Designation: C 480 – 99

Standard Test Method for Flexure Creep of Sandwich Constructions[1]

This standard is issued under the fixed designation C 480; 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 creep characteristics and creep rate of sandwich constructions loaded in flexure, at any desired temperature.

1.2 The values stated in SI units are to be regarded as the standard. The inch-pound units given 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:*

C 393 Test Method for Flexural Properties of Flat Sandwich Constructions[2]

3. Significance and Use

3.1 The determination of the creep rate provides information on the behavior of sandwich constructions under constant load. Creep is defined as deflection under constant load over a period of time beyond the initial deformation as a result of the application of the load. Deflection data obtained from this test method can be plotted against time, and a creep rate determined. By using standard specimen constructions and constant loading, the test method may also be used to evaluate creep behavior of sandwich panel core-to-facing adhesives.

3.2 This test method provides a standard method of obtaining flexure creep of sandwich constructions for quality control, acceptance specification testing, and research and development.

4. Apparatus

4.1 The apparatus for loading the specimen shall conform to Test Method C 393 except that a constant load shall be applied by means of weights and a lever system. Fig. 1 shows a lever and weight-loading apparatus that has been found satisfactory.

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

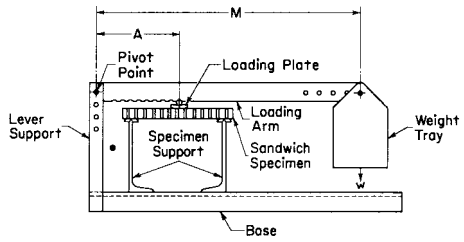

FIG. 1 Creep Test Apparatus and Loading System

5. Test Specimens

5.1 The test specimen shall be of sandwich construction of a size and proportions conforming to the flexure test specimen described in Test Method C 393.

5.2 The number of test specimens and the method of their selection depend on the purpose of the particular test under consideration, and no general rule can be given to cover all cases. However, when specimens are to be used for acceptance tests, at least three specimens shall be tested.

6. Conditioning

6.1 When the test is performed at room temperature and 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 with temperature and humidity control. The tests, preferably, should be made 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 for standard control conditions.

7. Procedure

7.1 Measure the dimensions of the specimens in millimetres (inches) to a precision of ±0.5 %.

7.2 The load applied to the specimen by the lever system shown in Fig. 1 may be calculated as follows:

$$P = \frac{W M + w B}{A} + p \quad (1)$$

where:

P = load applied to specimen, N (lb);
W = weight (including tray mass), N (lb);
M = distance between pivot point and weight point, mm (in.);
w = mass of lever arm, N (lb);
p = mass of loading plate and rod, N (lb);

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[2] *Annual Book of ASTM Standards*, Vol 15.03.

B = distance from pivot point to center of gravity of the loading arm, mm (in.); and
A = distance between pivot point and load point, mm (in.).

7.3 Attach the weight tray to the lever arm and support it temporarily so that no load is applied to the specimen. If the test is to be conducted at an elevated temperature, place the apparatus and specimen in the oven and bring the oven up to the desired test temperature. Allow sufficient time for the oven and specimen to stabilize at the test temperature. Remove the temporary support and apply the load slowly.

7.4 Measure deflections to the nearest 0.025 mm (0.001 in.). Read the initial deflection and record it. Take deflection readings at sufficient time intervals (Note 1) to define completely a creep curve with deflection plotted as the ordinate and time as the abscissa.

NOTE 1—A recommended procedure is to take readings at 10-min intervals for the first hour, then at hourly intervals up to 7 h. After this, readings may be taken at any desired interval, such as twice a day, until the total test time has been reached or failure has occurred.

8. Calculations

8.1 Calculate the creep deflection rate in millimetres (inches) per hour or millimetres (inches) per day for any portion of the curve (beyond the initial deformation) by obtaining the difference of the two deflections and dividing by the period of time.

8.2 For comparison of materials, the creep deflection may be expressed as a percentage of the initial deflection after a period of time as follows:

$$\text{Creep, \% of original deflection} = \frac{D - d}{d} \times 100 \quad (2)$$

where:
D = total deflection under constant load at time t, mm (in.) and
d = initial static deflection under the same load and at the same temperature, mm (in.).

9. Report

9.1 The report shall include the following:

9.1.1 Description of the test specimens; facings, core, and core-to-facing adhesive,

9.1.2 Dimensions of the test specimens, core orientation,

9.1.3 Test conditions including apparatus, test temperature, span, loads, and test time,

9.1.4 Bending stress in the facings and shear stress in the core calculated for the applied load in accordance with Test Method C 393,

9.1.5 Creep deflection curve, and

9.1.6 Type and location of failure, if any, such as excessive creep in the adhesive, core shear, and so forth.

10. Precision and Bias

10.1 *Precision*— It is not possible to specify the precision of the procedure in Test Method C 480 for measuring the sandwich panel creep deflection because of the unavailability of consistent samples for testing.

10.2 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 creep; creep deflection; sandwich; sandwich construction