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Standard Test Methods for Stress Relaxation for Materials and Structures[1]

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INTRODUCTION

These test methods cover a broad range of testing activities. To aid in locating the subject matter pertinent to a particular test, the standard is divided into a general section, which applies to all stress relaxation tests for materials and structures. This general section is followed by letter-designated parts that apply to tests for material characteristics when subjected to specific, simple stresses, such as uniform tension, uniform compression, bending or torsion. To choose from among these types of stress, the following factors should be considered:

(1) When the material data are to be applied to the design of a particular class of component, the stress during the relaxation test should be similar to that imposed on the component. For example, tension tests are suitable for bolting applications and bending tests for leaf springs.

(2) Tension and compression relaxation tests have the advantage that the stress can be reported simply and unequivocally. During bending relaxation tests, the state of stress is complex, but can be accurately determined when the initial strains are elastic. If plastic strains occur on application of force, stresses can usually be determined within a bounded range only. Tension relaxation tests, when compared to compression tests, have the advantage that it is unnecessary to guard against buckling. Therefore, when the test method is not restricted by the type of stress in the component, tension testing is recommended.

(3) Bending tests for relaxation, when compared to tension and compression tests, have the advantage of using lighter and simpler apparatus for specimens of the same cross-sectional area. Strains are usually calculated from deflection or curvature measurements. Since the specimens can usually be designed so that these quantities are much greater than the axial deformation in a direct stress test, strain is more easily measured and more readily used for machine control in the bending tests. Due to the small forces normally required and the simplicity of the apparatus when static fixtures are sufficient, many specimens can be placed in a single oven or furnace when tests are made at elevated temperatures.

1. Scope

NOTE 1—The method of testing for the stress relaxation of plastics has been withdrawn from this standard, and the responsibility has been transferred to Practice D 2991.

1.1 These test methods cover the determination of the time dependence of stress (stress relaxation) in materials and structures under conditions of approximately constant constraint, constant environment, and negligible vibration. In the procedures recommended, the material or structure is initially constrained by externally applied forces, and the change in the external force necessary to maintain this constraint is determined as a function of time.

1.2 Specific methods for conducting stress relaxation tests on materials subjected to tension, compression, bending and torsion stresses are described in Parts A, B, C, and D, respectively. These test methods also include recommendations for the necessary testing equipment and for the analysis of the test data.

1.3 It is recognized that the long time periods required for these types of tests are often unsuited for routine testing or for specification in the purchase of material. However, these tests are valuable tools in obtaining practical design information on the stress relaxation of materials subjected to the conditions enumerated, and in investigations of the fundamental behavior of materials.

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.*

[1] These test methods are under the jurisdiction of ASTM Committee E28 on Mechanical Testing and is the direct responsibility of Subcommittee E28.10 on Effect of Elevated Temperature on Properties.

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