Designation: E6 – 09b$^{\varepsilon 1}$

Standard Terminology Relating to Methods of Mechanical Testing[1]

This standard is issued under the fixed designation E6; 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 U.S. Department of Defense.

ε[1] NOTE—Editorial corrections were made throughout in March 2011.

1. Scope

1.1 This terminology covers the principal terms relating to methods of mechanical testing of solids. The general definitions are restricted and interpreted, when necessary, to make them particularly applicable and practicable for use in standards requiring or relating to mechanical tests. These definitions are published to encourage uniformity of terminology in product specifications.

1.2 Terms relating to fatigue and fracture testing are defined in Terminology E1823.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

E8/E8M Test Methods for Tension Testing of Metallic Materials

E796 Test Method for Ductility Testing of Metallic Foil (Withdrawn 2009)[3]

E1823 Terminology Relating to Fatigue and Fracture Testing

2.2 *ISO Standard:*[4]

ISO/IEC Guide 99:2007 International Vocabulary of metrology—Basic and general concepts and terms (VIM)

3. Index of Cross-References and Associated Definitions

3.1 The terms listed below are associated with terminology that is fundamental or commonly used. The definition for the term of interest is related to or is given below the definition for the fundamental term cited.

Term	
angular strain	see **strain**
axial strain	see **strain**
bending strain	see **strain**
chord modulus	see **modulus of elasticity**
direct verification	see **verification**
compressive stress	see **stress**
elastic constants	see **modulus of elasticity** and **Poisson's ratio**
elastic modulus	see **modulus of elasticity**
engineering strain	see **strain**
engineering stress	see **stress**
fracture stress	see **stress**
indirect verification	see **verification**
linear (tensile or compressive) strain	see **strain**
macrostrain	see **strain**
malleability	see **ductility**
microstrain	see **strain**
modulus of rigidity	see **modulus of elasticity**
nominal stress	see **stress**
normal stress	see **stress**
physical properties	see **mechanical properties**
pin	see **mandrel (in bend testing)**
plunger	see **mandrel (in bend testing)**
principal stress	see **stress**
residual strain	see **strain**
residual stress	see **stress**
Rockwell superficial hardness number	see **Rockwell hardness number**
secant modulus	see **modulus of elasticity**
shear strain	see **strain**
shear stress	see **stress**
static fatigue strength	see **creep rupture strength**
strain gauge fatigue life	see **fatigue life**
stress-rupture strength	see **creep rupture strength**
tangent modulus	see **modulus of elasticity**
tensile stress	see **stress**
torsional modulus	see **modulus of elasticity**
torsional stress	see **stress**
transverse strain	see **strain**
true strain	see **strain**
true stress	see **stress**
ultimate tensile strength (UTS)	see **tensile strength**
yield strength	see also **upper yield strength** and **lower yield strength**

4. Terminology

4.1 *Terms and Definitions:*

accuracy, *n*—the permissible variation from the correct value. **(E28.01)**

[1] This terminology is under the jurisdiction of ASTM Committee E28 on Mechanical Testing and is the direct responsibility of Subcommittee E28.91 on Terminology except where designated otherwise. A subcommittee designation in parentheses following a definition indicates the subcommittee with responsibility for that definition.

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

[4] Available from International Organization for Standardization (ISO), 1 rue de Varembé, Case postale 56, CH-1211, Geneva 20, Switzerland, http://www.iso.ch.

alignment, *n*—the condition of a testing machine and load train (including the test specimen) that influences the introduction of bending moments into a specimen during tensile loading. **(E28.04)**

angle of bend, *n*—the change in the angle between the two legs of the specimen during a bend test, measured before release of the bending forces.

