



# Standard Terminology Relating to Petroleum, Petroleum Products, 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 Department of Defense.*

## 1. Scope\*

1.1 This terminology standard covers the compilation of terminology developed by Committee D02 on Petroleum Products 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.

## 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. Some abbreviations, acronyms and symbols are included in the list.

**3-MPA**, *n*—3-methylphenylamine [D02.J0] D6812

**abrasion**, *n*—wear by displacement of material caused by hard particles or hard protuberances. [D02.B0] D4998

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

**absolute filtration rating**, *n*—the diameter of the largest hard spherical particle that will pass through a filter under specified test conditions. This is an indication of the largest opening in the filter element. [D02.N0] D4174

**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.

<sup>1</sup> This terminology is under the jurisdiction of ASTM Committee D02 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.95 on Terminology.

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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

**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 the value that takes into account the specification value, the test method precision, and the confidence level desired for defining minimum acceptable quality relative to the specification value. [D02.94] D3244

**accepted reference value**, *n*—a 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. [D02.01] D6890, [D02.94] D6299, D6792, [E11] E456, E177

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, D2700

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

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

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

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

**accuracy, *n***—the closeness of agreement between an observed value and an accepted reference value. [D02.94] D6299, D7372

**acid number, *n***—the quantity of base, expressed as milligrams of potassium hydroxide per gram of sample, required to titrate a sample in a specified solvent to a specified end point.

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.

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*.

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

**acid number, *n***—the quantity of base, expressed in milligrams of potassium hydroxide per gram of sample that is required to titrate a sample to a specified end point. [D02.06] D974, 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 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

**acid number, *n***—the quantity of base, expressed in milligrams of potassium hydroxide per gram of sample, that is required to titrate a sample dissolved in a specified solvent to a specified end point.

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

**acid number, *n***—quantity of base, expressed in milligrams of potassium hydroxide per gram of sample that is required to titrate a sample in a specific solvent to a specific end point.

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

**acid number, *n***—the quantity of base, expressed as milligrams of potassium hydroxide per gram of sample, required to titrate a sample in a specified solvent to a specified end point.

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.

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*.

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.

**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***—the 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:

$$OR = Z \exp(-E_a / RT) \quad (1)$$

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 ( $1/T$ ):

$$\log_{10}(OR) = \log_{10} Z - E_a / (2.303 RT) \quad (2)$$

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

**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 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 the life span. [D02.12] D6384

**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. [D02.12] D6384

**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*—a material added to another, usually in small amounts, to impart or enhance desirable properties or to suppress undesirable properties. [D02.B0] D5862, [D02.95] D4175

**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

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

**adherent insolubles (formerly adherent gum)**, *n*—material that is produced in the course of stressing distillate fuel under the conditions of this test and which adheres to the glassware after fuel has been flushed from the system. [D02.14] D7462

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

DISCUSSION—On certain newer, commercially available digital density analyzer instruments, an adjustment may be made rather than calibrating the instrument. The adjustment procedure uses air and redistilled, freshly boiled and cooled water as standards to establish the linearity of measurements over a range of operating temperatures. [D02.04] D4052

**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 re-

quire 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.N0] D6006, D6046

**AET**—abbreviation for atmospheric equivalent temperature.

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

**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 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

DISCUSSION—In this test method, air-fuel ratio (AFR), is controlled by the EEC IV engine control module.

[D02.B0] D6593

**amine number of reference fuels above 100**, AN—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 if 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

**AN**, *n*—amine number [D02.J0] D6812

**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.N0] D6006, 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 sample**—the reduced and divided representative portion of the bulk sample, prepared for use in the laboratory. [D02.05] D4930, D6969

**analysis of variance (ANOVA)**, *n*—a procedure for dividing the total variation of a set of data into two or more parts, one of which estimates the error due to selecting and testing specimens and the other part(s) possible sources of added variation. [D02.94] D6300, [D13] D123



**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

**analyzer lag**, *n*—Deprecated term. Use the preferred term **instrument response time**.

**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 (aminobenzene) and sample.

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

**anisotropic nuclear graphite**, *n*—graphite in which the isotropy ratio based on the value of the coefficient of thermal expansion (25–500°C) is greater than 1.15. [D02.F0] C709

**ANOVA**, *n*—*in statistics*, acronym for analysis of variance.

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

**anti-knock index**, *n*—the arithmetic average of the Research octane number (RON) and Motor octane number (MON).

**antiknock index**, *n*—the arithmetic average of the Research octane number (RON) and Motor octane number (MON), that is, (RON + MON)/2. [D02.04] D4814

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

**API**—abbreviation for American Petroleum Institute.

**API gravity**, *n*—a special function of relative density (specific gravity) 60/60°F (15.56/15.56°C), represented by:  
API gravity, deg = (141.5/sp gr 60/60°F) – 131.5

DISCUSSION—No statement of reference temperature is required, since 60°F is included in the definition. [D02.04] D287

**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 (see 10.1). [D02.G0] D1092

**apparent viscosity**, *n*—the determined viscosity obtained by use of this test method. [D02.07] D3829, D4741, D4684

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

**area-normalized oxidation rate (OR<sub>a</sub>)**—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<sub>a</sub>, are g h<sup>-1</sup> m<sup>-2</sup>. [D02.F0] D7542

**area-normalized standard oxidation rate (SOR<sub>a</sub>)**—value of area normalized oxidation rate corresponding to 1% weight loss in 24 h. Area-normalized standard oxidation rate, SOR<sub>a</sub>, depends on the initial specimen density. For carbon and graphite samples (density 1.2 – 2.2 g cm<sup>-3</sup>) SOR<sub>a</sub> varies between 2 and 4 g h<sup>-1</sup> m<sup>-2</sup>. [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. [D02.04.0C] 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, D7464

**ash**, *n*—*in carbon and graphite technology*, the 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.

**asphaltene**, *n*—*in petroleum technology*, a molecule of high molecular mass, high carbon/hydrogen ratio, and containing heteroatoms.

DISCUSSION—Asphaltenes are found largely in crude oils and in heavy fuel oils containing residual fractions. They are insoluble in alkanes such as *n*-heptane and cetane, but soluble in aromatic solvents such as benzene, toluene, and 1-methylnaphthalene. [D02.14] D7060, D7061

**asphaltenes**, *n*—wax-free organic material insoluble in heptane, but soluble in hot toluene (benzene).

DISCUSSION—Benzene is included in this definition solely on the basis of its classical references in the definition of asphaltenes. The precision of this test method when using toluene has been found to be the same as when using benzene. [D02.14] D6560

**assignable cause**, *n*—a factor that contributes to variation and that is feasible to detect and identify. [D02.94] D6299, D7372, [E11] E456

**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 of the color of a petroleum liquid darker than Saybolt color based on a scale of 0.5 (lightest) to 8.0 Dil (darkest) and determined by Test Method D1500.

[D02.05] D6045

**ASTM color, *n***—an empirical definition of the color of a petroleum liquid based on a scale of 0.5 to 8 as determined by Test Method D1500.

[D02.05] D6756

**ASTM supercharge octane number of a fuel below 100, *n***—the whole number nearest the percentage by volume of *isooctane* (equals 100) in a blend with *n*-heptane (equals 0) that matches the knock characteristics of the fuel when compared by this test method.

[D02.01] D909

**ASTM supercharge rating of a fuel above 100, *n***—the amount of tetraethyllead (TEL) in *isooctane*, expressed in millilitres per U.S. gallon.

[D02.01] D909

**ATV**—*in statistics*, abbreviation for assigned test value.

**audit, *n***—a systematic examination of a laboratory's quality system procedure and related activities by an internal or external team to determine whether these procedures or activities are implemented according to the documented system.

[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.

**autoignition temperature, *n***—the minimum temperature at which autoignition occurs.

**automatic sampler, *n***—device used to repetitively extract a 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

**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

**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.

[D02.04.0C] D7419

**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.

[D02.14]

D6469

**base number, *n***—the quantity of an acid, expressed in terms of the equivalent number of milligrams of potassium hydroxide per gram of sample, that is required to titrate a sample dissolved in the specified solvent to a specified end point (for example, Test Method D4739).

**DISCUSSION**—This method uses fixed amounts of *isooctane* and alcoholic hydrochloric acid as the sample solvent and the end point is defined as the amount of titrant required to reach a yellow end-point with a methyl red indicator solution.

[D02.06] D5984

**base number**—the quantity of perchloric acid expressed in terms of the equivalent number of milligrams of potassium hydroxide that are required to titrate 1 g of the sample dissolved in the specified solvent to a well-defined inflection point as specified in this test method.

[D02.06] D2896

**base number, *n***—the quantity of acid, expressed in milligrams of potassium hydroxide per gram of sample that is required to titrate a sample to a specified end point.

**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

**base numbers, *n***—the quantity of acid, expressed in milligrams of potassium hydroxide per gram of sample that is required to titrate a sample, dissolved in a specified solvent to a specified end point.

**DISCUSSION**—In this test method, the sample is titrated to a meter reading corresponding to a freshly prepared nonaqueous acidic buffer solution.

[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.B0] 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.B0] 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.

DISCUSSION—For factors to convert basis weight in grams per square metre to other commercial terms, see Test Method D646. [D02.10] D2423

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

**BDC**, *n*—bottom dead center [D02.B0] D6750

**bias**, *n*—the difference between the population mean of the test results and an accepted reference value. [D02.94] D6300, D6792, [E11] E456

**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] D6299, D7372, [E11] E177, E456

**bias, relative**, *n*—the difference between the population mean of the test results and an accepted reference value, which is the agreed upon value obtained using an accepted reference method for measuring the same property. [D02.94] D6300

**binder**, *n*—a 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**, *n*—any substance containing < 10 % wt. O<sub>2</sub> content which undergoes ≥60 % biodegradation as theoretical CO<sub>2</sub> uptake 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.

