



Designation: D4175 – 23<sup>ε1</sup>

# Standard Terminology Relating to Petroleum Products, Liquid Fuels, and Lubricants<sup>1</sup>

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 ( $\epsilon$ ) 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.*

<sup>ε1</sup> NOTE—Terms were transferred and updated editorially in October 2023.

## 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.

**1,3-butadiene**—hydrocarbon product containing more than 99 % 1,3-butadiene. [D02.D0] D5274

**abrasion**,  $n$ —wear by displacement of material caused by hard particles or hard protuberances. [D02.96] D7684, D7690

<sup>1</sup> 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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**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

DISCUSSION—Also called cutting wear in some instances such as machining swarf. [D02.96] D7898

**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:

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

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—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

**absorbance** (A),  $n$ —the logarithm to the base 10 of the reciprocal of the transmittance, ( $T$ ).

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

DISCUSSION—Absorbance is a measure of the capacity of a substance to absorb light of a specific wavelength. [D02.25] D8470

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

$$a = A/lbc$$

where:

A = the absorbance,

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

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

[D02.04] D2008

**absorptivity,  $n$** —the absorbance divided by the product of the concentration of the substance and the sample pathlength,  $a = A/(bc)$ . The units of  $b$  and  $c$  shall be specified. [D02.25]

D8321

**acceptance limit (AL),  $n$** —a numerical value that defines the point between making the property conformance or non-conformance to a specification decision.

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 making the conformance to specification decision if the true value (see 3.1.17) of the property 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. [D02.04] D6596; [D02.25] D8340;

[D02.94] D8428

DISCUSSION—In the context of this test method, accepted reference value is understood to apply to the cetane number of specific reference materials determined empirically under reproducibility conditions by the National Exchange Group or another recognized exchange testing organization.

[D02.01] D613

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 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

DISCUSSION—In the context of this method, accepted reference value is understood to apply to the ignition delay and the combustion delay

of specific reference materials determined under reproducibility conditions by collaborative experimental work. [D02.01] D7668

**accepted reference value (ARV),  $n$** —a value that serves as an agreed-upon reference for comparison, and which is derived as: (1) a theoretical or established value, based on scientific principles, (2) an assigned or certified value, based on experimental work of some national or international organization, or (3) a consensus or certified value, based on collaborative experimental work under the auspices of a scientific or engineering group. [D02.25] D3764

**accepted reference value, ARV**—a value that serves as an agreed upon reference for comparison, and which 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

**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 a test result and an accepted reference value. [D02.91] D8164;

[D02.07] D8278; [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.

[D02.06] D8045; [D02.09] D943

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—In this test method, the solvent is a toluene-water-isopropanol mixture and the end point is determined when a green/green brown color is obtained using the specified *p*-naphtholbenzein indicator solution. [D02.06] D3242

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—The amount of acid titrated with a base (NaOH or KOH) in a sample of ethanol or ethanol blend with gasoline, calculated as acetic acid in mg/kg (ppm mass). [D02.06] D7795

**action limit, *n***—for multivariate spectroscopic analyzers used in the analysis of liquid petroleum products and fuels, the limiting value from an instrument performance test, beyond which the analyzer is expected to produce potentially invalid results. [D02.25] D6122

**action limit, *n***—for multivariate spectroscopic analyzers used in the analysis of liquid petroleum products and fuels, the limiting value from an instrument performance test, beyond which the multivariate spectroscopic analyzer is expected to produce potentially invalid results. [D02.25] D8470

**activated sludge, *n***—the precipitated solid matter, consisting mainly of bacteria and other aquatic microorganisms, that is produced at a domestic wastewater treatment plant and is used primarily in secondary sewage treatment to microbially oxidize dissolved organic matter in the effluent. [D02.12] D6731, D6139, D6384

**activation energy ( $E_a$ ), *n***—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<sup>-1</sup> K<sup>-1</sup> 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<sup>-1</sup> m<sup>-2</sup> (for  $Z_a$  calculated from area-normalized oxidation rates,  $OR_a$ ) or g g<sup>-1</sup> h<sup>-1</sup> (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; [D02.12] D8324

**acute ecotoxicity, *n***—the propensity of a test material to produce adverse behavioral, biochemical, or physiological effects in non-human organisms or populations in a short period, usually not constituting a substantial portion of their life span. [D02.N0] D8029

**acute ecotoxicity test, *n***—a comparative ecotoxicity 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.N0] D8029

**acute toxicity test, *n***—a comparative 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***—a material added to another, usually in a small amount, to impart or enhance desirable properties or to suppress undesirable properties. [D02.B0] D6681

**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

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

DISCUSSION—Additives are generally included in finished diesel fuel to enhance performance properties (for example, cetane number, lubricity, cold flow, etc.).

