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Designation: D6112 – 97 (Reapproved 2005)

Standard Test Methods for Compressive and Flexural Creep and Creep-Rupture of Plastic Lumber and Shapes[1]

This standard is issued under the fixed designation D6112; 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 These test methods cover the determination of the creep and creep-rupture properties of plastic lumber and shapes, when loaded in compression or flexure under specified environmental conditions. Test specimens in the "as-manufactured" form are employed. As such, these are test methods for evaluating the properties of plastic lumber or shapes as a product and not material property test methods.

1.2 Plastic lumber and plastic shapes are currently made predominantly with recycled plastics. However, this test method would also be applicable to similar manufactured plastic products made from virgin resins where the product is non-homogenous in the cross-section.

1.3 The values stated in inch–pound units are to be regarded as standard. The values given in parentheses are for information only.

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 and health practices and determine the applicability of regulatory limitations prior to use.*

NOTE 1—There is no similar or equivalent ISO standard.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D543 Practices for Evaluating the Resistance of Plastics to Chemical Reagents

D883 Terminology Relating to Plastics

D2990 Test Methods for Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastics

D4000 Classification System for Specifying Plastic Materials

D5033 Guide for Development of ASTM Standards Relating to Recycling and Use of Recycled Plastics[3]

D5947 Test Methods for Physical Dimensions of Solid Plastics Specimens

E4 Practices for Force Verification of Testing Machines

3. Terminology

3.1 *Definitions:*

3.1.1 *compression—in a compressive creep test,* the decrease in length produced in the gage length or the total length of a test specimen.

3.1.2 *creep modulus*—the ratio of initial applied stress to creep strain.

3.1.3 *creep strain*—the total strain, at any given time, produced by the applied stress during a creep test.

3.1.3.1 *Discussion*—The term creep, as used in this test method, reflects current plastics engineering usage. In scientific practice, creep is often defined to be the nonelastic portion of strain. However, this definition is not applicable to existing engineering formulas. Plastics have a wide spectrum of retardation times, and elastic portions of strain cannot be separated in practice from nonelastic. Therefore, wherever "strain" is mentioned in these test methods, it refers to the sum of elastic strain plus the additional strain with time.

3.1.4 *deflection—in a flexural creep test,* the change in mid-span position of a test specimen.

3.1.5 *deformation*—a change in shape, size or position of a test specimen as a result of compression, deflection, or extension:

3.1.6 *plastic lumber, n*—a manufactured product composed of more than 50 weight percent resin, and in which the product generally is rectangular in cross-section and typically supplied in board and dimensional lumber sizes, may be filled or unfilled, and may be composed of single or multiple resin blends.

[1] These test methods are under the jurisdiction of ASTM Committee D20 on Plastics and are the direct responsibility of Subcommittee D20.20 on Plastic Products (Section D20.20.01).

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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.

[3] Withdrawn. The last approved version of this historical standard is referenced on www.astm.org.

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3.1.7 *plastic shape*, *n*—a manufactured product composed of more than 50 weight percent resin, and in which the product generally is not rectangular in cross-section, may be filled or unfilled, and may be composed of single or multiple resin blends.

3.1.8 *resin*, *n*—a solid or pseudo-solid organic material often of high molecular weight, that exhibits a tendency to flow when subjected to stress, usually has a softening or melting range, and usually fractures conchoidally. (See Terminology D883.)

3.1.8.1 *Discussion*—In a broad sense, the term is used to designate any polymer that is a basic material for plastics.

3.1.9 *stress—for compressive creep,* the ratio of the applied load to the initial cross-sectional area. For flexural creep, maximum fiber stress is calculated according to Eq 1.

3.1.10 Additional definition of terms applying to this test method appear in Terminology D883 and Guide D5033.

4. Summary of Test Method

4.1 These test methods consist of measuring the deflection or compression as a function of time and time-to-rupture, or failure of a specimen subject to constant flexural or compressive load under specified environmental conditions.

4.2 The four-point loading a outlined in this testing standard shall be used for the flexural creep tests.

4.3 Compressive loading as outlined in this testing standard shall be used for the compressive creep tests.

4.4 These test methods represent modifications of the compressive and flexural creep and creep rupture test methods specified in Test Methods D2990.

5. Significance and Use

5.1 Data from creep and creep-rupture tests are necessary to predict the creep modulus and strength of materials under long-term loads and to predict dimensional changes that may occur as a result of such loads.

5.2 Data from these test methods can be used to characterize plastic lumber: for comparison purposes, for the design of fabricated parts, to determine long-term performance under constant load, and under certain conditions, for specification purposes.