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

**biodegradation**, *n*—the process of chemical breakdown or transformation of a substance caused by organisms or their enzymes. [D02.12] D5864

DISCUSSION—Biodegradation is only one mechanism by which materials are transformed in the environment. [D02.12] D6006

**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 as B100. [D02.E0] D7467

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, D7371

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. 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. [D02.E0] D6751

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

**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*—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. [D02.04.0F] D7371

**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.E0] D6751

**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. [D02.07.0D] D7397

**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*—any material, excluding fossil fuels, which is or was a living organism or component of a living organism. [D02.12] D5864
- biomass**, *n*—density of biological material per unit sample volume, area, or mass (g biomass / g (or / mL or / cm<sup>2</sup>) sample). [D02.14] D6469
- 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*—*in biodegradability testing*, a test system containing all system components with the exception of the test substance. [D02.N0] D6006
- blank**, *n*—a flask containing the test medium and the inoculum with no additional carbon source added. [D02.12] D5864
- 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.
- DISCUSSION—This is a coded reference oil which is submitted by a source independent from the test facility. [D02.B0] D6483, D6709, D6750, D7156
- blowby**, *n*—*in internal combustion engines*, the combustion products and unburned air-and-fuel mixture that enter the crankcase. [D02.B0] D5966, D5967, D6593, D6709, D6837, D6891, D6984, D7156, D7320
- blowby**, *n*—*in internal combustion engines*, that portion of the combustion products and unburned air/fuel mixture which leaks past piston rings into the engine crankcase during operation.
- boilup rate**, *n*—*in column distillation*, the quantity of vapor entering the column per unit of time.
- boilup rate**, *n*—the quantity of vapor entering the column per unit of time.
- DISCUSSION—It is expressed in millilitres of liquid per hour for a given column or in millilitres per hour per square centimetre of cross-sectional area for comparative purposes. In the latter case, it refers to the test mixture of *n*-heptane and methylcyclohexane in the efficiency evaluation (see Annex A1) and is measured at the bottom of the column. The maximum boilup of the *n*-heptane-methylcyclohexane test mixture is that which the column can handle under stable conditions without flooding. In routine adiabatic operation, the boilup rate can be estimated roughly from the takeoff rate multiplied by the reflux ratio plus one. [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, [D02.J0] D5452
- bonded glycerin**, *n*—is the glycerin portion of the mono-, di-, and triglyceride molecules. [D02.04] D6584
- borderline pumping temperature**, *n*—the lowest temperature at which the critical yield stress or critical viscosity that allows a fluid to be pumped occurs.
- 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
- 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. (Synonym—*run-in*, *wear-in*.) [D02.G0] D5706, D5707, [D02.L0] D6425
- 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
- bromine index**, *n*—the number of milligrams of bromine that will react with 100 g of sample under the conditions of the test. [D02.04] D2710
- bromine number**, *n*—the number of grams of bromine that will react with 100 g of the sample under the conditions of the test.
- BSOC**, *n*—break specific oil consumption [D02.B0] D6750
- BTDC**, *adj*—abbreviation for Before Top Dead Center; 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, D6984, D6837
- BTDC (before top dead center)**, *adj*—the angular position of the crankshaft relative to its 0 position at the point of uppermost travel of the piston in the cylinder, used with the degree symbol (°). [D02.B0] D7320
- bulk sample**, *n*—a large sample, either from one place or made up of several incremental samples of the same material. [D02.05] D4296
- 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
- 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. [D02.11] 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. [D02.11] D3827
- burn**, *vt*—*in emission spectroscopy*, to vaporize and excite a specimen with sufficient energy to generate spectral radiation. [D02.03] D6595, D6728

**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

**BXX blend**, *n*—fuel blend consisting of up to 20 volume percent biodiesel designated as up to B20 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 test method.

DISCUSSION—The abbreviation BXX represents a specific blend concentration in the range B2 to B20, where XX is the percent volume of biodiesel in the fuel blend. [D02.14] D7501

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

**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, D6791

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

**calibrate**, *v*—to determine the indication or output of a measuring device with respect to that of a standard. [D02.B0] D5862, D5966, D5967, D6794, D6795, D6984, D7156, D7320

**calibrate**, *v*—to determine the indication or output of a measuring device or a given engine with respect to a standard. [D02.B0] D6557, D6837, D6894

**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

**calibration**, *n*—the act of determining the indication or output of a measuring device or a given engine with respect to a standard. [D02.B0] D6202

**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

**calibration**—set of operations that establishes the relationship between the reference density of standards and the corresponding density reading of the instrument. [D02.04] D4052

**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

**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] D6202, D6837

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

**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

**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 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

**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

**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

**candidate oil**, *n*—an oil that is intended to have the performance characteristics necessary to satisfy a specification and is to be tested against that specification. [D02.B0] D5862, D6618, D6681, D6750, D6794, D6795, D7156, D7456

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

**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

**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*—an element, number 6 of the periodic table of elements, electronic ground state  $1s^2 2s^2 2p^2$ . [D02.F0] C709

**carbon**, *n*—*in carbon and graphite technology*, an artifact consisting predominantly of the element carbon and possessing limited long range order.

DISCUSSION—The presence of limited long range order is usually associated with low electrical and thermal conductivity and difficult machinability when compared with graphite. [D02.F0] C709

**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 foam**, *n*—*in carbon and graphite technology*, a porous carbon product containing regularly shaped, predominantly concave, homogeneously dispersed cells which interact to form a three-dimensional array throughout a continuum material of carbon, predominantly in the non-graphitic state. The final result is either an open or closed cell product.

DISCUSSION—In most foam, the cell wall thickness is less than half the average cell size. [D02.F0] C709

**carbon residue**, *n*—*in petroleum products*, the part remaining after a sample has been subjected to thermal decomposition.

DISCUSSION—The amount of residue is dependent on the test conditions of evaporation and pyrolysis. The term may be misleading here in that the residue may contain other than carbon decomposition products. However, the term is retained due to its wide common usage. [D02.06] D4530

**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. The term carbon residue is retained in deference to its wide common usage. [D02.06] D189, D524

**category**, *n*—*in engine oils*, a designation such as SH, SJ, SL, SM, CF-4, CF, CF-2, CG-4, CH-4, CI-4, Energy Conserving, and so forth, for a given level of performance in specified engine and bench tests. [D02.B0] D4485

**CCCFP**, *n*—continually closed cup flash point [D02.E0] D6985

**cell (bubble)**, *n*—*in carbon and graphite technology*, a single small cavity formed by gaseous displacement in a precursor material in its plastic state, and surrounded completely by its walls when formed. Cells can be open or closed.

DISCUSSION—After processing at high temperatures, the basic structure of the cell will remain even as the material converts from a plastic state to a rigid carbonaceous structure. Hence, the term cell will apply to a carbon product. [D02.F0] C709

**cell count**, *n*—*in carbon and graphite technology*, in closed-cell foams, the number of cells aligned in one plane in one linear inch, as determined by stereoscopic image analysis. [D02.F0] C709

**cell size**, *n*—*in carbon and graphite technology*, the average diameter of the cells in the final foam product. [D02.F0] C709

**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. [D02.94] D6792

**cetane index**, *n*—an approximation of the cetane number (the ignition performance) of distillate diesel fuel, which does not contain a cetane improver additive, calculated from the density and the mid-boiling point temperature (see also **diesel index**).

**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 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, D7170

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

**CFU**, *n*—colony forming unit [D02.14] D6974

**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

**charge volume**, *n*—the volume of the specimen, 100 mL, charged to the distillation flask at the temperature specified in Table 1. [D02.08] D86

**charge volume**, *n*—*in petroleum products, in distillation*, volume of the liquid sample transferred to the specimen container. [D02.08] D7344

**Check Fuel**, *n*—*for quality control testing*, a spark-ignition engine fuel of selected characteristics having an octane number accepted reference value (O.N.<sub>ARV</sub>) determined by round-robin testing under reproducibility conditions. [D02.01] D2699, D2700

**check fuel**, *n*—*for quality control testing*, a spark-ignition aviation gasoline having supercharge rating ARV determined by the National Exchange Group. [D02.01] D909

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

**check standard**, *n*—*in QC testing*, material having an accepted reference value used to determine the accuracy of a measurement system.

DISCUSSION—In the context of this test method, check standard refers to heptane. [D02.01] D6890, D7170

**chronic 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 period of time which constitutes a major portion of their life span. [D02.12] D6384

**chronic toxicity test**, *n*—a comparative toxicity test in which a representative subpopulation of organisms are exposed to different treat rates of a test material and is observed for a period of time which constitutes a major portion of their life span. [D02.12] D6081

**CHT**, *n*—cylinder head temperature [D02.J0] D6812

**CIE**, *n*—the abbreviation for the French title of the International Commission on Illumination, or Commission Internationale de l'Éclairage. [D02.05] D6045, [E12] E284

**CIE Standard Illuminant C**, *n*—Colorimetric illuminant, representing daylight with a correlated color temperature of 6774 K, defined by the CIE in terms of a relative spectral power distribution. [D02.05] D6045, [E12] E284

**CIE 1931 standard observer**, *n*—ideal colorimetric observer

with color matching functions  $x(\lambda)$ ,  $y(\lambda)$ ,  $z(\lambda)$  corresponding to a field of view subtending a  $2^\circ$  angle on the retina; commonly called the “ $2^\circ$  Standard Observer.” [D02.05] D6045, [E12] E284

**C.L.A.**,  $n$ —in measuring surface finish, the arithmetic average of the absolute distances of all profile points from the mean line for a given distance. [D02.L0] D6425

**classification**,  $n$ —in engine oils, the systematic arrangement into categories in accordance with different levels of performance in specified engine and bench tests. [D02.B0] D4485

**clogging**,  $n$ —the restriction of a flow path due to the accumulation of material along the flow path boundaries. [D02.B0] D6618, D6984, D7320

**closed cell**,  $n$ —in carbon and graphite technology, a cell totally enclosed by its walls and hence not interconnected with other cells. A closed cell foam is a foam consisting predominantly of closed cells. [D02.F0] C709

**closeness sum of squares (CSS)**,  $n$ —a statistic used to quantify the degree of agreement between the results from two test methods after bias-correction using the methodology of this practice. [D02.94] D6708

**cloud point**,  $n$ —in petroleum products and biodiesel fuels, the temperature of a liquid specimen when the smallest observable cluster of hydrocarbon crystals first occurs upon cooling under prescribed conditions.

DISCUSSION—The cloud point occurs when the temperature of the specimen is low enough to cause hydrocarbon crystals to precipitate. In a homogeneous liquid, the cloud is always noted first at the location in the specimen where the specimen temperature is the lowest. The cloud point is the temperature at which the crystals first occur, regardless of their location in the specimen, and not after extensive crystallization has taken place. The hydrocarbon crystals that precipitate at lower temperatures are typically, but not excluded to, straight chain hydrocarbons commonly called “wax crystals.”

