Designation: ~~C109/C109M – 20b~~ C109/C109M – 21

Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50 mm] Cube Specimens)[1]

This standard is issued under the fixed designation C109/C109M; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope*

1.1 This test method covers determination of the compressive strength of hydraulic cement mortars, using 2-in. or [50 mm] cube specimens.

NOTE 1—Test Method C349 provides an alternative procedure for this determination (not to be used for acceptance tests).

1.2 This test method covers the application of the test using either inch-pound or SI units. The values stated in either SI units or inch-pound units are to be regarded separately as standard. Within the text, the SI units are shown in brackets. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the standard.

1.3 Values in SI units shall be obtained by measurement in SI units or by appropriate conversion, using the Rules for Conversion and Rounding given in IEEE/ASTM SI-10, of measurements made in other units.

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. (***Warning—***Fresh hydraulic cementitious mixtures are caustic and may cause chemical burns to skin and tissue upon prolonged exposure.[2])*

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]

C91/C91M Specification for Masonry Cement
C114 Test Methods for Chemical Analysis of Hydraulic Cement
C150/C150M Specification for Portland Cement
C230/C230M Specification for Flow Table for Use in Tests of Hydraulic Cement
C305 Practice for Mechanical Mixing of Hydraulic Cement Pastes and Mortars of Plastic Consistency

[1] This test method is under the jurisdiction of ASTM Committee C01 on Cement and is the direct responsibility of Subcommittee C01.27 on Strength.

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[2] See the section on Safety, Manual of Cement Testing, *Annual Book of ASTM Standards*, Vol 04.01.

[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.

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

C349 Test Method for Compressive Strength of Hydraulic-Cement Mortars (Using Portions of Prisms Broken in Flexure)
C511 Specification for Mixing Rooms, Moist Cabinets, Moist Rooms, and Water Storage Tanks Used in the Testing of Hydraulic Cements and Concretes
C595/C595M Specification for Blended Hydraulic Cements
C618 Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
C670 Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials
C778 Specification for Standard Sand
C989/C989M Specification for Slag Cement for Use in Concrete and Mortars
C1005 Specification for Reference Masses and Devices for Determining Mass and Volume for Use in Physical Testing of Hydraulic Cements
C1157/C1157M Performance Specification for Hydraulic Cement
C1328/C1328M Specification for Plastic (Stucco) Cement
C1329/C1329M Specification for Mortar Cement
C1437 Test Method for Flow of Hydraulic Cement Mortar
E4 Practices for Force Verification of Testing Machines

2.2 *IEEE/ASTM Standard:*[3]
IEEE/ASTM SI-10 Standard for Use of the International System of Units (SI): The Modern Metric System

3. Summary of Test Method

3.1 The mortar used consists of 1 part cement and 2.75 parts of sand proportioned by mass. ~~Portland~~ Portland, air-entraining portland, portland-limestone, or air-entraining ~~portland~~portland-limestone cements are mixed at a specified ~~water/cement ratios.~~water content. Water content for other cements is that sufficient to obtain a flow of 110 ± 5 in 25 drops of the flow table. Two-inch or [50 mm] test cubes are compacted by tamping in two layers. The cubes are cured one day in the molds and stripped and immersed in lime water until tested.

4. Significance and Use

4.1 This test method provides a means of determining the compressive strength of hydraulic cement and other mortars and results may be used to determine compliance with specifications. Further, this test method is referenced by numerous other specifications and test methods. Caution must be exercised in using the results of this test method to predict the strength of concretes.

5. Apparatus

5.1 *Weights and Weighing Devices,* shall conform to the requirements of Specification C1005. The weighing device shall be evaluated for precision and accuracy at a total load of 2000 g.

5.2 *Glass Graduates,* of suitable capacities (preferably large enough to measure the mixing water in a single operation) to deliver the indicated volume at 20 °C. The permissible variation shall be ±2 mL. These graduates shall be subdivided to at least 5 mL, except that the graduation lines may be omitted for the lowest 10 mL for a 250 mL graduate and for the lowest 25 mL of a 500 mL graduate. The main graduation lines shall be circles and shall be numbered. The least graduations shall extend at least one seventh of the way around, and intermediate graduations shall extend at least one fifth of the way around.

