Designation: C 1201 – 91 (Reapproved 2003)

Standard Test Method for Structural Performance of Exterior Dimension Stone Cladding Systems by Uniform Static Air Pressure Difference[1]

This standard is issued under the fixed designation C 1201; 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 test method covers the determination of the structural performance of dimension stone cladding systems under positive and negative uniform static air pressure differences, using a test chamber.

1.2 The proper use of this test method requires a knowledge of the principles of pressure and deflection measurement.

1.3 This test method describes the apparatus and the procedure to be used for applying either specific test loads or unknown ultimate values of uniformity distributed test loads to a specimen.

1.3.1 Procedure A (see 11.2) shall be used when deflections at maximum load only are required.

1.3.2 Procedure B (see 11.3) shall be used when a load-deflection curve is required.

1.4 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

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 and health practices and determine the applicability of regulatory limitations prior to use.* For specific hazard statements, see Section 7.

2. Referenced Documents

2.1 *ANSI Standard:*

ANSI A58.1 Building Code Requirements for Minimum Design Loads in Buildings and Other Structures[2]

2.2 *AAMA Standard:*

AAMA TIR-A2 Design Wind Loads for Aluminum Curtain Walls[3]

3. Terminology

3.1 *Descriptions of Terms Specific to This Standard:*

3.1.1 *permanent deformation*—the permanent displacement from an original position that remains after an applied load has been removed.

3.1.2 *specimen*—the entire assembled unit submitted for test as described in Section 8.

3.1.3 *test load*—the specified difference in static air pressure (positive or negative) for which the specimen is to be tested, expressed in pascals (pounds-force per square foot).

3.1.4 *ultimate load*—the difference in static air pressure (positive or negative) at which failure of the specimen occurs, expressed in pascals (pounds-force per square foot).

4. Summary of Test Method

4.1 This test method consists of sealing the test specimen into or against one face of a test chamber; supplying air to, or exhausting air from, the chamber at the rate required to maintain the test-pressure difference across the specimen; and observing, measuring, and recording the deflection, deformations, and nature of any failures.[4,5]

5. Significance and Use

5.1 This test method gives a standard procedure for determining structural performance under uniform static air pressure difference. This typically is intended to represent the effects of wind loads on exterior building surface elements. The actual loading on building surfaces is quite complex, varying with wind direction, time, height above ground, building shape, terrain, surrounding structures, and other factors. These factors are discussed in the literature in 2.1 and 2.2 and Footnotes 4 and 5.

NOTE 1—In applying the results of tests by this test method, it should be borne in mind that the performance of a cladding system may be a function of fabrication, installation, and adjustment, and that the specimen may or may not truly represent the actual structure. In service, the

[1] This test method is under the jurisdiction of ASTM Committee C-18 on Dimension Stone and is the direct responsibility of Subcommittee C18.01 on Test Methods.

Current edition approved May 10, 2003. Published June 2003. Originally approved in 1991. Last previous edition approved in 1996 as C 1201–91 (1996).

[2] Available from American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036.

[3] Available from American Architectural Manufacturers Association, 2700 River Road, Suite 118, Des Plaines, IL 60018.

[4] *ASHRAE Handbook of Fundamentals*, American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., Chapter 26, 1977.

[5] "Wind Forces on Structures," *Transactions of the American Society of Civil Engineer*, Vol 126, Part II, Paper 3269, 1961, pp. 1124–1198.

performance will also depend on the rigidity of supporting construction and on the resistance of components to deterioration by various causes, to vibration, to thermal expansion and contraction, etc.

6. Apparatus

6.1 The description of apparatus is general in nature; any equipment capable of performing the test procedure within the allowable tolerances is permitted.

6.2 *Major Components* (see Fig. 1):

6.2.1 *Test Chamber*—A test chamber or box with an opening, a removable mounting panel, or one open side in which, or against which, the specimen is installed. Care should be taken when designing the chamber-to-specimen seal, to avoid edge conditions not representative of the cladding system being tested. At least one static pressure tap shall be provided to measure the chamber pressure and shall be so located that the reading is unaffected by the velocity of the air supply to or from the chamber, or any other air movement. The air supply opening into the chamber shall be arranged so that the air does not impinge directly on the test specimen. A means of access into the chamber may be provided to facilitate adjustments and observations after the specimen has been installed.

