~~25[B]~~
Tetracalcium aluminoferrite plus twice the tricalcium aluminate (C_4AF + 2(C_3A)), or solid solution (C_4AF + C_2F), as applicable, max, %	See Annex A1	...	...	...	...	...	25[B]

[A] See Note 2.
[B] Does not apply when the sulfate resistance limit in Table 4 is specified.
[C] Does not apply when the heat of hydration limit in Table 4 is specified.
[D] It is permissible to exceed the values in the table for SO_3 content, provided it has been demonstrated by Test Method C1038 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 6.
[E] See Annex A1 for calculation.
[F] Not applicable.
[G] See Note 5.
[H] In addition, three-day heat of hydration testing by Test Method C1702 shall be conducted at least once every six months. Such testing shall not be used for acceptance or rejection of the cement, but results shall be reported for informational purposes.

NOTE 5—The limit on the sum, C_3S + 4.75C_3A, in Table 1 provides control on the heat of hydration of the cement and is consistent with a Test Method ~~C186 seven-day heat of hydration limit of 335 kJ/kg [80 cal/g], or a Test Method~~ C1702 three-day heat of hydration limit of 315 kJ/kg [75 cal/g].

NOTE 6—There are cases where performance of a cement is improved with SO_3 in excess of the Table 1 limits in this specification. Guide C563 is one of several methods a manufacturer can use to evaluate the effect of sulfate content on cement characteristics. Whenever SO_3 content of a cement exceeds Table 1 limits, Test Method C1038 results provide evidence that excessive expansion does not occur at this higher sulfate content.

7. Physical Properties

7.1 Portland cement of each of the ten types shown in Section 1 shall conform to the respective standard physical requirements prescribed in Table 3. In addition, optional physical requirements are shown in Table 4.

8. Sampling

8.1 When the purchaser desires that the cement be sampled and tested to verify compliance with this specification, perform sampling and testing in accordance with Practice C183.

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

9. Test Methods

9.1 Determine the applicable properties enumerated in this specification in accordance with the following test methods:

9.1.1 *Chemical Analysis*—Test Methods C114.

TABLE 2 Optional Composition Requirements[A]

Cement Type	Applicable Test Method	I and IA	II and IIA	II(MH) and II(MH)A	III and IIIA	IV	V	Remarks
~~Tricalcium aluminate (C_3A)[B], max, %~~	~~See Annex A1~~	~~...~~	~~...~~	~~...~~	~~8~~	~~...~~	~~...~~	~~for moderate sulfate resistance~~
Tricalcium aluminate (C_3A)[B], max, %	See Annex A1	. . .	. . .	. . .	8	. . .	. . .	for moderate sulfate resistance
~~Tricalcium aluminate (C_3A)[B], max, %~~	~~See Annex A1~~	~~...~~	~~...~~	~~...~~	~~5~~	~~...~~	~~...~~	~~for high sulfate resistance~~
Tricalcium aluminate (C_3A)[B], max, %	See Annex A1	. . .	. . .	. . .	5	. . .	. . .	for high sulfate resistance
Equivalent alkalies ($Na_2O + 0.658K_2O$), max, %	C114	0.60[C]	0.60[C]	0.60[C]	0.60[C]	0.60[C]	0.60[C]	low-alkali cement

[A] These optional requirements apply only when specifically requested. Verify availability before ordering. See Note 2.
[B] See Annex A1 for calculation.
[C] Specify this limit when the cement is to be used in concrete with aggregates that are potentially reactive and no other provisions have been made to protect the concrete from deleteriously reactive aggregates. Refer to Specification C33 for information on potential reactivity of aggregates.

9.1.2 *Air Content of Mortar*—Test Method C185.
9.1.3 *Fineness by Air Permeability*—Test Method C204.
9.1.4 *Autoclave Expansion*—Test Method C151.
9.1.5 *Strength*—Test Method C109/C109M.
9.1.6 *Time of Setting by Vicat Needles*—Test Method C191.
9.1.7 *False Set*—Test Method C451.
9.1.8 *Heat of Hydration*—Test Method ~~C186 or~~ C1702.
9.1.9 *Sulfate Resistance*—Test Method C452 (sulfate expansion).
9.1.10 *Time of Setting by Gillmore Needles*—Test Method C266.
9.1.11 *Fineness by Turbidimeter*—Test Method C115.
9.1.12 *Calcium Sulfate (Expansion of) Mortar*—Test Method C1038.

