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Standard Test Method for Water-Soluble Chloride in Mortar and Concrete¹

This standard is issued under the fixed designation C 1218/C 1218M; 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 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~~

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.

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2. Referenced Documents

2.1 *ASTM Standards:*²

C42 42/C 42M Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

C 114 Test Methods for Chemical Analysis of Hydraulic Cement

C 670 Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials

C 823 Practice for Examination and Sampling of Hardened Concrete in Constructions

C 1084 Test Method for Portland-Cement Content of Hardened Hydraulic-Cement Concrete

D 1193 Specification for Reagent Water

E 11 ~~Specification for Wire-Cloth Sieves for Testing Purposes²~~ Specification for Wire Cloth and Sieves for Testing Purposes

E 832 Specification for Laboratory Filter Papers

3. Significance and Use

3.1 Water-soluble chloride, when present in sufficient amount, ~~may lead~~ 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 ~~may 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 ~~may be~~ is capable of being substantially different than that at another time; for example, the service environment ~~may result~~ 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 Water-soluble chloride determinations may be significantly affected by test conditions. Care should be taken~~ 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 ~~can cause~~ are capable of such interference and produce erroneously high test results.

¹ This test method is under the jurisdiction of ASTM Committee ~~C-9C09~~ on Concrete and Concrete Aggregates and 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*, Vol 04.02, volume information, refer to the standard's Document Summary page on the ASTM website.

Treatment with hydrogen peroxide, as discussed in Test Methods C 114, is used to eliminate such interference.

~~3.3 Users of this test method should be aware that there are aggregates that contain chloride that may not be available for corrosion. Such chloride will be detected by use of this test method.~~

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4. Apparatus

4.1 Sampling Equipment:

4.1.1 The apparatus required for obtaining samples by coring or sawing is described in Test Method C 42/C 42M.

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

4.1.2.1 Rotary impact drill and drill or 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- μ m [No. 20] sieve shall comply with Specification E 11.

4.3 The apparatus required for the chloride determination step is given as the reference test method for chloride in Test Methods C 114.

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 C 114.

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 C 823 may be used as a guide for sampling.

6.1.1 Take concrete cores in accordance with Test Method C 42/C 42M unless otherwise specified (Note 2):

NOTE 2—Concrete cores taken in accordance with Test Method C 42/C 42M may be cut longitudinally to provide a 12-mm [$\frac{1}{2}$ -in.] thick section generally representative of the core, or cut laterally into 12-mm [$\frac{1}{2}$ -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. ~~Such samples may be unrepresentative, especially when~~ When the nominal maximum coarse aggregate size is 25 mm [1 in.] or more, several more such samples should be combined, or the data 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- μ m [No. 20] sieve. Thoroughly blend the material by transferring it from one glazed paper to another at least ~~10~~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

³ Annual Book of ASTM Standards, Vol 04.01.

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.