Discussion—The angle of bend is measured before release of the bending force, unless otherwise specified. **(E28.02)**

angle of twist (torsion test), *n*—the angle of relative rotation measured in a plane normal to the torsion specimen's longitudinal axis over the gauge length. **(E28.04)**

bearing area [L^2], *n*—the product of the pin diameter and specimen thickness. **(E28.04)**

bearing force [F], *n*—a compressive force on an interface. **(E28.04)**

bearing strain, *n*—the ratio of the bearing deformation of the bearing hole, in the direction of the applied force, to the pin diameter. **(E28.04)**

bearing strength [FL^{-2}] **,** *n*—the maximum bearing stress which a material is capable of sustaining. **(E28.04)**

bearing stress [FL^{-2}] **,** *n*—the force per unit of bearing area. **(E28.04)**

bearing yield strength [FL^{-2}]**,** *n*—the bearing stress at which a material exhibits a specified limiting deviation from the proportionality of bearing stress to bearing strain. **(E28.04)**

bend test, *n*—a test for ductility performed by bending or folding a specimen, usually by steadily applied forces but in some instances by blows. The bending may be interrupted to examine the bent surface for cracks.

Discussion—The ductility is usually judged by whether or not the specimen cracks under the specified conditions of the test.

Discussion—There are four general types of bend tests according to the manner in which the forces are applied to the specimen to make the bend. These are as follows:

1. Free Bend
2. Guided Bend
3. Semi-Guided Bend
4. Wrap-Around Bend

Discussion—The specimen has a substantially uniform cross-section and a length several times as great as the largest dimension of the cross-section. **(E28.02)**

bias, statistical, *n*—a constant or systematic error in test results. **(E28.04)**

biaxial stretching, *v*—a mode of sheet metal forming in which positive strains are observed in all directions at a given location. **(E28.02)**

breaking force[F], *n*—the force at which fracture occurs.

Discussion—When used in connection with tension tests of thin materials or materials of small diameter for which it is often difficult to distinguish between the breaking force and the maximum force developed, the latter is considered to be the breaking force. **(E28.04)**

Brinell hardness number, HB **,** *n*—result from indentation hardness test in which a number proportional to the quotient obtained by dividing the test force by the curved surface area of the indentation which is assumed to be sphereical and of the diameter of the ball.

$$HBW = 0.102 \times 2F/\pi D\left[D - \left(D^2 - d^2\right)^{-1/2}\right. \quad (1)$$

where:

F = test force, N,
D = diameter of ball, mm, and
d = mean diameter of the indentation, mm.

Discussion—In former standards, a steel ball was allowed for hardness values below 450. In cases where a steel ball was used the Brinell hardness was denoted by HB or HBS.

Discussion—The symbol HBW is preceded by the hardness value when the test is carried out under the following conditions:

Ball diameter	10 mm
Force	3000 kgf
Duration of loading	10 to 15 s

When other conditions are used, the hardness value and symbol are supplemented by numbers indicating the test conditions in the following order: diameter of ball, force, and duration of loading. **(E28.06)**

Brinell hardness test, *n*—test in which an indenter (tungsten carbide ball) is forced into the surface of a test piece and the diameter of the indentation left in the surface after removal of the test force is measured.

Discussion—The tungsten carbide ball may be used for materials with Brinell hardness not exceeding 650. **(E28.06)**

calibration, *n*—a process that establishes, under specific conditions, the relationship between values indicated by a measuring system and the corresponding values indicated by one or more standards.

Discussion—This definition is intended to meet the principles of the definition of **calibration** provided by the ISO/IEC Guide 99:2007 International Vocabulary of Basic and General Terms in Metrology (VIM). **(E28.91)**

calibration factor, *n*—the factor by which a change in extensometer reading must be multiplied to obtain the equivalent strain.

Discussion—For any extensometer, the calibration factor is equal to the ratio of change in length to the product of the gauge length and the change in extensometer reading. For direct-reading extensometers the calibration factor is unity. **(E28.01)**

compressive strength [FL^{-2}] **,** *n*—the maximum compressive stress that a material is capable of sustaining. Compressive strength is calculated by dividing the maximum force during a compression test by the original cross-sectional area of the specimen.

Discussion—In the case of a material which fails in compression by a shattering fracture, the compressive strength has a very definite value. In the case of materials which do not fail in compression by a shattering fracture, the value obtained for compressive strength is an arbitrary value depending upon the degree of distortion which is regarded as indicating complete failure of the material. **(E28.04)**

compressometer, *n*—a specialized extensometer used for sensing negative or compressive strain. **(E28.01)**

constraint, *n*—any restriction to the deformation of a body. **(E28.11)**

creep, *n*—the time-dependent strain that occurs after the application of a force which is thereafter maintained constant.

