Designation: ~~D4175 – 17a$^{\varepsilon 1}$~~ D4175 – 17b

Standard Terminology Relating to Petroleum Products, Liquid Fuels, and Lubricants[1]

This standard is issued under the fixed designation D4175; 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—Terms were transferred and updated editorially, including a reorganization that created a new subsection 2.2 (Acronyms, Abbreviations, and Symbols), in October 2017.~~

1. Scope*

1.1 This terminology standard covers the compilation of terminology developed by Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants, except that it does not include terms/definitions specific only to the standards in which they appear.

1.1.1 The terminology, mostly definitions, is unique to petroleum, petroleum products, lubricants, and certain products from biomass and chemical synthesis. Meanings of the same terms outside of applications to petroleum, petroleum products, and lubricants can be found in other compilations and in dictionaries of general usage.

1.1.2 The terms/definitions exist in two places: *(1)* in the standards in which they appear and *(2)* in this compilation.

1.2 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Terminology

2.1 Alphabetical listing of terms with definitions for each term showing attributions as to source and subcommittee jurisdiction is in bold print following the definition. Those showing no attributes are under the jurisdiction of Subcommittee CS 95. Acronyms, abbreviations, and symbols are listed separately in 2.2, following the defined terms.

abrasive wear, *n*—wear due to hard particles or hard protuberances forced against and moving along a solid surface. **[D02.B0] D4998; [D02.L0] D5182**

absorbance, *n*—logarithm to the base 10 of the ratio of the reciprocal of the transmittance. **[D02.03] D7740**

absorbance, (A), *n*—the molecular property of a substance that determines its ability to take up radiant energy, expressed by:

$$A = \log_{10}(1/T) = -\log_{10}(T) \quad (1)$$

where T is the transmittance.

DISCUSSION—

Absorbance expresses the excess absorption over that of a specified reference or standard. It is implied that compensation has been affected for reflectance losses, solvent absorption losses, and refractive effects, if present, and that attenuation by scattering is small compared with attenuation by absorption. **[D02.14] D7996**

absorbance, *A*,*n*—the molecular property of a substance that determines its ability to take up radiant power, expressed by:

$$A = \log_{10}\ (1/T) = -\log_{10} T$$

where T is the transmittance.

DISCUSSION—

[1] This terminology is under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee D02.95 on Terminology.

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***A Summary of Changes section appears at the end of this standard**

Absorbance expresses the excess absorption over that of a specified reference or standard. It is implied that compensation has been affected for reflectance losses, solvent absorption losses, and refractive effects, if present, and that attenuation by scattering is small compared with attenuation by absorption. **[D02.04] D2008**

absorptivity, *a*,*n*—the specific property of a substance to absorb radiant power per unit sample concentration and path length, expressed by:

$$a = Af/bc$$

where:

A = the absorbance,
f = the dilution factor,
b = sample cell path length, and
c = the quantity of absorbing substance contained in a volume of solvent.

[D02.04] D2008

acceptance limit (*AL*), *n*—a numerical value that defines the point between acceptable and unacceptable quality.

DISCUSSION—

The *AL* is not necessarily the specification limit. It is a value that takes into account the specification limit, the test method precision, and the desired probability of product acceptance if the quality is at the specification limit.

[D02.94] D3244

accepted reference value (ARV), *n*—value that serves as an agreed-upon reference for comparison and that is derived as (*1*) a theoretical or established value, based on scientific principles, (*2*) an assigned value, based on experimental work of some national or international organization, such as the U.S. National Institute of Standards and Technology (NIST), or (*3*) a consensus value, based on collaborative experimental work under the auspices of a scientific or engineering group. **[D02.94] D6792**

DISCUSSION—

In the context of this test method, accepted reference value is understood to apply to the ignition delay of specific reference materials determined under reproducibility conditions by collaborative experimental work. **[D02.01] D6890**

DISCUSSION—

In the context of this method, accepted reference value is understood to apply to the ignition delay of specific reference materials determined under reproducibility conditions by collaborative experimental work. **[D02.01] D7170**

DISCUSSION—

In the context of this test method, accepted reference value is understood to apply to the Motor octane number of specific reference materials determined empirically under reproducibility conditions by the National Exchange Group or another recognized exchange testing organization. **[D02.01] D2700**

DISCUSSION—

In the context of this test method, accepted reference value is understood to apply to the Research octane number of specific reference materials determined empirically under reproducibility conditions by the National Exchange Group or another recognized exchange testing organization. **[D02.01] D2699**

DISCUSSION—

In the context of this test method, accepted reference value is understood to apply to the Supercharge and octane number ratings of specific reference materials determined empirically under reproducibility conditions by the National Exchange Group or another recognized exchange testing organization. **[D02.01] D909**

DISCUSSION—

In the context of this test method, accepted reference value is understood to apply to standard fuel or check fuel average research or motor octane numbers determined under reproducibility conditions by a recognized exchange testing organization having a minimum of 16 participants. **[D02.01] D2885**

accommodation cracks, *n*—(also referred to as Mrozowski-like cracks) cracks and voids formed between basal planes and at domain interfaces throughout the graphite microstructure from thermal contraction of the graphite during carbonization/graphitization (sometimes referred to as calcination cracks), from chemical decomposition of the liquid crystal hydrocarbon precursor in graphite manufacture (also referred to as calcination cracks) and following cooling after graphitization (manufacture). In irradiated graphite, they also comprise cracks arising from anisotropic responses to irradiation. **[D02.F0] D8075**

accuracy, *n*—the closeness of agreement between an observed value and an accepted reference value. **[D02.94] D7372**

accuracy, *n*—the closeness of agreement between a test result and an accepted reference value. **[D02.94] D6792**

acid number, *n*—the quantity of a specified base, expressed in milligrams of potassium hydroxide per gram of sample, required to titrate a sample in a specified solvent to a specified endpoint using a specified detection system.