5.3 *Specimen Molds,* for the 2-in. or [50 mm] cube specimens shall be tight fitting. The molds shall have not more than three cube compartments and shall be separable into not more than two parts. The parts of the molds when assembled shall be positively held together. The molds shall be made of hard metal not attacked by the cement mortar. For new molds the Rockwell hardness number of the metal shall be not less than 55 HRB. The sides of the molds shall be sufficiently rigid to prevent spreading or warping. The interior faces of the molds shall be plane surfaces and shall conform to the tolerances of Table 1.

5.3.1 Cube molds shall be checked for conformance to the design and dimensional requirements of this test method at least every 2½ years.

5.4 *Mixer, Bowl, and Paddle,* an electrically driven mechanical mixer of the type equipped with paddle and mixing bowl, as specified in Practice C305.

5.5 *Flow Table and Flow Mold,* conforming to the requirements of Specification C230/C230M.

TABLE 1 Permissible Variations of Specimen Molds

Parameter	2-in. Cube Molds		[50 mm] Cube Molds	
~~Parameter~~	~~New~~	~~In Use~~	~~New~~	~~In Use~~
New	In Use	New	In Use	
~~Planeness of sides~~	~~<0.001 in.~~	~~<0.002 in.~~	~~[<0.025 mm]~~	~~[<0.05 mm]~~
Planeness of sides	<0.001 in.	<0.002 in	[<0.025 mm]	[<0.05 mm]
Distance between opposite sides	2 in. ± 0.005	2 in. ± 0.02	[50 mm ± 0.13 mm]	[50 mm ± 0.50 mm]
~~Height of each compartment~~	~~2 in. + 0.01 in.~~	~~2 in. + 0.01 in.~~	~~[50 mm + 0.25 mm~~	~~[50 mm + 0.25 mm~~
Height of each compartment	2 in. + 0.01 in. to – 0.005 in. ~~to – 0.005 in.~~	2 in. + 0.01 in. to – 0.015 in. ~~to – 0.015 in.~~	[50 mm + 0.25 mm to – 0.13 mm] ~~to – 0.13 mm]~~	[50 mm + 0.25 mm to – 0.38 mm] ~~to – 0.38 mm]~~
Angle between adjacent faces[A]	90 ± 0.5°	90 ± 0.5°	90 ± 0.5°	90 ± 0.5°

[A] Measured at points slightly removed from the intersection. Measured separately for each compartment between all the interior faces and the adjacent face and between interior faces and top and bottom planes of the mold.

5.6 *Tamper,* a nonabsorptive, nonabrasive, nonbrittle material such as a rubber compound having a Shore A durometer hardness of 80 ± 10 or seasoned oak wood rendered nonabsorptive by immersion for 15 min in paraffin at approximately 392 °F or [200 °C], shall have a cross section of 0.5 (±0.06) by 1 in (±0.06) [13 (±1.6) by 25 (±1.6) mm] and a length of 5 to 6 in. or [120 to 150 mm]. The tamping face shall be flat and at right angles to the length of the tamper.

5.6.1 Tampers shall be checked for conformance to the design and dimensional requirements of this test method at least every six months.

NOTE 2—Each day that the tamper is used a visual inspection should confirm that the end is flat and at a right angle to the long axis of the tamper. Rounded or peeling tampers should not be allowed for use.

5.7 *Trowel,* having a steel blade 4 to 6 in. [100 to 150 mm] in length, with straight edges.

5.8 *Moist Cabinet or Room*, conforming to the requirements of Specification C511.

5.9 *Testing Machine,* either the hydraulic or the screw type, with sufficient opening between the upper bearing surface and the lower bearing surface of the machine to permit the use of verifying apparatus. The load applied to the test specimen shall be indicated with an accuracy of ±1.0 %. If the load applied by the compression machine is registered on a dial, the dial shall be provided with a graduated scale that can be read to at least the nearest 0.1 % of the full scale load (Note 3). The dial shall be readable within 1 % of the indicated load at any given load level within the loading range. In no case shall the loading range of a dial be considered to include loads below the value that is 100 times the smallest change of load that can be read on the scale. The scale shall be provided with a graduation line equal to zero and so numbered. The dial pointer shall be of sufficient length to reach the graduation marks; the width of the end of the pointer shall not exceed the clear distance between the smallest graduations. Each dial shall be equipped with a zero adjustment that is easily accessible from the outside of the dial case, and with a suitable device that at all times until reset, will indicate to within 1 % accuracy the maximum load applied to the specimen.