DISCUSSION—The purpose of the cloud point method is to detect the presence of the wax crystals in the specimen; however, trace amounts of water and inorganic compounds may be present. The intent of the cloud point method is to capture the temperature at which the liquids in the specimen begin to change from a single liquid phase to a two-phase system containing solid and liquid. It is not the intent of this test method to monitor the phase transition of the trace components, such as water. [D02.07] D5771, D5772, D5773

**coagulate**,  $v$ —to cause to become viscous or thickened into a coherent mass. [D02.06] D893, D7317

**coagulated pentane insolubles**,  $n$ —in used oil analysis, separated matter that results when a coagulant is added to a solution of used oil in pentane.

DISCUSSION—The addition of a coagulant will aid in separating finely divided materials that may have been held in suspension because of the dispersant characteristics of the oil.

DISCUSSION—This test method uses a 1 % coagulant solution. Test Method D893 uses a 5 % coagulant solution. [D02.06] D893, D7317

**coagulated toluene insolubles**,  $n$ —in used oil analysis, coagulated and separated matter not soluble in pentane or toluene. [D02.06] D893

**coefficient of friction, ( $\mu$ )**—the ratio of the tangential force that is needed to start or to maintain uniform relative motion

between two contacting surfaces to the perpendicular force holding them in contact. [D02.L0] D5183

**coefficient of friction,  $\mu$  or  $f$** ,  $n$ —in tribology, the dimensionless ratio of the friction force ( $F$ ) between two bodies to the normal force ( $N$ ) pressing these two bodies together.

$$\mu \text{ or } f = (F/N)$$

DISCUSSION—A distinction is often made between *static coefficient of friction* and *kinetic coefficient of friction*. [D02.L0] D2714, D3704

**coefficient of friction  $\mu$  or  $f$** ,  $n$ —in tribology, the dimensionless ratio of the friction force ( $F_f$ ) between two bodies to the normal force ( $F_n$ ) pressing these bodies together.

$$\mu = (F_f/F_n)$$

[D02.L0] D6425, [G02] G40

**coke**,  $n$ —a carbonaceous solid produced from coal, petroleum, or other materials by thermal decomposition with passage through a plastic state. [D02.F0] C709

**cold sticking**,  $n$ —of piston rings, a condition in which the ring is free in its groove while the engine is running but stuck when the piston is cold, normally indicated by the absence of varnish or other deposits on the outer face of the ring and of signs of blowby on the piston skirt. [D02.B0] D4857

**cold-stuck piston ring**,  $n$ —in internal combustion engines, a piston ring that is stuck when the piston and ring are at room temperature, but inspection shows that it was free during engine operation.

DISCUSSION—A cold-stuck piston ring cannot be moved with moderate finger pressure. It is characterized by a polished face over its entire circumference, indicating essentially no blowby passed over the ring-face during engine operation. [D02.B0] D6593, D6984, D7320

**combustion chamber**,  $n$ —in reciprocating internal combustion engines, the volume bounded by the piston crown and any portion of the cylinder walls extending above the piston crown when in the top dead center position, and the inner surface of the cylinder head including any spark plugs and other inserted components. [D02.B0] D4857, D4858

**commercial butane**—a hydrocarbon product for use where low volatility is required. [D02.H0] D1835

**commercial PB mixtures**—mixtures of propane and butane for use where intermediate volatility is required. [D02.H0] D1835

**commercial propane**—a hydrocarbon product for use where high volatility is required. Commercial propane is suitable for certain low severity internal combustion engine applications. [D02.H0] D1835

**compatibility**,  $n$ —of crude oils or of heavy fuel oils, the ability of two or more crude oils or fuel oils to blend together within certain concentration ranges without evidence of separation, such as the formation of multiple phases.

DISCUSSION—Incompatible heavy fuel oils or crude oils, when mixed or blended, result in the flocculation or precipitation of asphaltenes. Some oils may be compatible within certain concentration ranges in specific mixtures, but incompatible outside those ranges. [D02.14] D7060, D7061

**compensation line**,  $n$ —a line of plot on log-log paper where the coordinates are scar diameter in millimetres and applied

load in kilograms-force (or newtons) obtained under dynamic conditions.

DISCUSSION—Shown in Fig. 1 as line ABE. [D02.G0] D2596

**compensation scar diameter**, *n*—the average diameter, in millimetres, of the wear scar on the stationary balls caused by the rotating ball under an applied load in the presence of a lubricant, but without causing either seizure or welding.

[D02.G0] D2596, [D02.L0] D2783

**composite sample**—a thoroughly mixed gross sample.

[D02.05] D4296

**composite sample**—a sample, representative of an entire consignment of calcined petroleum coke, generated by mixing portions of gross samples from different lots together in mass fractions proportioned to the consignment.

[D02.05] D6969

**compression ratio**, *n*—the ratio of the volume of the combustion chamber including the precombustion chamber with the piston at bottom dead center to the comparable volume with the piston at top dead center.

[D02.01] D613

**compressive strength**, *n*—a property of solid material that indicates its ability to withstand a uniaxial compressive load.

[D02.F0] C709

**congealing point**, *n*—that temperature at which molten petroleum wax ceases to flow, when allowed to cool under prescribed conditions.

**congealing point**, *n*—of petroleum wax, that temperature at which molten petroleum wax, when allowed to cool under prescribed conditions, ceases to flow.

[D02.10] D938

**consistency**, *n*—of lubricating grease, the degree of resistance to movement under stress.

DISCUSSION—The term consistency is used somewhat synonymously with penetration. Generally, consistency refers to worked penetration of a grease.

[D02.G0] D217, D7342

**consortium (pl. consortia)**, *n*—microbial community comprised of more than one, species that exhibits properties not shown by individual community members.

DISCUSSION—Consortia often mediate biodeterioration processes that individual taxa cannot.

[D02.14] D6469

**continuous analyzer unit cycle time**—the time interval required to replace the volume of the analyzer measurement cell.

[D02.25] D7278

**control limits**, *n*—limits on a control chart that are used as criteria for signaling the need for action or for judging whether a set of data does or does not indicate a state of statistical control.

[D02.25] D6122, [D02.94] D6299, D7372, [E11] E456

**conventional hydrocarbons**, *n*—hydrocarbons derived from the following conventional sources: crude oil, natural gas liquid condensates, heavy oil, shale oil, and oil sands.

[D02.J0] D7566

**cool-on-column injector**, *n*—an injection port that allows controlled injection of the sample at a temperature close to or lower than the boiling point of the solvent into the gas chromatographic column or a liner within the injection port connected to the column.

DISCUSSION—After the injection, the injection port is heated at a fixed rate to a temperature sufficiently high enough to allow the transfer of sample components of interest from the injection port to the part of the column located in the gas chromatograph (GC) oven.

[D02.04] D7059

**corrected load**, *n*—the load in kilograms-force (or newtons) for each run obtained by multiplying the applied load by the ratio of the Hertz scar diameter to the measured scar diameter at that load.

[D02.L0] D2783

**corrected load**, *n*—the load in kilograms-force (or newtons) obtained by multiplying the applied load by the ratio of the Hertz scar diameter to the measured scar diameter at that load.

DISCUSSION—In this test method, the corrected load is calculated for each run.

[D02.G0] D2596

**correction factor**, *n*—a mathematical adjustment to a test result to compensate for industry-wide shifts in severity.

[D02.B0] D6984, D7320

**corrosion**, *n*—the chemical or electrochemical reaction between a material, usually a metal surface, and its environment that can produce a deterioration of the material and its properties.

[D02.B0] D5862, D6557, D6594, D7320

**corrosion**, *n*—the chemical or electrochemical oxidation of the surface of metal, which can result in loss of material or accumulation of deposits.

[D02.B0] D6984

**cracked gases**, *n*—hydrocarbon gases that contain unsaturates.

[D02.04] D2650

**critical parts**, *n*—those components used in the test that are known to affect test severity.

[D02.B0] D6709

**critical pressure**, *n*—that pressure needed to condense a gas at the critical temperature.

[D02.04.0C] D7347

**critical temperature**, *n*—highest temperature at which a gaseous fluid can be converted to a liquid by means of compression.

[D02.04.0C] D7347

**cross-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, [D02.94] D6708

DISCUSSION—A statement of cross-method reproducibility must include a description of any bias correction used in accordance with this practice.

DISCUSSION—Cross-method 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.

(see 6.7.)

[D02.94] D6708

**crude oil**, *n*—a naturally occurring hydrocarbon mixture, generally in a liquid state, which may also include compounds of sulfur, nitrogen, oxygen, metals, and other elements. (Synonym—*crude petroleum*, *crude*.)

**culturable**, *adj*—microorganisms that proliferate as indicated



by the formation of colonies in or on solid growth media, or the development of turbidity in liquid growth media under specified growth conditions. [D02.14] D7463

**cup grease**, *n*—any lubricating grease having physical properties, such as consistency and texture, suitable for its use in spring-loaded or screw-type lubricating cups.

DISCUSSION—Cup greases are predominantly NLGI No. 3 or 4 calcium greases, but grease types other than calcium are also used.

[D02.G0] D128

**cylinder height**, *n*—for the CFR engine, the relative vertical position of the engine cylinder with respect to the piston at top dead center (tdc) or the top machined surface of the crankcase. [D02.01] D2699, D2700

**cylinder stock**, *n*—lubricant for independently lubricated engine cylinders, such as those of steam engines and air compressors. Cylinder stock are also used for lubrication of valves and other elements in the cylinder area. [D02.07] D97

**debris**, *n*—in internal combustion engines, solid contaminant materials unintentionally introduced into the engine or resulting from wear. [D02.B0] D5862, D6593, D6750, D6984, D7320

DISCUSSION—Examples include such things as gasket material, silicone sealer, towel threads, and metal particles. [D02.B0] D6593

**debutanization**, *n*—of crude petroleum, the removal of the light hydrocarbons up to and including *n*-butane, and retention of the heavier hydrocarbons.