Discussion—Creep tests are usually made at constant force and temperature. For tests on plastics, the initial strain – however defined– is included; for tests on metals, the initial strain is not included. **(E28.04)**

creep recovery, *n*—the time-dependent decrease in strain in a solid, following the removal of force.

Discussion—Recovery is usually determined at constant temperature.

Discussion—In tests of plastics, the initial recovery is generally included; for metals, it is not. Thermal expansion is excluded. **(E28.04)**

creep rupture strength [FL^{-2}], *n*—the stress causing fracture in a creep test at a given time, in a specified constant environment.

Discussion—This is sometimes referred to as the *stress-rupture strength* or, in glass technology, the *static fatigue strength*. **(E28.04)**

creep strength [FL^{-2}] , *n*—the stress that causes a given creep in a creep test at a given time in a specified constant environment. **(E28.04)**

deep drawing, *v*—a metal sheet forming operation in which strains on the sheet surface are positive in the direction of the punch travel and negative at 90° to that direction. **(E28.02)**

deflectometer, *n*—a specialized extensometer used for sensing of extension or motion, usually without reference to a specific gauge length. **(E28.01)**

Demeri split-ring test, *n*—a test the measures the springback behavior of sheet metal by comparing the diameter of a ring extracted from the wall of a flat bottom cup to the diameter of the same ring, split to release residual stresses. **(E28.02)**

discontinuous yielding, *n*—a hesitation or fluctuation of force observed at the onset of plastic deformation, due to localized yielding.

Discussion—The stress-strain curve need not appear to be discontinuous. **(E28.04)**

discontinuous yielding stress, *n*—the peak stress at the initiation of the first measurable serration on the curve of stress-versus strain. **(E28.04)**

ductility, *n*—the ability of a material to deform plastically before fracturing.

Discussion—Ductility is usually evaluated by measuring (*1*) the elongation or reduction of area from a tension test, (*2*) the depth of cup from a cupping test, (*3*) the radius or angle of bend from the bend test, or (*4*) the fatigue ductility from the fatigue ductility test (see Test Method E796).

Discussion—Malleability is the ability to deform plastically under repetitive compressive forces. **(E28.02)**

dynamic mechanical measurement, *n*—a technique in which either the modulus or damping, or both, of a substance under oscillatory applied force or displacement is measured as a function of temperature, frequency, or time, or a combination thereof. **(E28.04)**

eccentricity, *n*—the distance between the line of action of the applied force and the axis of symmetry of the specimen in a plane perpendicular to the longitudinal axis of the specimen. **(E28.04)**

edge distance [L], *n*—the distance from the edge of a bearing specimen to the center of the hole in the direction of applied force. **(E28.04)**

edge distance ratio, *n*—the ratio of the edge distance to the pin diameter. **(E28.04)**

elastic calibration device, *n*—a device used in verifying the force readings of a testing machine consisting of an elastic member(s) to which forces may be applied, combined with a mechanism or device for indicating the magnitude (or a quantity proportional to the magnitude) of deformation of the member under an applied force. **(E28.01)**

elastic force measuring device, *n*—a device or system consisting of an elastic member combined with a device for indicating the magnitude (or a quantity proportional to the magnitude) of deformation of the member under an applied force. **(E28.01)**

elastic limit [FL^{-2}], *n*—the greatest stress which a material is capable of sustaining without any permanent strain remaining upon complete release of the stress.

Discussion—Due to practical considerations in determining the elastic limit, measurements of strain using a small force, rather than zero force, are usually taken as the initial and final reference.

elongation, *El*, *n*—the increase in gauge length of a body subjected to a tension force, referenced to a gauge length on the body. Usually elongation is expressed as a percentage of the original gauge length.

Discussion—The increase in gauge length may be determined either *at* or *after* fracture, as specified for the material under test.

