



## Standard Terminology for Geosynthetics<sup>1</sup>

This standard is issued under the fixed designation D 4439; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

**absorption**, *n*—the process by which a liquid is drawn into and tends to fill permeable pores in a porous solid body, also, the increase in mass of a porous solid body resulting from penetration of a liquid into its permeable pores. **D 125**

**aerobic**, *n*—a condition in which a measurable volume of air is present in the incubation chamber or system. **D 1987**

**anaerobic**, *n*—a condition in which no measurable volume of air is present in the incubation chamber or system. **D 1987**

**apparent opening size (AOS)**,  $O_{95}$ , *n*—for a geotextile, a property which indicates the approximate largest particle that would effectively pass through the geotextile. **D 4751**

**atmosphere for testing geosynthetics**, *n*—air maintained at a relative humidity between 50 to 70 % and a temperature of  $21 \pm 2^\circ\text{C}$  ( $70^\circ \pm 4^\circ\text{F}$ ). **D 4439, D 4751, D 5494**

**back flushing**, *n*—a process by which liquid is forced in the reverse direction to the flow direction. **D 1987**

**basis weight**—deprecated term (do not use in the sense of mass per unit area). **D 4439**

**bend**, *vt*—in mechanics, to force an object from its natural or manufactured shape into a curve or into increased curvature. **D 4439**

**blinding**, *n*—for geotextiles, the condition where soil particles block the surface openings of the fabric, thereby reducing the hydraulic conductivity of the system. **D 4439**

**biocide**, *n*—a chemical used to kill bacteria and other microorganisms. **D 1987**

**breaking force**, (*F*), *J*, *n*—the force at failure. **D 4885**

**breaking load**, *n*—the maximum force applied to a specimen in a tensile test carried to rupture. **D 4632**

**breaking toughness**, *T*, ( $FL^{-1}$ ),  $Jm^{-2}$ , *n*—for geotextiles, the actual work-to-break per unit surface area of material. **D 4595, D 4885**

**chemical resistance**, *n*—the ability to resist chemical attack. **D 5322**

**clogging**, *n*—for geotextiles, the condition where soil particles move into and are retained in the openings of the fabric, thereby reducing the hydraulic conductivity. **D 4439**

**clogging potential**, *n*—in geotextiles, the tendency for a given geotextile to decrease permeability due to soil particles that have either lodged in the geotextile openings or have built up a restrictive layer on the surface of the geotextile. **D 5101**

**compressed thickness** (*t*, (*L*), mm), *n*—thickness under a specified stress applied normal to the material. **D 4439**

**constant-rate-of-load tensile testing machine (CRL)**, *n*—a testing machine in which the rate of increase of the load being applied to the specimen is uniform with time after the first 3 s. **D 4439**

**corresponding force**, *n*—synonym for force at specified elongation. **D 4885**

**coupon**, *n*—a portion of a material or laboratory sample from which multiple specimens can be taken for testing. **D 5747**

**creep**, *n*—the time-dependent increase in accumulative strain in a material resulting from an applied constant force. **D 5262**

**critical height** (*ch*), *n*—the maximum exposed height of a cone or pyramid that will not cause a puncture failure of a geosynthetic at a specified hydrostatic pressure for a given period of time. **D 5514**

**cross-machine direction**, *n*—the direction in the plane of the fabric perpendicular to the direction of manufacture. **D 4632**

**density** ( $\rho$ , ( $ML^{-3}$ ),  $kg/m^3$ ), *n*—mass per unit volume. **D 4439**

**design load**—the load at which the geosynthetic is required to operate in order to perform its intended function. **D 5262**

**elastic limit**, *n*—in mechanics, the stress intensity at which stress and deformation of a material subjected to an increasing force cease to be proportional; the limit of stress within which a material will return to its original size and shape when the force is removed, and hence, not a permanent set. **D 4885**

**elongation at break**, *n*—the elongation corresponding to the breaking load, that is, the maximum load. **D 4632**

**failure**, *n*—an arbitrary point beyond which a material ceases to be functionally capable of its intended use. **D 4885, D 5262**

**failure**, *n*—in testing geosynthetics, water or air pressure in the test vessel at failure of the geosynthetic. **D 5514**

**flexible polypropylene**, *n*—a material having a 2 % secant modulus of less than 300 MPa (40,000 psi) as determined by Test Method D 5323 produced by polymerization of propylene with or without other alpha olefin monomers.