DISCUSSION—

In this test method, acids or salts with dissociation constants greater than 10^{-9}, are titrated to a green end point with p-naphtholbenzein indicator. **[D02.06] D3339**

DISCUSSION—

In this test method, the acid number is calculated from the number of drops required to produce a change in solution color from blue-green to orange, compared to the number of drops required to produce an identical color change using a reference standard. Because this is a direct comparison method, the acid number value can be reported in milligrams of potassium hydroxide per gram of sample. **[D02.06] D5770**

DISCUSSION—

In this test method, the indicator is p-naphtholbenzein titrated to a green/green-brown end point in a toluene-water-isopropanol solvent. **[D02.06] D974**

DISCUSSION—

This test method expresses the quantity of base as milligrams of potassium hydroxide per gram of sample, that is required to titrate a sample in a mixture of toluene and propan-2-ol to which a small amount of water has been added from its initial meter reading in millivolts to a meter reading in millivolts corresponding to an aqueous basic buffer solution or a well-defined inflection point as specified in the test method. **[D02.06] D664**

DISCUSSION—

This test method provides additional information. The quantity of base, expressed as milligrams of potassium hydroxide per gram of sample, required to titrate a sample in the solvent from its initial meter reading in millivolts to a meter reading in millivolts corresponding to a freshly prepared aqueous acidic buffer solution or a well-defined inflection point as specified in the test method shall be reported as the *strong acid number*. **[D02.06] D664**

DISCUSSION—

The causes and effects of the so-called strong acids and the causes and effects of the other acids can be very significantly different. Therefore, the user of this test method shall differentiate and report the two, when they are found. **[D02.06] D664**

acidity, *n*—the quality, state or degree of being acid.

DISCUSSION—

In this test method, the criterion for acidity is a pink or red color when methyl orange indicator is used. **[D02.06] D1093**

across (or against) grain, *n*—direction in a body with preferred orientation due to forming stresses that has the maximum *c*-axis alignment as measured in an X-ray diffraction test. **[D02.F0] C709**

activated sludge, *n*—the precipitated solid matter, consisting mainly of bacteria and other aquatic microorganisms, that is produced in a domestic wastewater treatment plant; activated sludge is used primarily in secondary sewage treatment to microbially oxidized dissolved organic matter in the effluent. **[D02.12] D6139**

activation energy (E_a)—measure of temperature effects on the rate of oxidation in the kinetic, or chemical control, regime. Activation energy is calculated from the Arrhenius equation:

$$OR = Z\exp(-E_a/RT)$$

where:

OR = oxidation rate,
R = 8.314 J mole^{-1} K^{-1} is the universal gas constant,
T = absolute temperature (in Kelvin), and
Z = pre-exponential factor.

The activation energy and pre-exponential factor are calculated from linearized form of Arrhenius equation, that is, from the slope and intercept of the linear plot of the logarithm of oxidation rate versus the inverse of absolute temperature (1/T):

$$\log_{10}(OR) = \log_{10} Z - E_a/(2.303\ RT)$$

Activation energy is expressed in units of kJ/mol. Pre-exponential factor is expressed in the same units as the oxidation rates, namely g h^{-1} m^{-2} (for Z_a calculated from area-normalized oxidation rates, OR_a) or g g^{-1} h^{-1} (for Z_w calculated from weight-normalized oxidation rates, OR_w). **[D02.F0] D7542**

active grease-sampling device, *n*—device designed to take an active sample of a lubricating grease from a bearing, gear, or drive shaft located in a grease-lubricated component. **[D02.G0] D7718**

active sampling, *v*—to use a sampling device to actively gather an in-service lubricating grease sample from a grease-lubricated component. **[D02.G0] D7718**

actuate, *v*—to hold the interior cylinder of the active grease-sampling device while pushing the exterior cylinder forward toward the grease-lubricated component that is being sampled allowing lubricating grease to fill the sampling device. **[D02.G0] D7718**

acute ecotoxicity, *n*—the propensity of a material to produce adverse behavioral, biochemical, or physiological effects in non-human organisms or populations in a short period of time, usually not constituting a substantial portion of the life span of the organism. **[D02.N0] D6046**

acute toxicity test, *n*—a comparative toxicity test in which a representative subpopulation of organisms is exposed to different treat rates of a test material and is observed for a short period usually not constituting a substantial portion of their life span. **[D02.12] D6081**

additive, *n—in aviation gasoline*, substance added to a base aviation gasoline in relatively small amounts that either enables that base aviation gasoline to meet the applicable specification properties or does not alter the applicable specification properties of that base aviation gasoline beyond allowable limits. **[D02.J0] D7826**

additive, *n—in fuel oils*, a substance added to fuel oil at a blend level not greater than 1 % by volume of the finished fuel.

DISCUSSION—

Additives are generally included in finished fuel oil to enhance performance properties (for example, stability, pour point, and so forth)

DISCUSSION—

Additives that contain hydrocarbon oil blended with other substances may exclude the hydrocarbon oil portion for determination of the volume percent of the finished fuel.