Discussion—The term elongation, when applied to metals, generally means measurement after fracture; when applied to plastics and elastomers, measurement at fracture. Such interpretation is usually applicable to values of elongation reported in the literature when no further qualification is given.

Discussion—In reporting values of elongation, the gauge length shall be stated.

Discussion—Elongation is affected by specimen geometry (area and shape of cross section, parallel length, parallelism, fillet radii, etc.), preparation (degree to which surfaces within the reduced section are smooth and free of cold work), and test procedure (alignment and test speed, for example). **(E28.04)**

error, *n*—for a measurement or reading, the amount it deviates from a known or reference value represented by a measurement standard. Mathematically, the error is calculated by subtracting the accepted value from the measurement or reading. (See also **percent error**.) **(E28.91)**

extensometer, *n*—a device for sensing strain. **(E28.01)**

extensometer system, *n*—a system for sensing and indicating strain.

Discussion—The system will normally include an extensometer, conditioning electronics, and auxiliary device (recorder, digital readout, computer, etc.). However, completely self-contained mechanical devices are permitted. An extensometer system may be one of three types. **(E28.01)**

Type 1 extensometer system, n— an extensometer system that both defines gauge length and senses extension; for example, a clip-on strain gauge type with conditioning electronics. **(E28.01)**

Type 2 extensometer system, n—an extensometer system that senses extension of a gauge length that is defined by specimen features such as ridges, notches, or overall height (in case of a compression test piece). **(E28.01)**

Discussion—The precision associated with gauge length setting for a Type 2 extensometer should be specified in relevant test method or product standard. The position readout on a testing machine is not recommended for use in a Type 2 extensometer system.

Type 3 extensometer system, n—an extensometer system that intrinsically senses strain (ratiometric principle); for example, video camera system. **(E28.01)**

fatigue ductility, D_f, *n*—the ability of a material to deform plastically before fracturing, determined from a constant-strain amplitude, low-cycle fatigue test.

Discussion—Fatigue ductility is usually expressed in percent, in direct analogy with elongation and reduction of area ductility measures.

Discussion—The fatigue ductility corresponds to the fracture ductility, the true tensile strain at fracture. Elongation and reduction of area represent the engineering tensile strain after fracture.

Discussion—The fatigue ductility is used for metallic foil for which the tension test does not give useful elongation and reduction of area measures. **(E28.02)**

fatigue life, N_f, *n*—the numbers of cycles of stress or strain of a specified character that a given specimen sustains before failure of a specified nature occurs. **(E28.01)**

forming limit curve, *n*—an empirically derived curve showing the biaxial strain levels beyond which localized through-thickness thinning (necking) and subsequent failure occur during the forming of a metallic sheet. **(E28.02)**

forming limit diagram, *n*—a graph on which the measured major and associated minor strain combinations are plotted to develop a forming limit curve. **(E28.02)**

fracture ductility, ε_f, *n*—the true plastic strain at fracture.

fracture strength, S_f [FL^{-2}], *n*—the normal stress at the beginning of fracture. Fracture strength is calculated by dividing the force at the beginning of fracture during a tension test by the original cross-sectional area of the specimen. **(E28.04)**

free bend, *n*—the bend obtained by applying forces to the ends of a specimen without the application of force at the point of maximum bending.

Discussion—In making a free bend, lateral forces first are applied to produce a small amount of bending at two points. The two bends, each a suitable distance from the center, are both in the same direction. **(E28.02)**

force [F], *n*—in mechanical testing, a vector quantity of fundamental nature characterized by a magnitude, a direction, a sense, and a discrete point of application, that acts externally upon a test object and creates stresses in it.

Discussion—Force is a derived unit of the SI system. Units of force in the SI system are newtons (N).

Discussion—Where applicable, the noun **force** is preferred to **load** in terminology for mechanical testing. **(E28.91)**

gauge length, *n*—the original length of that portion of the specimen over which strain, elongation, or change of length are determined. Typically, this length is also the distance between gauge marks, if gauge marking is used to facilitate measurement of the elongation after fracture.