10. Inspection

10.1 Inspection of the material shall be made as agreed upon between the purchaser and the seller as part of the purchase contract.

11. Rejection

11.1 The cement shall be rejected if it fails to meet any of the requirements of this specification.

11.2 At the option of the purchaser, retest, before using, cement remaining in bulk storage for more than six months or cement in bags in local storage in the custody of a vendor for more than three months after completion of tests and reject the cement if it fails to conform to any of the requirements of this specification. Cement so rejected shall be the responsibility of the owner of record at the time of resampling for retest.

11.3 Packages shall identify the mass contained as net weight. At the option of the purchaser, packages more than 2 % below the mass marked thereon shall be rejected and if the average mass of packages in any shipment, as shown by determining the mass of 50 packages selected at random, is less than that marked on the packages, the entire shipment shall be rejected.

12. Manufacturer's Statement

12.1 At the request of the purchaser, the manufacturer shall state in writing the nature, amount, and identity of any air-entraining addition and of any processing addition used, and also, if requested, shall supply test data showing compliance of such air-entraining addition with Specification C226 and of such processing addition with Specification C465.

12.2 When limestone is used, the manufacturer shall state in writing the amount thereof and, if requested by the purchaser, shall supply comparative test data on chemical and physical properties of the cement with and without the limestone (see Note 7). The comparative tests do not supersede the normal testing to confirm that the cement meets chemical and physical requirements of this standard. The amount of limestone in cement shall be determined in accordance with Annex A2.

NOTE 7—Comparative test data may be from qualification tests performed by the manufacturer during formulation of the cement with limestone.

TABLE 3 Standard Physical Requirements

Cement Type[A]	Applicable Test Method	I	IA	II	IIA	II(MH)	II(MH)A	III	IIIA	IV	V
Air content of mortar,[B] volume %:	C185										
~~max~~		~~12~~	~~22~~	~~12~~	~~22~~	~~12~~	~~22~~	~~12~~	~~22~~	~~12~~	~~12~~
max		12	22	12	22	12	22	12	22	12	12
~~min~~		~~...~~	~~16~~	~~...~~	~~16~~	~~...~~	~~16~~	~~...~~	~~16~~	~~...~~	~~...~~
min		...	16	...	16	...	16	...	16	...	...
Fineness, specific surface, m^2/kg											
~~Air permeability test~~	~~C204~~										
Air permeability test	C204										
~~min~~		~~260~~	~~260~~	~~260~~	~~260~~	~~260~~	~~260~~	~~...~~	~~...~~	~~260~~	~~260~~
min		260	260	260	260	260	260	...	...	260	260
~~max~~		~~...~~	~~...~~	~~...~~	~~...~~	~~430[C]~~	~~430[C]~~	~~...~~	~~...~~	~~430~~	~~...~~
max		...	...	...	...	430[C]	430[C]	...	...	430	...
Autoclave expansion, max, %	C151	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
~~Strength, not less than the values shown for the ages indicated as follows:[D]~~											
Strength, not less than the values shown for the ages indicated as follows:[D]											
~~Compressive strength, MPa [psi]:~~	~~C109/ C109M~~										
Compressive strength, MPa [psi]:	C109/ C109M										
~~1 day~~		~~...~~	~~...~~	~~...~~	~~...~~	~~...~~	~~...~~	~~12.0 [1740]~~	~~10.0 [1450]~~	~~...~~	~~...~~
1 day		...	...	...	...	...	...	12.0 [1740]	10.0 [1450]	...	...
~~3 days~~		~~12.0 [1740]~~	~~10.0 [1450]~~	~~10.0 [1450]~~	~~8.0 [1160]~~	~~10.0 [1450] 7.0[E] [1020][E]~~	~~8.0 [1160] 6.0[E] [870][E]~~	~~24.0 [3480]~~	~~19.0 [2760]~~	~~...~~	~~8.0 [1160]~~
3 days		12.0 [1740]	10.0 [1450]	10.0 [1450]	8.0 [1160]	10.0 [1450] 7.0[E] [1020][E]	8.0 [1160] 6.0[E] [870][E]	24.0 [3480]	19.0 [2760]	...	8.0 [1160]
~~7 days~~		~~19.0 [2760]~~	~~16.0 [2320]~~	~~17.0 [2470]~~	~~14.0 [2030]~~	~~17.0 [2470] 12.0[E] [1740][E]~~	~~14.0 [2030] 9.0[E] [1310][E]~~	~~...~~	~~...~~	~~7.0 [1020]~~	~~15.0 [2180]~~
7 days		19.0 [2760]	16.0 [2320]	17.0 [2470]	14.0 [2030]	17.0 [2470] 12.0[E] [1740][E]	14.0 [2030] 9.0[E] [1310][E]	...	...	7.0 [1020]	15.0 [2180]
~~28 days~~		~~...~~	~~...~~	~~...~~	~~...~~	~~...~~	~~...~~	~~...~~	~~...~~	~~17.0 [2470]~~	~~21.0 [3050]~~
28 days		...	...	...	...	...	...	...	...	17.0 [2470]	21.0 3050]
Time of setting; Vicat test:[F]	C191										
~~Time of setting, min, not less than~~		~~45~~	~~45~~	~~45~~	~~45~~	~~45~~	~~45~~	~~45~~	~~45~~	~~45~~	~~45~~
Time of setting, minutes, not less than		45	45	45	45	45	45	45	45	45	45
~~Time of setting, min, not more than~~		~~375~~	~~375~~	~~375~~	~~375~~	~~375~~	~~375~~	~~375~~	~~375~~	~~375~~	~~375~~
Time of setting, minutes, not more than		375	375	375	375	375	375	375	375	375	375