5.3 For many products, there may be a specification that requires the use of this test method, but with some procedural modifications that take precedence when adhering to the specification. Therefore, it is advisable to refer to that product specification before using this test method. Table 1 in Classification D4000 lists the ASTM materials standards that currently exist.

6. Apparatus

6.1 *General*:

6.1.1 *Loading System*:

6.1.1.1 The loading system must be so designed that the load applied and maintained on the specimen is within ±1 % of the desired load. The loading mechanism must allow reproductively rapid and smooth loading as specified in 11.1.3. In creep-rupture tests, provision must be made to ensure that shock loading, caused by a specimen failure, is not transferred to other specimens undergoing testing. The accuracy of the loading system shall be verified at least once each year in accordance with Practices E4.

6.1.1.2 Loading systems that provide a mechanical advantage require careful design to maintain constant load throughout the test. For example, lever systems must be designed so that the load does not change as the lever arm moves during the test.

6.1.2 *Compression and Deflection Measurements*:

6.1.2.1 The accuracy of the deformation measuring device shall be within ±1 % of the deformation to be measured.

6.1.2.2 Deformation measuring devices shall be calibrated against a precision micrometer screw or other suitable standard under conditions are nearly identical as possible with those encountered in the test. Caution is necessary when using deformation measuring devices whose calibration is subject to drifting with time and is dependent on temperature and humidity.

6.1.2.3 Deformation measuring devices shall be firmly attached to or seated on the specimen so that no slippage occurs. Electrical resistance gages are suitable only if the material tested will permit perfect adhesion to the specimen and if they are consistent with 6.2.1

6.1.3 *Time Measurement*—The accuracy of the time measuring device shall be ±1 % of the time-to-rupture or failure or the elapsed time of each creep measurement, or both.

6.1.4 *Temperature Control and Measurement*:

6.1.4.1 The temperature of the test space, especially close to the gage length of the specimen, shall be maintained within ±2°C by a suitable automatic device and shall be stated in reporting the results.

NOTE 2—The thermal contraction and expansion associated with small temperature changes during the test may produce changes in the apparent creep rate, especially near transition temperatures.

6.1.4.2 Care must be taken to ensure accurate temperature measurements over the gage length of the specimen throughout the test. The temperature measuring devices shall be checked regularly against temperature standards and shall indicate the temperature of the specimen gage area.

6.1.4.3 Temperature measurements shall be made at frequent intervals, or continuously recorded to ensure an accurate determination of the average test temperature and compliance with 6.1.5.

6.1.5 *Environmental Control and Measurements*:

6.1.5.1 When the test environment is air, the relative humidity shall be controlled to 50 ± 5 % during the test unless otherwise specified, or unless the creep behavior of the material under testing has been shown to be unaffected by humidity. The controlling and measuring instruments shall be stable for long time intervals and accurate to within ±1 %. (The control of relative humidity is known to be difficult at temperatures much outside the range from 50 to 104°F (10 to 40°C).)

6.1.5.2 If, for any reason, the specified relative humidity cannot be achieved or the test is conducted to determine the sensitivity of the product to high humidity, the actual average value and fluctuation of relative humidity used should be reported.

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6.1.5.3 The composition of the test environment shall be maintained constant throughout the test. (**Warning—**Safety precautions should be taken to void personal contact, to eliminate toxic vapors, and to guard against explosion hazards in accordance with any possible hazardous nature of the particular environment being used.)

6.1.6 *Vibration Control*—Creep tests are quite sensitive to shock and vibration. The location of the apparatus, the test equipment, and mounting shall be so designated that the specimen is isolated from vibration. Multiple-station test equipment must be of sufficient rigidity so that no significant deflection occurs in the test equipment during creep or creep-rupture testing. During time-to-rupture or failure, means to prevent jarring of other test specimens by the falling load from a failed test specimen shall be provided by a suitable net or cushion.

6.2 *Compressive Creep*:

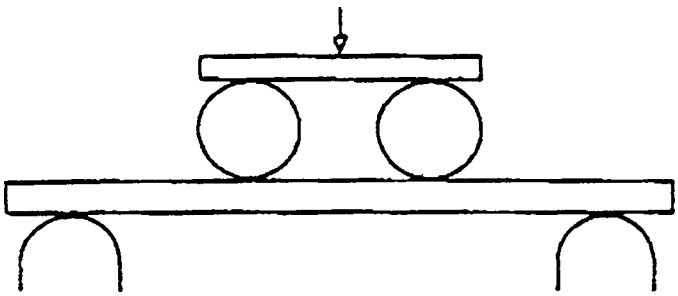
6.2.1 *Platens*—Parallel platens shall be used to apply the load to the unconfined-type specimen (see 8.2). One of the platens of the machine shall preferably be self-aligning and shall, in order that the load may be applied evenly over the face of the specimen, be arranged so that the specimen is accurately centered and the resultant of the load is through its center.