5.9.1 If the testing machine load is indicated in digital form, the numerical display must be large enough to be easily read. The numerical increment must be equal to or less than 0.10 % of the full scale load of a given loading range. In no case shall the verified loading range include loads less than the minimum numerical increment multiplied by 100. The accuracy of the indicated load must be within 1.0 % for any value displayed within the verified loading range. Provision must be made for adjusting to indicate true zero at zero load. There shall be provided a maximum load indicator that at all times until reset will indicate within 1 % system accuracy the maximum load applied to the specimen.

5.9.2 Compression machines shall be verified in accordance with Practices E4 at least annually to determine if indicated loads, with and without the maximum load indicator (when so equipped), are accurate to ±1.0 %.

NOTE 3—As close as can be read is considered 1/50 in. or [0.5 mm] along the arc described by the end of the pointer. Also, one half of the scale interval is about as close as can reasonably be read when the spacing on the load indicating mechanism is between 1/25 in. or [1 mm] and 1/16 in. or [1.6 mm]. When the spacing is between 1/16 in. or [1.6 mm] and 1/8 in. or [3.2 mm], one third of the scale interval can be read with reasonable certainty. When the spacing is 1/8 in. or [3.2 mm] or more, one fourth of the scale interval can be read with reasonable certainty.

5.9.3 The upper bearing assembly shall be a spherically seated, hardened metal block firmly attached at the center of the upper head of the machine. The center of the sphere shall coincide with the surface of the bearing face within a tolerance of ±5 % of the radius of the sphere. Unless otherwise specified by the manufacturer, the spherical portion of the bearing block and the seat that holds this portion shall be cleaned and lubricated with a petroleum type oil such as motor oil at least every six months. The block shall be closely held in its spherical seat, but shall be free to tilt in any direction. A hardened metal bearing block shall be used beneath the specimen to minimize wear of the lower platen of the machine. To facilitate accurate centering of the test specimen in the compression machine, one of the two surfaces of the bearing blocks shall have a diameter or diagonal of between 2.83 in. [70.7 mm] (see Note 4) and 2.9 in. [73.7 mm]. When the upper block bearing surface meets this requirement, the lower block bearing surface shall be greater than 2.83 in. [70.7 mm]. When the lower block bearing surface meets this requirement, the diameter or diagonal of upper block bearing surface shall be between 2.83 and 3⅛ in. [70.7 and 79.4 mm]. When the lower block is the only block with a diameter or diagonal between 2.83 and 2.9 in. [70.7 and 73.7 mm], the lower block shall be used to center the test specimen. In that case, the lower block shall be centered with respect to the upper bearing block and held in position by suitable means. The bearing block surfaces intended for contact with the specimen shall have a Rockwell harness number not less than 60 HRC. These surfaces shall not depart from plane surfaces by more than 0.0005 in. [0.013 mm] when the blocks are new and shall be maintained within a permissible variation of 0.001 in. or [0.025 mm].

5.9.3.1 Compression machine bearing blocks shall be checked for planeness in accordance with this test method at least annually using a straightedge and feeler stock and shall be refinished if found to be out of tolerance.

NOTE 4—The diagonal of a 2 in. [50 mm] cube is 2.83 in. [70.7 mm].

6. Materials

6.1 *Graded Standard Sand:*

6.1.1 The sand (Note 5) used for making test specimens shall be natural silica sand conforming to the requirements for graded standard sand in Specification C778.

NOTE 5—*Segregation of Graded Sand*—The graded standard sand should be handled in such a manner as to prevent segregation, since variations in the grading of the sand cause variations in the consistency of the mortar. In emptying bins or sacks, care should be exercised to prevent the formation of mounds of sand or craters in the sand, down the slopes of which the coarser particles will roll. Bins should be of sufficient size to permit these precautions. Devices for drawing the sand from bins by gravity should not be used.