DISCUSSION—In practice, a crude petroleum is regarded as debutanized if the light hydrocarbon cut collected in the cold trap contains more than 95 % of the C<sub>2</sub> to C<sub>4</sub> hydrocarbons and less than 5 % of the C<sub>5</sub> hydrocarbons initially present in the sample. [D02.08] D2892

**decomposition**, *n*—of a hydrocarbon, the pyrolysis or cracking of a molecule yielding smaller molecules with lower boiling points than the original molecule. [D02.08] D7344

DISCUSSION—Characteristic indications of thermal decomposition are evolution of fumes and erratic temperature readings that usually decrease after any attempt is made to adjust the heat. [D02.08] D86

**decomposition point**, *n*—the corrected thermometer reading that coincides with the first indications of thermal decomposition of the liquid in the flask.

DISCUSSION—The decomposition point, as determined under the conditions of this test method, does not necessarily correspond to the decomposition temperature in other applications. [D02.08] D86

**decomposition point**, *n*—corrected thermometer reading that coincides with the first indications of the liquid in the specimen container.

DISCUSSION—Characteristic indications of thermal decomposition are evolution of fumes and erratic, typically decreasing, temperature readings that occur during the final stages of the distillation.

DISCUSSION—The decomposition point, as determined under the conditions of this test method, does not necessarily correspond to the decomposition temperature in other applications. [D02.08] D7344

**defect**, *n*—of a manufactured carbon or graphite product, any

irregularity in the chemistry, microstructure, or macrostructure. [D02.F0] C709

**defective**, *adj*—having flaws or dimensional deviations greater than acceptable for the intended use. [D02.F0] C709

**degras (wool fat, wool grease, wool wax)**, *n*—a fat-like material comprised primarily of sterols, other higher alcohols, and fatty acids, obtained from the solvent extraction of sheep's wool. [D02.G0] D128

**degree of thickening (DT)**, *n*—the ratio of an oil's viscosity with an additive to that oil's viscosity without the additive. A measure of the amount by which an additive increases the base fluid viscosity. [D02.07] D6022

**degrees of freedom**, *n*—the divisor used in the calculation of variance.

DISCUSSION—This definition applies strictly only in the simplest cases. Complete definitions are beyond the scope of this practice.

[D02.94] D6300, [ISO/TC 28] ISO 4259

**demulsibility**, *n*—in petroleum products, the ability of a mixture of liquids (usually hydrocarbons and water) to separate into its components after the mixture has been vigorously agitated.

**denaturants**, *n*—natural gasoline, gasoline components, unleaded gasoline, or toxic or noxious materials added to fuel ethanol to make it unsuitable for beverage use but not unsuitable for automotive fuel use. [D02.A0] D6423

**denatured fuel ethanol**, *n*—fuel ethanol made unfit for beverage use by the addition of denaturants. [D02.A0] D6423

**density ( $\rho$ )**, *n*—mass per unit volume. [D02.07] D7483

**density**, *n*—mass per unit volume at a specified temperature. [D02.04] D4052

**density**—the weight in vacuo, (that is, the mass) of a unit volume of the material at any given temperature. [D02.04] D1217

**density**, *n*—the mass per unit volume. In the SI, the unit of density is the kg/m<sup>3</sup>, but for practical use, a submultiple is more convenient. The g/cm<sup>3</sup> is 10<sup>-3</sup> kg/m<sup>3</sup> and is customarily used. [D02.07] D4683, D4741, D6616

**density**, *n*—the mass of liquid per unit volume at 15°C and its saturation pressure with the standard unit of measurement being kilograms per cubic metre.

DISCUSSION—Other reference temperatures, such as 20°C may be used for some products or in some locations. Less preferred units of measurement; for example, kg/L or g/mL, are still in use. [D02.02] D1657

**depacifying**, *adj*—the process of removing hydrogen ions (protons) from the cathodic surface of an electrolytic cell, thereby promoting continued electrolytic corrosion. [D02.14] D6469

**deplasticize**, *v*—the process of breaking down polymers in plastics and similar materials, resulting in loss of the material's structural integrity. [D02.14] D6469

**detection limit**, *n*—a stated limiting value that designates the lowest concentration that can be determined with confidence and that is specific to the analytical procedure used. [D02.03] D7111

**detection limit**, *n*—the smallest concentration of an element

that can be measured for specific analysis conditions and data collection periods. [D02.03] D6728

**determinability, *n***—a quantitative measure of the variability associated with the same operator in a given laboratory obtaining successive determined values using the same apparatus for a series of operations leading to a single result; it is defined as that difference between two such single determined values as would be exceeded in the long run in only one case in 20 in the normal and correct operation of the test method.

DISCUSSION—This definition implies that two determined values, obtained under determinability conditions, which differ by more than the determinability value should be considered suspect. If an operator obtains more than two determinations, then it would usually be satisfactory to check the most discordant determination against the mean of the remainder, using determinability as the critical difference.

[D02.94] D6300

**determination, *n***—the process of carrying out the series of operations specified in the test method whereby a single value is obtained. [D02.94] D3244

**detonation meter, *n***—for knock testing, the signal conditioning instrumentation that accepts the electrical signal from the detonation pickup and provides an output signal for display.

[D02.01] D2699, D2700

**detonation pickup, *n***—for knock testing, a magnetostrictive-type transducer that threads into the engine cylinder and is exposed to combustion chamber pressure to provide an electrical signal that is proportional to the rate-of-change of cylinder pressure. [D02.01] D2699, D2700

**developer, *n***—of an ASTM test method, the assigned ASTM group, working under the supervision of its governing subcommittee and main committee, that formats the test method in accordance with the Form and Style for ASTM Standards, and continually refines the test method.

[D02.B0] D6594

**developer, *n***—of a test procedure, an individual or organization that selects the test apparatus and operating conditions.

[D02.B0] D6594

**dial indicator reading, *n***—for the CFR engine, a numerical indication of cylinder height, in thousandths of an inch, indexed to a basic setting at a prescribed compression pressure when the engine is motored. [D02.01] D2699, D2700

**diesel fuel, *n***—middle petroleum distillate fuel. [D02.E0] D6751

**diesel fuel, *n***—petroleum-based middle distillate fuel. [D02.04.0F] D7371

**diesel fuel oil, *n***—any petroleum liquid suitable for the generation of power by combustion in compression ignition (diesel) engines.

DISCUSSION—Different grades are characterized primarily by viscosity ranges and by minimum cetane numbers.

**diesel index, *n***—an approximation of the cetane number (the ignition performance) of diesel fuel, calculated from the density and the aniline point. (No longer widely used for distillate fuels but applicable to some blended distillate residual fuels (see also **cetane index**)).

**diffuser, *n***—for gas, a device for dispersing gas into a fluid.

DISCUSSION—In this test method the diffuser may be made of either metallic or non-metallic materials. [D02.06] D892

**diffuser, *n***—for gas, a device for dispersing gas into a liquid. (Test Method D892).

DISCUSSION—Although diffusers can be made of either metallic or non-metallic materials, in this test method the diffuser is sintered stainless steel. [D02.06] D6082

**digital counter reading, *n***—for the CFR engine, a numerical indication of cylinder height, indexed to a basic setting at a prescribed compression pressure when the engine is motored. [D02.01] D2699, D2700

**dilution factor, *f, n***—the proportion of solvent increase made to reduce the concentration and thus the absorbance of a solute, expressed by the ratio of the volume of the diluted solution to the volume of original solution containing the same quantity of solute as the diluted solution. [D02.04] D2008

**DIN**—abbreviation for Deutsches Institut für Normung (the German Standards Body).

**dispersant, *n***—in engine oil, an additive that reduces deposits on oil-wetted engine surfaces primarily through suspension of particles.

**dispute, *n***—when there is a question as to product quality conformance to specification because a test value obtained falls outside the specification limit(s). [D02.94] D3244

**dissolved and free water**—water may be present in the fuel as dissolved water or as “free” (undissolved) water, or both. The free water may be fresh or saline. Fresh water may enter the fuel from steam coils in storage tanks, from condensation out of moisture-laden air, or from leaking cooling coils. Saline water can enter the fuel during transportation in barges or tankers. [D02.E0] D4418

**distillate, *n***—in the petroleum industry, an overhead or side stream liquid from a distillation process. (Synonym—**petroleum distillate**.)

DISCUSSION—Distillates can be produced either directly from crude oil (called straight-run distillates) or from distillation after processing crude oil by cracking, coking, hydrocracking, or other conversion processes. The term is often given a modifier, such as cracked distillate.

DISCUSSION—The term distillate is sometimes used to mean middle distillate. This practice is discouraged.

**distillation pressure, *n***—the pressure measured as close as possible to the point where the vapor temperature is taken, normally at the top of the condenser. [D02.08] D2892

**distillation residue, *n***—that portion of the sample remaining after distillation using specified procedures. [D02.06] D1093

**distillation temperature, *n***—in column distillation, the temperature of the saturated vapor measured just above the top of the fractionating column. (Synonym—**head temperature, vapor temperature**.)

**double-blind reference oil, *n***—a reference oil, the identity of which is unknown by either the submitting source or the test facility and is not known to be a reference oil by the test facility.

DISCUSSION—This is a coded reference oil that is supplied by an independent source to a second party, who applies their own coded designation to the oil (and if necessary, repackages it to preserve its anonymity), and submits it to a third party for testing. [D02.B0] D6750

**double-blind test**, *n*—a standard test performed on a double-blind reference oil. [D02.B0] D6750

**drain and dry mode**, *n*—the effect from being sprayed, dipped, or brushed with a fluid lubricant and the excess material draining from the surface leaving behind a thin film that remains wet and must act as a lubricant on its own, without benefit of recirculation or continuous supply. [D02.L0] D5620

**drop melting point of petroleum wax**, *n*—the temperature at which material becomes sufficiently fluid to drop from the thermometer used in making the determination under definite prescribed conditions. [D02.10] D127

**dropping point**, *n*—a numerical value assigned to a grease composition representing the corrected temperature at which the first drop of material falls from the test cup and reaches the bottom of the test tube.

DISCUSSION—In the normal and proper operation of this test method, the observed dropping point is corrected by adding to it a value representing one third of the difference between the oven block temperature and the observed dropping point temperature. This corrected value is recorded as the dropping point of the grease.

