Designation: C 1262 – 98ε1

Standard Test Method for Evaluating the Freeze-Thaw Durability of Manufactured Concrete Masonry Units and Related Concrete Units[1]

This standard is issued under the fixed designation C 1262; 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—A temperature conversion error was corrected in Paragraph 8.2.1 editorially in April 2002.

1. Scope *

1.1 This test method covers the resistance to freezing and thawing manufactured concrete masonry and related concrete units. Units are tested either in water or in a saline solution depending on the intended use of the units in actual service.

NOTE 1—Concrete masonry and related concrete units include units such as hollow and solid concrete masonry units, concrete brick, segmental retaining wall units, concrete pavers, and concrete roof pavers.

1.2 *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 140 Test Methods of Sampling and Testing Concrete Masonry Units[2]

C 1093 Practice for the Accreditation of Testing Agencies for Unit Masonry[2]

C 1209 Terminology of Concrete Masonry Units and Related Units[2]

3. Terminology

3.1 Terminology defined in Terminology C 1209 shall apply for this test method.

4. Significance and Use

4.1 The procedure described in this test method is intended to determine the effects of freezing and thawing on concrete units in the presence of water or saline solution.

4.2 The procedure is not intended to provide a quantitative measure of the length of service that may be expected from a specific type of concrete unit.

NOTE 2—The testing laboratory performing this test method should be evaluated in accordance with Practice C 1093.

NOTE 3—Compressive strength and absorption tests should be performed on different but representative specimens. While compressive strength and absorption values by themselves have been shown by research to not be reliable indicators of durability, they have been shown to be good reference values for units manufactured from a given set of materials.

5. Apparatus

5.1 *Freezing-and-Thawing Apparatus*:

5.1.1 In the event that a chamber or chambers are used to subject the specimens to the specified freezing or thawing cycles, or both, the chamber or chambers shall be capable of maintaining the air temperature throughout the chamber within the specified test ranges when measured at any given time. If the apparatus operates automatically, it must be able to provide reproducible cycles within the specified temperature requirements.

5.1.2 The apparatus includes a non-rigid plastic container for each test specimen and test specimen supports as illustrated in Fig. 1. The containers shall be of sufficient size to provide a minimum of ⅛ in. (3 mm) and a maximum of 1½ in. (38 mm) water surrounding the specimen. Test specimen supports to hold the specimen above the container bottom shall be two ⅛ ± 1/24 in. (3 ± 1 mm) rods of a solid noncorrosive, nonabsorptive material (brass, plastic, etc.). The container shall be flat enough that when the specimen coupon is set on the support rods the specimen shall not deviate from level by more than 1/16 in. (2 mm) from one end of the specimen to the opposite end.

5.2 *Temperature-Measuring Equipment*—Thermometers, resistance thermometers, or thermocouples, capable of measuring the temperature at various points within the test chamber to within 2°F (1°C).

5.3 *Scales*—Scales for weighing full-size specimens shall have a capacity of at least 50 % greater than the weight of the largest specimen tested and shall be accurate to at least 1 g (0.002 lb). Scales for weighing the filter paper and specimen

[1] This test method is under the jurisdiction of ASTM Committee C15 on Manufactured Masonry Units and is the direct responsibility of Subcommittee C15.03 on Concrete Masonry Units and Related Units.

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[2] *Annual Book of ASTM Standards,* Vol 04.05.

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

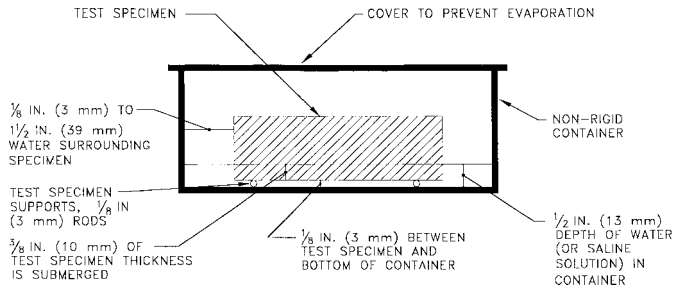

FIG. 1 Test Specimen in Freezing–and–Thawing Container

residue (spall), as required in 8.2.3, shall be accurate to at least 0.2 g (0.0005 lb).