7. Temperature and Humidity

7.1 *Temperature*—The temperature of the air in the vicinity of the mixing slab, the dry materials, molds, base plates, and mixing bowl, shall be maintained between 73.5 ± 5.5 °F or [23.0 ± 3.0 °C]. The temperature of the mixing water, moist closet or moist room, and water in the storage tank shall be set at 73.5 ± 3.5 °F or [23 ± 2 °C].

7.2 *Humidity*—The relative humidity of the laboratory shall be not less than 50 %. The moist closet or moist room shall conform to the requirements of Specification C511.

8. Test Specimens

8.1 Make two or three specimens from a batch of mortar for each period of test or test age.

9. Preparation of Specimen Molds

9.1 Apply a thin coating of release agent to the interior faces of the mold and non-absorptive base plates. Apply oils and greases using an impregnated cloth or other suitable means. Wipe the mold faces and the base plate with a cloth as necessary to remove any excess release agent and to achieve a thin, even coating on the interior surfaces. When using an aerosol lubricant, spray the release agent directly onto the mold faces and base plate from a distance of 6 to 8 in. or [150 to 200 mm] to achieve complete coverage. After spraying, wipe the surface with a cloth as necessary to remove any excess aerosol lubricant. The residue coating should be just sufficient to allow a distinct finger print to remain following light finger pressure (Note 6).

9.2 Seal the surfaces where the halves of the mold join by applying a coating of light cup grease such as petrolatum. The amount should be sufficient to extrude slightly when the two halves are tightened together. Remove any excess grease with a cloth.

9.3 Seal molds to their base plates with a watertight sealant. Use microcrystalline wax or a mixture of three parts paraffin wax to five parts rosin by mass. Paraffin wax is permitted as a sealant with molds that clamp to the base plate. Liquefy the wax by heating it to a temperature of between 230 and 248 °F or [110 and 120 °C]. Effect a watertight seal by applying the liquefied sealant at the outside contact lines between the mold and its base plate (Note 7).

9.4 Optionally, a watertight sealant of petroleum jelly is permitted for clamped molds. Apply a small amount of petroleum jelly to the entire surface of the face of the mold that will be contacting the base plate. Clamp the mold to the base plate and wipe any excess sealant from the interior of the mold and base plate.

NOTE 6—Because aerosol lubricants evaporate, molds should be checked for a sufficient coating of lubricant immediately prior to use. If an extended period of time has elapsed since treatment, retreatment may be necessary.

NOTE 7—*Watertight Molds*—The mixture of paraffin wax and rosin specified for sealing the joints between molds and base plates may be found difficult to remove when molds are being cleaned. Use of straight paraffin wax is permissible if a watertight joint is secured, but due to the low strength of paraffin wax it should be used only when the mold is not held to the base plate by the paraffin wax alone. When securing clamped molds with paraffin wax, an improved seal can be obtained by slightly warming the mold and base plate prior to applying the wax. Molds so treated should be allowed to return to room temperature before use.

10. Specimen Preparation Procedure

10.1 *Composition of Mortars:*

~~10.1.1 The proportions of materials for the standard mortar shall be one part of cement to 2.75 parts of graded standard sand by weight. Use a water-cement ratio of 0.485 for all portland cements and 0.460 for all air-entraining portland cements. The amount of mixing water for other than portland and air-entraining portland cements shall be such as to produce a flow of 110 ± 5 as determined in accordance with 10.3 and shall be expressed as weight percent of cement.~~

10.1.1 Materials for the standard mortar shall be cement, graded standard sand, and water. The quantities of materials to be mixed at one time in the batch of mortar for making six, nine, and twelve test specimens shall be in accordance with Table 2~~as follows:~~. Use specified water content for all portland, portland-limestone, air-entraining portland, or air-entraining portland-limestone cements. The amount of mixing water for other cements shall be such as to

~~Number of Specimens~~	~~6~~	~~9~~	~~12~~
~~Cement, g~~	~~500~~	~~740~~	~~1060~~
~~Sand, g~~	~~1375~~	~~2035~~	~~2915~~
~~Water, mL~~			
~~— Portland (0.485)~~	~~242~~	~~359~~	~~514~~
~~— Air-entraining portland (0.460)~~	~~230~~	~~340~~	~~488~~
~~— Other (to flow of 110 ± 5)~~	~~...~~	~~...~~	~~...~~

produce a flow of 110 ± 5 as determined in accordance with 10.3.

