



Standard Test Method for Water-Extractable Chloride in Aggregate (Soxhlet Method)¹

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1. Scope

1.1 This test method provides procedures for sampling and analysis of aggregate for water-extractable chloride using a Soxhlet extractor.

NOTE 1—This test method is to be used when significantly high chloride content has been found in aggregates, concretes, or mortars.

1.2 The values stated in SI units are to be regarded as standard.

1.3 *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:

C 114 Test Methods for Chemical Analysis of Hydraulic Cement²

C 670 Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials³

C 1152/C 1152M Test Method for Acid-Soluble Chloride in Mortar and Concrete³

C 1218/C 1218M Test Method for Water-Soluble Chloride in Mortar and Concrete³

D 75 Practice for Sampling Aggregates⁴

D 1193 Specification for Reagent Water⁵

E 11 Specification for Wire Cloth and Sieves for Testing Purposes⁶

2.2 American Concrete Institute Standard:

ACI 222.1–96 Provisional Standard Test Method for Water-

Soluble Chloride Available for Corrosion of Embedded Steel in Mortar and Concrete Using the Soxhlet Extractor⁷

3. Significance and Use

3.1 Water-extractable chloride, when present in sufficient amount, has a potential to initiate or accelerate corrosion of metals, such as steel, embedded in or contacting a cementitious system, such as mortar, grout, or concrete. This test method is applicable when aggregates contain a high background of naturally occurring chloride (see ACI 222.1–96). Test Method C 1152/C 1152M determines acid-soluble chloride and Test Method C 1218/C 1218M determines water-soluble chloride. Both Test Methods C 1152/C 1152M and C 1218/C 1218M pulverize the sample to a fine powder or fine granular material. The Soxhlet method is intended to use nonpulverized material. Results with some aggregates have shown that the Soxhlet procedure extracts an extremely low amount of chloride, with most of it remaining in the rock, and therefore, it is not available for corrosion.

3.2 The Soxhlet extraction apparatus consists of three sections: the boiling flask, which contains reagent water at the beginning of the test; the extractor, which contains the sample inside a thimble; and, the condenser. The extractor functions by boiling the water, which condenses and drips on to the sample. When the water attains a fixed height above the sample, the extractor siphons the water from the thimble back to the boiling flask. The process repeats itself until the test is terminated. (Refer to Fig. 1.)

4. Apparatus

4.1 Sampling Equipment:

4.1.1 The apparatus required for obtaining aggregate samples is described in Practice D 75.

4.2 *Sampling Processing Apparatus*, the same as in Test Method C 1218/C 1218M without pulverization.

4.3 *Soxhlet Extractor Apparatus*, shall have the following minimum size and consist of the following (see Fig. 1).

4.3.1 *Reflux-Type Condenser*, with a 34/45-mm ground-glass fitting to the extractor, and having a 27-mm inside diameter by a 192-mm body length.

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

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² *Annual Book of ASTM Standards*, Vol 04.01.

³ *Annual Book of ASTM Standards*, Vol 04.02.

⁴ *Annual Book of ASTM Standards*, Vol 04.03.

⁵ *Annual Book of ASTM Standards*, Vol 11.01.

⁶ *Annual Book of ASTM Standards*, Vol 14.02.

⁷ Available from American Concrete Institute (ACI), P.O. Box 9094, Farmington Hills, MI 48333.