Discussion—When sensing extension or motion with a gauge length that is predetermined by the specimen geometry or specific test method, then only resolution and strain error for the specified gauge length should determine the class of the extensometer system. **(E28.91)**

guided bend, *n*—the bend obtained by using a mandrel to guide and force the portion of the specimen being bent between two faces of a die. **(E28.02)**

hardness, *n*—the resistance of a material to deformation, particularly permanent deformation, indentation, or scratching.

Discussion—Different methods of evaluating hardness give different ratings because they are measuring somewhat different quantities and characteristics of the material. There is no absolute scale for hardness; therefore, to express hardness quantitatively, each type of test has its own scale of arbitrarily defined hardness. **(E28.06)**

indentation hardness, *n*—the hardness as evaluated from measurements of area or depth of the indentation made by pressing a specified indenter into the surface of a material under specified static loading conditions. **(E28.06)**

initial recovery, *n*—the decrease in strain in a specimen resulting from the removal of force, before creep recovery takes place.

Discussion—This is sometimes referred to as instantaneous recovery.

Discussion—Recovery is usually determined at constant temperature. Thermal expansion is excluded.

Discussion—For tests on plastics, the initial recovery is generally included as part of creep recovery.

Discussion—This definition describes a quantity which is difficult to measure accurately. The values obtained may vary greatly with the sensitivity and accuracy of the test equipment. When determining this quantity, the procedure and characteristics of the test equipment should be reported. **(E28.04)**

initial strain, *n*—the strain introduced into a specimen by the given loading conditions, before creep takes place.

Discussion—This is sometimes referred to as instantaneous strain. **(E28.04)**

initial stress, *n*—the stress introduced into a specimen by imposing the given constraint conditions before stress relaxation begins.

DISCUSSION—This is sometimes referred to as instantaneous stress. **(E28.11)**

Knoop hardness number, HK, *n*—a number related to the applied force and to the projected area of the permanent impression made by a rhombic-based pyramidal diamond indenter having included edge angles of 172° 30 min and 130° 0 min computed from the equation:

$$HK = P/0.07028d^2 \quad (2)$$

where:

P = applied force, kgf, and
d = long diagonal of the impression, mm.

In reporting Knoop hardness numbers, the test force is stated. **(E28.06)**

Knoop hardness test, *n*—an indentation hardness test using calibrated machines to force a rhombic-based pyramidal diamond indenter having specified edge angles, under specified conditions, into the surface of the material under test and to measure the long diagonal after removal of the force. **(E28.06)**

least count, *n*—the smallest change in indication that can customarily be determined and reported.

DISCUSSION—In machines with close graduations the least count may be the value of a graduation interval; with open graduations or with magnifiers for reading, it may be an estimated fraction, rarely as fine as one tenth, of a graduated interval; and with verniers it is customarily the difference between the scale and vernier graduation measured in terms of scale units. If the indicating mechanism includes a stepped detent, the detent action may determine the least count.

limiting dome height (LDH)—an evaluative test for metal sheet forming capability employing a 200 mm (4in.) hemisphereical punch and circumferential clamping force sufficient to prevent metal from the surrounding flange being pulled into the cavity. **(E28.02)**

load [F] **,** *n*—in mechanical testing, an external force or system of forces or pressures, acting upon the test specimen or sample.

DISCUSSION—**Load** is a deprecated term and, where practical, should be replaced by **force**, particularly when used as a noun. For reasons of editorial simplicity or traditional usage, replacement of **load** by **force** may not always be desirable when used as a verb, adjective, or other part of speech. For example, it is appropriate to refer to **loading** a specimen, a **loading** rate, a **load** cell, or a **load**–line displacement. **(E28.91)**

lower yield strength, *LYS*[FL^{-2}], *n*—the minimum stress recorded during discontinuous yielding, ignoring transient effects. See Figs. 1 and 2. **(E28.04)**

mandrel (in bend testing), *n*—the tool used to control the strain on the concave side of a bend in a wrap-around bend test and also to apply the bending force in a semi-guided or guided bend test.

DISCUSSION—The terms "pin" and "plunger" have been used in place of mandrel.