NOTE 8—The water-to-portland-cement and water-to-portland-limestone-cement ratio used in Table 2 is 0.485 by mass. For air-entraining cements, the water-to-portland-cement or water-toportland-limestone-cement ratio is 0.460 by mass. The sand-to-cement ratio is 2.75.

10.2 *Preparation of Mortar:*

10.2.1 Mechanically mix in accordance with the procedure given in Practice C305.

10.3 *Determination of Flow:*

TABLE 2 Standard Test Mortar Proportions

Material	Number of Specimens		
	6	9	12
Cement, g	500	740	1060
Sand, g	1375	2035	2915
Water, mL			
Portland or portland-limestone cements	242	359	514
Air-entraining portland or air-entraining portland-limestone cements	230	340	488
Other cements (to flow of 110 ± 5)	. . .	. . .	. . .

10.3.1 Determine flow in accordance with procedure given in Test Method C1437.

10.3.2 For ~~portland and air-entraining portland cements, merely~~ portland, portland-limestone, air-entraining portland, or air-entraining portland-limestone cements, record the flow.

10.3.3 In the case of cements other than ~~portland~~ portland, portland-limestone, air-entraining portland, or air-entraining ~~portland~~portland-limestone cements, make trial mortars with varying percentages of water until the specified flow is obtained. Make each trial with fresh mortar. Record the water content used to achieve the specified flow as weight percent of cement.

10.3.4 Immediately following completion of the flow test, return the mortar from the flow table to the mixing bowl. Quickly scrape the bowl sides and transfer into the batch the mortar that may have collected on the side of the bowl and then remix the entire batch 15 s at medium speed. Upon completion of mixing, the mixing paddle shall be shaken to remove excess mortar into the mixing bowl.

10.3.5 When a duplicate batch is to be made immediately for additional specimens, the flow test may be omitted and the mortar allowed to stand in the mixing bowl 90 s without covering. During the last 15 s of this interval, quickly scrape the bowl sides and transfer into the batch the mortar that may have collected on the side of the bowl. Then remix for 15 s at medium speed.

10.4 *Molding Test Specimens:*

10.4.1 Complete the consolidation of the mortar in the molds either by hand tamping or by a qualified alternative method. Alternative methods include but are not limited to the use of a vibrating table or mechanical devices.

10.4.2 *Hand Tamping*—Start molding the specimens within a total elapsed time of not more than 2 min and 30 s after completion of the original mixing of the mortar batch. Place a layer of mortar about 1 in. or [25 mm] (approximately one half of the depth of the mold) in all of the cube compartments. Tamp the mortar in each cube compartment 32 times in about 10 s in four rounds, each round to be at right angles to the other and consisting of eight adjoining strokes over the surface of the specimen, as illustrated in Fig. 1. The tamping pressure shall be just sufficient to ensure uniform filling of the molds. The four rounds of tamping (32 strokes) of the mortar shall be completed in one cube before going to the next. When the tamping of the first layer in all of the cube compartments is completed, fill the compartments with the remaining mortar and then tamp as specified for the first layer. During tamping of the second layer, bring in the mortar forced out onto the tops of the molds after each round of tamping by means of the gloved fingers and the tamper upon completion of each round and before starting the next round of tamping. On completion of the tamping, the tops of all cubes should extend slightly above the tops of the molds. Bring in the mortar that has been forced out onto the tops of the molds with a trowel and smooth off the cubes by drawing the flat side of the trowel (with the leading edge slightly raised) once across the top of each cube at right angles to the length of the mold. Then, for the purpose of leveling the mortar and making the mortar that protrudes above the top of the mold of more uniform thickness, draw the flat side of the trowel (with the leading edge slightly raised) lightly once along the length of the mold. Cut off the mortar to a plane surface flush with the top of the mold by drawing the straight edge of the trowel (held nearly perpendicular to the mold) with a sawing motion over the length of the mold.