[D02.12] **D5864, D6006, D6139, D6731;**  
 [D02.N0] **D6046; [D02.14] D8070**

DISCUSSION—Additives that contain hydrocarbon oil blended with other substances may exclude the hydrocarbon oil portion for determination of the volume percent of the additive in 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. Similar fouling is expected in diesel engine applications and triglycerides are therefore not allowed as additives or components of additives. **[D02.E0] D975**

**additive, *n*—in liquid fuels**, a component used in a finished fuel at 1 % by volume (volume fraction) or less that is included to enhance performance properties of the fuel or to comply with a requirement of the finished fuel.

DISCUSSION—Dilution of an additive to facilitate handling may be needed. The volume of the diluent is not considered part of the dosage of the additive for the purpose of determining the concentration of the additive. **[Coordinating Subcommittee D02.95]**

**additive, *n*—in aviation turbine fuel**, a substance added to a base aviation turbine fuel in relatively small amounts that either enables that base aviation turbine fuel to meet the applicable specification properties or does not alter the applicable specification properties of that base aviation turbine fuel beyond allowable limits. **[D02.J0] D4054**

**adenosine monophosphate (AMP), *n***—molecule formed by the removal of two molecules of phosphate (one pyrophosphate molecule) from ATP. **[D02.14] D7463, D7687**

**adenosine triphosphate (ATP), *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, D7687**

**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.B0] D8074; [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.C0.01] D8506; [D02.14] D6469**

**aerobic, *adj***—(1) taking place in the presence of oxygen; (2) living or active in the presence of oxygen.

**agglomerate, *n*—in manufactured carbon and graphite product technology**, composite particle containing a number of grains. **[D02.F0] 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 milligram CaCO<sub>3</sub> L<sup>-1</sup>.

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.C0.01] D8506**

**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<sub>3</sub>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, D8111, D8114, D8226, D8350**

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**

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

**all-levels sample, *n***—a sample obtained by lowering the closed sampling device to the bottom of the outlet suction level, but always above free water, then opening the sampler and raising it at a uniform rate such that it is between 70 % and 85 % full when withdrawn from the product. Alternatively, all-levels samples may be taken with samplers designed for filling as they pass downward through the product.

DISCUSSION—If required by the test method, the sampler may be greater than 85 % full when withdrawn but in no case shall it be completely full. In these cases, take special handling precautions to consider the hazards associated with product thermal expansion. **[D02.02] D4057**

**alloy, *n***—unique composition of two or more metals that has one or more of the metals treated or processed in a special way to confer enhanced performance characteristics on the resulting material. **[D02.96] D8182**

**alpha corrections, *n***—influence correction factors that compensate for inter-element X-ray matrix effects; alpha corrections may be determined by best-fit regression, XRF Fundamental Parameters (FP), or XRF theory (called theoretical alphas). **[D02.03] D8252**

**alternative blendstock**, *n*—in diesel fuels and fuel oils, a non-hydrocarbon oil substance added to diesel fuel or 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

**alternative blendstock**, *n*—in diesel fuels and fuel oils, a non-hydrocarbon oil substance added to diesel fuel and 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 for guidance regarding new materials for #1-D and #2-D grades of diesel fuels. [D02.E0] D975

**amine number of reference fuels above 100**, AN, *n*—determined in terms of the weight percent of 3-methylphenylamine in reference grade *isooctane* (2,2,4-trimethylpentane). For example, 5 % of 3-methylphenylamine in reference grade *isooctane* 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] D6424, D6812

**amplicon**, *n*—the product of the qPCR reaction resulting from the amplification of a genetic target using a particular pair of primers. [D02.14] D8412

**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.C0.01] D8506; [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**, *n*—in multivariate spectroscopic measurement, the process of applying the multivariate model to a spectrum, preprocessed as required, to predict a component concentration value or property, the prediction being referred to herein as a Predicted Primary Test Method Result (PPTMR). [D02.25] D8321, D8340

**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 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 sample handling and preparation, test equipment, instrumentation, display devices, data handlers, printouts or output transmitters, that are used to determine a quantitative value of a specific property for an unknown sample in accordance with a standard test method. [D02.94] D7372

**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.

DISCUSSION—In the context of this test method, the analytical measurement system is comprised of the knock testing unit, automated analyzer system, and any auxiliary equipment required for the safe operation of the engine. [D02.01] D2885

**analyzer**, *n*—see **analyzer system**. [D02.25] D3764, D6122, D7808, D8321, D8340

**analyzer system**, *n*—for equipment in the analysis of liquid petroleum products and fuels, all piping, hardware, computer, software, instrument, linear correlation or multivariate model required to analyze a process or product sample; the analyzer system may also be referred to as the analyzer, or the total analyzer system.

DISCUSSION—Online analyzers that utilize extractive sampling include sample loop, sample conditioning system and excess sample return system.