**field testing**, *n*—testing performed in the field under actual conditions of temperature and exposure to the fluids for which the immersion testing is being performed. **D 5496**

**fill**—deprecated term, see **filling**.

<sup>1</sup> This terminology is under the jurisdiction of D-35 on Geosynthetics and is the direct responsibility of Subcommittee D35.93 on Terminology.

Current edition approved March 10, 2000. Published June 2000. Originally published as D 4439 – 84. Last previous edition D 4439 – 99a.

**filling**, *n*—yarn running from selvage to selvage at right angles to the warp in a woven fabric. **D 4439**

**force at specific elongation, FASE**, *n*—the force associated with a specific elongation on the force-elongation curve. **D 4439**

**force-elongation curve**, *n*—*in a tensile test*, a graphical representation of the relationship between the magnitude of an externally applied force and the change in length of the specimen in the direction of the applied force. (*Synonym for stress-strain curve.*) **D 4885**

**geocomposite**, *n*—a product composed of two or more materials, at least one of which is a geosynthetic.

**geofoam**, *n*—block or planar rigid cellular foamed polymeric material used in geotechnical engineering applications.

**geogrid**, *n*—a geosynthetic formed by a regular network of integrally connected elements with apertures greater than 6.35 mm (1/4 in.) to allow interlocking with surrounding soil, rock, earth, and other surrounding materials to function primarily as reinforcement. **D 5262**

**geonet**, *n*—a geosynthetic consisting of integrally connected parallel sets of ribs overlying similar sets at various angles for planar drainage of liquids or gases. **D 4439**

**geomembrane**, *n*—an essentially impermeable geosynthetic composed of one or more synthetic sheets. **D 4439, D 4873, D 4885, D 5994, D 5820**

**geosynthetic**, *n*—a planar product manufactured from polymeric material used with soil, rock, earth, or other geotechnical engineering related material as an integral part of a man-made project, structure, or system. **D 4354, D 4759, D 4873, D 5617, D 5818**

**geosynthetic clay liner**, *n*—a manufactured hydraulic barrier consisting of clay bonded to a layer or layers of geosynthetic materials.

**geotechnical engineering**, *n*—the engineering application of geotechnics. **D 4439, D 4595**

**geotechnics**, *n*—the application of scientific methods and engineering principles to the acquisition, interpretation, and use of knowledge of materials of the earth's crust to the solution of engineering problems. **D 4439, D 4491, D 4595, D 4716, D 4751**

**geotextile**, *n*—a permeable geosynthetic comprised solely of textiles.

DISCUSSION—Geotextiles perform several functions in geotechnical engineering applications, including: separation; filtration; drainage; reinforcement; and protection. **D 1987, D 4439, D 5594**

**grab test**, *n*—*in fabric testing*, a tension test in which only a part of the width of the specimen is gripped in the clamps. **D 4632**

**gradient ratio**, *n*—*in geotextiles*, the ratio of the hydraulic gradient through a soil-geotextile system to the hydraulic gradient through the soil alone. **D 5101**

**gravity flow**, *n*—flow in a direction parallel to the plane of a geotextile or related product driven predominately by a difference in elevation between the inlet and outflow points of a specimen. **D 4716**

**head**, *n*—pressure at a point in a liquid, expressed in terms of the vertical distance of the point below the surface of the liquid. **D 4716**

**hydraulic conductivity (*k*)**, *n*—the rate of discharge of water under laminar flow conditions through a unit cross-sectional area of a porous medium under a unit hydraulic gradient and standard temperature conditions (20°C). **D 5567**

**hydraulic conductivity ratio (HCR)**, *n*—the ratio of the hydraulic conductivity of the soil/geotextile system,  $k_{sg}$ , at any time during the test, to the initial hydraulic conductivity,  $k_{sg0}$ , measured at the beginning of the test (new).