[A] See Note 2.
[B] Compliance with the requirements of this specification does not necessarily ensure that the desired air content will be obtained in concrete.
[C] Maximum fineness limits do not apply if the sum of $C_3S + 4.75C_3A$ is less than or equal to 90.
[D] The strength at any specified test age shall be not less than that attained at any previous specified test age.
[E] When the optional heat of hydration in Table 4 is specified.

12.3 At the request of the purchaser, the manufacturer shall report the ~~total chloride content,~~ chloride content as determined using Test Methods C114, in percent by mass of the cement, in the manufacturer's report (see Note 8).

NOTE 8—Chlorides in concrete come from multiple ingredients and cement chloride content may be required ~~in the estimation of~~ to estimate concrete chloride content. Requirements for concrete chloride content are provided in building codes and other documents. ~~Total chloride content is higher than water-soluble chloride content, which is commonly referenced in codes.~~

[F] The time of setting is that described as initial setting time in Test Method C191.

TABLE 4 Optional Physical Requirements[A]

Cement Type	Applicable Test Method	I and II	IA and IIA	II(MH)	II(MH)A	III	IIIA	IV	V
False set, final penetration, min, %	C451	50	50	50	50	50	50	50	50
~~Heat of hydration[B] (alternative methods):~~									
Heat of hydration:									
Isothermal Conduction Calorimetry:									
~~3 days, max, kJ/kg [cal/g]~~	~~C1702~~	~~. . .~~	~~. . .~~	~~255 [60][C]~~	~~255 [60][C]~~	~~. . .~~	~~. . .~~	~~200 [50][D]~~	~~. . .~~
3 days, max, kJ/kg [cal/g]	C1702	. . .	. . .	255 [60][B]	255 [60][B]	. . .	. . .	200 [50][C]	. . .
~~7 days, max, kJ/kg [cal/g]~~		~~. . .~~	~~. . .~~	~~. . .~~	~~. . .~~	~~. . .~~	~~. . .~~	~~225 [55][D]~~	~~. . .~~
7 days, max, kJ/kg [cal/g]		. . .	. . .	. . .	. . .	. . .	. . .	225 [55][C]	. . .
~~Heat of solution:~~									
~~7 days, max, kJ/kg [cal/g]~~	~~C186~~	~~. . .~~	~~. . .~~	~~290 [70][C]~~	~~290 [70][C]~~	~~. . .~~	~~. . .~~	~~250 [60][D]~~	~~. . .~~
~~28 days, max, kJ/kg [cal/g]~~		~~. . .~~	~~. . .~~	~~. . .~~	~~. . .~~	~~. . .~~	~~. . .~~	~~290 [70][D]~~	~~. . .~~
Strength, not less than the values shown:									
Compressive strength, MPa [psi]	C109/C109M								
~~28 days~~		~~28.0 [4060]~~	~~22.0 [3190]~~	~~28.0 [4060]~~ ~~22.0[C] [3190][C]~~	~~22.0 [3190]~~ ~~18.0[C] [2610][C]~~	~~. . .~~	~~. . .~~	~~. . .~~	~~. . .~~
28 days		28.0 [4060]	22.0 [3190]	28.0 [4060] 22.0[B] [3190][B]	22.0 [3190] 18.0[B] [2610][B]	. . .	. . .	. . .	. . .
~~Sulfate resistance,[E] 14 days, max, % expansion~~	~~C452~~	~~. . .[F]~~	~~. . .[F]~~	~~. . .[F]~~	~~. . .[F]~~	~~. . .~~	~~. . .~~	~~. . .~~	~~0.040~~