6.2.2 The compression of specimen gage length under load shall be measured by means of any device that will not influence the specimen behavior by mechanical (undesirable deformation, notches, etc.) physical (heating of specimen, etc.), or chemical effects. Alternatively, the compression of the specimen can be measured using platen displacement with the entire length of the specimen serving as the gage length.

6.3 *Flexural Creep*:

6.3.1 *Test Rack*—A rigid test rack shall be used to provide support of the test specimen at both ends with a span equal to 16 (tolerant +4 and −2) times the depth of the specimen. In order to avoid excessive indentation of the specimen, the radius of the support shall be a minimum of 0.5 in. (12.7 mm) and up to 1.5 times the depth of the specimen. Sufficient space must be allowed below the specimen for dead-weight loading.

6.3.2 *Loading Beam*—The loading beam shall be configured with loading noses with cylindrical surfaces (see Fig. 1). The radius of noses shall be at least 0.5 in. (12.7 mm) or all specimens. For large specimens the radius of the supports may be up to 1.5 times the specimen depth.



NOTE—Minimum radius = 0.5 in. (12.7 mm); maximum radius = 1.5 times the specimen depth.

FIG. 1 Four Point Loading and Support Noses at Maximum Radius

6.3.3 A four point loading arrangement shall be used as shown in Fig. 1.

6.3.4 For flexural testing the deflection of the specimen shall be measured at the midpoint of the load span at the bottom face of the specimen.

7. Reagents

7.1 *Purity of Reagents*—Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specification are available[4]. Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

7.2 *Purity of Water*—Unless otherwise indicated, references to water shall be understood to mean distilled water or water of equal purity.

7.3 *Specified Reagents*—Should this test method be referenced in a material specification, the specific reagent to be used shall be as stipulated in the specification.

7.4 *Standard Reagents*—A list of standard reagents is also available in Test Method D543.

8. Test Specimen

8.1 *General*:

8.1.1 Test specimens may be made by any of the techniques normally employed to produce plastic lumber. When the testing objective is to obtain design data, the method of sample fabrication shall be the same as that used in the application.

8.1.2 In the case of materials whose dimensions are known to change significantly due to the specified environment alone (for example, the shrinkage of some thermosetting plastics due to post-curing at elevated temperatures), provision shall be made to test unloaded control specimens alongside the test specimen so that compensation may be made for changes other than creep. A minimum of three control specimens shall be tested at each test temperature.

8.1.3 In creep testing at a single temperature, the minimum number of test specimens at each stress shall be two if four or more levels of stress are used or three if fewer than four levels are used.

8.1.4 In creep-rupture testing, a minimum of two specimens shall be tested at each of the stress levels specified in 10.2.1 at each temperature.

NOTE 3—The scatter of creep-rupture data is considerable, with one half to a full decade of variation in time-to-rupture being typical. Therefore, it may be necessary to test more than two specimens at each stress level to obtain satisfactory results.

8.2 *Compressive Creep*:

8.2.1 The standard test specimen shall be in the form of a right prism. With the exception that specimen cross sections

[4] *Reagent Chemicals, American Chemical Society Specifications* , American Chemical Society, Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see *Analar Standards for Laboratory Chemicals*, BDH Ltd., Poole, Derner, U.K., and the *United States Pharmacopeia and National Formulary*, U.S. Pharmacopeial Convention, Inc. (USPC), Rockville, MD.

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are the full sections of any manufactured plastic lumber or shape. Surfaces of the test specimens shall be plane and parallel.

8.2.2 Test specimens for determining compressive properties of plastic lumber and shapes shall be cut from the "as manufactured" profile. Great care shall be taken in cutting and machining the ends so that smooth, flat parallel surfaces and sharp, clean edges to within 1/300 (0.0033) of the specimen length perpendicular to the long axis of the specimen results. Plastic lumber is generally nonuniform through the cross-section; no machining operations other than those required to provide flat, parallel ends shall be carried out.

8.2.2.1 The standard test specimen, except as indicated in 8.2.2.2 to 8.2.2.3, shall be in the form of a right cylinder or prism whose height is twice its *minimum* width or diameter.

8.2.2.2 For rod material, the test specimen shall have a diameter equal to the diameter of the rod and whose height is twice its diameter.

8.2.2.3 When testing hollow profiles, the test specimen shall have a minimum length equal to twice its minimum cross sectional dimension.