[D02.G0] D2265

**dry method**, *n*—*in vapor pressure methods*, a specific empirical test method (D4953) for measuring the vapor pressure of gasoline and other volatile products in which contact of the test specimen with water is not allowed. [D02.08] D4953

**dry point**, *n*—*in batch distillation*, the temperature observed at the instant the last drop of liquid evaporates from the lowest point in the flask.

**dry point**, *n*—the corrected thermometer reading that is observed at the instant the last drop of liquid (exclusive of any drops or film of liquid on the side of the flask or on the temperature sensor), evaporates from the lowest point in the distillation flask.

DISCUSSION—The end point (final boiling point), rather than the dry point, is intended for general use. The dry point can be reported in connection with special purpose naphthas, such as those used in the paint industry. Also, it is substituted for the end point (final boiling point) whenever the sample is of such a nature that the precision of the end point (final boiling point) cannot consistently meet the requirements given in the precision section. [D02.08] D86

**dry solid film lubricants**, *n*—dry coatings consisting of lubricating powders in a solid matrix bonded to one or both surfaces to be lubricated. [D02.L0] D2510

**dry vapor pressure equivalent (DVPE)**, *n*—value calculated by a defined correlation equation, that is expected to be comparable to the vapor pressure value obtained by Test Method D4953, Procedure A. [D02.08] D4953

**DT**—*in viscometry*, abbreviation for degree of thickening.

**dynamic**, *adj*—*in petroleum products—in petroleum product flash point test methods*—the condition where the vapor

above the test specimen and the test specimen are not in temperature equilibrium at the time that the ignition source is applied.

DISCUSSION—This is primarily caused by the heating of the test specimen at the constant prescribed rate with the vapor temperature lagging behind the test specimen temperature. [D02.08] D92, D93

**dynamic fuel level**, *n*—*for knock testing*, test procedure in which the fuel-air ratio for maximum knock intensity for sample and reference fuels is determined using the falling level technique that changes carburetor fuel level from a high or rich mixture condition to a low or lean mixture condition, at a constant rate, causing knock intensity to rise to a maximum and then decrease, thus permitting observation of the maximum knockmeter reading. [D02.01] D2699, D2700

**dynamic hold-up**, *n*—*in column distillation*, the quantity of liquid held up in the column under normal operating conditions.

**dynamic hold-up**, *n*—the quantity of liquid held up in the column under normal operating conditions.

DISCUSSION—It is expressed as a percentage of the packed volume for packed columns so that the data can be compared. For real plate columns, it is expressed in millilitres per plate. The data can only be compared with others of the same diameter because of different tray spacing. Data for packed columns cannot be compared with those of real plate columns except in absolute units of millilitres per theoretical plate (see Table 1). Dynamic hold-up increases with increasing distillation rate up to the flood point and varies from one kind of fractionator to another. [D02.08] D2892

**dynamic holdup**, *n*—the amount of material present in the neck of the flask, in the sidearm of the flask, and in the condenser tube during the distillation. [D02.08] D86

**dynamic holdup**, *n*—amount of material present in the distillation column, and in the condenser during the distillation. [D02.08] D7344

**dynamic viscosity ( $\eta$ )**, *n*—the ratio between the applied shear stress and rate of shear of a liquid.

DISCUSSION—It is sometimes called the coefficient of dynamic viscosity or, simply, viscosity. Thus, dynamic viscosity is a measure of the resistance to flow or to deformation of a liquid under external shear forces.

DISCUSSION—The term dynamic viscosity can also be used in a different context to denote a frequency-dependent quantity in which shear stress and shear rate have a sinusoidal time dependence.

[D02.07] D7042

**ecotoxicity**, *n*—the propensity of a material to produce adverse behavioral, biochemical, or physiological effects in non-human organisms or populations. [D02.N0] D6046

**effect load XX (ELXX)**, *n*—a statistically or graphically estimated loading rate of test material that is expected to cause one or more specified effects in XX % of a group of organisms under specified conditions for a specified time.

DISCUSSION—This terminology should be used for hydraulic fluids instead of the standard effect concentration (ECXX) when the hydraulic fluid is not completely soluble under test conditions. [D02.N0] D6046



**effect load XX (ELXX), *n***—a statistically or graphically estimated loading rate of test material that is expected to cause one or more specified effects in XX % of a representative subpopulation of organisms under specified conditions.

DISCUSSION—This terminology should be used instead of the standard ECXX when the test material is not completely soluble at the test treatment rates. [D02.12] D6081

**effective composition to biodegradation (ECB), *n***—component of material that can be biodegradable by bacteria.

DISCUSSION—The term ECB is a part of bio-kinetic model is sum of non-aromatic components in a lubricant. [D02.12] D7373

**EGT, *n***—exhaust gas temperature [D02.J0] D6812

**elastomer, *n***—a natural or synthetic polymer having the property of substantially recovering its size and shape after removal of a deforming force.

**elastomer, *n***—a natural or synthetic polymer having the rubber-like property of substantially recovering its size and shape after removal of a deforming force. [D02.G0] D4289

**electrical resistivity, *n***—the electrical resistance offered by a material to the flow of current, times the cross-sectional area of current flow and per unit length of current path, the reciprocal of conductivity. It is also known as resistivity, or specific resistance.<sup>2</sup> [D02.05] D6120

**electrographite, *n***—*in carbon and graphite technology*, a synonym for manufactured graphite. [D02.F0] C709

**electronic pressure control, *n***—electronic pneumatic control of carrier gas flows. It can be flow or pressure programmed to speed up elution of components. [D02.04] D7059

**emergent stem effect, *n***—the offset in temperature reading caused by the use of total immersion mercury-in-glass thermometers in the partial immersion mode.

DISCUSSION—In the partial immersion mode, a portion of the mercury thread, that is, the emergent portion, is at a lower temperature than the immersed portion, resulting in a shrinkage of the mercury thread and a lower temperature reading. [D02.08] D86

**emission spectroscopy, *n***—measurement of energy spectrum emitted by or from an object under some form of energetic stimulation; for example, light, electrical discharge, and so forth. [D02.03] D6595, D6728

**emulsion, *n***—a suspension of fine particles or globules, or both, of one or more liquids in another liquid. [D02.03] D5761

**end point (EP) or final boiling point (FBP), *n***—the maximum corrected thermometer reading obtained during the test. [D02.08] D7344

DISCUSSION—This usually occurs after the evaporation of all liquid from the bottom of the flask. The term maximum temperature is a frequently used synonym. [D02.08] D86

**energy equivalent (effective heat capacity or water**

**equivalent)**—the energy equivalent of the calorimeter expressed as joules per degree Celsius, J/°C.

DISCUSSION—The energy equivalent may be expressed in any energy unit and any temperature unit so long as the value is used consistently throughout the calculations. [D02.05] D4809

**engine motor octane requirement, *n***—one full motor octane number greater than the maximum motor octane number that results in knock (graphic knock level descriptions can be seen in Annex A1). For example, a test engine knocks on primary reference fuels with 96 and 97 motor octane numbers. The test engine does not knock on a primary reference fuel with a 98 motor octane number. The maximum motor octane number that results in knock is 97, so the motor octane requirement is 98. [D02.J0] D6424

**engine oil, *n***—a liquid that reduces friction or wear, or both, between the moving parts within an engine; removes heat, particularly from the underside of pistons; and serves as a combustion gas sealant for piston rings. [D02.B0] D5862, D5966, D6750, D6794, D6795, D6837

DISCUSSION—It may contain additives to enhance certain properties. Inhibition of engine rusting, deposit formation, valve train wear, oil oxidation, and foaming are examples. [D02.B0] D5862, D5966, D6750, D6794, D6795

**engine oil, *n***—a liquid that reduces friction and wear between the moving parts within an engine, and also serves as a coolant. [D02.B0] D4485, D6984, D7320

DISCUSSION—It can contain additives to enhance certain properties. Inhibition of engine rusting, deposit formation, valve train wear, oil oxidation, and foaming are examples. [D02.B0] D4485

**entrained air (or gas), *n***—*in liquids*, a two-phase mixture of air (or gas) dispersed in a liquid in which the volume of the liquid is the major component.

DISCUSSION—The air (or gas) is in the form of discrete bubbles of about 10 to 1000 μm in diameter. The bubbles are not uniformly dispersed. In time they tend to rise to the surface to coalesce to form larger bubbles which break or form foam. Subsurface coalescence can also occur, in which case, the bubbles rise more rapidly. [D02.06] D892

**entrained air (or gas), *n***—*in liquids*, a two-phase mixture of air (or gas) dispersed in a liquid in which the liquid is the major component on a volumetric basis.

DISCUSSION—The air (or gas) is in the form of discrete bubbles of about 10 to 1000 μm in diameter. The bubbles are not uniformly dispersed. In time, they rise to the surface to coalesce to form larger bubbles which break or form foam. Subsurface coalescence can also occur, in which case, the bubbles will rise more rapidly. [D02.06] D6082

**environmental compartment, *n***—a subdivision of the environment based on physical or chemical properties, or both. [D02.12] D6006, D6384, [D02.N0] D6046

DISCUSSION—Examples of environmental compartments are aerobic fresh water, aerobic marine and aerobic soil. The results of test procedures may be applied to environmental compartments but the test systems do not constitute an environmental compartment. [D02.12] D6006

<sup>2</sup> Parker, Sybil P., Ed in Chief, *Dictionary of Scientific and Technical Terms*, McGraw Hill Book Co., Fourth Ed., 1989, p 615.

DISCUSSION—Examples of environmental compartments are aerobic fresh water, aerobic marine, aerobic soil, and anaerobic media. The results of test procedures may be applied to environmental compartments, but the test systems do not constitute an environmental compartment. [D02.12] D6384, [D02.N0] D6046

**EOT**, *n*—end of test [D02.B0] D6750

**EOTC**, *n*—end of test oil consumption [D02.B0] D6750

**EP**—*in tribology*, abbreviation for extreme pressure.

**EP lubricating oil**, *n*—a liquid lubricant containing an extreme pressure (EP) additive. [D02.L0] D6425

**equilibrium**, *n*—*in petroleum products—in petroleum product flash point test methods*—the condition where the vapor above the test specimen and the test specimen are at the same temperature at the time the ignition source is applied.