DISCUSSION—

Triglycerides (for example, vegetable oils, animal fats, greases, and so forth) have been found to cause fouling of fuel oil burning equipment, and triglycerides are therefore not allowed as additives or components of additives. **[D02.E0] D396**

DISCUSSION—

Additives are generally included in finished fuel oil to enhance performance properties (for example, cetane number, lubricity, cold flow, etc.). **[D02.E0] D975**

adenosine monophosphate, *n*—molecule formed by the removal of two (2) molecules of phosphate (one pyrophosphate molecule) from ATP. **[D02.14] D7463**

adenosine triphosphate, *n*—molecule comprised of a purine and three phosphate groups, that serves as the primary energy transport molecule in all biological cells.

[D02.14] D7463

adhesive wear (scuffing), *n*—wear due to localized bonding between contacting solid surfaces leading to material transfer between the two surfaces or loss from either surface. **[D02.L0] D5182**

adiabaticity, *n*—the condition in which there is no significant gain or loss of heat throughout the length of the column.

DISCUSSION—

When distilling a mixture of compounds as is the case of crude petroleum, there will be a normal increase in reflux ratio down the column. In the case where heat losses occur in the column, the internal reflux is abnormally greater than the reflux in the head. The opposite is true when the column gains heat, as with an overheated mantle. **[D02.08] D2892**

adjustment, *n*—operation of bringing the portable digital density meter to a state of performance suitable for its use, by setting or adjusting the instrument constants.

[D02.04] D7777

aerobe, *n*—an organism that requires oxygen to remain metabolically active.

DISCUSSION—

Aerobes use oxygen as their terminal electron acceptor in their primary energy-generating metabolic pathways. Aerobes require oxygen for survival, using *aerobic* metabolic processes to generate energy for growth and survival. **[D02.14] D6469**

aerobic, *adj*—(*1*) taking place in the presence of oxygen; (*2*) living or active in the presence of oxygen.
[D02.12] D6006; [D02.N0] D6046; [D02.14] D8070

agglomerate, *n—in manufactured carbon and graphite product technology*, composite particle containing a number of grains. **[D02.F0] C709, D8075**

aggressiveness index (A.I.), *n*—the value computed from the sum of the pH + log alkalinity + log hardness of water sample where both alkalinity and hardness are reported as milligrams $CaCO_3$L.

DISCUSSION—

As A.I. decreases, water becomes more corrosive. At A.I. ≥ 12, water is noncorrosive. At 10 ≤ A.I. < 12, water is moderately corrosive. At A.I. < 10, water is strongly corrosive. **[D02.14] D6469**

air-fuel ratio, *n—in internal combustion engines*, the mass ratio of air-to-fuel in the mixture being induced into the combustion chambers.

[D02.B0] D6593, D6709, D6837, D7589

DISCUSSION—

In this test method, air-fuel ratio (AFR), is controlled by the EEC IV engine control module. **[D02.B0] D6593**

alarm, *n*—means of alerting the operator that a particular condition exists. **[D02.96] D7720**

aliphatic ether, *n*—an oxygen-containing, ashless, organic compound in which the oxygen atom is interposed between two carbon atoms (organic groups), has the general formula $C_nH_{2n+2}O$ with *n* being 5 to 8, and in which the carbon atoms are connected in open chains and not closed rings.

DISCUSSION—

Aliphatic compounds can be straight or branched chains and saturated or unsaturated. The term aliphatic ether, as used in this specification, refers only to the saturated compounds.

[D02.A0] D5797

aliquot, *n*—portion of sample being tested that is a representative portion of the whole. **[D02.25] D7808**

alternative blendstock, *n*—*in fuel oils*, a non-hydrocarbon oil substance added to fuel oil at blend levels greater than 1 % by volume of the finished fuel.

DISCUSSION—

An alternative blendstock should normally have an industry consensus standard or an annex in this specification that defines its physical and chemical properties.

DISCUSSION—

See Appendix X3 for guidance regarding new materials for No. 1 and No. 2 grades of fuel oils. **[D02.E0] D396, D975**

amine number of reference fuels above 100, AN—determined in terms of the weight percent of 3-methylphenylamine in reference grade *iso*octane (2,2,4-trimethylpentane). For example, 5 % of 3-methylphenylamine in reference grade *iso*octane has an amine number of 105 (AN 105). No attempt has been made to correlate performance number of leaded reference fuels to the amine number of unleaded reference fuels, and none is implied. **[D02.J0] D6812**

ampule, *n*—a glass vessel for the storage of liquid materials, possessing a long narrow neck for the purpose of providing a flame-sealed closure. **[D02.04] D6596**

anaerobe, *n*—an organism that cannot grow or proliferate in the presence of oxygen.

DISCUSSION—

Anaerobes use molecules other than oxygen in their primary energy-generating metabolic pathways, such as sulfate, nitrate, ketones, and other high-energy organic molecules. Although anaerobes may survive in the presence of oxygen, anaerobic growth typically occurs only in an oxygen depleted environment. **[D02.14] D6469**

anaerobic, *adj*—(*1*) taking place in the absence of oxygen; (*2*) living or active in the absence of oxygen. **[D02.12] D6006; [D02.N0] D6046**

analysis cycle time, *n*—the period of time required to properly obtain and analyze a representative sample of the process stream material. **[D02.25] D6624**

analysis of variance (ANOVA), *n*—technique that enables the total variance of a method to be broken down into its component factors. (ISO 4259) **[D02.94] D6300**

analysis sample, *n*—the reduced and divided representative portion of the bulk sample, prepared for use in the laboratory. **[D02.05] D4930, D6969**