8.3 *Flexural Creep*:

8.3.1 The specimens shall be full size as manufactured. The original surfaces shall be unaltered.

8.3.2 For flatwise (plank) tests, the depth of the specimen shall be the thickness, or smaller dimension, of the material. For edgewise (joist) tests the width becomes the smaller dimension and depth the larger. For all tests, the support span shall be 16 (tolerance +4 and −2) times the depth of the beam. The specimen shall be long enough to allow for overhanging on each end of at least 10 % of the support span, but in no case less than 0.25 in. (6.4 mm) on each end. Overhand shall be sufficient to prevent the specimen from slipping through the supports.

9. Conditioning

9.1 The specimen shall be preconditioned in the test environment for at least 48 h prior to being tested or for a longer period if needed to establish an equilibrium condition. Those materials whose creep properties are suspected to be affected by moisture content shall be brought to moisture equilibrium appropriate to the test conditions prior to testing.

9.2 If warranted, based on projected usage, the test specimen should be submerged in water for at least 24 h or until it achieves an equilibrium moisture content prior to conditioning. The ends of the test specimen should be taped prior to water immersion.

10. Selection of Test Conditions

10.1 *Test Temperatures*—Selection of temperatures for creep and creep-rupture testing depends on the intended use of the test results and shall be made as follows:

10.1.1 To characterize a material, select two or more test temperatures to cover the useful temperature range usually at elevated temperatures, in suitable increments that reflect the variation of the creep of the material with temperature and transitions of the material. Unless actual conditions warrant otherwise, test temperatures of 50, 73.4, and 104°F (10, 23, and 40°C) are recommended.

10.1.2 To obtain design data, the test temperatures and environment shall be the same as those of the intended end-use application.

10.1.3 To obtain the stress for 1 % strain at 1000 h (see 10.3.2) or for other simple material comparisons such as data sheets, use the recommended test temperatures cited in 10.1.1.

10.2 *Creep-Rupture*:

10.2.1 At each test temperature, make creep-rupture tests at a minimum of seven stress levels selected so as to produce rupture at approximately the following times: 1, 10, 30, 100, 300, 1000, and 3000 h.

10.2.1.1 The objective of these tests is to produce at each test temperature, a curve of stress-at-rupture versus time-to-rupture, often called a "creep-rupture envelope," which indicated a limit of a material's load-bearing capability at the test temperature. For the prediction of long-term performance, for example, in the design of parts that will bear constant loads six months or longer, test times longer than 3000 h are usually necessary, particularly at elevated temperatures where heat aging of the material may be occurring, and in aggressive environments, both of which can greatly affect creep-rupture.

10.2.2 For materials that fail catastrophically (that is, with negligible yielding, drawing, or flowing) measure and report the time-to-rupture. For materials that yield, draw, or flow significantly prior to rupture, measure and report the time at the onset of tertiary creep (onset of yielding, flowing, or drawing) shall be considered the time-to-failure and shall be measured and reported. For materials that yield, draw, or flow, creep strain may have to be measured with a recorder.

10.3 *Creep*:

10.3.1 To obtain design data or to characterize a material, select stress levels as follows:

10.3.1.1 For materials that show linear viscoelasticity, that is, successive creep modulus versus time for different stresses that superimpose upon each other (Boltzman superposition principle,[5] select a minimum of three stress levels for each temperature of interest.

10.3.1.2 For materials that are significantly affected by stress, select at least five stresses (and preferably more) for each temperature of interest.

10.3.1.3 Select stress levels in approximately even increments up to the 1000–h creep-rupture stress: stress levels above 1000 psi (6.9 MPa) to the nearest 500 psi (3.4 MPa); stress levels below 1000 psi (6.9 MPa) to the nearest 100 psi (0.7 MPa).

10.3.1.4 Do not use stress levels that produce failure in less than 1000 h in creep testing.

10.3.2 For simple material comparisons, as for data sheets and the like, determine the stress to produce 1 % strain in 1000 h. Do this by selecting several loads to produce strains in the approximate range of 1 % (both somewhat greater and less than 1 % in 1000 h) and plotting a 1000-h isochronous stress-strain curve from which the stress to produce 1 % strain may be determined by interpolation.

NOTE 4—Isochronous stress-strain curves are cartesian plots of the

[5] Nielsen, L.E., *Mechanical Properties of Polymers*, Reinhold Publishing Corp., New York, NY, 1962.

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applied stress used in the creep test versus the creep strain at a specific time, in this case 1000 h. Since only one point of an isochronous plot is obtained from each creep test, it is usually necessary to run creep tests at least three stress levels (and preferably more) to obtain an isochronous plot (See Fig. 2).

11. Procedure

11.1 *General*:

11.1.1 Mount a properly conditioned and measured specimen in the compressive creep fixture of flexural creep rack. If necessary, mount a properly conditioned and measured control specimen alongside the test specimen in the same manner.