DISCUSSION—At-line, field and laboratory analyzers include the instrument and all associated sample introduction apparatuses. [D02.25] D8340

**analyzer system**, *n*—for equipment in the analysis of liquid petroleum products and fuels, all piping, hardware, computer, software, instrument, linear correlation or multivariate model required to analyze a process or product

sample; the analyzer may also be referred to as the analyzer system, or the total analyzer system.

DISCUSSION—Online analyzers that utilize extractive sampling include sample loop, sample conditioning system and excess sample return system (see Fig. 1 in D3764 for example). Online analyzers that utilize insertion probes include fiber optics and sample probes.

DISCUSSION—At-line, field and laboratory analyzers include the instrument and all associated sample introduction apparatuses.

[D02.25] D3764

**analyzer system, *n***—for equipment in the analysis of liquid petroleum products and fuels, all piping, hardware, computer, software, instrument, linear correlation or multivariate model required to analyze a process or product sample; the analyzer system may also be referred to as the analyzer, or the total analyzer system.

DISCUSSION—Online analyzers that utilize extractive sampling include sample loop, sample conditioning system and excess sample return system (see Fig. 1 in D3764 for example). Online analyzers that utilize insertion probes include fiber optics and sample probes.

DISCUSSION—At-line, field and laboratory analyzers include the instrument and all associated sample introduction apparatuses.

[D02.25] D6122, D7808, D8321

**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

DISCUSSION—For continuous and intermittent analyzers with sufficiently short cycle times, the total analyzer response time is the analyzer dead time plus 5.3 times the analyzer unit time constant. For intermittent analyzers with long cycle times, the analyzer unit response time is effectively equal to the analyzer unit cycle time. For intermittent analyzers with intermediate cycle times, the analyzer unit response time should be defined as the multiple of the analyzer unit cycle time needed to exceed 99.5 % response.

[D02.25] D3764

**Anderson-Darling Resolution Sensitive Statistic, ADrs, *n***—a goodness-of-fit statistical tool used to objectively test for normality of proficiency testing data.

DISCUSSION—ADrs is a modified version of the Anderson-Darling Statistic (see D6299) and was developed specifically for use in assessing normality in proficiency test program data. The ADrs statistic assesses normality regardless of the adequacy of data measurement resolution relative to the overall variation in the dataset.

[D02.94] D7372

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

**annulus**—a cut gasket shape consisting of two concentric circles of known geometry. [D02.B0] F118

**anoxic, *adj***—oxygen free. [D02.C0.01] D8506; [D02.14] D6469

**anti-Stokes line (band), *n***—a Raman line (band) that has a frequency higher than that of the incident monochromatic beam. [D02.25] D8321

**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.C0.01] D8506; [D02.14] D6469

**antinodes, *n***—two or more locations that have local maximum displacements, called antinodes, in an unconstrained slender rod or bar in resonance. For the fundamental flexure resonance, the antinodes are located at the two ends and the center of the specimen. [D02.F0] C747

**API gravity, *n***—a special function of relative density 60/60 °F (15.56/15.56 °C), represented by:

$$^{\circ}\text{API} = [141.5 / (\text{relative density } 60/60 \text{ } ^{\circ}\text{F})] - 131.5$$

[D02.02] D287

**API gravity, *n***—special function of relative density (specific gravity) SG60 °F/60 °F, represented by:

$$^{\circ}\text{API} = 141.5 / (\text{SG}60 \text{ } ^{\circ}\text{F} / 60 \text{ } ^{\circ}\text{F}) - 131.5$$

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 XI for a brief explanation. [D02.07] D2983

DISCUSSION—In all cases the term “viscosity” implies that the value is the “apparent viscosity.” [D02.07] D8210

DISCUSSION—Apparent viscosity may vary with the spindle speed (shear rate) of a rotational viscometer when the fluid is non-Newtonian. [D02.07] D8210

**apparent viscosity, *n***—of a lubricating grease is 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***—the viscosity obtained by use of this test method. [D02.07] D7110

**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 ( $OR_a$ ), *n***—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 ( $SOR_a$ ), *n***—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

**as-calcined particles, *n***—*of coke*, those particles that have not been subject to laboratory crushing. [D02.05] D7454

**aseptic, *adj***—sterile, free from viable microbiological contamination. [D02.14] D6974, D7463, D7464, D7687

**ash, *n***—*in carbon and graphite technology*, residue remaining after oxidation of a carbon or graphite. [D02.F0] C561

**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-methylnaphthalene, and the paraffinic solvent is n-hexadecane. [D02.14] D7060

DISCUSSION—Asphaltenes are found largely in crude oils and in heavy fuel oils containing residual fractions. They are insoluble in alkanes such as heptane and pentane, but soluble in aromatic solvents such as benzene or toluene. [D02.14] D8253

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

**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

**attenuated total reflection (ATR), *n***—reflection that occurs when an absorbing coupling mechanism acts in the process of total internal reflection to make the reflectance less than unity.