analyte, *n*—a specific compound to be measured quantitatively in a mixture of compounds. **[D02.04] D7920**

analytical column, *n*—a chromatographic column used to further separate a specific analyte from a mixture of compounds which can coelute in the primary column. **[D02.04] D7920**

analytical column, *n*—porous layer open tubular (PLOT) column with a stationary phase selective for oxygenates. It is used to resolve methanol from 1-propanol to provide accurate quantitative results. **[D02.04] D7059**

analytical detector, *n*—a device used to quantify the compounds of interest after they elute from the analytical column. **[D02.04] D7920**

analytical measurement system, *n*—a collection of one or more components or subsystems, such as samplers, test equipment, instrumentation, display devices, data handlers, and printouts or output transmitters, that is used to determine a quantitative value of a specific property for an unknown sample in accordance with a test method. **[Subcommittee D02.94]**

DISCUSSION—

ASTM or ISO standard test methods are examples of a test method.

analyzer unit response time, *n*—time interval between the introduction of a step change in property characteristic at the inlet of the analyzer unit and when the analyzer output indicates a value corresponding to 99.5 % of the subsequent change in analyzer results. **[D02.25] D7453**

aniline point, *n*—the minimum equilibrium solution temperature for equal volumes of aniline and sample. **[D02.04] D611**

anistropic nuclear graphite, *n*—graphite in which the isotropy ratio based on the value of the coefficient of thermal expansion (25 °C to 500 °C) is greater than 1.15.

[D02.F0] C709

anoxic, *adj*—oxygen free. **[D02.14] D6469**

antibody, *n*—an immunoglobulin, a protein that is produced as a part of the immune response which is capable of specifically combining with the antigen.

DISCUSSION—

In the context of this test method, antibodies created for this purpose are utilized in conjunction with visual indicators to detect presence of microbial antigens. **[D02.14] D8070**

antifreeze, *n*—antifreeze is typically a dilution of ethylene glycol and possibly other glycols, and additives, in water to act as a machine coolant. 1,2-propanediol is found in some antifreeze formulations. **[D02.04] D7922**

antigen, *n*—a substance that stimulates the host to produce an immune response. In the context of this test method, specific antigens are detected as indicators of microbial contamination. **[D02.14] D8070**

antiknock index, *n*—the arithmetic average of the Research octane number (RON) and Motor octane number (MON), that is, (RON + MON)/2. **[D02.A0] D4814**

antimicrobial, *n*—see **biocide**. **[D02.14] D6469**

API gravity, *n*—a special function of relative density (specific gravity) 60/60 °F (15.56/15.56 °C), represented by:
°API = [141.5/relative density 60/60 °F] – 131.5
No statement of reference temperature is required, since 60 °F is included in the definition.

[D02.02] D287, D1298, D6822

DISCUSSION—

Relative density SG15 °C/15 °C is also applied. **[D02.04] D7777**

apparent density, *n*—the weight per unit volume of a substance, including voids inherent in the material tested. **[D02.05] D5502**

apparent viscosity, *n*—the determined viscosity obtained by use of this test method. **[D02.07] D3829, D4684, D5133, D6821, D6896**

DISCUSSION—

Apparent viscosity may vary with the spindle speed (shear rate) of a rotational viscometer if the fluid is non-Newtonian. See Appendix X1 for a brief explanation. **[D02.07] D2983**

apparent viscosity, *n—of a lubricating grease*, the ratio of shear stress to shear rate calculated from Poiseuille's equation, and is measured in poises.

[D02.G0] D1092

apparent viscosity, *n*—the viscosity determined by this test method and expressed in milliPascal seconds. Its value may vary with the spindle and rotational speed selected because many hot melts are non-Newtonian. **[D02.10] D3236**

apparent viscosity, *n*—viscosity of a non-Newtonian liquid determined by this test method at a particular shear rate and shear stress. **[D02.07] D4683, D4741, D5481**

area slice, *n*—area under a chromatogram within a specified retention time interval. **[D02.04] D7096**

area slice, *n—in gas chromatography*, the area, resulting from the integration of the chromatographic detector signal, within a specified retention time interval. **[D02.04] D7798**

area-normalized oxidation rate (OR_a)—rate of weight loss due to oxidation of a machined test specimen at a given temperature, divided by the nominal geometric surface area of the specimen.

DISCUSSION—

The rate of weight loss is determined by a linear fit of the weight loss plotted against time in the range from 5 % to 10 % loss of original specimen weight. The units of area-normalized oxidation rate, OR_a, are g h^{-1} m^{-2}. **[D02.F0] D7542**

area-normalized standard oxidation rate (SOR_a)—value of area normalized oxidation rate corresponding to 1 % weight loss in 24 h. Area-normalized standard oxidation rate, SOR_a, depends on the initial specimen density. For carbon and graphite samples (density 1.2 – 2.2 g cm^{-3}) SOR_a varies between 2 and 4 g h^{-1} m^{-2}. **[D02.F0] D7542**

aromatics, *n—in high performance liquid chromatography*, aromatic hydrocarbon components, minus polar material, that has a longer retention time than saturates on the specified polar columns, but can be removed as a single peak by backflushing the columns with heptane.