DISCUSSION—This condition may not be fully achieved in practice, since the temperature may not be uniform throughout the test specimen, and the test cover and shutter on the apparatus can be cooler. [D02.08] D93

**equilibrium**—the vapor above the liquid (specimen) and the liquid in a flash point apparatus specimen cup are at the same temperature at the time the ignition source is applied.

DISCUSSION—This condition may not be fully achieved in practice. Although the temperature pattern is in equilibrium, the temperature is not uniform throughout the specimen cup because of the contrast between the hot liquid test specimen and the cooler lid and shutter. [D02.08] D3828

**equilibrium fuel level**, *n*—*for knock testing*, test procedure in which the fuel-air ratio for maximum knock intensity for sample and reference fuels is determined by making incremental step changes in fuel-air ratio, observing the equilibrium knock intensity for each step, and selecting the level that produces the highest knock intensity reading. [D02.01] D2699, D2700

**equilibrium headspace**, *n*—the vapor space above the liquid in which all vapor components are in equilibrium with the liquid components. [D02.E0] D5705

**erosion**, *n*—wearing away gradually, especially by rubbing or corroding. [D02.B0] D6750

**ethanol**, *n*—ethyl alcohol, the chemical compound C<sub>2</sub>H<sub>5</sub>OH. [D02.A0] D4806, D5798, D6423

**ethylene product**, *n*—hydrocarbon product containing at least 99.85 mass % ethylene. [D02.D0] D5234

**EWMA**, *n*—abbreviation for exponentially-weighted moving average. [D02.B0] D6984, D7320

**exhaust gas recirculation (EGR)**, *n*—a method by which a portion of the engine exhaust is returned to the combustion chambers through the intake system. [D02.B0] D7468

**exhaust gas recirculation (EGR)**, *n*—the mixing of exhaust gas with intake air to reduce the formation of nitrogen oxides (NO<sub>x</sub>). [D02.B0] D6987, D7156

**extracellular ATP**, *n*—ATP that is not contained inside a cell.

DISCUSSION—ATP is released into the environment when cells die and break open (lyse), for example, as when they are killed by exposure to some microbicides. ATP released into the environment can persist for several days after a cell has been lysed. Consequently extracellular ATP must be subtracted from total ATP to determine the concentration of viable cell-associated (biomass associated) ATP. However, extracellular ATP can also be an indicator of “distant” biomass, for example, biofilm

in the system.

[D02.14] D7463

**extreme pressure (EP) additive**, *n*—*in a lubricant*, a substance that minimizes damage to metal surfaces in contact under high stress rubbing conditions.

**extruded**, *v*—formed by being forced through a shaping orifice as a continuous body. [D02.F0] C709

**facultative anaerobe**, *n*—a microorganism capable of growing in both oxic and anoxic environments.

DISCUSSION—Facultative anaerobes use oxygen when it is present, and use either organic or inorganic energy sources (nitrate, sulfate, and so forth) when oxygen is depleted or absent. [D02.14] D6469

**filler**, *n*—*in manufactured carbon and graphite product technology*, carbonaceous particles comprising the base aggregate in an unbaked green-mix formulation. [D02.F0] C709

**film**, *n*—thin, translucent layer that does not adhere to the wall of glass test tube. [D02.14] D7451

**filterable insolubles**, *n*—material that is produced in the course of stressing the sample fuel under the conditions of this test and can be removed from the fuel by filtration. This includes both material suspended in the fuel and material easily removed from the oxidation cell and oxygen delivery tube with hydrocarbon solvent. [D02.14] D7462

**filtering**, *n*—*in data acquisition*, a means of attenuating signals in a given frequency range. They can be mechanical (volume tank, spring, mass) or electrical (capacitance, inductance) or digital (mathematical formulas), or a combination thereof. Typically, a low-pass filter attenuates the unwanted high frequency noise. [D02.B0] D6593

**final boiling point (FBP)**—the point at which a cumulative volume count equal to 99.5 % of the total volume count under the chromatogram is obtained. [D02.04] D3710

**final boiling point (FBP)**—(Synonym—*end point* (EP).)

**fire point**, *n*—the lowest temperature at which a liquid or solid specimen will sustain burning for 5 s.

**fire point**, *n*—*in petroleum products*, the lowest temperature corrected to a barometric pressure of 101.3 kPa (760 mm Hg), at which application of an ignition source causes the vapors of a test specimen of the sample to ignite and sustain burning for a minimum of 5 s under specified conditions of test. [D02.08] D92

**fire-resistant fluid**, *n*—any liquid that is able to withstand fire or give protection from fire. [D02.N0] D7044

**firing**, *n*—*for the CFR engine*, operation of the CFR engine with fuel and ignition. [D02.01] D2699, D2700

**fit-for-use**, *n*—a product, system, or service that is suitable for its intended use. [D02.25] D6624

**flash point**—the lowest temperature corrected to a pressure of 101.3 kPa (760 mm Hg) at which application of an ignition source causes the vapors of a specimen of the sample to ignite under specified conditions of test.

DISCUSSION—The specimen is deemed to have flashed when a flame appears and instantaneously propagates itself over the entire surface of the fluid.

DISCUSSION—When the ignition source is a test flame, the application of the test flame may cause a blue halo or an enlarged flame prior to the actual flash point. This is not a flash and should be ignored. [D02.08] D56

**flash point**, *n*—*in petroleum products*, the lowest temperature corrected to a barometric pressure of 101.3 kPa (760 mm Hg), at which application of an ignition source causes the vapors of a specimen of the sample to ignite under specified conditions of test. [D02.08] D92, D93

DISCUSSION—The test specimen is deemed to have flashed when a flame appears and instantaneously propagates itself over the entire surface of the test specimen.

DISCUSSION—When the ignition source is a test flame, the application of the test flame may cause a blue halo or an enlarged flame prior to the actual flash point. This is not a flash point and shall be ignored. [D02.08] D92

**flash point**—the lowest temperature corrected to a pressure of 760 mm Hg (101.3 kPa) at which application of a test flame causes the vapors of a specimen of the sample to ignite under specified conditions of test.

DISCUSSION—The specimen is deemed to have flashed when a flame appears and instantaneously propagates itself over the surface of the specimen.

DISCUSSION—Occasionally, particularly near the actual flash point, application of the test flame will cause a blue halo or an enlarged flame; this is not a flash and should be ignored. [D02.08] D3828

**flash point**, *n*—the lowest temperature corrected to a pressure of 101.3 kPa at which application of an ignition source causes the vapors of a specimen of the sample to ignite momentarily under specified conditions of the test.

DISCUSSION—For the purpose of this test method, the test specimen is deemed to have flashed when the hot flame of the ignited vapor causes an instantaneous pressure increase of at least 20 kPa inside the closed measuring chamber. [D02.08] D6450

**flash point**, *n*—lowest temperature corrected to a pressure of 101.3 kPa, at which application of a test flame causes the vapors of a test specimen of the sample to ignite momentarily under the specified conditions of the test. [D02.08] D7236

**flaw**, *n*—a defect sufficiently greater than those typical of the morphology of a carbon or graphite body to influence a property. [D02.F0] C709

**flexural strength**, *n*—a property of solid material that indicates its ability to withstand a flexural or transverse load. [D02.F0] C709

**floating piston cylinder (FPC)**—a high pressure sample container, with a free floating internal piston that effectively divides the container into two separate compartments. [D02.H0] D3700

**flocculation**, *n*—*of asphaltenes from crude oils or heavy fuel oils*, the aggregation of colloiddally dispersed asphaltenes into visibly larger masses which may or may not settle. [D02.14] D7060, D7061

**flood point**, *n*—(*in column distillation*) the point at which the upflowing vapor flow obstructs the down-coming reflux and the column suddenly loads with liquid.

**flood point**, *n*—the point at which the velocity of the upflowing vapors obstructs the downcoming reflux and the column suddenly loads with liquid.

DISCUSSION—Under these conditions no vapor can reach the head and the heat to the distillation flask must be reduced to establish normal

operations again. The flood point is normally determined during the efficiency evaluation of a column using the *n*-heptane-methylcyclohexane test mixture (see Annex A1). [D02.08] D2892

**flow line**, *n*—a defect induced by discontinuous flow velocities during forming of molded or extruded bodies. [D02.F0] C709

**flow proportional sampler**, *n*—sampler designed to automatically adjust the sampling rate to be proportional to the flow rate of the stream. [D02.25] D7453

**flow-proportioned average property value (FPAPV)**, *n*—the average property value of the collected material in the tank or vessel, calculated by using the flow-proportioned average technique described in the practice of all measurements performed on aliquots of the material while it is flowing into the tank or vessel.

DISCUSSION—The term *property* as used in this practice can be the physical, chemical, or performance property measurements as provided by on-line, at-line analyzer systems, or, can be the deviation of such measurements from a desired value.

DISCUSSION—The FPAPV can include a value contributed by material (commonly referred to as a tank heel) present in the collection tank or vessel before the start of delivery of the current process stream material. [D02.25] D6624

**fluid coke**, *n*—petroleum coke with a granular, microscopic layered structure resulting from injection of petroleum feedstock into a flowing, loose bed of coke particles. [D02.05] D5003

**fluid**, *adj*—describing a state of matter showing an ability to flow in a gaseous or liquid state.

DISCUSSION—A quantity of solid particles, powders, or pellets, for example, fluidized catalyst beds, can also flow like a liquid in the presence of an applied force. The state of the individual particles, nevertheless, remains a solid.

**fluid**, *n*—substance (matter) that flows, a liquid or a gas.

DISCUSSION—*In automotive technology*, often used to mean a liquid only, such as hydraulic fluid, a liquid.

DISCUSSION—Other fluids, such as supercritical fluids, behave with aspects of both gases and liquids under certain ranges of temperature and pressure.

**foam**, *n*—*in liquids*, a collection of bubbles formed in the liquid or on (at) its surface in which the air (or gas) is the major component on a volumetric basis. [D02.06] D892

**foam**, *n*—*in liquids*, a collection of bubbles formed in or on the surface of a liquid in which the air or gas is the major component on a volumetric basis. [D02.06] D6082

**foreflush**, *v*—elution of HPLC mobile phase in the forward direction.

DISCUSSION—In this test method, the sample enters the cyano column first followed by elution through the silica gel column. [D02.04.0C] D7419

**Fourier transform infrared (FT-IR) spectrometry**, *n*—form of infrared spectrometry in which an interferogram is obtained; this interferogram is then subjected to a Fourier transform calculation to obtain an amplitude-wavenumber (or wavelength) spectrum. [D02.96] D7418

**free alkali**, *n*—*in lubricating grease*, unreacted basic (alkaline)



material present in the product.

