



Designation: C1716/C1716M – 23

Standard Specification for Compression Testing Machine Requirements for Concrete Masonry Units, Related Units, and Prisms¹

This standard is issued under the fixed designation C1716/C1716M; 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 specification provides minimum design standards for testing machines used to measure the compressive strength of concrete masonry units, related units, and masonry prisms covered under Test Methods C140/C140M and C1314.

1.2 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 this standard.

1.3 This specification shall be used to determine the maximum allowable specimen size and the maximum allowable load limits on a specific specimen for any test machine. These limits are based on deflection of the bearing surfaces and the machine load frame. These limits may not reflect the actual capacity of the machine and do not supersede the machine manufacturer's recommended operational limits. The user must determine if testing machine capacities, allowable specimen size and maximum allowable load are appropriate for the sample to be tested.

1.4 The values stated in either SI units or inch-pound units are to be regarded separately as standard. 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 non-conformance with the standard.

1.5 *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.*

1.6 *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 Recom-*

mendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

2. Referenced Documents

2.1 *ASTM Standards:*²

C140/C140M Test Methods for Sampling and Testing Concrete Masonry Units and Related Units

C1093 Practice for Accreditation of Testing Agencies for Masonry

C1232 Terminology for Masonry

C1314 Test Method for Compressive Strength of Masonry Prisms

E4 Practices for Force Calibration and Verification of Testing Machines

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of terms used in this specification, refer to Terminology C1232.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *bearing, adj*—direct contact with the specimen being tested, as in bearing plate, bearing block, and bearing platen.

3.2.1.1 *Discussion*—Plates, blocks or platens used for bearing purposes must have hardened bearing surfaces. Spacers do not have to be hardened. Blocks are structural while plates are not.

3.2.2 *block, n*—steel piece 50 mm [2 in.] thick or greater that provides additional load capacity in bending to platens.

3.2.2.1 *Discussion*—Blocks may be used to accommodate testing specimens of various heights in a testing machine. Hardened blocks can be used as bearing surfaces.

3.2.3 *composite, adj*—made up of two or more pieces or materials.

3.2.4 *load frame, n*—all components of the testing machine that react against forces applied to the test specimen during testing.

¹ This specification is under the jurisdiction of ASTM Committee C15 on Manufactured Masonry Units and is the direct responsibility of Subcommittee C15.04 on Research.

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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* 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

3.2.5 *plate, n*—steel piece less than 50 mm [2 in.] thick that does not provide additional load capacity in bending to platens.

3.2.5.1 *Discussion*—Plates may be used to accommodate test specimens of various heights in a testing machine but do not provide additional load capacity in bending to platens or blocks. Hardened plates can be used as bearing surfaces.

3.2.6 *platen, n*—the primary loading surfaces of the testing machine.

3.2.6.1 *Discussion*—Platen is a general term without specific properties implied. In general, the lower platen is semi-permanently fixed to the testing machine and the upper platen is semi-permanently fixed to a hemispherical thrust bearing. Platens 50 mm [2 in.] thick or greater act as blocks and bearing capacities in bending are calculated accordingly.

3.2.7 *spacer, n*—plates, blocks, or equipment and fixtures specific to a testing machine, used to adjust the position of bearing surfaces to accommodate test specimens.

4. Testing Machine Requirements

4.1 Machine Loading Requirements:

4.1.1 The testing machine must be power operated and apply the load continuously, rather than intermittently, and without shock.

4.1.2 The machine must be capable of maintaining specific loading rates required by the test. Variations in the loading rate over the elastic portion of the test shall not exceed $\pm 20\%$ of the set loading rate.

4.1.3 The testing machine must be capable of a minimum of 50 mm [2 in.] of continuous travel or displacement to accommodate positioning and testing of a specimen.

4.2 *Gauges and Displays*—Gauges and displays indicating loads shall meet the requirements of Practices E4, except in no case shall the verified force range include forces less than 100 times the resolution of the force indicator.