DISCUSSION—

Generally, aromatic hydrocarbons contain 1 to 4 rings. **[D02.04] D7419**

aromatics fraction, *n*—portion of the sample desorbed with the polar eluants. The aromatics fraction is divided into nonpolar and polar based. They may contain aromatics, condensed naphthenic-aromatics, aromatic olefins, and compounds containing sulfur, nitrogen, and oxygen atoms. **[D02.12] D7373**

aseptic, *adj*—sterile, free from viable microbiological contamination. **[D02.14] D6974, D7463, D7464**

ash, *n—in carbon and graphite technology*, residue remaining after oxidation of a carbon or graphite. **[D02.F0] C709**

asphalt, *n*—a dark brown-to-black cementitious material in which the predominating constituents are bitumens.

DISCUSSION—

Asphalt can be a natural product or a material obtained from petroleum processing. **[D02.G0] D128**

asphalt, *n—in North American usage*, (1) the heavy, black, viscous hydrocarbon-based material used for roofing and paving *or* (2) mixtures of that material with aggregate *or* (3) finished paving.

DISCUSSION—

Asphalt free of aggregate is of three types: (1) natural asphalt, (2) asphalt from the processing of crude oils, and (3) asphalt that has been modified by blowing with air or other means. Natural asphalt is obtained from tar pits or tar lakes, such as those in Trinidad. In the refinery, asphalt is usually the residual portion of asphaltic crude oil obtained as bottoms from vacuum distillation or by propane deasphalting. Either of these types of asphalt can be air blown for further removal of lighter fractions and for mild oxidation, to modify the properties of the final product.
[Coordinating Subcommittee D02.95]

asphaltenes, *n*—(rarely used in the singular)—*in petroleum technology*, represent an oil fraction that is soluble in a specified aromatic solvent but separates upon addition of an excess of a specified paraffinic solvent.

DISCUSSION—

In this test method, the aromatic solvent is hot toluene and the paraffinic solvent is heptane.

DISCUSSION—

Historically, benzene was the aromatic solvent, but benzene is not typically used now for health reasons. The precision of this test method when using toluene has been found to be the same as when using benzene. **[D02.14] D6560**

DISCUSSION—

In this test method, the aromatic solvent is toluene and the paraffinic solvent is heptane. **[D02.14] D7061, D7827, D7996**

DISCUSSION—

In this test method, the aromatic solvent is toluene and the paraffinic solvent is n-heptane. **[D02.14] D7157**

DISCUSSION—

In this test method, the aromatic solvent is xylene and the paraffinic solvent is n-heptane. **[D02.14] D7112**

DISCUSSION—

In this test method, the aromatic solvent is 1-methylnapthalene, and the paraffinic solvent is n-hexadecane. **[D02.14] D7060**

assay, *n*—the procedure to determine the presence, absence, or quantity of one or more components. **[D02.02] D4057**

assignable cause, *n*—a factor that contributes to variation and that is feasible to detect and identify. **[D02.94] D7372**

assignable cause, *n*—factor that contributes to variation in a process or product output that is feasible to detect and identify; also called *special cause*. **[D02.96] D7720**

assigned test value (ATV), *n*—the average of all results obtained in the several laboratories which are considered acceptable based on the reproducibility of the test method. **[D02.94] D3244**

ASTM color, *n*—the name of an empirical scale of expressing the color of a petroleum liquid darker than Saybolt color based on a scale of 0.5 (lightest) to 8 Dil (darkest) and determined by Test Method D1500. **[D02.05] D6045, D6756**

atomic absorption spectrometry, *n*—analytical technique for measuring metal content of solutions, based on a combination of flame source, hollow cathode lamp, photomultiplier, and a readout device. **[D02.03] D7740**

atomizer, *n*—usually a flame source used to decompose the chemical constituents in a solution to its elemental components. **[D02.03] D7740**

audit, *n*—a systematic examination of the laboratory's quality management system documentation and related activities by an internal or external team to determine conformance to the applicable quality management system standard, such as described in this practice. **[D02.94] D6792**

autoignition, *n*—the ignition of a material caused by the application of pressure, heat, or radiation, rather than by an external ignition source, such as a spark, flame, or incandescent surface. **[Subcommittee D02.01]**

automatic sampler, *n*—a device used to extract a representative sample from the liquid flowing in a pipe; the automatic sampler generally consists of a probe, a sample extractor, an associated controller, a flow measuring device, and a sample receiver. **[D02.02] D4057**

automatic sampler, *n*—device used to repetitively extract an grab and collect a representative sample of a batch or process stream. **[D02.25] D7453**

automatic sampling system, *n*—system consisting of a sample probe, sample fast cycle loop, sample supply line stream conditioning, an automatic sampler and an associated controller, a flow measuring device, and sample holding, mixing and handling capabilities. **[D02.25] D7453**

automotive, *adj*—descriptive of equipment associated with self-propelled machinery, usually vehicles driven by internal combustion engines. **[D02.B0] D4485, D6709, D6837, D6894, D7216**

automotive fuel rating, *n*—the automotive fuel rating required under the amended Octane Certification and Posting Rule (or as amended, the Fuel Rating Rule), 16 CFR, Part 306.

DISCUSSION—

Under this Rule, sellers of liquid automotive fuels, including alternative fuels, must determine, certify, and post an appropriate automotive fuel rating. The automotive fuel rating for gasoline is the antiknock index (octane rating). The automotive fuel rating for alternative liquid fuels consists of the common name of the fuel along with a disclosure of the amount, expressed as a minimum percentage by volume, of the principal component of the fuel. For alternative liquid automotive fuels, a disclosure of other components, expressed as a minimum percentage by volume, may be included, if desired. This is applicable in the United States. **[D02.A0] D7794**

automotive wheel bearing grease, *n*—a lubricating grease specifically formulated to lubricate automotive wheel bearings at relatively high grease temperatures and bearing speeds. **[D02.G0] D4693**

aviation gasoline, *n*—fuel derived from petroleum or non-petroleum materials possessing specific properties suitable for operating aircraft powered by spark-ignition piston engines.