**hydraulic gradient**, *i, s (D)*—the loss of hydraulic head per unit distance of flow,  $dH/dL$ . **D 5101**

**hydraulic transmissivity**,  $\theta (L^2 T^{-1})$ , *n*—*for a geotextile or related product*, the volumetric flow rate of water per unit width of specimen per unit gradient in a direction parallel to the plane of the specimen. **D 4716**

**hydrostatic pressure**, *n*—a state of stress in which all the principal stresses are equal (and there is no shear stress), as in a liquid at rest; induced artificially by means of a gaged pressure system; the product of the unit weight of the liquid and the difference in elevation between the given point and the free water elevation. **D 5514**

**index test**, *n*—a test procedure which may contain a known bias but which may be used to establish an order for a set of specimens with respect to the property of interest. **D 4833, D 4885**

**inflection point**, *n*—the first point of the force-elongation curve at which the second derivative equals zero. **D 4885**

**initial tensile modulus**,  $J_p (FL^{-1}), Nm^{-1}$ , *n*—*for geosynthetics*, the ratio of the change in force per unit width to the change in elongation of the initial portion of a force-elongation curve. **D 4885**

**in-plane flow**, *n*—fluid flow confined to a direction parallel to the plane of a geotextile or related product. **D 4716**

**integral**, *adj*—*in geosynthetics*, forming a necessary part of the whole; constituent. **D 4439**

**laboratory sample**, *n*—a portion of material taken to represent the lot sample, or the original material, and used in the laboratory as a source of test specimens. **D 4354**

**laminar flow**, *n*—flow in which the head loss is proportional to the first power of the velocity. **D 4716**

**linear density**, *n*—mass per unit length; the quotient obtained by dividing the mass of a fiber or yarn by its length.

**lot**, *n*—a unit of production, or a group of other units or packages, taken for sampling or statistical examination, having one or more common properties and being readily separable from other similar units. **D 4354**

**lot sample**, *n*—one or more shipping units taken at random to represent an acceptance sampling lot and used as a source of laboratory samples. **D 4354**

**minimum test value**, *n*—*for geosynthetics*, the lowest sample value from documented manufacturing quality control test results for a defined population from one test method associated with one specific property.

**machine direction**, *n*—the direction in the plane of the fabric parallel to the direction of manufacture. **D 4632**

**modulus of elasticity**,  $MPa (FL^{-2})$ , *n*—the ratio of stress (nominal) to corresponding strain below the proportional limit of a material, expressed in force per unit area, such as megapascals (pounds-force per square inch). **D 5323**