DISCUSSION—In this process, if an absorbing sample is placed in contact with the reflecting surface, the reflectance for total internal reflection will be attenuated to some value between zero and unity ( $0 < R < 1$ ) in regions of the spectrum where absorption of the radiant power can take place. [D02.25] D8321

**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 commonly in the air as the result of a heat liberation due to the exothermic oxidation reaction in the absence of an external ignition source, such as a spark or flame. [Subcommittee D02.01]; [D02.N0] D2155

**autoignition temperature, *n***—the minimum temperature at which autoignition occurs under the specified conditions of the test. [D02.N0] D2155

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

**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 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, D7216, D8047, D8111, D8114, D8226, D8350

**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***—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

**aviation turbine fuel, *n***—refined petroleum distillate, generally used as a fuel for aviation gas turbines.

DISCUSSION—Different grades are characterized by volatility ranges, freeze point, and by flash point. [D02.J0] D1322

**B6 to B20, *n***—fuel blend consisting of 6 volume percent 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 *Archaeobacteriota*. 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.C0.01] D8506; [D02.14] D6469

**base fuel, *n***—*in automotive spark-ignition engine fuels*, a material composed primarily of hydrocarbons that may also contain oxygenates, anti-oxidants, corrosion inhibitors, metal deactivators, and dyes but does not contain deposit control or lead additives.

DISCUSSION—A jurisdiction may set limits on lead content from all sources. [D02.A0] D5500, D6201

**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—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 peak of a compound, *n***—the peak used as 100 % in computing the cracking pattern coefficient. [D02.04] D2650

**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

**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*—discrete shipment of commodity defined by a specified quantity, a time interval, or quality.

[D02.25]  
D7453

**bearing failure**, *n*—the termination of the bearing's ability to perform its design function.

[D02.96] D7973, D8128

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

[D02.96] D7973, D8128

**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 numerical limit for the difference between two such averages that would be exceeded in about 5 % of the time (one case in 20 in the long run).

[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-method 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.

[D02.25] D6122

DISCUSSION—Within the context of this practice,  $R_{XY}$  is interpreted to be the 95 % confidence limit for the prediction deviation between any single Primary Test Method Result (PTMR) and the Predicted Primary Test Method Result (PPTMR) produced by the analyzer system that is deemed acceptable on the assumption that both the analyzer system and primary test method are in statistical control, and that the correlation relationship applied to the analyzer results to produce the PPTMR is fit-for-purpose.

[D02.25] D3764

**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 numerical limit for the difference between two such single and independent results that would be exceeded about 5 % of the time (one case in 20 in the long run) in the normal and correct operation of both test methods.

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 population mean of the test results and an accepted reference value.

[D02.94] D6792

**binary**, *adj*—characterized by, or consisting of, two components.

[D02.J0] D7719

**binder**—a component of certain gasket materials, which solidifies the structure, imparts uniform adhesion to surfaces, and has an impact on the pore structure and resiliency.

[D02.B0] F118

**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

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

[D02.N0] D7044, D8029

**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.C0.01] D8506; [D02.14] D6469

**biochemical oxygen demand (BOD)**, *n*—the mass concentration of dissolved oxygen consumed under specified conditions by the biological oxidation of organic or inorganic matter, or both.

DISCUSSION—BOD determination is performed using empirical tests employing standardized laboratory procedures. These tests measure oxygen utilization during a specified incubation period for the biochemical degradation of organic material (carbonaceous demand) in water.

[D02.12] D6731

**biocide**, *n*—a physical or chemical agent that kills living organisms.

DISCUSSION—Biocides are further classified as bactericides (kill bacteria), fungicides (kill fungi), and microbicides (kill both bacterial and fungi). They are also referred to as antimicrobials.

[D02.C0.01]  
D8506

**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<sub>2</sub> content which undergoes ≥60 % biodegradation as theoretical CO<sub>2</sub> in 28 days and ≥67 % biodegradation as theoretical O<sub>2</sub> uptake in 28 days, or any hydraulic fluid containing ≥10 % wt. O<sub>2</sub> content which undergoes ≥60 % biodegradation as theoretical CO<sub>2</sub> or as theoretical O<sub>2</sub> 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.

[D02.12] D6006, D6139, D7044, D8324; [D02.N0] D6046

DISCUSSION—Biodegradation is only one mechanism by which materials are transformed in the environment.

[D02.12] D5864; [D02.N0] D8029

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

DISCUSSION—Biodegradation is only one mechanism by which materials are removed, transformed, or both, in the environment.

[D02.12] D6731

**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

**biodeterioration, *n***—the loss of commercial value or performance characteristics, or both, of a product or material through biological processes.

DISCUSSION—In turbine oil systems, turbine oil is the product and turbine oil system components such as filter media, transfer lines, heat exchangers, reservoirs, etc. are the materials. [D02.C0.01] D8506

**biodiesel, *n***—fuel comprised of mono-alkyl esters of long chain fatty acids derived from vegetable oils or animal fats, designated B100.