**DISCUSSION**—Many greases are made with a slight excess of alkali to ensure complete saponification. Free alkali is determined by acidification of a solvent-thinned specimen and back titration with standardized, alcoholic potassium hydroxide. It is expressed in terms of the predominating alkali and a mass % of the total grease composition (for example, mass % lithium hydroxide.) **[D02.G0] D128**

**free fatty acid, *n***—in *lubricating grease*, unreacted carboxylic acid(s) present in the product.

**DISCUSSION**—Some greases are made with a slight excess of carboxylic acid to ensure a non-alkaline product. Free fatty acid is determined by neutralization of a solvent-thinned specimen with standardized, alcoholic potassium hydroxide. Regardless of the actual composition of the carboxylic acid(s), it is expressed as free oleic acid and as a mass % of the total grease composition. **[D02.G0] D128**

**free glycerin, *n***—a measure of the amount of glycerin remaining in the fuel.

**free piston ring, *n***—in *internal combustion engines*, a piston ring that will fall in its groove under its own weight when the piston, with the ring in a horizontal plane, is turned 90° (putting the ring in a vertical plane). **[D02.B0] D5862, D6984, D7320**

**DISCUSSION**—In the determination of this condition, the ring may be touched slightly to overcome static friction. **[D02.B0] D6984, D7320**

**freezing point, *n***—in *aviation fuels*, the fuel temperature at which solid hydrocarbon crystals, formed on cooling, disappear when the temperature of the fuel is allowed to rise under specified conditions of test. **[D02.07] D5972**

**fresh water environment, *n***—the aerobic, fresh water environmental compartment. **[D02.N0] D6046**

**fresh water environment, *n***—the aerobic, aqueous compartment, characteristically with a salinity of less than five parts per thousand. **[D02.12] D6384**

**fretting wear, *n***—a form of attritive wear caused by vibratory or oscillatory motion of limited amplitude characterized by the removal of finely-divided particles from the rubbing surfaces.

**DISCUSSION**—Air can cause immediate local oxidation of the wear particles produced by fretting wear. In addition, environmental moisture or humidity can hydrate the oxidation product. In the case of ferrous metals, the oxidized wear debris is abrasive iron oxide (Fe<sub>2</sub>O<sub>3</sub>) having the appearance of rust, which gives rise to the nearly synonymous terms, fretting corrosion and friction oxidation. A related, but somewhat different phenomenon often accompanies fretting wear. False brinelling is localized fretting wear that occurs when the rolling elements of a bearing vibrate or oscillate with small amplitude while pressed against the bearing race. The mechanism proceeds in stages: (1) asperities weld, are torn apart, and form wear debris that is subsequently oxidized; (2) due to the small-amplitude motion, the oxidized detritus cannot readily escape, and being abrasive, the oxidized wear debris accelerates the wear. As a result, wear depressions are formed in the bearing race. These depressions appear similar to the Brinell depressions obtained with static overloading. Although false brinelling can occur in this test, it is not characterized as such, and instead, it is included in the determination of fretting wear.

**NLGI Lubricating Grease Guide, [D02.G0] D4170**

**friction, *n***—the resistance to sliding exhibited by two surfaces

in contact with each other. Basically there are two frictional properties exhibited by any surface; static friction and kinetic friction. **[D02.10] D2534**

**friction force, *n***—the resisting force tangential to the interface between two bodies when, under the action of an external force, one body moves or tends to move relative to the other. **[D02.L0] D2714, D3704**

**friction mean effective pressure, *n***—for *spark-ignition engines*, the measure of the difference between IMEP and BMEP or power absorbed in mechanical friction and any auxiliaries. **[D02.01] D909**

**front end loss, *n***—loss due to evaporation during transfer from receiving cylinder to distillation flask, vapor loss during the distillation, and uncondensed vapor in the flask at the end of the distillation. **[D02.08] D86**

**fuel contaminants**—in principle, are any fuel component other than hydrocarbon oils. In the present context the contaminants are foreign materials that make the fuel less suitable or even unsuitable for the intended use. The contaminants of primary interest are foreign materials introduced subsequent to the manufacture of specification quality fuel. Hence they are materials introduced in the distribution system (that is storage tanks, pipelines, tank, trucks, barges, etc.), or in the user's storage and handling systems, or generated within these systems (rust generated in steel pipes and tanks by moist fuel, etc.). Contaminants may be soluble or insoluble in the fuel. **[D02.E0] D4418**

**fuel diluent, *n***—in *used oil analysis*, unburnt fuel components that enter the engine crankcase causing dilution of the oil.

**DISCUSSION**—In this test method, the fuel diluent components being determined are from gasoline. **[D02.06] D322**

**fuel entering the combustor(s)**—this term is used to designate the fuel that is actually burned in the gas turbine. Fuel may actually be sampled at a point upstream from the point of entry into the combustor(s), provided the sample is representative of the fuel actually entering the combustor(s). **[D02.E0] D4418**

**fuel ethanol (Ed75-Ed85), *n***—a blend of ethanol and hydrocarbons of which the ethanol portion is nominally 75 to 85 volume % denatured ethanol. **[D02.04] D6423**

**fuel-air ratio, *n***—mass ratio of fuel to air in the mixture delivered to the combustion chamber. **[D02.01] D909**

**fuel-air ratio for maximum knock intensity, *n***—for *knock testing*, that proportion of fuel to air that produces the highest knock intensity for each fuel in the knock testing unit, provided this occurs within specified carburetor fuel level limits. **[D02.01] D2699, D2700**

**full rich, *n***—condition in which the mixture control is at the full stop position with the fuel flow within manufacturer's recommended settings. **[D02.J0] D6424**

**functional properties, *n***—those properties of the mineral lubricating oil that are required for satisfactory operation of the machinery. **[D02.C0] D4304**

**fungus (pl. fungi), *n***—single cell (yeasts) or filamentous (molds) microorganisms that share the property of having the true intracellular membranes (organelles) that characterize all higher life forms (*Eukaryotes*). **[D02.14] D6469**

**gas, n**—a fluid (such as air) that has neither independent shape nor volume but tends to expand indefinitely. [D02.06] D6082

**gas, n**—substance (matter) in a gaseous state (see **gaseous**).

**gaseous, adj**—describing a state of matter that shows free flow, has neither a definite shape nor a definite volume, and tends to expand indefinitely unless contained.

**gasoline, n**—a volatile mixture of liquid hydrocarbons, generally containing small amounts of additives, suitable for use as a fuel in spark-ignition, internal combustion engines. [D02.A0] D4806, D4814, D6422

**gasoline-alcohol blend, n**—a fuel consisting primarily of gasoline along with a substantial amount (more than 0.35 mass % oxygen, or more than 0.15 mass % oxygen if methanol is the only oxygenate) of one or more alcohols. [D02.A0] D4814

**gasoline-alcohol blend, n**—a spark-ignition engine fuel consisting primarily of gasoline along with a substantial amount of one or more alcohols.

**gasoline-ethanol blend, n**—a fuel consisting primarily of gasoline along with a substantial amount (more than 0.35 mass % oxygen) of denatured fuel ethanol. [D02.A0] D4806

**gasoline-ether blend, n**—a fuel consisting primarily of gasoline along with a substantial amount (more than 0.35 mass % oxygen) of one or more ethers. [D02.A0] D4814

**gasoline-ether blend, n**—a spark-ignition engine fuel consisting primarily of gasoline along with a substantial amount of one or more ethers.

**gasoline-oxygenate blend, n**—a fuel consisting primarily of gasoline along with a substantial amount (more than 0.35 mass % oxygen, or more than 0.15 mass % oxygen if methanol is the only oxygenate) of one or more oxygenates. [D02.A0] D4814

**gasoline-oxygenate blend, n**—a spark-ignition engine fuel consisting primarily of gasoline along with a substantial amount of one or more oxygenates.

**gasoline-oxygenate blend, n**—spark-ignition engine fuel consisting primarily of gasoline with one or more oxygenates. [D02.08] D323, D4953

**gloss retention, n**—the percent of the original gloss retained by the specimen after aging under specified conditions. It is the final gloss divided by the initial gloss, multiplied by 100. [D02.10] D2895

**GLP**—*in laboratory practice*, abbreviation for good laboratory practice.

**glycol-base antifreeze, n**—*in engine coolants*, ethylene or propylene glycol commonly used in admixture with water and additives to lower the coolant freezing point. [D02.06] D2982

**good laboratory practices (GLP), n**—guidelines for the management of laboratory experiments which are published by regulatory agencies or other recognized groups and are concerned with the organizational process and the conditions under which laboratory studies are planned, performed, monitored, recorded, and reported.

DISCUSSION—The major GLPs used are USEPA-TSCA, USFDA, OECD, and to some extent the MITI version from Japan for submis-

sions in Japan. [D02.N0] D6046, [D02.12] D6384

**grab, n**—volume of sample extracted from a batch by a single actuation of the sample extractor. [D02.25] D7453

**grade, n**—the designation given a material by a manufacturer such that it is always reproduced to the same specifications established by the manufacturer. [D02.F0] C709

**Grade S15 B100, n**—a grade of biodiesel meeting ASTM Specification D6751 and having a sulfur specification of 15 ppm maximum. [D02.E0] D6751

**Grade S500 B100, n**—a grade of biodiesel meeting ASTM Specification D6751 and having a sulfur specification of 500 ppm maximum. [D02.E0] D6751

**grain, n**—*in manufactured (synthetic) carbon and graphite*, a particle of filler material (usually coke or graphite) in the starting mix formulation. Also referred to as granular material, filler particle, or aggregate material. The term is also used to describe the general texture of a carbon or graphite body, as in the descriptions listed below:

*coarse grained, adj*—containing grains in the starting mix that are substantially greater than 4 mm in size.

*fine grained, adj*—containing grains in the starting mix that are generally less than 100 μm in size.

*medium grained, adj*—containing grains in the starting mix that are generally less than 4 mm in size.

*microfine grained, adj*—containing grains in the starting mix that are generally less than 2 μm in size.