- multi-axial tension**, *n*—stress in more than one direction. **D 5617**
- nominal**, *n*—representative value of a measurable property determined under a set of conditions, by which a product may be described. **D 4439**
- nominal value**, *n*—representative value of a measurable property by which a product may be identified **D 4439**
- normal direction**, *n*—*for geotextiles*, the direction perpendicular to the plane of a geotextile. **D 4439**
- normal stress**,  $(FL^{-2})$ , *n*—the component of applied stress that is perpendicular to the surface on which the force acts. **D 4439**
- offset modulus**,  $J_o$ ,  $(FL^{-1})$ ,  $Nm^{-1}$ , *n*—*for geosynthetics*, the ratio of the change in force per unit width to the change in elongation below an arbitrary offset point at which there is a proportional relationship between force and elongation, and above the inflection point on the force-elongation curve. **D 4885**
- performance property**, *n*—a result obtained by conducting a performance test. **D 5141**
- performance test**, *n*—a test which simulates in the laboratory as closely as practicable selected conditions experienced in the field and which can be used in design. (Synonym for **design test**.) **D 4885**
- performance test**, *n*—*in geosynthetics*, a laboratory procedure which simulates selected field conditions which can be used in design. **D 5141**
- permeability**, *n*—the rate of flow of a liquid under a differential pressure through a material. **D 1987, D 4491**
- permeability**, *n*—*of geotextiles*, hydraulic conductivity. **D 4491**
- permeation**, *n*—the transmission of a fluid through a porous medium (NEW).
- permittivity**,  $(\Psi)$ ,  $(T^{-1})$ , *n*—*of geotextiles*, the volumetric flow rate of water per unit cross sectional area per unit head under laminar flow conditions, in the normal direction through a geotextile. **D 1987, D 4491**
- pore volume of flow**  $(V_{pq})$ , *n*—the cumulative volume of flow through a test specimen divided by the volume of voids within the specimen. **D 5567**
- pressure flow**, *n*—flow in a direction parallel to the plane of a geotextile or related product driven predominately by a differential fluid pressure. **D 4716**
- primary sampling unit**, *n*—the sampling unit containing all the sources of variability which should be considered in acceptance testing; the sampling unit taken in first stage of selection in any procedure for sampling a lot or shipment. **D 4354**
- production unit**—*as referred to in this practice*, is a quantity of geotextile agreed upon by the purchaser and seller for the purpose of sampling. **D 4354**
- proportional limit**, *n*—the greatest stress which a material is capable of sustaining without any deviation from proportionality of stress to strain (Hooke's law). **D 4595**
- puncture resistance**,  $(F)$ , *n*—the inherent resisting mechanism of the test specimen to the failure by a penetrating or puncturing object. **D 4833**
- quality assurance**, *n*—all those planned or systematic actions necessary to provide adequate confidence that a material, product, system, or service will satisfy given needs. **D 4354**
- quality control**, *n*—the operational techniques and the activities which sustain a quality of material, product, system, or service that will satisfy given needs; also the use of such techniques and activities. **D 4354**
- rate of creep**, *n*—the slope of the creep-time curve at a given time. **D 5262**
- sample**, *n*—(1) a portion of material which is taken for testing or for record purposes. (2) a group of specimens used, or of observations made, which provide information that can be used for making statistical inferences about the population(s) from which the specimens are drawn. (See also **laboratory sample**, **lot sample**, and **specimen**.) **D 4354, D 5818**
- sample, laboratory*—See **laboratory sample**.
- sample, lot*—See **lot sample**.
- sampling unit**, *n*—an identifiable, discrete unit or subunit of material that could be taken as part of a sample. (See also **primary sampling unit**, **laboratory sample**, and **specimen**.) **D 4354**
- sampling unit, primary*—See **primary sampling unit**.
- seam**, *n*—a permanent joining of two or more materials. **D 5820**
- seam**, *n*—the connection of two or more pieces of material by mechanical, chemical, or fusion methods to provide the integrity of a single piece of the material. **D 5641**
- seam allowance**, *n*—the width of fabric used in making a seam assembly, bounded by the edge of the fabric and the furthest stitch line. **D 4884**
- seam assembly**, *n*—the unit obtained by joining fabrics with a seam, including details such as fabric direction(s), seam allowance, sewing threads used, and number of stitches per unit length; and sometimes additional details of fabrication such as sewing-machine type and speed, needle type and size, etc. **D 4884**
- seam design engineering**, *n*—the procedures used to select a specific thread, a specific stitch type, and a specific seam type to achieve the required seam strength. **D 4884**
- seam efficiency**, *sewn*, *n*—*in sewn fabrics*, the ratio expressed as a percentage of seam strength to fabric strength.
- seam interaction**, *n*—the result of combining a specific textile, a specific stitch type, and a specific seam type. **D 4884**
- seam type**, *n*—*in sewn fabrics*, an alphanumeric designation relating to the essential characteristics of fabric positioning and rows of stitching in a specific sewn fabric seam (see Federal Standard 751). **D 4884**
- secant modulus**, *n*—the ratio of stress (nominal) to corresponding strain at any specified point on the stress-strain curve. **D 5323**
- secant modulus**,  $J_{sec}$ ,  $(FL^{-1})$ ,  $Nm^{-1}$ , *n*—*for geosynthetics*, the ratio of change in force per unit width to the change in elongation between two points on a force-elongation curve. **D 4885**
- selvage**, *n*—the woven edge portion of a fabric parallel to the warp. **D 4884**
- sewing thread**, *n*—a flexible, small diameter yarn or strand, usually treated with a surface coating, lubricant, or both,