DISCUSSION—In free bends or semi-guided bends to an angle of 180° a shim or block of the proper thickness may be placed between the legs of the specimen as bending is completed. This shim or block is also referred to as a pin or mandrel. **(E28.02)**

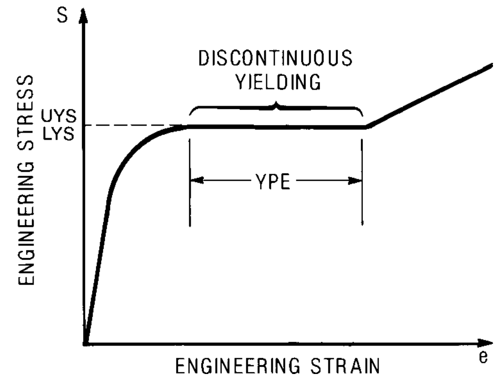

FIG. 1 Stress-Strain Diagram for Determination of Upper and Lower Yield Strengths and Yield Point Elongation in a Material Exhibiting Discontinuous Yielding

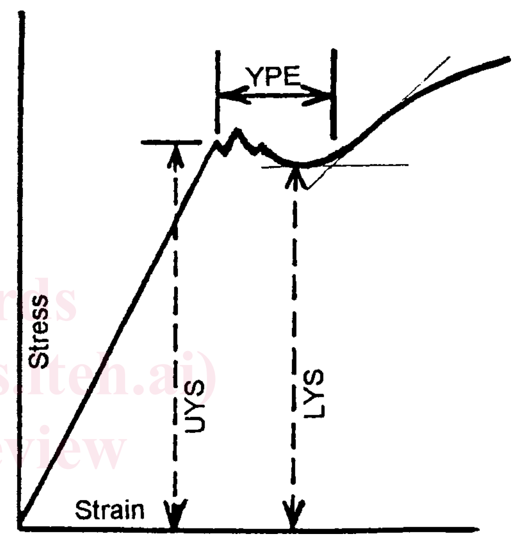

FIG. 2 Stress Strain Diagram Showing Yield Point Elongation and Upper and Lower Yield Strengths

mechanical hysteresis, *n*—the energy absorbed in a complete cycle of loading and unloading.

DISCUSSION—A complete cycle of loading and unloading includes any stress cycle regardless of the mean stress or range of stress. **(E28.04)**

mechanical properties, *n*—those properties of a material that are associated with elastic and inelastic reaction when force is applied, or that involve the relationship between stress and strain.

DISCUSSION—These properties have often been referred to as "physical properties," but the term "mechanical properties" is preferred. **(E28.91)**

mechanical testing, *n*—determination of the properties or the mechanical states of a material that are associated with elastic and inelastic reactions to force or that involve relationships between stress and strain. **(E28.91)**

modulus of elasticity [FL^{-2}]**,** *n*—the ratio of stress to corresponding strain below the proportional limit.

DISCUSSION—The stress-strain relationships of many materials do not conform to Hooke's law throughout the elastic range, but deviate therefrom even at stresses well below the elastic limit. For such materials, the slope of either the tangent to the stress-strain curve at the origin or at a low stress, the secant drawn from the origin to any specified point on the stress-strain curve, or the chord connecting any two specified points on the stress-strain curve is usually taken to be the "modulus of elasticity." In these cases, the modulus should be designated as the "tangent modulus," the "secant modulus," or the "chord modulus," and the point or points on the stress-strain curve described. Thus, for materials where the stress-strain relationship is curvilinear rather than linear, one of the four following terms may be used:

(*a*) *initial tangent modulus* [FL^{-2}], *n*—the slope of the stress-strain curve at the origin.

(*b*) *tangent modulus* [FL^{-2}], *n*—the slope of the stress-strain curve at any specified stress or strain.

(*c*) *secant modulus* [FL^{-2}], *n*—the slope of the secant drawn from the origin to any specified point on the stress-strain curve.

(*d*) *chord modulus* [FL^{-2}], *n*—the slope of the chord drawn between any two specified points on the stress-strain curve below the elastic limit of the material.