[D02.01] D6890; [D02.03] D8351; [02.04] D7398, D7861; [D02.08] D93; [D02.14] D7501, D7321; [D02.E0] D396, D975, D7467, D8181

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. [D02.E0] D6751; [D02.07] D5771, D5772, D5773, D7397, D7683, D7689

**biodiesel, *n***—a fuel comprised of mono-alkyl esters of long chain fatty acids derived from vegetable oils or animal fats, designated B100.

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] D2500

**biodiesel, *n***—a fuel composed of mono-alkyl esters of long chain fatty acids derived from vegetable oils or animal fats, designated B100 in Specification D6751. [D02.04] D7806

**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 (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.

[D02.04] D7861

**biodiesel blend (BXX), *n***—a homogeneous mixture of hydrocarbon oils and mono-alkyl esters of long chain fatty acids.

DISCUSSION—In the abbreviation BXX, the XX represents the volume percentage of biodiesel in the blend. [D02.E0] D396, D975;

[D02.01] D6890

DISCUSSION—The mono-alkyl esters of long chain fatty acids (that is, biodiesel) used in the mixture shall meet the requirements of Specification D6751.

DISCUSSION—Diesel fuel, fuel oil, and non-aviation gas turbine oil are examples of hydrocarbon oils. [D02.E0] D6751;

[D02.07] D2500, D5771, D5772, D5773, D7397, D7683, D7689; [D02.14] D7321

DISCUSSION—B0 is synonymous with a hydrocarbon oil to which no biodiesel has been added. [D02.14] D7321

DISCUSSION—In the abbreviation, BXX, the XX represents the volume percentage of biodiesel fuel in the blend. [D02.03] D8351;

[D02.14] D7321, D7501

DISCUSSION—Diesel fuel, fuel oil, and non-aviation turbine oil are examples of hydrocarbon oils [D02.03] D8351

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

**biodiesel fuel, *n***—synonym for **biodiesel**. [D02.E0] D6751; [D02.03] D8351; [D02.07] D5771, D5772, D5773, D7397, D7683, D7689

**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.C0.01] D8506;

[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, D7687

**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.

[D02.14] 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<sup>2</sup>) sample); when used for products derived from organisms biomass is typically expressed in terms of mass (kg, MT, etc.) or volume (L, m<sup>3</sup>, bbl, etc.).

[D02.C0.01] D8506

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).

[D02.12] D5864, D6006, D6139, D6384; [D02.14] D6469

**biosurfactant, *n***—a biologically produced molecule that acts as a soap or detergent. [D02.C0.01] D8506; [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] D6006, D6139, D6384

**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

**blendstock, *n***—*in liquid fuels*, a component that is not an additive used in a finished fuel, which when added to other materials comprises a finished fuel.

DISCUSSION—The blendstock is usually a liquid.

DISCUSSION—The material usually is 1 % by volume (volume fraction) or more of the finished fuel. Materials added in small amounts, less than 1 % by volume (volume fraction), to improve performance of the finished fuel in its intended application are usually called additives.

[Coordinating Subcommittee D02.95]

**blind reference oil, *n***—a reference oil, the identity of which is unknown by the test facility. [D02.B0] D5967, D7468

DISCUSSION—This is a coded reference oil which is submitted by a source independent from the test facility. [D02.B0] D6681, D6709, D7156, D7422, D7484, D7549, D8048, D8074, D8165

**blowby, *n***—that portion of the combustion products and unburned air/fuel mixture that leaks past piston rings into the engine crankcase during operation. [D02.B0] D6891

**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.A0] D6201; [D02.B0] D5966, D5967, D6593, D6681, D6709, D6837, D6984, D7156, D7320, D7422, D7468, D7484, D7549, D7589, D8048, D8047, D8074, D8111, D8114, D8226

**blowby, *n***—*in internal combustion engines*, that portion of the combustion by-products and unburned air/fuel mixture that leaks past piston rings into the engine crankcase during operation. [D02.B0] D8350

**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] D7321, D7501; [D02.J0] D5452

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

**boring sample, *n***—a sample of the material contained in a barrel, case, bag, or cake that is obtained from the chips created by boring holes into the material with a ship auger. [D02.02] D4057

**bottom sample, *n***—a spot sample collected from the material at the bottom of the tank, container, or line at its lowest point. In practice, the term bottom sample has a variety of meanings. As a result, it is recommended that the exact sampling location (for example 15 cm (6 in.) from the bottom) should be specified when using this term.