DISCUSSION—

Principal properties include combustion, fluidity, volatility corrosion, stability, water shedding, and detonation-free performance in the engine (or engines) for which it is intended. In the context of this guide, the terms fuel and gasoline are interchangeable. **[D02.J0] D7826**

aviation gasoline, *n*—gasoline possessing specific properties suitable for fueling aircraft powered by reciprocating spark ignition engines.

DISCUSSION—

Principal properties include volatility limits, stability, detonation-free performance in the engine for which it is intended and suitability for low temperature performance.

[D02.J0] D910, D6227

B6 to B20, *n*—fuel blend consisting of 6 to 20 volume percent biodiesel conforming to the requirements of Specification D6751 with the remainder being a light middle or middle distillate grade diesel fuel and meeting the requirements of this specification.

DISCUSSION—

The abbreviation BXX represents a specific blend concentration in the range B6 to B20, where XX is the percent volume of biodiesel in the fuel blend.

[D02.E0] D7467

backflush, *v*—elution of the HPLC mobile phase in the backward or reverse direction from the silica gel column towards the cyano column.

DISCUSSION—

In this test method, it is used to elute the total aromatics plus polars as one sharp component. **[D02.04] D7419**

background RLU, *n*—quantity of relative light units resulting from running the test method without incorporation of the sample. **[D02.14] D7687**

bacterium (pl. bacteria), *n*—a single cell microorganism characterized by the absence of defined intracellular membranes that define all higher life forms.

DISCUSSION—

All bacteria are members of the biological diverse kingdoms *Prokaryota* and *Archaebacteriota*. Individual taxa within these kingdoms are able to thrive in environments ranging from sub-zero temperatures, such as in frozen foods and polar ice, to superheated waters in deep-sea thermal vents, and over the pH range <2.0 to >13.0. Potential food sources range from single carbon molecules (carbon dioxide and methane) to complex polymers, including plastics. Oxygen requirements range from obligate anaerobes, which die on contact with oxygen, to obligate aerobes, which die if oxygen pressure falls below a species specific threshold.

[D02.14] D6469

base number, *n*—the quantity of a specified acid, expressed in terms of the equivalent number of milligrams of potassium hydroxide per gram of sample, required to titrate a sample in a specified solvent to a specified endpoint using a specified detection system. **[D02.06] D2896, D8126**

DISCUSSION—

In this test method, the indicator is *p*-naphtholbenzein titrated to an orange end point in a toluene-water-isopropanol solvent. **[D02.06] D974**

DISCUSSION—

This test method uses fixed amounts of *iso*octane and alcoholic hydrochloric acid as the sample solvent and the endpoint is defined as the amount of titrant required to reach a yellow endpoint with a methyl red indicator solution. **[D02.06] D5984**

DISCUSSION—

In this test method, the sample is titrated to a meter reading corresponding to aqueous acidic buffer solution or appropriate inflection point. **[D02.06] D4739**

base oil, *n*—a base stock or a blend of two or more base stocks used to produce finished lubricants, usually in combination with additives. **[D02.P0] D6074**

base stock, *n*—a hydrocarbon lubricant component, other than an additive, that is produced by a single manufacturer to the same specifications (independent of feed source or manufacturer's location), and that is identified by a unique formula number or product identification number, or both.

[D02.P0] D6074

basicity, *n*—the quality, state or degree of being basic.

DISCUSSION—

In this test method, the criterion for basicity is a pink or red color when phenolphthalein indicator is used. **[D02.06] D1093**

basis weight of paper, *n*—basis weight is expressed in grams per square metre. In countries where the metric system is not universal, basis weight is also expressed in pounds per ream. **[D02.10] D2423**

batch, *n*—term referring to a volume or parcel being transferred. **[D02.25] D7453**

bearing failure, *n*—the termination of the bearing's ability to perform its design function. **[D02.96] D7973**

bearing failure initiation, *n*—the moment a bearing starts to perform outside of its design function measured by performance characteristics. **[D02.96] D7973**

between ILCP method-averages reproducibility ($R_{ILCP\_X^{-},ILCP\_Y}$), *n*—a quantitative expression of the random error associated with the difference between the bias-corrected ILCP average of method X versus the ILCP average of method Y from a Proficiency Testing program, when the method X has been assessed versus method Y, and an appropriate bias-correction has been applied to all method X results in accordance with this practice; it is defined as the 95 % confidence limit for the difference between two such averages. **[D02.94] D6708**

between-method bias, *n*—a quantitative expression for the mathematical correction that can statistically improve the degree of agreement between the expected values of two test methods which purport to measure the same property. **[D02.94] D6708**

between-methods reproducibility (R_{XY}), *n*—a quantitative expression of the random error associated with the difference between two results obtained by different operators using different apparatus and applying the two methods *X* and *Y*, respectively, each obtaining a single result on an identical test sample, when the methods have been assessed and an appropriate bias-correction has been applied in accordance with this practice; it is defined as the 95 % confidence limit for the difference between two such single and independent results.

DISCUSSION—

A statement of between methods reproducibility must include a description of any bias correction used in accordance with this practice.