11.1.2 Attach the deformation measuring devices to the specimen (and control specimen) or, if these are optical devices, install ready for measurements. Make the initial or reference measurement for compression or deflection.

11.1.2.1 If the test environment would be disturbed during the attachment of the deformation measuring device, mount the device prior to mounting the specimen.

11.1.3 Apply the full load rapidly and smoothly to the specimen, preferably in 1 to 5 s. In no case shall the loading time exceed 5 s. Start the timing at the onset of loading.

11.1.4 If an environmental agent is used, apply it to the entire gage length of the specimen immediately after loading.

11.1.4.1 If the environmental agent is volatile, cover the specimen to retard evaporation without affecting the applied load. Replenish volatile agents periodically.

NOTE 5—For liquid environmental agents a cotton swab, film, or other device may be wrapped or sealed around the gage length or span of the specimen, and the liquid agent applied to saturate the swab.

11.1.5 Measure the compression or flexure of the specimen in accordance with the following approximate time schedule: 1, 6, 12, and 30 min; 1, 2, 5, 20, 50, 100, 200, 500, 700, and 1000 h. For creep tests longer than 1000 h, measure deformation at least monthly.

11.1.5.1 If discontinuities in the creep strain versus time plot are suspected or encountered, reading should be taken more frequently than scheduled above.

11.1.6 Measure temperature, relative humidity, and other environmental variables and deformation of control specimen in accordance with the same schedule as that for deformation of the test specimen.

11.1.7 Upon completion of the test interval without rupture, remove the load rapidly and smoothly.

NOTE 6—If desired, measurements of the recovery can be initiated on the same schedule as used in 11.1.5 during the load application. Calculate recovery strain as described in 12.2.2.

11.2 *Flexural Creep*:

11.2.1 Flexural deflection shall be measured at the bottom of the test specimen at the midpoint of the load span.

11.2.2 Measure the width and thickness or diameter of the specimen to a precision of 1 % of the measured dimension at several points along its length. Calculate and record the minimum value of the cross-sectional area (see Test Methods D5947 for additional information).

11.3 *Compressive Creep*—Measure the width and thickness or diameter of the specimen to a precision of 1 % of the