DISCUSSION—Modulus of elasticity, like stress, is expressed in force per unit of area (pounds per square inch, etc.). **(E28.04)**

modulus of rupture in bending [FL^{-2}], *n*—the value of maximum tensile or compressive stress (whichever causes failure) in the extreme fiber of a beam loaded to failure in bending, computed from the flexure equation:

$$S_b = Mc/I \quad (3)$$

where:

M = maximum bending moment, computed from the maximum force and the original moment arm,
c = initial distance from the neutral axis to the extreme fiber where failure occurs, and
I = initial moment of inertia of the cross section about the neutral axis.

DISCUSSION—When the proportional limit in either tension or compression is exceeded, the modulus of rupture in bending is greater than the actual maximum tensile or compressive stress in the extreme fiber, exclusive of the effect of stress concentration near points of force application.

DISCUSSION—If the criterion for failure is other than rupture or attaining the first maximum force, it should be so stated. **(E28.02)**

modulus of rupture in torsion [FL^{-2}], *n*—the value of maximum shear stress in the extreme fiber of a member of circular cross section loaded to failure in torsion, computed from the equation:

$$S_s = Tr/J \quad (4)$$

where:

T = maximum twisting moment,
r = original outer radius, and
J = polar moment of inertia of the original cross section.

DISCUSSION—When the proportional limit in shear is exceeded, the modulus of rupture in torsion is greater than the actual maximum shear stress in the extreme fiber, exclusive of the effect of stress concentration near points of application of torque.

DISCUSSION—If the criterion for failure is other than fracture or attaining the first maximum of twisting moment, it should be so stated. **(E28.04)**

necking, *n*—the onset of nonuniform or localized plastic deformation, resulting in a localized reduction of cross-sectional area. **(E28.02)**

percent error, *n*—the ratio, expressed as a percent, of an error to the known accepted value represented by a measurement standard. (See also, **error**.) **(E28.91)**

precision, *n*—the degree of mutual agreement among individual measurements made under prescribed like conditions. **(E28.04)**

primary force standard, *n*—a deadweight force applied directly without intervening mechanisms (such as levers, hydraulic multipliers, or the like) whose mass has been determined by comparison with reference standards traceable to national standards of mass. **(E28.01)**

Poisson's ratio, μ, *n*—the negative of the ratio of transverse strain to the corresponding axial strain resulting from an axial stress below the proportional limit of the material.

DISCUSSION—Poisson's ratio may be negative for some materials, for example, a tensile transverse strain will result from a tensile axial strain.

DISCUSSION—Poisson's ratio will have more than one value if the material is not isotropic. **(E28.04)**

proportional limit [FL^{-2}] , *n*—the greatest stress which a material is capable of sustaining without any deviation from proportionality of stress to strain (Hooke's law).

DISCUSSION—Many experiments have shown that values observed for the proportional limit vary greatly with the sensitivity and accuracy of the testing equipment, eccentricity of loading, the scale to which the stress-strain diagram is plotted, and other factors. When determination of proportional limit is required, the procedure and the sensitivity of the test equipment should be specified.

radius of bend, *n*—the radius of the cylindrical surface of the pin or mandrel that comes in contact with the inside surface of the bend during bending. In the case of free or semi-guided bends to 180° in which a shim or block is used, the radius of bend is one half the thickness of the shim or block. **(E28.02)**

rapid indentation hardness test, *n*—an indentation hardness test using calibrated machines to force a hard steel or carbide ball, under specified conditions, into the surface of the material under test and to measure the depth of the indentation. The depth measured can be from the surface of the test specimen or from a reference position established by the application of a preliminary test force. **(E28.06)**

rate of creep, *n*—the slope of the creep-time curve at a given time. **(E28.04)**

reading, *n*—a quantity (typically a measurement or test result) indicated by a piece of equipment, such that it can be read by a user. **(E28.91)**

reduced section, *n*—the part of the specimen length between the fillets. **(E28.04)**

reduced section, *n*—section in the central portion of the specimen, which has a cross section smaller than the gripped ends. **(E28.04)**