DISCUSSION—

Between methods reproducibility is a meaningful concept only if there are no statistically observable sample-specific relative biases between the two methods, or if such biases vary from one sample to another in such a way that they may be considered random effects. **[D02.94] D6708**

bias, *n*—the difference between the expectation of the test results and an accepted reference value.

DISCUSSION—

The term "expectation" is used in the context of statistics terminology, which implies it is a "statistical expectation." (E177) **[D02.94] D6300, D6792**

bias, *n*—a systematic error that contributes to the difference between a population mean of the measurements or test results and an accepted reference or true value.

[D02.94] D7372

binary, *adj*—characterized by, or consisting of, two components. **[D02.J0] D7719**

binder, *n*—substance such as coal tar pitch or petroleum pitch, used to bond the coke or other filler material prior to baking. **[D02.F0] D8075**

binder, *n*—substance, usually an organic material such as coal tar pitch or petroleum pitch, used to bond the coke or other filler material prior to baking. **[D02.F0] C709**

bioaccumulation, *n*—the net accumulation of a substance by an organism as a result of uptake from all environmental sources. **[D02.N0] D7044**

bioburden, *n*—the level of microbial contamination (*biomass*) in a system.

DISCUSSION—

Typically, bioburden is defined in terms of either biomass or numbers of cells per unit volume or mass or surface area material tested (g biomass/mL; g biomass/g; cells/mL sample, and so forth). The specific parameter used to define bioburden depends on critical properties of the system evaluated and the investigator's preferences. **[D02.14] D6469**

biocide, *n*—a poisonous substance that can kill living organisms.

DISCUSSION—

Biocides are further classified as bactericides (kill bacteria), fungicides (kill fungi), and microbiocides (kill both bacteria and fungi). They are also referred to as *antimicrobials*.

[D02.14] D6469

biodegradability, *n*—ability of a substance to be broken down into simpler substances by bacteria. **[D02.12] D7373**

biodegradable, *adj*—any substance containing <10 % wt. O_2 content which undergoes ≥60 % biodegradation as theoretical CO_2 in 28 days and ≥67 % biodegradation as theoretical O_2 uptake in 28 days, or any hydraulic fluid containing ≥10 % wt. O_2 content which undergoes ≥60 % biodegradation as theoretical CO_2 or as theoretical O_2 uptake in 28 days. **[D02.N0] D7044**

biodegradation, *n*—the process of chemical breakdown or transformation of a material caused by organisms or their enzymes.

DISCUSSION—

Biodegradation is only one mechanism by which materials are removed from the environment. **[D02.N0] D6046**

DISCUSSION—

Biodegradation is only one mechanism by which materials are transformed in the environment. **[D02.12] D5864, D6006, D6139, D7044**

biodeterioration, *n*—the loss of commercial value or performance characteristics, or both, of a product (fuel) or material (fuel system) through biological processes. **[D02.14] D6469**

biodiesel, *n*—fuel comprised of mono-alkyl esters of long chain fatty acids derived from vegetable oils or animal fats, designated B100. **[D02.E0] D396, D975, D7467; [D02.08] D93; [D02.14] D7501; [D02.01] D7170; [D02.04] D7806, D7861**

DISCUSSION—

biodiesel, as defined above, is registered with the U.S. EPA as a fuel and a fuel additive under Section 211(b) of the Clean Air Act 40 CFR Part 79). There is, however, other usage of the term biodiesel in the marketplace. Due to its EPA registration and the widespread commercial use of the term biodiesel in the U.S. marketplace, the term biodiesel will be maintained for this specification.

DISCUSSION—

Biodiesel is typically produced by a reaction of a vegetable oil or animal fat with an alcohol such as methanol or ethanol in the presence of a catalyst to yield mono-alkyl esters and glycerin, which is removed. The finished biodiesel derives approximately 10 % of its mass from the reacted alcohol. The alcohol used in the reaction may or may not come from renewable resources.

DISCUSSION—

Biodiesel is typically produced by a reaction of vegetable oil or animal fat with an alcohol such as methanol or ethanol in the presence of a catalyst

to yield mono-esters and glycerin. The fuel typically may contain up to 14 different types of fatty acids that are chemically transformed into fatty acid methyl esters (FAME). **[D02.07] D5771 [D02.E0] D6751 [D02.E0] D6751**

biodiesel (B-100), *n*—fuel comprised of mono-alkyl esters of long chain fatty acids derived from vegetable oils or animal fats. **[D02.04] D6584**

biodiesel blend, *n*—a blend of biodiesel fuel with petroleum-based diesel fuel designated BXX, where XX is the volume % of biodiesel. **[D02.07] D5771**

biodiesel blend (BXX), *n*—blend of biodiesel fuel with diesel fuel oils.

DISCUSSION—

In the abbreviation, BXX, the XX represents the volume percentage of biodiesel fuel in the blend.

[D02.01] D7170; [D02.E0] D396, D975, D6751, ~~D7861~~; [D02.04] D7861

biodiesel blend (BXX), *n*—blend of biodiesel fuel with petroleum-based diesel fuel designated BXX, where XX is the volume percentage (as a whole number without the percentage sign) of biodiesel. **[D02.07] D7397**

biodiesel blend, BXX, *n*—a blend of biodiesel fuel with petroleum-based diesel fuel.

DISCUSSION—

In the abbreviation BXX, the XX represents the volume percentage of biodiesel fuel in the blend.