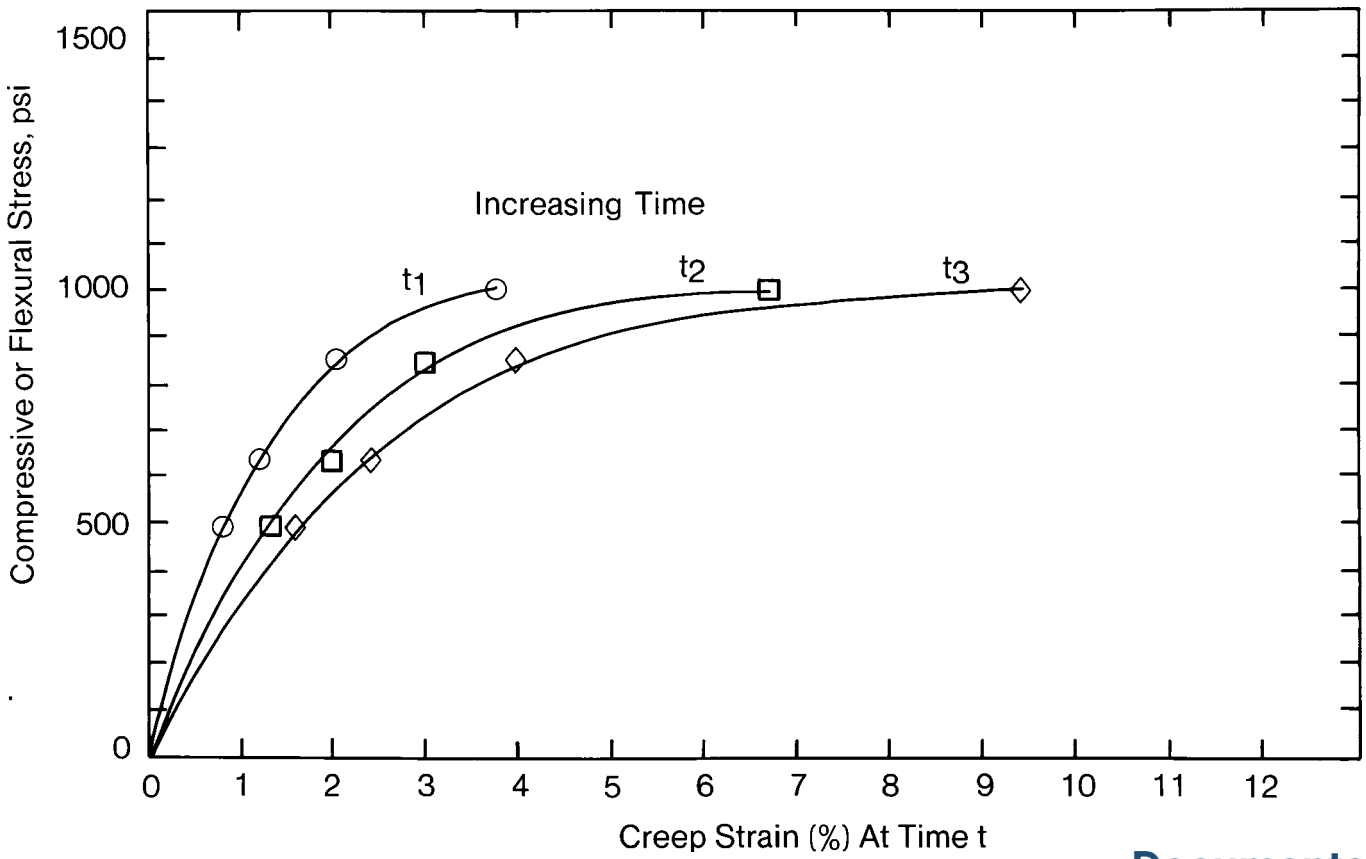


FIG. 2 Cartesian Isochronous Stress Strain Curves at Various Times

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measured dimension at several points along its length. Calculate and record the minimum value of the cross-sectional area. Measure the length of the specimen at several points and record the average value (see Test Methods D5947 for additional information).

12. Calculation

12.1 *General*:

12.1.1 When a material shows a significant dimensional change due to the environment alone, either of the following approaches may be used, depending on the intended use of the results:

12.1.2 Correct each measurement of deformation under load by the algebraic addition to it of the average deformation measured on three nonloaded control specimens at the same time and at the same temperature. Contraction of the control specimens used for compressive measurements shall be considered negative (−), expansion positive (+). Upward deflection of the control specimens used for flexural measurements shall be considered positive (+); downward shall be considered negative (−). Calculate corrected strain using the deformation corrected for or dimensional change due to the environment. Multiply corrected strain by 100 to obtain percent corrected strain.

12.1.3 If, because of the intended use of the results, it is desired not to correct the deformation under load for significant dimensional change due to the environment alone, then the strain calculated in accordance with 12.2.2 or 12.3.1 shall be called uncorrected strain. Calculate the strain change due to the environment in accordance with 12.2.2 or 12.3.1 by using the average deformation in the control specimen. Multiply by 100 to obtain percent strain change due to the environment. Contraction of the control specimens used for compressive measurements shall be considered negative (−), expansion positive (+). Upward deflection of the control specimens used for flexural measurements shall be considered positive (+), downward negative (−).

12.1.4 Calculate creep modulus in megapascals by dividing the initial stress by the strain at the times specified in 11.1.5.

NOTE 7—For purposes of comparing materials, the plot of creep modulus versus time not only realistically ranks materials but also provides modulus values for use in many design equations (see Fig. 3).

12.1.5 At each test temperature, calculate a statistical least squares regression equation of log stress versus log time-to-rupture or failure. From the regression equation calculate the stress-to-rupture failure in megapascals at 1000 h (see Fig. 4).

12.1.6 To calculate the stress to produce 1 % strain at 1000 h, plot at each test temperature the 1000–h isochronous stress-strain curve (see Fig. 2) and interpolate for the stress at 1 % strain. The isochronous stress-strain curve at 1000 h is obtained from several (at least three, and preferably more) creep curves at different stresses by plotting stress versus strain calculated from deformation measurements at 1000 h.