NOTE 2—The test chamber and the specimen mounting frame must not deflect under the test load in such a manner that the performance of the specimen will be affected.

6.2.2 *Air System*—A controllable blower, a compressed-air supply, an exhaust system, or reversible controllable blower designed to provide the required maximum air-pressure difference across the specimen. The system shall provide an essentially constant air-pressure difference for the required test period.

NOTE 3—It is convenient to use a reversible blower or a separate pressure and exhaust system to provide the required air-pressure difference so that the test specimen can be tested for the effect of positive pressure and for the effect of negative pressure without removing, reversing, and reinstalling the test specimen. If an adequate air supply is available, a completely airtight seal need not be provided around the perimeter of the test specimen and the mounting panel, although it is preferable. However, substantial air leakage will require an air supply of much greater capacity to maintain the required pressure differences.

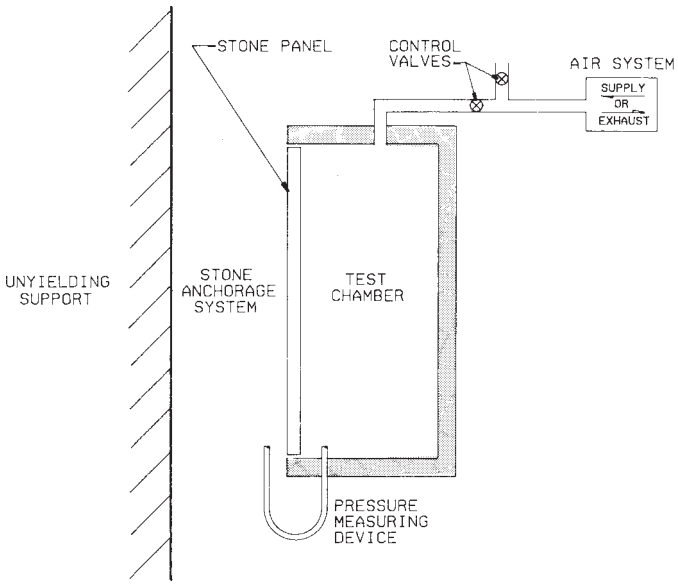

FIG. 1 General Arrangement of Testing Apparatus

6.2.3 *Pressure-Measuring Apparatus*—A device to measure the test pressure difference within an accuracy of ±2 %.

6.2.4 *Deflection-Measuring System*—A means of measuring deflections with an accuracy of ±0.025 mm (±0.001 in.).

6.2.4.1 Stone deflections shall be measured perpendicular to the stone surface at anchorage locations and at the position of maximum displacement. Additional locations for deflection measurements, if required, shall be stated by the specifier.

6.2.4.2 Deflection gages shall be supported independently of the cladding system being tested.

6.2.4.3 For tests to determine the ultimate performance of a specimen, deflection-measuring devices with lesser precision may be used due to possible destruction of the instruments.

7. Hazards

7.1 Take proper precautions to protect the observers in the event of any failure. At the pressures used in this test method, considerable energy and hazard are involved. In cases of failure, the hazard to personnel is less with an exhaust system, as the specimen will tend to blow into the test chamber rather than out. Do not permit personnel in such chambers during tests.

8. Test Specimens

8.1 Test specimens shall be of sufficient size and extent to determine the performance of all typical components of the cladding system.

8.1.1 All parts of the test specimen shall be full size, using the same materials, material finishes, details, and methods of construction, and anchorage as used, or planned to be used, on the building.

8.1.2 Accurately simulate conditions of structural support back to a reasonably unyielding support.

8.2 Test a minimum of five specimens.

NOTE 4—It should be recognized that performance is likely to be a function of size and geometry. Therefore, one should select specimens covering the range of sizes and thicknesses to be used on a building. In general, the largest size or most heavily loaded of a particular design, type, thickness, construction, or configuration to be used should be tested.

9. Calibration

9.1 Calibration of fluid manometers and dial gage deflection measuring devices is normally not required, provided the instruments are used at or near their design temperature. Appropriately calibrate other types of pressure and deflection measuring devices.