Sulfate resistance,[D] 14 days, max, % expansion	C452	. . .[E]	. . .[E]	. . .[E]	. . .[E]	. . .	. . .	. . .	0.040
Gillmore test:	C266								
Initial set, min, not less than		60	60	60	60	60	60	60	60
Final set, min, not more than		600	600	600	600	600	600	600	600
Turbidimeter test	C115								
min		150	150	150	150	. . .	. . .	150	150
~~max~~		~~. . .~~	~~. . .~~	~~245[G]~~	~~245[G]~~	~~. . .~~	~~. . .~~	~~245~~	~~. . .~~
max		. . .	. . .	245[F]	245[F]	. . .	. . .	245	. . .

[A] These optional requirements apply only when specifically requested. Verify availability before ordering. See Note 2.

~~[B] The method used shall be identified on all test reports that include this data. If test results do not meet requirements of the heat of solution method, the isothermal conduction calorimetry method shall be used, and the requirements for the isothermal conduction calorimetry method shall govern.~~

[B] The limit for the sum of $C_3S + 4.75C_3A$ in Table 1 shall not apply when this optional limit is requested. These strength requirements apply when the optional heat of hydration requirement is requested.

[C] When the heat of hydration limit is specified, it shall be instead of the limits of C_3S, C_2S, C_3A, and Fe_2O_3 listed in Table 1.

[D] When the sulfate resistance is specified, it shall be instead of the limits of C_3A, $C_4AF + 2\ C_3A$, and Fe_2O_3 listed in Table 1.

[E] Cement meeting the high sulfate resistance limit for Type V is deemed to meet the moderate sulfate resistance requirement of Type II and Type II(MH).

[F] Maximum fineness limits do not apply if the sum of $C_3S + 4.75\ C_3A$ is less than or equal to 90.

13. Packaging and Package Marking

13.1 When the cement is delivered in packages, the words “Portland Cement,” the type of cement, the name and brand of the manufacturer, and the mass of the cement contained therein shall be plainly marked on each package. When the cement is an air-entraining type, the words “air-entraining” shall be plainly marked on each package. Similar information shall be provided in the shipping documents accompanying the shipment of packaged or bulk cement. All packages shall be in good condition at the time of inspection.

NOTE 9—With the change to SI units, it is desirable to establish a standard SI package for portland cements. To that end 42 kg [92.6 lb] provides a convenient, even-numbered mass reasonably similar to the traditional 94-lb [42.6-kg] package.

14. Storage

14.1 The cement shall be stored in such a manner as to permit easy access for proper inspection and identification of each shipment, and in a suitable weather-tight building that will protect the cement from dampness and minimize warehouse set.