[D02.02] D4057

**bottom water sample, *n***—a spot sample of free water taken from beneath the petroleum contained in a ship or barge compartment or a storage tank. [D02.02] D4057

**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; [D02.E0] D6079

**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, D8047, D8074**

**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 longterm behavior. (Synonym: **run-in, wear in**) [D02.L0] **D8316, D7217; [D02.L0.11] D8503**

**Bremsstrahlung**, *n*—the component of X-ray tube source beam due to radiation emitted when electrons from the tube cathode stop their motion (also called the continuum or white noise). [D02.03] **D8252**

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

DISCUSSION—Bubble point pressures are higher at high temperatures. [D02.02] **D4057**

**buffer**, *n*—a compound or mixture that, when contained in solution, causes the solution to resist change in pH.

DISCUSSION—Each buffer has a characteristic limited range of pH over which it is effective. [D02.14] **D8070**

**bulk density**, *n*—in carbon and graphite technology, the mass of a unit volume of material including both permeable and impermeable voids (and boron compounds in the case of boronated carbon or boronated graphite) present in the material at room temperature. [D02.F0] **C559, C838**

**bulk density**, *n*—of coke, the ratio of the mass of a collection of particles of a specified size range to the volume occupied. [D02.05] **D7454, D8097**

**bulk sample**—the reduced and divided representative portion of the gross sample as prepared for shipment to and received by a laboratory to be prepared for analysis. [D02.05] **D4930**

**bumping**, *v*—violent boiling which displaces liquid into the distillation flask. [D02.J0] **D7872**

**Bunsen coefficient**, *n*—the solubility of a gas expressed as the volume, reduced to 273 K (32 °F) and 101.3 kPa (1 atm), dissolved by one volume of liquid at the specified temperature and 101.3 kPa. [D02.L0] **D2779**

**Bunsen coefficient**, *n*—the solubility of a gas, expressed as the gas volume reduced to 273 K (32 °F) and 0.10 MPa (1 atm), dissolved by one volume of liquid at the specified temperature and 0.10 MPa. [D02.L0] **D3827**

**burn**, *vt*—in emission spectroscopy, to vaporize and excite a specimen with sufficient energy to generate spectral radiation. [D02.03] **D6595, D6728, D8315**

**burner**, *n*—flame device used to atomize the analyte by burning in a high temperature flame mixed of a fuel and an oxidant. [D02.03] **D7740**

**burner fuel oil**, *n*—any petroleum liquid suitable for the generation of heat by combustion in a furnace or firebox as a vapor or a spray, or a combination of both.

DISCUSSION—Different grades are characterized primarily by viscosity ranges. [D02.P0] **D6448, D6823**

**butanol**, *n*—butyl alcohol, an alcohol with four isomers, 1-butanol or n-butanol (CH<sub>3</sub>CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>OH), 2-butanol or sec-butanol (CH<sub>3</sub>CH(OH)CH<sub>2</sub>CH<sub>3</sub>), 2-methyl-1-propanol or iso-butanol (CH<sub>3</sub>CH(CH<sub>3</sub>)CH<sub>2</sub>OH), and 2-methyl-2-propanol or tert-butanol (CH<sub>3</sub>C(CH<sub>3</sub>)(OH)CH<sub>3</sub>). [D02.A0] **D7862**

**butanol**, *n*—butyl alcohol refers to: 1-butanol or n-butanol (CH<sub>3</sub>CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>OH), 2-butanol or sec-butanol (CH<sub>3</sub>CH(OH)CH<sub>2</sub>CH<sub>3</sub>), and 2-methyl-1-propanol or iso-butanol (CH<sub>3</sub>CH(CH<sub>3</sub>)CH<sub>2</sub>OH), three isomeric alcohols with the molecular formula C<sub>4</sub>H<sub>9</sub>OH, either individually or as mixtures. [D02.04] **D7875**

**calcined petroleum coke**, *n*—petroleum coke that has been thermally treated to drive off the volatile matter and to develop crystalline structure. [D02.05] **D2638, D5003, D5004, D6376, D6791**

**calibrate**, *v*—to determine the indication or output of a device (e.g., thermometer, manometer, engine) with respect to that of a standard. [D02.B0] **D5966, D5967, D6557, D6681, D6794, D6795, D6837, D6894, D6984, D7156, D7320, D7422, D7468, D7484, D7549, D7589, D7603, D8048, D8074, D8111, D8114, D8146, D8226, D8350**

**calibrate**, *v*—to determine the indication or output of a measuring device or a given engine with respect to a standard. [D02.B0] **D8047**

**calibrated test stand**, *n*—a test stand on which the testing of reference material(s), conducted as specified in the standard, provided acceptable test results.