10. Required Information

10.1 In specifying this test method, the following information shall be supplied by the specifying authority:

10.1.1 *Procedure A*:

10.1.1.1 The positive and negative test loads,

10.1.1.2 The duration of maximum load, and

10.1.1.3 The number and location of required deflection measurements.

10.1.2 *Procedure B*:

10.1.2.1 The number of incremental loads and the positive and negative test loads at these increments at which deflection measurements are required,

10.1.2.2 The duration of incremental and maximum loads, and

10.1.2.3 The number and location of required deflection measurements.

11. Procedure

11.1 Fit the specimen into or against the chamber opening. The outdoor side of the specimen shall face the higher pressure side for positive loads; the indoor side shall face the higher pressure side for negative loads. Support and secure the specimen by the same number and type of anchors to be used in installing the unit on a building.

11.2 *Procedure A*—Use the following procedure when deflections at maximum load are required:

11.2.1 Check the specimen for proper adjustment.

11.2.2 Install required deflection measuring devices at their specified locations.

11.2.3 Apply positive pressure equal to one-half of the maximum specified test load, and maintain for not less than 10 s. Release the pressure difference across the specimen, and after a recovery period of not less than 1 min nor more than 5 min at zero load, read and record initial deflection gage readings.

11.2.4 Unless otherwise specified, apply positive pressure equal to the maximum specified test load and maintain for not less than 10 s. Apply load in such a manner as to avoid shock loading. Read and record deflection gage readings to determine maximum deformation.

11.2.5 Reduce the pressure difference to zero, and, after a recovery period of not less than 1 min nor more than 5 min, read and record deflection gage readings to determine permanent deformation.

11.2.6 Repeat the procedure using negative pressures.

11.3 *Procedure B*—Use the following procedure when the determination of a load-deflection curve is required:

11.3.1 Follow 11.2.1-11.2.3.

11.3.2 Apply the load using positive pressure in the specified number of increments up to the maximum specified test load. The specifier shall determine the number of increments to be used in this test method, not to be less than four equal increments to maximum test load. At each increment, unless otherwise specified, apply and maintain the test load for not less than 10 s. Read and record deflection gage readings.

11.3.3 Reduce the pressure difference to zero, and, after a recovery period of not less than 1 min nor more than 5 min, read and record deflection gage readings to determine permanent deformation.

11.3.4 When the behavior of the specimen under load indicates that sudden failure may occur and damage the measuring devices, the deflection measuring devices may be removed and the load increased incrementally until the maximum test load or the maximum load that can be sustained is reached, whichever occurs first.

11.3.5 Repeat the procedure using negative pressures.

12. Report

12.1 Report the following information:

12.1.1 Dates of the test and the report,

12.1.2 Identification of the specimen (manufacturer, source of supply, dimensions, model types, materials, material finishes, and other pertinent information),

12.1.3 Detailed drawings of the specimen, showing dimensioned section profiles, framing location, installation and spacing of anchorage, hardware, sealants, and any other pertinent construction details. Any modifications made on the specimen to obtain the reported values shall be noted on the drawings,

12.1.4 Any preconditioning of the stone (wetting, drying, etc.) shall be fully documented,

12.1.5 *Procedure A*—A tabulation of pressure differences exerted across the specimen during the test and the deflections and permanent deformations at locations specified for each specimen tested,

12.1.6 *Procedure B*—A tabulation of the number of test load increments, the pressure differences exerted across the specimen at these increments, the pertinent deflections at these pressure differences, and permanent deformations at locations specified for each specimen tested,

12.1.7 The duration of test loads, including incremental loads for Procedure B,

12.1.8 A record of visual performance observations,

12.1.9 When the tests are made to check conformity of the specimen to a particular specification, an identification or description of that specification,

12.1.10 A statement that the tests were conducted in accordance with this test method. A full description of any deviations from this test method shall also be included, and

12.2 If several essentially identical specimens are tested, results for all specimens shall be reported, each specimen being properly identified, particularly with respect to distinguishing features or differing adjustments. A separate drawing for each specimen will not be required if all differences between them are noted on the drawings provided.

13. Precision and Bias

13.1 Individual variations in a natural product may result in deviation from accepted values. A precision section will be added when sufficient data are available to indicate acceptable tolerances in repeatability and reproducibility.

14. Keywords

14.1 dimension stone; load test; stone; strength; structural performance; test