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Standard Test Method for Water-Soluble Chloride in Mortar and Concrete[1]

This standard is issued under the fixed designation C1218/C1218M; 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~~ Scope*

1.1 This test method provides procedures for the sampling and analysis of hydraulic-cement mortar or concrete for chloride that is water soluble under the conditions of test.

1.2 The text of this standard references notes and footnotes that provide explanatory information. These notes and footnotes shall not be considered as requirements of this standard.

1.3 The values stated in either SI units or inch-pound units are to be regarded separately as a standard. Within the text, the inch-pound units are shown in brackets. The values stated in each system are not exact equivalents; therefore, each system shall be used independently of the other.

1.4 *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]

C42/C42M Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
C114 Test Methods for Chemical Analysis of Hydraulic Cement
C670 Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials
C823 Practice for Examination and Sampling of Hardened Concrete in Constructions
C1084 Test Method for Portland-Cement Content of Hardened Hydraulic-Cement Concrete
D1193 Specification for Reagent Water
E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves
E832 Specification for Laboratory Filter Papers

3. Significance and Use

3.1 Water-soluble chloride, when present in sufficient amount, is capable of leading to initiation or acceleration of the corrosion of metals, such as steel, embedded in or contacting a cement system such as mortar, grout, or concrete. Thus, its determination shall be required to evaluate the potential of a cement system for undergoing such reactions or to investigate cement systems where such reaction has already occurred. However, it must be recognized that water-soluble chloride determined at some particular time in the life of a cement system is capable of being substantially different than that at another time; for example, the service environment is capable of resulting in a higher water-soluble chloride content due to changes in solubility or a lower one due to leaching.

3.1.1 Test conditions are capable of affecting water-soluble chloride determinations. Take caution when comparing results from this test method with those from other test methods.

3.2 Sulfides are known to interfere with the determination of chloride content. Blast-furnace slag aggregates and cements contain sulfide sulfur in concentrations that are capable of such interference and produce erroneously high test results. Treatment with hydrogen peroxide, as discussed in Test Methods C114, is used to eliminate such interference.

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[1] This test method is under the jurisdiction of ASTM Committee C09 on Concrete and Concrete Aggregatesand is the direct responsibility of Subcommittee C09.69 on Miscellaneous Tests.

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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**

3.3 There are aggregates that contain chloride that is not available for corrosion. Such chloride will be detected by use of this test method.[3]

4. Apparatus

4.1 *Sampling Equipment:*

4.1.1 The apparatus required for obtaining samples by coring or sawing is described in Test Method C42/C42M.

4.1.2 Use the following apparatus for sampling by drilling (pulverization):

4.1.2.1 Rotary impact drill ~~and~~or drill ~~or~~with pulverizing bits.

4.1.2.2 Spoon or other suitable means to collect without contamination pulverized sample material produced by drilling.

4.1.2.3 Sample containers capable of maintaining samples in an uncontaminated state.

4.2 *Sample Processing Apparatus*—The apparatus required for processing samples shall be chosen for its suitability for the purposes of the investigation, and frequently includes a concrete saw and one or more pulverizers.

4.2.1 Samples more than 25 mm [1 in.] in maximum dimension shall be reduced in size by use of a jaw crusher or broken into smaller pieces by hammering carefully to avoid loss of smaller pieces.

4.2.2 Crush particles less than 25 mm [1 in.] in maximum dimension using a rotating-puck grinding apparatus, or by using a disc pulverizer, or mortar and pestle operated to restrict to negligible levels the loss of fine particles.

4.2.3 The 850-µm [No. 20] sieve shall comply with Specification E11.

4.3 The apparatus required for the chloride determination step is given as the reference test method for chloride in Test Methods C114.

4.4 Glazed paper to minimize adherence of fine particles for use as described in 7.1.

5. Reagents

5.1 The reagents required for the chloride determination are given in the reference test method for chloride of Test Methods C114.

6. Sampling

6.1 Select the sample as required for the purpose of the investigation (Note 1).

NOTE 1—Because of the small nominal maximum size of the aggregate in a mortar, pieces of mortar having a mass of at least 10 g will be more representative of a much larger volume of mortar than would an equivalently sized sample of concrete. Practice C823 may be used as a guide for sampling.

6.1.1 Take concrete cores in accordance with Test Method C42/C42M unless otherwise specified (Note 2):

NOTE 2—Concrete cores taken in accordance with Test Method C42/C42M may be cut longitudinally to provide a 12-mm [½-in.] thick section generally representative of the core, or cut laterally into 12-mm [½-in.] thick discs representative of the concrete core at various depths. Experience has shown that the cooling water from core cutting will not dissolve a significant amount of the chloride.

6.1.2 Powdered concrete obtained by use of a rotary impact drill is frequently useful in determining chloride concentration with depth in bridge decks and pavements. When the nominal maximum coarse aggregate size is 25 mm [1 in.] or more such samples are unrepresentative. The data must be used with care or several samples combined. Procedures for this method of sampling are as follows:

6.1.2.1 Using the rotary impact drill, drill perpendicular to the concrete surface or parallel to the axis of a cored specimen to a specified depth or a depth sufficient to obtain a representative sample of at least 20 g of powdered material. To prevent sample contamination, avoid contact of sample with hands and other sources of perspiration. Clean all sampling tools prior to each sampling operation (Note 3). Do not use lubricants during drilling.

NOTE 3—Sampling tools may be cleaned with a brush, cloth, ethyl alcohol rinse, water rinse, or other method that will not contaminate the sample.

6.1.2.2 Transfer powdered sample into the sample container using a spoon or other suitable means.

7. Sample Preparation

7.1 Pulverize the sample so that all the material will pass a 850-µm [No. 20] sieve. Thoroughly blend the material by transferring it from one glazed paper to another at least ten times.

8. Procedure

8.1 Select a sample having a mass of approximately 10 g. Weigh the sample to the nearest 0.01 g and place it into a 250-mL beaker. Add 50 ± 1 mL of reagent water meeting Specification D1193, cover with a watch glass, bring to a boil and boil for 5 min. Allow to stand 24 h. Filter by gravity or suction through a fine-texture, Type II, Class G filter paper of Specification E832.

[3] For more information see "The Determination of the Chloride Content of Concrete," by Brian B. Hope, John A. Page and John S. Poland, *Cement and Concrete Research*, Volume 15, Number 5, Pergamon Press, New York, September 1985, pp. 863–870.