INTERNATIONAL

Designation: C1202 – 22$^{\varepsilon 1}$

Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration[1]

This standard is issued under the fixed designation C1202; 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.

ε^1 NOTE—Equation 2's legend was editorially corrected in June 2022.

1. Scope*

1.1 This test method covers the determination of the electrical conductance of concrete to provide a rapid indication of its resistance to the penetration of chloride ions. This test method is applicable to types of concrete where correlations have been established between this test procedure and long-term chloride ponding procedures such as those described in AASHTO T 259. Examples of such correlations are discussed in Refs (**1-5**).[2]

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

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 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *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:*[3]

C31/C31M Practice for Making and Curing Concrete Test Specimens in the Field

C42/C42M Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

C192/C192M Practice for Making and Curing Concrete Test Specimens in the Laboratory

C670 Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials

C802 Practice for Conducting an Interlaboratory Test Program to Determine the Precision of Test Methods for Construction Materials

C1542/C1542M Test Method for Measuring Length of Concrete Cores

2.2 *AASHTO Standard:*

T 259 Method of Test for Resistance of Concrete to Chloride Ion Penetration[4]

3. Summary of Test Method

3.1 This test method consists of monitoring the amount of electrical current passed through 50 mm thick slices of 100 mm nominal diameter cores or cylinders during a 6 h period. A potential difference of 60 V dc is maintained across the ends of the specimen, one of which is immersed in a sodium chloride solution, the other in a sodium hydroxide solution. The total charge passed, in coulombs, has been found to be related to the resistance of the specimen to chloride ion penetration.

[1] This test method is under the jurisdiction of ASTM Committee C09 on Concrete and Concrete Aggregates and is the direct responsibility of Subcommittee C09.66 on Concrete's Resistance to Fluid Penetration.

Current edition approved April 1, 2022. Published May 2022. Originally approved in 1991. Last previous edition approved in 2019 as C1202 – 19. DOI: 10.1520/C1202-22E01.

[2] The boldface numbers in parentheses refer to a list of references at the end of this standard.

[3] 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.

[4] *Methods of Sampling and Testing*, 1986, available from American Association of State Highway and Transportation Officials (AASHTO), 444 N. Capitol St., NW, Suite 249, Washington, DC 20001, http://www.transportation.org.

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

4. Significance and Use

4.1 This test method covers the laboratory evaluation of the electrical conductance of concrete samples to provide a rapid indication of their resistance to chloride ion penetration. In most cases the electrical conductance results have shown good correlation with chloride ponding tests, such as AASHTO T259, on companion slabs cast from the same concrete mixtures (Refs **1-5**).

4.2 This test method is suitable for evaluation of materials and material proportions for design purposes and research and development.

4.3 Sample age has significant effects on the test results, depending on the type of concrete and the curing procedure. Most concretes, if properly cured, become progressively and significantly less permeable with time.

4.4 This test method was developed originally for evaluations of alternative materials, but in practice its use has evolved to applications such as quality control and acceptance testing. Factors such as ingredient materials used in concrete mixtures and the method and duration of curing test specimens affect the results of this test (see Note 1). When this method is used for mixture qualification and acceptance testing, it is imperative that the curing procedures and the age at time of testing be clearly specified.

NOTE 1—When using this test for determining acceptability of concrete mixtures, statistically-based criteria and test age for prequalification, or for acceptance based on jobsite samples, should be stated in project specifications. Acceptance criteria for this test should consider the sources of variability affecting the results and ensure balanced risk between supplier and purchaser. The anticipated exposure conditions and time before a structure will be put into service should be considered. One approach to establishing criteria is discussed in Ref (**6**).

4.5 Table X1.1 in Appendix X1 provides a qualitative relationship between the results of this test and the chloride ion penetrability of concrete.

4.6 Care should be taken in interpreting results of this test when it is used on surface-treated concretes, for example, concretes treated with penetrating sealers. The results from this test on some such concretes indicate low resistance to chloride ion penetration, while 90 day chloride ponding tests on companion slabs show a higher resistance.

4.7 The details of the test method apply to 100 mm nominal diameter specimens. This includes specimens with actual diameters ranging from 95 mm to 100 mm. Other specimen diameters may be tested with appropriate changes in the applied voltage cell design (see 7.5 and Fig. 1).

4.7.1 For specimen diameters other than 95 mm, the test result value for total charge passed must be adjusted following the procedure in 11.2. For specimens with diameters less than 95 mm, particular care must be taken in coating and mounting the specimens to ensure that the conductive solutions are able to contact the entire end areas during the test.

5. Interferences

5.1 This test method can produce misleading results when calcium nitrite has been admixed into a concrete. The results from this test on some such concretes indicate higher coulomb values, that is, lower resistance to chloride ion penetration, than from tests on identical concrete mixtures (controls) without calcium nitrite. However, long-term chloride ponding tests indicate the concretes with calcium nitrite were at least as resistant to chloride ion penetration as the control mixtures.

NOTE 2—Other admixtures might affect results of this test similarly. Long term ponding tests are recommended if an admixture effect is suspected.

5.2 Since the test results are a function of the electrical resistance of the specimen, the presence of reinforcing steel or other embedded electrically conductive materials may have a significant effect. The test is not valid for specimens containing reinforcing steel positioned longitudinally, that is, providing a continuous electrical path between the two ends of the specimen.

6. Apparatus

6.1 *Vacuum Saturation Apparatus* (see Fig. 2 for example):

6.1.1 *Separatory Funnel,* or other sealable, bottom-draining container with a minimum capacity of 500 mL.

6.1.2 *Beaker (1000 mL or larger) or other container*—Capable of holding concrete specimen(s) and water and of fitting into vacuum desiccator (see 6.1.3).

6.1.3 *Vacuum Desiccator*—The volume of desiccator shall be large enough to maintain sample immersion throughout the saturation process. Desiccator must allow two hose connections through a rubber stopper and sleeve or through a rubber stopper only. Each connection must be equipped with a stopcock.

6.1.4 *Vacuum Pump or Aspirator*—Capable of maintaining an absolute pressure of less than 50 mm Hg (6650 Pa) in desiccator (see Note 4).

NOTE 3—Because vacuum will be drawn over water, a vacuum pump should be protected with a water trap, or pump oil should be changed after each operation.

NOTE 4—Absolute pressure is zero-referenced against a perfect vacuum. At sea level, atmospheric pressure is an absolute pressure of 760 mm Hg. Gauge pressure is zero-referenced against atmospheric air pressure, so it is equal to the absolute pressure minus atmospheric pressure. An absolute pressure of 50 mm Hg will correspond to a gauge pressure of -710 mm at sea level. Some gauges may display this value as +710 mm.

6.1.5 *Vacuum Gage or Manometer*—Accurate to the nearest ±5 mm Hg (±665 Pa) over the entire of measured pressure.

6.2 *Coating Apparatus and Materials:*

6.2.1 *Coating*—Rapid setting, electrically nonconductive, capable of sealing side surface of concrete cores.

6.2.2 *Balance or Scale, Paper Cups, Wooden Spatulas, and Disposable Brushes*—For mixing and applying coating.

6.3 *Specimen Sizing Equipment* (not required if samples are cast to final specimen size).

6.3.1 *Movable Bed Water-Cooled Diamond Saw or Silicon Carbide Saw.*

6.4 *Jaw caliper*—meeting the requirements of Test Method C1542/C1542M.

7. Reagents, Materials, and Test Cell

7.1 *Specimen-Cell Sealant*—Capable of sealing concrete to poly (methyl methacrylate), for example, Plexiglas, against