Designation: E 132 – 97

Standard Test Method for Poisson's Ratio at Room Temperature[1]

This standard is issued under the fixed designation E 132; 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.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This test method covers the determination of Poisson's ratio from tension tests of structural materials at room temperature. This test method is limited to specimens of rectangular section and to materials in which and stresses at which creep is negligible compared to the strain produced immediately upon loading.

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

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]

E 8 Test Methods for Tension Testing of Metallic Materials[2]

E 83 Practice for Verification and Classification of Extensometers[2]

E 111 Test Method for Young's Modulus, Tangent Modulus, and Chord Modulus[2]

E 1012 Practice for Verification of Specimen Alignment Under Tensile Loading

3. Terminology

3.1 *Definitions:*

3.1.1 *Poisson's ratio*—the absolute value of the ratio of transverse strain to the corresponding axial strain resulting from uniformly distributed axial stress below the proportional limit of the material.

3.1.2 *Discussion*—Above the proportional limit, the ratio of transverse strain to axial strain will depend on the average stress and on the stress range for which it is measured and, hence, should not be regarded as Poisson's ratio. If this ratio is reported, nevertheless, as a value of "Poisson's ratio" for stresses beyond the proportional limit, the range of stress should be stated.

3.1.3 *Discussion*—Poisson's ratio will have more than one value if the material is not isotropic. Deviations from isotropy should be suspected if the Poisson's ratio, μ, determined by the method described below differs significantly from that determined when the ratio E/G of Young's modulus, E, to shear modulus, G, is substituted in the following equation:

$$\mu = (E/2G) - 1 \tag{1}$$

where E and G must be measured with greater precision than the precision desired in the measurement of μ.

4. Significance and Use

4.1 When uniaxial force is applied to a solid, it deforms in the direction of the applied force, but also expands or contracts laterally depending on whether the force is tensile or compressive. If the solid is homogeneous and isotropic, and the material remains elastic under the action of the applied force, the lateral strain bears a constant relationship to the axial strain. This constant, called Poisson's ratio, after a French scientist that developed the concept, is a definite material property just like Young's modulus and Shear modulus.

4.2 Poisson's ratio is used for design of structures where all dimensional changes resulting from application of force need to be taken into account, and in the application of the generalized theory of elasticity to structural analysis.

4.3 In this test method, the value of Poisson's ratio is obtained from strains resulting from uniaxial stress only.

5. General Considerations

5.1 The accuracy of the determination of Poisson's ratio is usually limited by the accuracy of the transverse strain measurements because the percentage errors in these measurements are usually greater than in the axial strain measurements. Since a ratio rather than an absolute quantity is measured, it is only necessary to know accurately the relative value of the calibration factors of the extensometers. Also, in general, the values of the applied loads need not be accurately known. It is frequently

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