12.1.6.1 Isochronous stress-strain curves may be plotted at times other than 1000 h for purposes of analysis or for

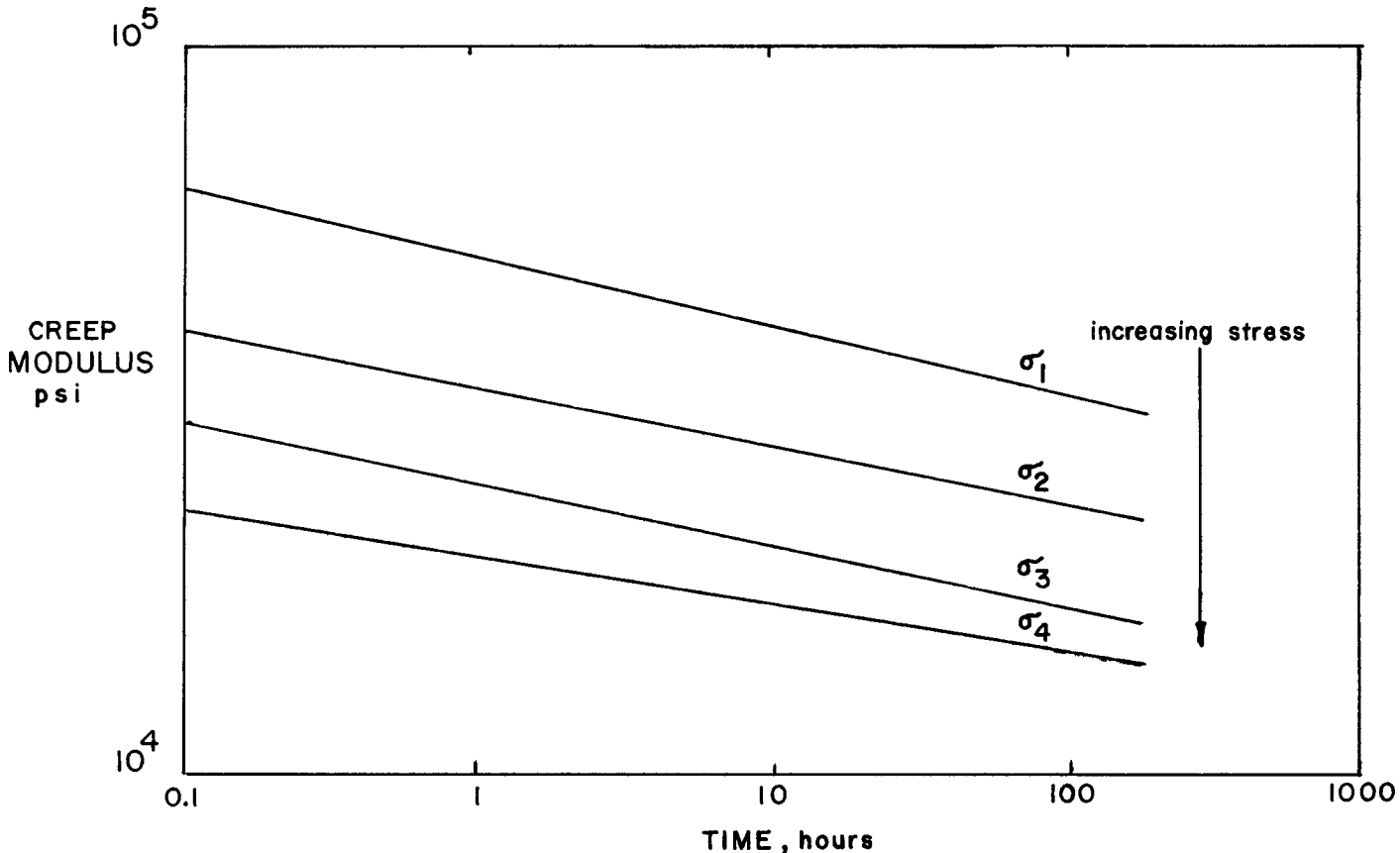


FIG. 3 Logarithmic Creep Modulus Versus Time Curves at Various Stress Levels

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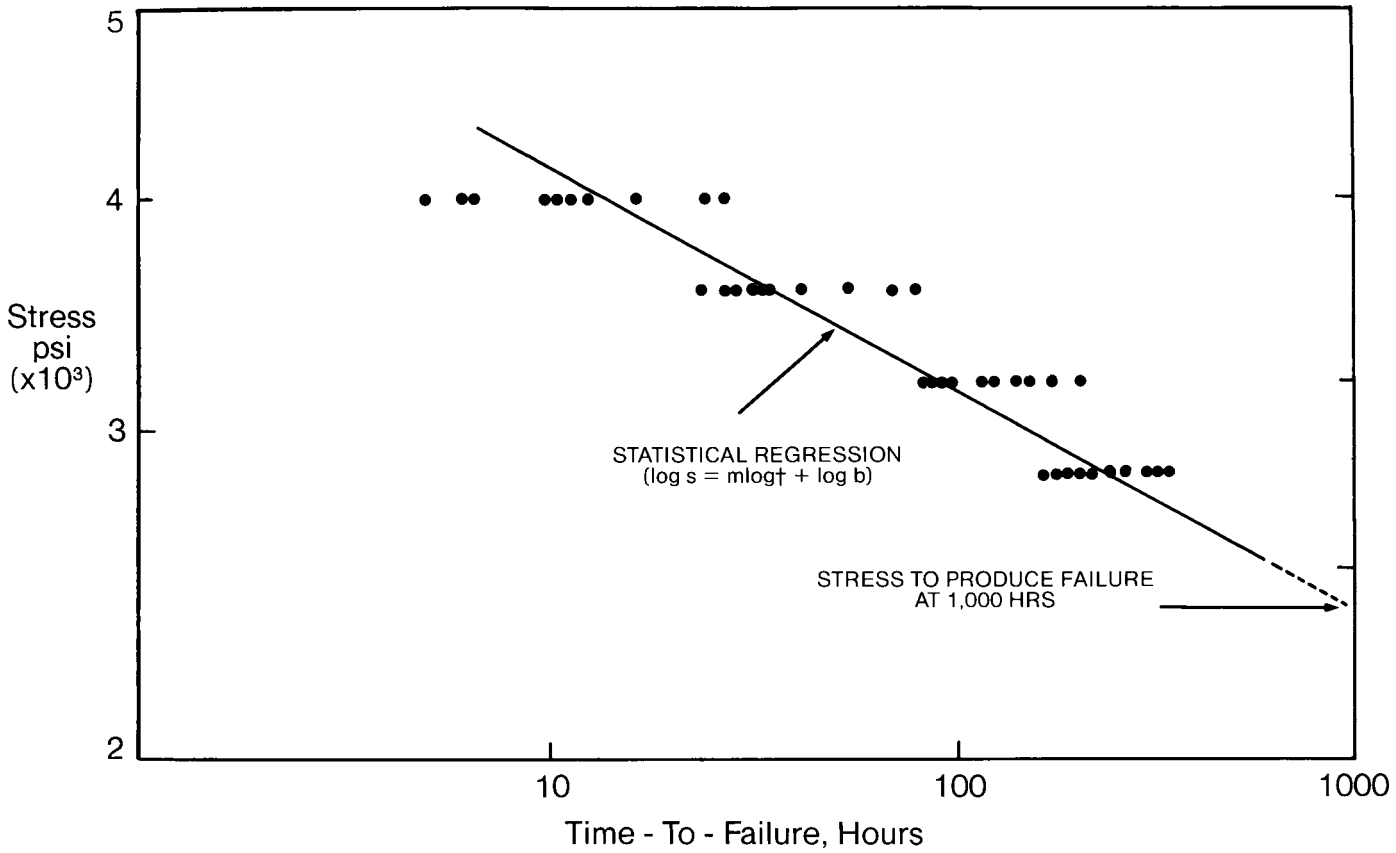


FIG. 4 Logarithmic Time-to-Failure (Stress Rupture) Curve

specialized design situations involving relatively short-time loads and materials that show pronounced creep at such times. For long-term loading and in general, however, creep modulus curves are more useful.

12.2 *Compressive Creep*:

12.2.1 For compressive measurements, calculate the stresses for each specimen in megapascals (or pounds-force per square inch) by dividing the load by the average initial or effective cross-sectional area.

12.2.2 Calculate strain by dividing the extension or compression at the times specified in 11.1.5 by the initial gage length of the conditioned specimen; multiply strain by 100 to obtain percent strain.

12.3 *Flexural Creep*:

12.3.1 For flexural measurements, calculate the maximum fiber stress for each specimen in megapascals as follows:

$$S = PL/bd^2 \quad (1)$$

where:

S = stress in outer fiber throughout load span, psi (MPa),
P = load at a given point on the load-deflection curve, lb (N)
L = support span, in. (mm),
b = width of beam, in. (mm), and
d = depth of beam, in. (mm).

NOTE 8—Eq 1 represents only a first-order approximation to the actual flexural stress because the distribution of stress across the section becomes increasingly nonlinear as creep occurs. Its use is consistent with Test Methods D2990.

12.3.2 Calculate the maximum strain in the outer fiber at the mid-span as follows:

$$r = 4.70\ Dd/L^2 \quad (2)$$

where:

r = maximum strain, in./in. (mm/mm),
D = maximum deflection at mid-span, in. (mm),
d = depth of beam, in. (mm), and
L = support span, in. (mm).

Multiply strain by 100 to obtain percent strain.

13. Report

13.1 Report the following information:

13.1.1 Complete identification of the material tested, including type, source, manufacturer's code number, form, principal dimensions, and previous history,

13.1.2 Laboratory name,

13.1.3 Date of test,

13.1.4 Dimensions of the test specimen,

13.1.5 All pertinent information on composition, preparation, date of manufacture, type of molding, annealing, etc.,

13.1.6 Preconditioning used and description of test conditions, including the relative humidity, temperatures, as well as concentration and composition of the environment other than air, loads used, type loading, etc.,

13.2 For each test temperature, plot log strain in percent versus log time in hours under load with stress as a parameter (see Fig. 5),

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