- intended to be used to stitch one or more pieces of material or an object to a material. **D 4884**
- sewn seam**, *n*—*in sewn fabrics*, a series of stitches joining two or more separate plies of a material or materials of planar structure such as textile fabric. **D 4884**
- sewn seam strength**, *n*—*for geotextiles*, the maximum resistance, measured in kilonewtons per metre, of the junction formed by stitching together two or more planar structures. **D 4884**
- specification**, *n*—a precise statement of a set of requirements to be satisfied by a material, product, system or service that indicates the procedures for determining whether each of the requirements is satisfied. **D 4759**
- specific gravity**, *n*—the ratio of the density of the substance in question to the density of a reference substance at specified conditions of temperature and pressure. **D 4439**
- specimen**, *n*—a specific portion of a material or laboratory sample upon which a test is performed or which is taken for that purpose. (*Syn.* test specimen) **D 4354**
- stiffness**, *n*—resistance to bending. **D 4439**
- stitch**, *n*—the repeated unit formed by the sewing thread in the production of seams in a sewn fabric (see Federal Standard 751a). **D 4884**
- strain**, *n*—the change in length per unit of length in a given direction. **D 4439**
- stress crack**, *n*—an external or internal crack in a plastic caused by tensile stresses less than its short-time mechanical strength. **D 5397**
- tangent point**, *n*—*for geotextiles*, the first point of the force-elongation curve at which a major decrease in slope occurs. **D 4595**
- tearing strength**, (F, (F), kN), *n*—the force required either (1) to start or (2) to continue or propagate a tear in a fabric under specified conditions. **D 4439, D 4533**
- temperature stability**, *n*—*for a geotextile*, the percent change in tensile strength or in percent elongation as measured at a specified temperature and compared to values obtained at the standard conditions for testing geotextiles. **D 4594**
- tensile creep rupture strength**, [FL<sup>-1</sup>], *n*—*for geosynthetics*, the force per unit width that will produce failure by rupture in a creep test in a given time, at a specified constant environment **D 5262**
- tensile creep strain**, *n*—the total strain at any given time. **D 5262**
- tensile modulus**, *J*, (FL<sup>-1</sup>), Nm<sup>-1</sup>, *n*—*for geotextiles*, the ratio of the change in tensile force per unit width to a corresponding change in strain (slope). **D 4595**
- tensile strength**, *n*—*for geotextiles*, the maximum resistance to deformation developed for a specific material when subjected to tension by an external force. **D 4595**
- tensile test**, *n*—*in textiles*, a test in which a textile material is stretched in one direction to determine the force-elongation characteristics, the breaking force, or the breaking elongation. **D 4595**
- test result**, *n*—a value obtained by applying a given test method, expressed either as a single observation or a specified combination of a number of observations. **D 4354**
- test section**, *n*—a distinct area of construction. **D 5818**
- thickness, compressed**—See **compressed thickness**.
- turbulent flow**, *n*—that type of flow in which any water particle may move in any direction with respect to any other particle, and in which the head loss is approximately proportional to the second power of the velocity. **D 4716**
- typical value**, *n*—*for geosynthetics*, the mean value calculated from documented manufacturing quality control test results for a defined population obtained from one test method associated with on specific property. **D 4439**
- vacuum chamber**, *n*—a device that allows a vacuum to be applied to a surface. **D 5641**
- vertical strip drain**, *n*—a geocomposite consisting of a geotextile cover and drainage core installed vertically into soil to provide drainage for accelerating consolidation of soils.
- DISCUSSION—Also known as band drain, wick drain, or prefabricated vertical drain (PVD).
- void ratio** (e, (D)), *n*—the ratio of the volume of void space to the volume of solids. **D 4439**
- warp**, *n*—the yarn running lengthwise in a woven fabric. **D 4884**
- weft**, *n*—see **filling**.
- wide strip tensile test**, *n*—*for geosynthetics*, a tensile test in which the entire width of a 200 mm (8.0 in.) wide specimen is gripped in the clamps and the gage length is 100 mm (4.0 in.). **D 4885**
- wide-width strip tensile test**, *n*—*for geotextiles*, a uniaxial tensile test in which the entire width of a 200-mm (8.0-in.) wide specimen is gripped in the clamps and the gage length is 100 mm (4.0 in.). **D 4595**
- work-to-break** (W, LF), *n*—*in tensile testing*, the total energy required to rupture a specimen. **D 4439, D 4595, D 4885**
- yield point**, *n*—*in geosynthetics*, the point on the force-elongation curve at which the first derivative equals zero (the first maximum). **D 4885**

*The American Society for Testing and Materials takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.*

*This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.*

 **D 4439**

*This standard is copyrighted by ASTM, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or [service@astm.org](mailto:service@astm.org) (e-mail); or through the ASTM website ([www.astm.org](http://www.astm.org)).*