Designation: C 364 – 99

Standard Test Method for Edgewise Compressive Strength of Sandwich Constructions[1]

This standard is issued under the fixed designation C 364; 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 flat structural sandwich construction compressive properties in a direction parallel to the sandwich facing plane.

1.2 The values stated in SI units are to be regarded as the standard. The inch-pound units given in parentheses may be approximate.

1.3 *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:*

E 4 Practices for Force Verification of Testing Machines[2]

3. Significance and Use

3.1 The edgewise compressive strength of short sandwich construction specimens provides a basis for judging the load-carrying capacity of the construction in terms of developed facing stresses as compared to the facing yield stress.

3.2 The sandwich column, no matter how short, usually is subject to a buckling type of failure unless the facings are so thick that they themselves are in the short column class. The failure of the facings manifests itself by wrinkling of the facing, in which the core deforms to the wavy shape of the facings; by dimpling of the facings into the honeycomb cells; or by bending of the sandwich, resulting in crimping near the ends as a result of shear failure of the core or failure in the facing-to-core bond.

3.3 This test method provides a standard method of obtaining sandwich edgewise compressive strengths for panel design and research and development.

4. Apparatus

4.1 *Testing machine*, capable of maintaining a controlled loading rate and indicating the load with an accuracy of ±1 % of the indicated value. The accuracy of the test machine shall be verified in accordance with Practices E 4.

4.2 *Spherical bearing block*, preferably of the suspended, self-aligning type.

4.3 *Strain gage*, capable of measuring strain to at least 0.001 mm/mm (0.0001 in./in.) and having a gage length not greater than two thirds of the unsupported length of the specimens to be tested.

4.4 *Micrometer, gage, or caliper*, capable of measuring accurately to 0.025 mm (0.001 in.).

5. Test Specimens

5.1 The test specimens shall be rectangular in cross section. The width of the specimens shall be at least 50 mm (2 in.) but not less than twice the total thickness nor less than four complete honeycomb cells. The unsupported length (dimension parallel to direction of applied load) shall be not greater than eight times the total thickness.

5.2 Take care in preparing the test specimens to ensure smooth end surfaces free of burrs. The ends shall be parallel to each other and at right angles to the length of the specimens. Good flat ends are essential for preventing localized end failures. The loaded ends may be potted with resin and then milled or ground flat.

6. Conditioning

6.1 When the physical properties of the component materials are affected by moisture, bring the test specimens to constant weight (±1 %) before testing, preferably in a conditioning room having temperature and humidity control, and make the tests, preferably, in a room under the same conditions. A temperature of 23 ± 3°C (73 ± 5°F) and a relative humidity of 50 ± 5 % are recommended as standard control conditions.

7. Procedure

7.1 The length and width dimensions of the specimen shall be measured to the nearest 0.25 mm (0.001 in.). Measure each facing thickness to the nearest 0.025 mm (0.001 in.).

7.2 Test specimens shall be laterally supported adjacent to the loaded ends on the facings of the sandwich to prevent early bucking failure as a result of separation of the facings from the core at the point of contact with the loading plates. This may be done (1) by using clamps made of rectangular steel bars

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[2] *Annual Book of ASTM Standards*, Vol 03.01.

fastened together so as to clamp the specimen lightly between them (the cross-sectional dimensions of each of these bars shall be not less than 6 mm (0.25 in.)) or (2) by fitting the specimen snugly in round steel bars slotted axially to their diameter, where such bars shall have a diameter not less than the thickness of the sandwich plus 6 mm (0.25 in.). End support may also be obtained by casting the ends of the specimens in resin or other suitable molding material. The cast ends of the specimen should be ground flush with the facings.

7.3 Apply the load through apparatus designed to distribute the load properly to each facing and uniformly in each facing. A suitable apparatus is shown in Fig. 1. The load may be considered to be distributed properly if the strains measured on each facing are within 5 % of each other in the early stages of loading. It is essential that strains be measured in the early stages to avoid widely varying results caused by different eccentricities which occur if strains are not properly balanced.

FIG. 1 Edgewise Compression Test Setup

7.4 Apply the load through constant rate of movement of the movable head of the testing machine (Note 1) such that the maximum load will occur between 3 and 6 min.

NOTE 1—A suggested rate of cross-head movement is 0.50 mm/min (0.020 in./min).

8. Calculation

8.1 Calculate the facing compressive stress as follows:

$$\sigma = \frac{P}{A} \quad (1)$$

where:

σ = facing compressive stress, MPa (psi);
P = ultimate load, N (lb); and
A = area of both facings, mm^2 ($in.^2$).

9. Report

9.1 The report shall include the following:

9.1.1 Description of test specimens; facings, core, adhesive,

9.1.2 Dimensions of test specimens, core orientation,

9.1.3 Type of end support, flatness of specimens,

9.1.4 Specimens conditioning, if any,

9.1.5 Test temperature and specimens time at temperature,

9.1.6 Test machine cross-head loading rate,

9.1.7 Maximum load and maximum stress in facings; individual and average values, and

9.1.8 Description of failure mode; whether the facing wrinkled, dimpled, or crimped; whether the specimen was bent before failure occurred; and whether the core-to-facing bond failed.

10. Precision and Bias

10.1 *Precision*—It is not possible to specify the precision of the procedure in Test Method C 364 for measuring the facing stress of the sandwich panel because of the unavailability of consistent samples for testing.

10.2 *Bias*—Since there is no accepted reference material suitable for determining the bias for the procedure in this test method, bias has not been determined.

11. Keywords

11.1 edgewise; facing compressive stress; sandwich; sandwich construction