DISCUSSION—In several automotive lubricant standard test methods, the ASTM Test Monitoring Center provides testing guidance and determines acceptability. [D02.B0] **D6681, D6750, D8047, D8074, D8111, D8350**

**calibration**, *n*—operation that establishes the relationship between the reference density of standards and the corresponding reading of the instrument. [D02.04] **D7777**

*validation, n*—operation of checking the calibration of the portable digital density meter at a single point close to the required operating point. [D02.04] D7777

**calibration, n**—process by which the relationship between signal intensity and elemental concentration is determined for a specific element analysis. [D02.03] D7740, D8315

**calibration, n**—process by which the relationship between signal intensity and elemental mass fraction is determined for a specific element analysis. [D02.03] D8322, D8351

**calibration, n**—set of operations that establishes the relationship between the reference density of standards and the corresponding density reading of the instrument. [D02.04.0D] D7961

**calibration, n**—the determination of the values of the significant parameters by comparison with values indicated by a set of calibration standards. [D02.03] D7171

**calibration, n**—the determination of the values of the significant parameters by comparison with values indicated by a set of reference standards. [D02.03] D6595, D6728, D7111

**calibration, n**—*in multivariate spectroscopic measurement*, a process for creating a multivariate model relating component concentrations or sample properties to spectra for a set of known samples, referred to as calibration samples. [D02.25] D8321, D8340, D8470

**calibration curve, n**—specific to C560, graphical or mathematical representation of the relationship between known concentrations of an element in a series of standard calibration solutions and the measured response from the measurement system. [D02.F0] C560

**calibration curve, n**—plot of signal intensity versus elemental concentration using data obtained by making measurements with standards. [D02.03] D7740

**calibration curve, n**—the graphical or mathematical representation of a relationship between the assigned (known) values of standards and the measured responses from the measurement system. [D02.03] D6595, D6728, D7111, D8315

**calibration curve (or calibration line), n**—the graphical or mathematical representation of a relationship between the assigned (known) values of calibration standards and the measured responses from the measurement system. [D02.03] D7171

**calibration oil, n**—an oil that is used to determine the indication or output of a measuring device or a given engine with respect to a standard. [D02.B0] D6837, D7589, D8047, D8114, D8226

**calibration samples, n**—*in multivariate spectroscopic measurement*, the set of samples with known (measured by the PTM) component concentrations or property values that are used for creating a multivariate model. [D02.25] D6122, D8321, D8340

**calibration solutions, n**—solutions of accurately known concentrations of the chemical element to be determined using the calibration curve method. [D02.F0] C560

**calibration standard, n**—a material with a certified value for a relevant property, issued by or traceable to a national organization such as NIST, and whose properties are known with sufficient accuracy to permit its use to evaluate the same property of another sample. [D02.94] D6792; [D02.03] D7740

**calibration standard, n**—a standard having an accepted value (reference value) for use in calibrating a measurement instrument or system. [D02.03] D6595, D6728, D7111, D8315

**calibration standard, n**—a standard having an assigned (known) value (reference value) for use in calibrating a measurement instrument or system. This standard is not used to determine the accuracy of the measurement instrument or system (see *check standard*). [D02.03] D7171

**calibration standard, n**—a material with a certified value for a relevant property, issued by or traceable to a national organization such as NIST or whose production was ISO 17034 accredited, and whose properties are known with sufficient accuracy to permit its use to evaluate the same property of another sample. [D02.94] D8428

**calibration test, n**—an engine test conducted on a reference oil under carefully prescribed conditions, the results of which are used to determine the suitability of the engine stand/laboratory for such tests on non-reference oils.

DISCUSSION—A calibration test also includes tests conducted on parts to ensure their suitability for use in reference and non-reference tests.

[D02.B0] D6750, D8047, D8074

**calibration test, n**—a test, using a coded oil, conducted as specified in the test method.

DISCUSSION—The test result is used to determine the suitability of the testing facility/laboratory to conduct such tests on non-reference oils.

[D02.B0] D6794, D6795

**calibration test stand, n**—a test stand on which the testing of reference material(s), conducted as specified in the standard, provided acceptable results.

DISCUSSION—In several automotive lubricant standard test methods, the ASTM Test Monitoring Center provides testing guidance and determines acceptability. [D02.B0] D6891

**calibration transfer, n**—a method of applying a multivariate calibration developed using spectra from one analyzer for analysis of spectra collected on a second analyzer by mathematically modifying the multivariate model or by instrument standardization. [D02.25] D6122, D8321

**candidate oil, n**—an oil which is intended to have the performance characteristics necessary to satisfy a specification and is tested against that specification.

[D02.B0] D5966, D6794, D7156, D7216, D7422, D7484, D7603, D8048, D8074, D8146

DISCUSSION—These oils are mainly submitted for testing as *candidates* to satisfy a specified performance; hence the designation of the term. [D02.B0] D6681, D8047

**candle pitch, n**—a dark brown-to-black, tarry or solid, by-product residue from soap and candle stock manufacture,

refining of vegetable oils, refining of wool grease, or refining of refuse animal fats. [D02.G0] D128

**capillary**, *n*—For the purpose of this test method, a capillary is any right cylindrical tube having a length to diameter ratio of 40 to 1. [D02.G0] D1092

**capture solution**, *n*—aqueous solution of proprietary composition used to capture and concentrate hydrophilic compounds and particles from liquid fuels. [D02.14] D7463

**carbon**, *n*—*in manual transmissions and final drive axles*, a hard, dry, generally black or gray deposit that can be removed by solvents but not by wiping with a cloth. [D02.B0] D5704

**carbon residue**, *n*—the residue formed by evaporation and thermal degradation of a carbon containing material.

DISCUSSION—The residue is not composed entirely of carbon but is a coke that can be further changed by carbon pyrolysis.