10.4.3 *Alternative Methods*—Any consolidation method may be used that meets the qualification requirements of this section. The consolidation method consists of a specific procedure, equipment and consolidation device, as selected and used in a consistent

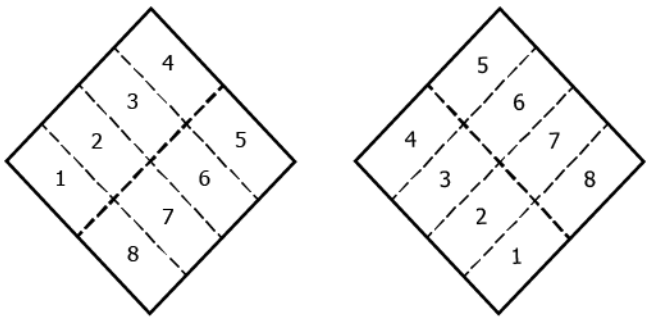

FIG. 1 Order of Tamping in Molding of Test Specimens

manner by a specific laboratory. The mortar batch size of the method may be modified to accommodate the apparatus, provided the proportions maintain the same ratios as given in ~~10.1.2~~10.1.1.

10.4.3.1 Separate qualifications are required for the following classifications:

Class A, *Non-air-entrained Cements*—for use in concrete, such as sold under Specifications C150/C150M, C595/C595M, and C1157/C1157M.

Class B, ~~*Air-Entrained*~~*Air-entrained Cements*—for use in concrete, such as sold under Specifications C150/C150M, C595/C595M, and C1157/C1157M.

Class C, *Masonry, Mortar, and Stucco Cements*—such as sold under Specifications C91/C91M, C1328/C1328M, and C1329/C1329M.

10.4.3.2 An alternative method may only be used to test the cement types as given in 10.4.3.1 above, for which it has been qualified.

10.4.3.3 It can also be used for Strength Activity Index determinations for fly ash and Slag Activity Index determination for slag cement, such as sold under Specifications C618 and C989/C989M, provided the alternative method has qualified for both Class A and Class C cements.

10.4.4 *Qualification Procedure*—Contact CCRL to purchase cement samples that have been used in the Proficiency Sample Program (PSP). Four samples (5 kg each) of the class to be qualified will be required to complete a single qualification (see Note ~~8~~9).

10.4.4.1 In one day, prepare replicate six-cube or nine-cube batches using one of the cements and cast a minimum of 36 cubes. Complete one round of tests on each cement on different days. Store and test all specimens as prescribed in the sections below. Test all cubes at the age of seven days.

10.4.4.2 Tabulate the compressive strength data and complete the mathematical analyses as instructed in Annex A1.

10.4.5 *Requalification of ~~the~~ Alternate Compaction Method:*

10.4.5.1 Requalification of the method shall be required if any of the following occur:

(1) Evidence that the method may not be providing data in accordance with the requirements of Table ~~2~~3.

(2) Results that differ from the reported final average of a CCRL-PSP sample with a rating of 3 or less.

(3) Results that differ from the accepted value of a known reference sample with established strength values by more than twice the multi-laboratory 1s % values of Table ~~2~~3.

Before starting the requalification procedure, evaluate all aspects of cube fabrication and testing process to determine if the offending result is due to some systematic error or just an occasional random event.

10.4.5.2 If the compaction equipment is replaced, significantly modified, repaired, or has been recalibrated, requalify the equipment in accordance with 10.4.4.

NOTE 9—It is recommended that a large homogenous sample of cement be prepared at the time of qualification for use as a secondary standard and for method evaluation. Frequent testing of this sample will give early warning of any changes in the performance of the apparatus.

10.5 *Storage of Test Specimens*—Immediately upon completion of molding, place the test specimens in the moist closet or moist room. Keep all test specimens, immediately after molding, in the molds on the base plates in the moist closet or moist room from 20 to 72 h with their upper surfaces exposed to the moist air but protected from dripping water. If the specimens are removed from the molds before 24 h, keep them on the shelves of the moist closet or moist room until they are 24-h old, and then immerse the specimens, except those for the 24-h test, in saturated lime water in storage tanks constructed of noncorroding materials. Keep the storage water clean by changing as required.

11. Determination of Compressive Strength

11.1 Test the specimens immediately after their removal from the moist closet in the case of 24-h specimens, and from storage water in the case of all other specimens. All test specimens for a given test age shall be broken within the permissible tolerance prescribed as follows:

Test Age	Permissible Tolerance
24 h	±½ h