6. Sampling

6.1 *Selection of Test Specimens*—Select whole units representative of the lot from which they are selected. The units shall be free from visible cracks or structural defects.

6.2 *Number of Specimens*—Select five units for freezing and thawing tests. If compression and absorption tests are to be performed on the same set of units in accordance with Test Methods C 140, select additional units as required. Specimens (coupons) used for Test Methods C 140 tests shall not be used as specimens for freezing–and–thawing tests.

6.3 *Identification*—Mark each freezing–and–thawing specimen so that it is identifiable at any time.

7. Preparation of Test Specimens

7.1 *Freezing–and–Thawing Test Specimens*—Test specimens shall consist of solid coupons saw-cut from full sized units. Do not saw-cut test specimens from units that have been previously oven-dried. Do not subject test specimens to oven-drying prior to completion of freezing–and–thawing testing.

7.1.1 One coupon shall be cut from each of the five sampled units. Using a water-cooled saw, cut the coupon from the exposed surface of the unit as the unit is used in service unless the exposed surface is a split, fluted (ribbed), or other nonplanar surface. In the case of a unit with an exposed nonplanar surface, cut the coupon from another flat molded surface. Immediately following saw-cutting, remove loose particles and residue from the coupon by rinsing in tap water and brushing with a soft bristle brush. Do not fully immerse coupons in water.

7.1.2 Place the coupons on edge on a ⅜ in. (10 mm) or coarser mesh such that there is an air space of not less than 1 in. (25 mm) between coupons. Allow the coupons to dry for not less than 48 h in laboratory air at a temperature of 75 ± 15°F (24 ± 8°C) and a relative humidity of less than 80 %.

7.1.3 The thickness of each coupon shall be 1¼ in. (32 mm) ± 1/16 in. (2 mm), unless the unit does not permit this minimum thickness, in which case the thickness shall be the maximum thickness that can be obtained from the unit. The thickness of the coupon shall not be less than ¾ in. (19 mm).

7.1.4 The area of the submerged surface of the test specimen shall be at least 25 in.^{2} (161 cm^2) and shall not exceed 35 in.^{2} (225 cm^2), unless the unit does not permit a coupon meeting the minimum area, in which case the test specimen shall consist of two coupons. The combined area of the two coupons shall be at least 25 in.^{2} (161 cm^2) and shall not exceed 35 in.^{2} (225 cm^2). These two coupons shall be tested as and considered to be a single specimen.

8. Procedure

8.1 *Specimen Conditioning*:

8.1.1 After preparation of the freezing–and–thawing test specimens in accordance with Section 7, place the specimen in the container face down on the specimen supports such that the non-saw-cut surface of the specimen is in contact with the specimen supports. Add a sufficient amount of water at a temperature of 60 to 80°F (16 to 27°C) to the container to achieve a water depth of ½± 1/16 in. (13 ± 2 mm). Do not pour water directly onto the specimen. For test specimens being evaluated for freezing–and–thawing durability in saline solutions, use a 3 ± 0.1 % (by weight) sodium chloride saline solution in lieu of water in the container. Seal the container and store on a level surface in laboratory air as defined in 7.1.2.

NOTE 4—The submerged portion of the specimen is ⅜ in. (10 mm) of its thickness. There is ⅛ in. (3 mm) of water between the bottom of the container and the face of the specimen.

8.1.2 After 1 h, open the container and add water as necessary to maintain the water level required in 8.1.1. Reseal the container. After another 23 h, remove the specimen from the water and allow to drain for 1 min by placing it on a ⅜-in. (10-mm) or coarser sieve, removing visible surface water with a damp cloth. Immediately weigh the specimen to the nearest 1 g (0.002 lb) and record as W_p.