4.3 *Accuracy*—The accuracy and calibration of the testing machine shall meet the requirements of Practices E4. Prior to testing, calibration is required:

4.3.1 At the frequency prescribed in Practice C1093,

4.3.2 On original installation or after relocation,

4.3.3 Whenever there is reason to suspect the accuracy of the indicated loads, or

4.3.4 After making repairs or adjustments that affect the operation of the force applying system or the values displayed on the load indicating system, except for zero adjustments that compensate for the mass of bearing blocks or specimen, or both.

4.4 Load Frame:

4.4.1 Load frames shall have a minimum longitudinal stiffness of 18×10^8 N/m [10×10^6 lb/in.].

NOTE 1—Evaluating the differential longitudinal strain in the side elements of the load frame due to an assumed eccentric loading can be used to estimate compliance with 4.4.1. Limit the differential strain to 0.0001 mm/mm [0.0001 in./in.] at the maximum capacity of the machine or the rated capacity of the specific test setup assuming the eccentricity of the load as 5 % of the maximum width of the specimen. See Appendix X1 for a discussion on allowable longitudinal strain and machine capacity.

NOTE 2—Stiffer machines deflect less under load, have less frame distortion, truer load application and measurement capability.

NOTE 3—In testing machines with significant differences in lateral stiffness, the center of mass and center of effort shall lie on the axis perpendicular to the axis of maximum lateral stiffness (see Fig. X1.1). Test specimen centroid of compressive strength may not coincide with its centroid of mass. Test specimen section aspect ratio affects measured compressive strength but not mass.

4.4.2 If the design of the load frame makes it an integral part of the support against deflection for platens, blocks, or testing heads, the specific parts of the load frame supporting platens, blocks, or testing heads shall meet the requirements of 4.9 for flatness, finish, and materials.

4.4.3 Testing machines with fixed geometry frames and adjustable geometry frames are permitted.

4.5 Plates, Blocks, and Platens:

4.5.1 Plates, blocks, and platens shall meet requirements of 4.9 for flatness and surface finish. Surface treatments or plating to reduce corrosion is permitted.

4.5.2 *Plate*—A one piece steel plate, less than 50 mm [2 in.] in thickness and greater than 11.5 mm [0.45 in.] in thickness. Plates provide no additional load capacity in bending to platens or blocks.

4.5.3 *Block*—A one piece steel plate, 50 mm [2 in.] in thickness or greater.

4.5.4 *Platen*—A one piece steel plate, at least 25 mm [1 in.] thick when new and at least 22 mm [0.9 in.] thick when in service.

4.6 Spacers:

4.6.1 Spacers and bearing plates are permitted. Plates, blocks, and spacers are used to adjust the position of bearing surfaces to accommodate test specimens.

4.6.2 Spacers excluding those provided by the testing machine manufacturer must be constructed of steel.

4.6.3 Non-ferrous and composite spacers, provided by the testing machine manufacturer, used between the upper testing head and the lower platen shall have their load capacity clearly indicated on the spacer and shall be used with a block or bearing block between the spacer and the test specimen.

NOTE 4—The block may be integral to the design of a composite spacer.

4.6.4 Spacers placed between the lower platen and lower bearing block must be a minimum of 6 mm [0.25 in.] wider and 6 mm [0.25 in.] longer than the effective bearing area of the lower platen required for the test, or the length and width of the platen, whichever is smaller.

4.6.5 Spacers used between the upper and lower platen must meet all requirements of 4.9 for flatness and surface finish.

4.7 Hemispherical Head Design:

4.7.1 The upper platen or bearing surface of the testing machine shall be supported with a hemispherical thrust bearing to allow small angular movement of the bearing surface.

NOTE 5—The preferred design includes a socket and ball hemispherical section semi-permanently or permanently attached to a single bearing block or platen.

4.7.2 The ball and the socket shall be designed so that the steel in the contact area of the hemispherical bearing does not permanently deform when loaded to the capacity of the testing machine or the rated load of the testing head.