[D02.04] D7806

biodiesel blend, BXX, *n*—a fuel composed of biodiesel blendstock with hydrocarbon-based diesel fuel. **[D02.14] D7321**

biodiesel blends, *n*—a blend of biodiesel fuel with petroleum-based diesel fuel. **[D02.08] D93**

biodiesel fuel, *n*—synonym for *biodiesel*. **[D02.E0] D6751**

biofilm, *n*—a film or layer of microorganisms, biopolymers, water, and entrained organic and inorganic debris that forms as a result of microbial growth and proliferation at phase interfaces (liquid-liquid, liquid-solid, liquid-gas, and so forth). (Synonym—**skinnogen**.) **[D02.14] D6469**

bio-kinetic model, *n*—model that can predict the biodegradability of a lubricant. **[D02.12] D7373**

bioluminescence, *n*—production and emission of light by a living organism as the result of a chemical reaction during which chemical energy is converted to light energy. **[D02.14] D7463**

biomass, *n*—biological material including any material other than fossil fuels which is or was a living organism or component or product of a living organism.

[D02.12] D5864; [D02.14] D7463; [D02.J0] D7719

DISCUSSION—

In biology and environmental science, biomass is typically expressed as density of biological material per unit sample volume, area, or mass (g biomass/g (or /mL or /cm^2) sample); when used for products derived from organisms biomass is typically expressed in terms of mass (kg, MT, etc.) or volume (L, m^3, bbl, etc.).

DISCUSSION—

Products of living organisms include those materials produced directly by living organisms as metabolites (for example, ethanol, various carbohydrates and fatty acids), materials manufactured by processing living organisms (for example, pellets manufactured by shredding and pelletizing plant material) and materials produced by processing living organisms, their components or metabolites (for example, transesterified oil; also called biodiesel).

[D02.14] D6469; [D02.12] D6384

biosurfactant, *n*—a biologically produced molecule that acts as a soap or detergent. **[D02.14] D6469**

bituminous material, *n*—*in petroleum technology*, a black or dark-colored very viscous liquid or semi-solid composed principally of high molecular weight condensed aromatic, or naphthenic compounds, or both. **[D02.02] D95**

black oil, *n*—lubricant containing asphaltic materials. Black oils are used in heavy-duty equipment applications, such as mining and quarrying, where extra adhesiveness is desired. **[D02.07] D97**

blank, *n*—a flask containing the test medium and the inoculum with no additional carbon source added. **[D02.12] D5864**

blank, *n—in biodegradability testing*, a test system containing all system components with the exception of the test material. **[D02.12] D6384**

blank, *n—in biodegradability testing*, a test system containing all system components with the exception of the test substance. **[D02.12] D6006**

blank, *n*—solution which is similar in composition and contents to the sample solution but does not contain the analyte being measured. **[D02.03] D7740**

bleed (bleeding), *n—of lubricating greases*, the separation of a liquid lubricant from a lubricating grease for any cause. **[D02.G0] D6185**

blind reference oil, *n*—a reference oil, the identity of which is unknown by the test facility. **[D02.B0] D7468**

DISCUSSION—

This is a coded reference oil which is submitted by a source independent from the test facility. **[D02.B0] D6681, D6709, D6750, D7156, D7422, D7484**

blowby, *n—in internal combustion engines*, that portion of the combustion products and unburned air/fuel mixture that leaks past piston rings into the engine crankcase during operation. **[D02.B0] D6593, D6681, D6891, D7156, D7422, D7484, D7589**

boilup rate, *n—in distillation*, the quantity of vapor entering the column per unit of time. **[D02.08] D2892**

bond, *v*—to connect two parts of a system electrically by means of a conductive wire to eliminate voltage differences. **[D02.14] D6217, D7501; [D02.J0] D5452**

bonded glycerin, *n*—glycerin portion of the mono-, di-, and triglyceride molecules. **[D02.04] D6584**

boundary lubrication, *n*—condition in which the friction and wear between two surfaces in relative motion are determined by the properties of the surfaces and the properties of the contacting fluid, other than bulk viscosity.

DISCUSSION—

Metal to metal contact occurs and the chemistry of the system is involved. Physically adsorbed or chemically reacted soft films (usually very thin) support contact loads. Consequently, some wear is inevitable. **[D02.96] D7720**

Bourdon spring gauge, *n*—pressure measuring device that employs a Bourdon tube connected to an indicator. **[D02.08] D323, D4953**

Bourdon tube, *n*—flattened metal tube bent to a curve that straightens under internal pressure. **[D02.08] D323, D4953**

brake mean effective pressure, *n—for spark-ignition engines*, the measure of engine power at the output shaft as typically measured by an absorption dynamometer or brake. **[D02.01] D909**

break-in, *v—in internal combustion engines*, the running of a new engine under prescribed conditions to help stabilize engine response and help remove initial friction characteristics associated with new engine parts. **[D02.B0] D7589**

break-in, *n—in tribology*, an initial transition process occurring in newly established wearing contacts, often accompanied by transients in coefficient of friction or wear rate, or both, that are uncharacteristic of the given tribological system's long-term behavior. **[D02.G0] D5706, D5707, D7420, D7594 [D02.L0] D6425**

bromine index, *n*—the number of milligrams of bromine that will react with 100 g of sample under the conditions of the test. **[D02.06] D2710**

BTDC (before top dead center), *adj*—used with the degree symbol to indicate the angular position of the crankshaft relative to its position at the point of uppermost travel of the piston in the cylinder. **[D02.B0] D5966, D6837, D6984, D7320**

bubble point, *n*—the pressure at the which the first bubble of vapor forms is the bubble point when the pressure is lowered on a liquid held at a constant temperature.