NOTE 5—The weight W_p as determined in 8.1.2 is not required to be reported at the conclusion of the test, nor is it used to calculate the reported weight loss of the specimen throughout the test. However, because the initial dry-weight of the specimen is not determined until the completion of freezing–and–thawing testing by adding the dry-weight of the collected residue to the dry-weight of the remains of the specimen (see 8.3.5), this W_p weight is needed as a reference weight to be used during the testing to estimate percentage weight loss and to predict relative performance between test specimens.

8.1.3 Return the specimens to the container and adjust water level as required in 8.1.1.

8.1.4 Water added to the containers shall be at a temperature of 60 to 80°F (16 to 27°C).

8.2 *Cyclical Testing*:

8.2.1 Begin the test with a freezing cycle. Place the containers into the freezing test chamber such that each container is surrounded by a minimum air space of ½ in. (13 mm) on all sides. During testing the container shall be level within 1/16 in. (2 mm). During the freezing cycle, maintain the air temperature in the chamber at 0 ± 10°F (-18 ± 5°C) for a period of not less than 4.0 h and not more than 5.0 h. The cycle time does not include the time required for the air temperature in the chamber to reach the prescribed temperature. Periodically, at the end of a freezing cycle, open the containers and visually inspect the specimens to determine if all the water surrounding the specimen is frozen solid. If not, extend the length of the freezing cycle to ensure that all water is frozen solid.

NOTE 6—Temperature probes should be used to monitor the air temperature throughout the chamber. If warm units are placed into a freezing chamber, the air temperature within the chamber rises. The start of the freezing cycle time period begins only after the temperature of the

air within the chamber is within the permissible range. Typically, constant temperature monitoring is not necessary, but it should be preformed through the first several cycles to ensure that the specimens remain in the freezing chamber for the appropriate length of time to comply with the cycle requirements. The same procedures should also be used to verify compliance with thawing cycle requirements in 8.2.6.

8.2.2 After the freezing cycle, immediately begin the thawing cycle. During the thawing cycle, maintain the air temperature around the containers at 75 ± 10°F (24 ± 5°C) for a period of not less than 2.5 h and not more than 96 h. The cycle time does not include the time required for the air temperature around the specimens to reach the prescribed temperatures. Each container shall be surrounded by a minimum air space of ½ in. on all sides. If the air surrounding the containers is not continuously circulated during the thawing cycle, the containers shall be laid out in a single layer without stacking in the vertical direction. Periodically, at the end of a thawing cycle, open the containers and visually inspect the specimens to determine if no ice remains. If ice is still present, extend the length of the thawing cycle to ensure that all ice has thawed.

8.2.3 One freezing–and–thawing cycle is defined as a completed freezing cycle followed by a completed thawing cycle.

8.2.4 At 25 ± 5 cycle intervals, remove containers from the test chamber. Open containers to visually inspect the condition of the specimens and to adjust the water level to comply with 8.1.1.

8.2.5 Every time a container is replaced into a multi-level freezing test chamber, the container shall be placed on the level immediately above the level on which it was previously located. If the container was previously located on the top level of a multi-level freezing chamber, replace it onto the bottom level.

8.2.6 If the test method is being used to document compliance of a set of specimens with specific freezing–and–thawing durability criteria, repeat the freezing–and–thawing cycle to reach the specified number of cycles. After the specified number of cycles have been completed, collect residue in accordance with 8.3.

8.2.7 Collection of residue at more frequent intervals is permitted.

8.3 *Collection of Residue*:

8.3.1 Weigh to the nearest 0.2 g (0.0005 lb) and record as W_f a filter paper of high wet strength and smooth surface that has come to equilibrium temperature with the lab environment. Remove a single specimen from its container. Immediately rinse the specimen with water (if the specimen is tested in saline solution, use saline solution to rinse the specimen) using a squeeze bottle, being careful to collect in the specimen container the rinse water and all loose particles from the specimen. Consider any pieces that separated from the specimen as part of the residue. Pour the water (or saline solution) from the specimen container through the filter paper to collect the residue (spall) from the test specimen. Replace the specimen in the container. Using fingertips and a squeeze bottle, remove loose particles from all surfaces of the specimen, again being careful to collect all rinse water and loose particles in the specimen container. The top surface of the specimen shall not be immersed in water at anytime and the collected rinse water shall not exceed a depth of ½ in. (13 mm) in the container. Remove the specimen from the container, pour the rinse water through the filter paper, and rinse the specimen container until all residue (spall) in the specimen container is collected on the filter paper. Rinse the residue from specimens tested in saline solution three times with water to remove any soluble salt.

NOTE 7—The filtering may be expedited by using filter paper rated at a faster speed or vacuum filtration, or both. This is acceptable as long as the water that passes through the filter paper (filtrate) is clear to the naked eye. If it is cloudy, then filter papers of increasingly slower speeds should be used until the filtrate is clear.

8.3.2 If testing is to be continued, return the specimen to the container positioned on its supports. Check that the specimen container still meets the flatness requirement of 5.1.2. If it fails to meet the flatness requirement, use a different container. Add fresh water (or saline solution) to the container in accordance with 8.3.1, and seal the container.

8.3.3 Repeat the procedures described in 8.3.1 and 8.3.2 with each remaining specimen.

8.3.4 Dry all the filter paper and residue (spall) collected from each specimen at 212 to 239°F (100 to 115°C) for not less than 4 h and until two successive weighings at intervals of 2 h show an increment of loss not greater than 0.2 % of the last previously determined weight. Place the filter paper and residue in a draft-free location within the laboratory for a period of 2 h to allow the filter paper and residue to come to equilibrium temperature with the laboratory environment. Weigh the filter paper and residue to the nearest 0.2 g (0.0005 lb) and record as W_{f+r}. Calculate the residue weight, W_r, as follows:

$$W_r = W_{f+r} - W_f \quad (1)$$

where:

W_r = weight of residue (spall), g (lb),
W_{f+r} = weight of the dried residue and filter paper, g (lb), and
W_f = initial weight of the filter paper, g (lb).

8.3.5 At the completion of the freezing–and–thawing testing, dry each specimen at 212 to 239°F (100 to 115°C) for 24 ± 1 h. Weigh to the nearest 1 g (0.002 lb) the final oven-dried specimen and record as W_{final}. Calculate the initial weight of the specimen, $W_{initial}$, as follows:

$$W_{initial} = W_{final} + W_{residue} \quad (2)$$

where:

$W_{initial}$ = calculated initial weight of the specimen, g (lb),
W_{final} = final weight of the specimen, g (lb), and
$W_{residue}$ = total accumulated residue weight (equal to the sum of the residue weight, W_r, from each evaluation period, g (lb).

9. Calculation and Report

9.1 Determine and report the cumulative weight loss of each residue collection interval expressed in terms of g (lb) and as a percent of the calculated initial weight of the specimen, $W_{initial}$, determined in accordance with 8.3.5. Where the coupon thickness is less than 1.25 in. (32 mm), the percentage and cumulative weight loss shall be multiplied by a value equal to the actual thickness in inches (mm) divided by 1.25 in. (32

mm). Report these values for each specimen as well as the average of the specimens tested.

NOTE 8—If compressive strength and absorption test results (determined in accordance with Test Methods C 140) from representative specimens are available, it is recommended that these values be reported for reference purposes.

10. Precision and Bias

10.1 Precision and bias data for freezing–and–thawing durability is not available.

11. Keywords

11.1 absorption; compressive strength; freezing–and–thawing durability; manufactured concrete units

SUMMARY OF CHANGES

This section identifies the location of changes to this test method that have been incorporated since C 1262–97. Committee C15 has highlighted those changes that affect the technical interpretation or use of this test method.

(*1*) C 1209 was added to Section 2 on Referenced Documents, and Section 3 on Terminology was added.

(*2*) Paragraph 8.1.1 was revised to define saline solution requirements.