[D02.06] D4530

DISCUSSION—The residue is not composed entirely of carbon but is a coke that can be further changed by carbon pyrolysis. The term carbon residue is retained in deference to its wide common usage.

[D02.06] D189, D524

**carburization**, *n*—carburizing is not defined in the ASTM Dictionary of Engineering Science and Technology, but is defined in DIN EN 17022-3 "Heat treatment of ferrous materials; heat treatment methods; case hardening".

[D02.L0] D8227

**catalytic thermometric titration**, *n*—a method to determine the end point of a chemical reaction through the use of a temperature measuring device and the addition of a chemical to enhance the detection of the endpoint. [D02.06] D8045

**category**, *n*—*in engine oils*, a designation such as SJ, SL, SM, SN, SP, CH-4, CI-4, CJ-4, CK-4, FA-4, Energy Conserving, Resource Conserving, and so forth, for a given level of performance in specified engine and bench tests. [D02.B0] D4485

**cause(s) of failure**, *n*—underlying source(s) for each potential failure mode that can be identified and described by analytical testing. [D02.96] D7874, D7973, D8128

**cellular adenosine triphosphate (cellular-ATP)**, *n*—ATP present in whole cells, whether they are living or dead.

DISCUSSION—Cellular-ATP is released upon intentional lysis of microbial cells during the sample preparation process. Microbially infected fluids contain both cellular (cell-associated/cell-bound) and extra-cellular ATP. [D02.14] D7687

DISCUSSION—Cellular-ATP is released upon intentional lysis (rupturing) of microbial cells during the sample preparation process. Microbially infected fluids contain both cellular (cell-associated/cell-bound) and extra-cellular ATP. [D02.14] D7463

**cellulose acetate butyrate**, *n*—thermoplastic that is known to be adequate for manufacture of field monitors and chemically compatible for use with aviation fuel. [D02.J0] D8194

**center line**, *n*—line on a control chart depicting the average level of the statistic being monitored. [D02.96] D7720

**Certificate of Analysis (COA)**, *n*—the quality document issued by independent inspectors and/or laboratories that contains the results of measurements made of Table 1 properties but does not necessarily contain or provide information regarding those identified as being required at point of manufacture.

DISCUSSION—Typically, COAs are produced downstream of refineries in intermediate supply terminals or intermediate storage locations. A Certificate of Analysis is not considered equivalent to a Certificate of Quality. [D02.J0.01] D1655

**Certificate of Quality (COQ) (including Refinery Certificate of Quality, RCQ)**, *n*—the quality document that is the definitive original document describing the quality of aviation fuel at the point of manufacture.

DISCUSSION—A COQ contains the results of measurements, usually made by the product originator's laboratory, of all the properties listed in Table 1, the additive information as per Table 2, as well as those additional testing requirements detailed in Annex A1 for fuels containing synthesized components and confirms conformance to the specification. [D02.J0.01] D1655

**certified reference material**, *n*—reference material one or more of whose property values are certified by a technically valid procedure, accompanied by a traceable certificate or other documentation which is issued by a certifying body. [D02.03] D7740

**certified reference material, CRM**, *n*—a reference material one or more of whose property values are certified by a technically valid procedure, accompanied by a traceable certificate or other documentation which is issued by a certifying body. [D02.03] D7578; [D02.04.0D] D7961; [D02.94] D6792, D8428

**cetane number**, *n*—a measure of the ignition performance of a diesel fuel oil obtained by comparing it to reference fuels in a standardized engine test.

DISCUSSION—In the context of this test method, cetane number is that defined by Test Method D613/IP41. [D02.01] D7668, D8183

**cetane number (CN)**, *n*—a measure of the ignition performance of a diesel fuel oil obtained by comparing it to reference fuels in a standardized engine test.

DISCUSSION—In the context of this test method, ignition performance is understood to mean the ignition delay of the fuel as determined in a standard test engine under controlled conditions of fuel flow rate, injection timing and compression ratio. [D02.01] D613

DISCUSSION—In the context of this test method, cetane number is that defined by Test Method D613/IP 41. [D02.01] D6890

**chance cause**, *n*—source of inherent random variation in a process which is predictable within statistical limits; also called *common cause*. [D02.96] D7720

**channel**, *n*—*in WDXRF*, the wavelength channel used to measure X-ray intensity for an element of interest. [D02.03] D8252

**char**, *n*—fine carbonaceous powder that is separated from the vapors of biomass during pyrolysis.

DISCUSSION—Pyrolysis liquid biofuel contains uniformly suspended char at varying concentrations. [D02.06] D7579