*superfine grained, adj*—containing grains in the starting mix that are generally less than 50 μm in size.

*ultrafine grained, adj*—containing grains in the starting mix that are generally less than 10 μm in size.

DISCUSSION—All of the above descriptions relate to the generally accepted practice of measuring the sizing fractions with a criterion that 90 % of the grains will pass through the stated screen size in a standard particle sizing test. [D02.F0] C709

**graphene layer, n**—*in carbon and graphite technology*, a single carbon layer of the graphite structure, describing its nature by analogy to a polycyclic aromatic hydrocarbon of quasi-infinite size.

DISCUSSION—The term graphite designates a modification of the chemical element carbon in which planar sheets of carbon atoms, each atom bound to three neighbors in a honeycomb-like structure, are stacked in a three dimensional regular order. For a single layer, it is not correct to use the term graphite, which implies a three dimensional structure. [D02.F0] C709

**graphite, n**—an allotropic crystalline form of the element carbon, occurring as a mineral, commonly consisting of a hexagonal array of carbon atoms (space group P 6<sub>3</sub>/mmc) but also known in a rhombohedral form (space group R 3m). [D02.F0] C709

**graphite, n**—*in carbon and graphite technology*, a material consisting predominantly of the element carbon and possessing extensive long-range three-dimensional crystallographic order as determined by X-ray diffraction studies.

DISCUSSION—The presence of long-range order is usually accompanied with high electrical and thermal conductivity within the hexagonal plane. This results in a material having relatively easy machinability when compared to non-graphitic materials. The use of the term

*graphite* without reporting confirmation of long-range crystallographic order should be avoided as it can be misleading. [D02.F0] C709

**graphite foam**, *n*—*in carbon and graphite technology*, a porous graphite product containing regularly shaped, predominantly concave, homogeneously dispersed cells which interact to form a three-dimensional array throughout a continuum material of carbon, predominantly in the graphitic state. The final result is either an open or closed cell product.

DISCUSSION—In most foam, the cell wall thickness is less than half the average cell size. [D02.F0] C709

**graphitic**, *adj*—*in carbon and graphite technology*, all varieties of substances consisting predominantly of the element carbon in the allotropic form of graphite irrespective of the presence of structural defects.

DISCUSSION—The use of the term graphitic is justified if three-dimensional hexagonal crystalline long-range order can be detected in the material by X-ray diffraction methods, independent of the volume fraction and the homogeneity of distribution of such crystalline domains. Otherwise, the term non-graphitic should be used. [D02.F0] C709

**graphitizable carbon**, *n*—*in carbon and graphite technology*, a non-graphitic carbon, which, upon graphitization, converts into graphitic carbon (also known as a soft carbon). [D02.F0] C709

**graphitization**, *n*—*in carbon and graphite technology*, a solid-state transformation of thermodynamically unstable non-graphitic carbon into graphite by thermal treatment.

DISCUSSION—The degree of graphitization is a measure of the extent of long-range 3D crystallographic order as determined by diffraction studies only. The degree of graphitization affects many properties significantly, such as thermal conductivity, electrical conductivity, strength, and stiffness.

DISCUSSION—A common, but incorrect, use of the term graphitization is to indicate a process of thermal treatment of carbon materials at  $T > 2200^{\circ}\text{C}$  regardless of any resultant crystallinity. The use of the term graphitization without reporting confirmation of long range three dimensional crystallographic order determined by diffraction studies should be avoided, as it can be misleading. [D02.F0] C709

**green carbon**, *n*—a formed, but unfired carbon body. [D02.F0] C709

**green petroleum coke**, *n*—same as raw petroleum coke. [D02.05] D6376

**gross heat of combustion**,  $Q_g$  (MJ/kg), *n*—the quantity of energy released when a unit mass of fuel is burned in a constant volume enclosure, with the products being gaseous, other than water that is condensed to the liquid state.

DISCUSSION—The fuel can be either liquid or solid, and contain only the elements carbon, hydrogen, nitrogen, and sulfur. The products of combustion, in oxygen, are gaseous carbon dioxide, nitrogen oxides, sulfur dioxide, and liquid water. In this procedure,  $25^{\circ}\text{C}$  is the initial temperature of the fuel and the oxygen, and the final temperature of the products of combustion. [D02.05] D240

**gross heat of combustion**—expressed as megajoules per kilogram. The gross heat of combustion at constant volume of a liquid or solid fuel containing only the elements carbon, hydrogen, oxygen, nitrogen, and sulfur is the quantity of heat

liberated when a unit mass of the fuel is burned in oxygen in an enclosure of constant volume, the products of combustion being gaseous carbon dioxide, nitrogen, sulfur dioxide, and liquid water, with the initial temperature of the fuel and the oxygen and the final temperature of the products at  $25^{\circ}\text{C}$ . Gross heat of combustion is represented by the symbol  $Q_g$ .<sup>3</sup>

DISCUSSION—Users of this test method desiring to calculate  $\Delta H^{\circ}$  for a pure compound should note that corrections must be applied to the value of  $Q_g$  for buoyancy of air, heat capacities of reaction components, reduction to a constant-pressure process, and deviations of the reaction from the thermodynamic standard state. In any comparison of measurements on pure compounds with those cited in these compilations<sup>4</sup>, the user of this test method should realize that impurities of various kinds, including water and foreign hydrocarbons may cause significant effects on the values obtained for particular samples of material. [D02.05] D4809

**gross sample**, *n*—a large sample made up of several portions (increments) of a mass of material. [D02.05] D4296

**gross sample**—the original, uncrushed representative portion taken from a shipment or lot of coke. [D02.05] D6969

**ground**, *vt*—to connect electrically with ground (earth). [D02.J0] D5452

**guide**, *n*—a series of options or instructions that do not recommend a specific course of action.

DISCUSSION—Whereas a practice describes a general usage principle, a guide only suggests an approach. The purpose of a guide is to offer guidance, based on a consensus of viewpoints, but not to establish a fixed procedure. A guide is intended to increase the awareness of the user to available techniques in a given subject area and to provide information from which subsequent evaluation and standardization can be derived. [D02.P0] D6074

**guide tables**, *n*—*for knock testing*, the specific relationship between cylinder height (compression ratio) and octane number at standard knock intensity for specific primary reference fuel blends tested at standard or other specified barometric pressure. [D02.01] D2699, D2700

**handling point**, *n*—an indication of the minimum temperature to which an oil should be heated in any part of the suction or delivery line of an oil-handling installation when the installation is operating.

**handling point**, *n*—an indication of the minimum temperature to which an oil should be heated in any part of the suction or delivery line of an oil-handling installation when the installation is operating. If the storage tank does not contain an outflow heater, this temperature is necessarily the minimum oil storage temperature. [D02.07] D3245

<sup>3</sup> Prosen, E. J., "Experimental Thermochemistry." F. D. Rossini, editor, Interscience Publishers, 1956, pp. 129–148. Reliable values for heats of combustion of pure compounds are given in National Bureau of Standards *Circular C-461*, "Selected Values of Properties of Hydrocarbons" (U.S. Government Printing Office, Washington, DC, 1947) and in F. D. Rossini, et al., "Selected Values of Physical and Thermodynamic Properties of Hydrocarbons and Related Compounds," Carnegie Press, Pittsburgh, PA, 1953. These compilations were prepared by F. D. Rossini, et al, as part of American Petroleum Institute Research Project 44.

<sup>4</sup> Wissmann, D., "Latest Improvements on Using Polarized X-Ray Excitation EDXRF for the Analysis of Low Sulfur Content in Automotive Fuel," *Journal of ASTM International*, Vol 2, Issue 9, Paper ID JAI12975, October 2005. Visit the ASTM website, [www.astm.org](http://www.astm.org), Books & Journals.



**hard carbon, *n***—see **non-graphitizable carbon**. [D02.F0] C709

**hardness, *n***—of an elastomer, the resistance to deformation or indentation.

DISCUSSION—In this test method the hardness of an elastomer is measured with a Shore Durometer A (see Test Method D2240).

[D02.G0] D4289

**hardness, *n***—resistance to permanent deformation or indentation.

**hardness, *n***—the resistance of a material to deformation, particularly permanent deformation, indentation, or scratching. [D02.F0] C709

**headspace, *n***—the unfilled capacity of an ampule that allows for physical expansion due to temperature and pressure changes of the filled material while maintaining the integrity of the package. [D02.04] D6596

**heavy distillate, *n***—a fuel produced from the distillation of crude oil which has a kinematic viscosity at 40°C between 5.5 and 24.0 mm<sup>2</sup>/s, inclusive. [D02.E0] D6021

**heavy distillate, *n***—in the petroleum industry, a distillate whose entire boiling range lies above about 350°C (about 660°F) atmospheric equivalent temperature (AET), and excludes residual bottoms.

DISCUSSION—Heavy distillates are usually obtained from vacuum distillation as the temperatures required for distillation under atmospheric pressures are often high enough to initiate cracking or thermal degradation. For comparison, the temperatures in the vacuum distillation have to be converted to what they would have been under atmospheric conditions as atmospheric equivalent temperatures (AET).

**heavy distillate/residual fuel oil blend, *n***—a blend of heavy distillate and residual fuel oil having a viscosity at 40°C between 5.5 and 24.0 mm<sup>2</sup>/s, inclusive. [D02.E0] D6021

**heavy duty, *adj***—in internal combustion engine operation, characterized by average speeds, power output, and internal temperatures that are close to the potential maximums. [D02.B0] D4485, D5862, D5967, D7156

**heavy-duty engine, *n***—in internal combustion engines, one that is designed to allow operation continuously at or close to its peak output. [D02.B0] D5862, D5967, D6750, D7156

**heavy-duty engine, *n***—in internal combustion engine types, one that is designed to allow operation continuous at or close to its peak output.

DISCUSSION—This type of engine is typically installed in large trucks and buses as well as farm, industrial, and construction equipment.

[D02.B0] D4485

**heavy scum, *n***—assessment that the fuel/water interface is covered with more than 50% scum that extends into either of the two layers or forms an emulsion (1 mL or greater in volume), or both. [D02.14] D 7451.

**Henry's Law, *n***—the principle that the mass of a gas dissolved in a liquid is proportional to the pressure of the gas above the liquid.

**Henry's Law, *n***—the principle that the ratio of partial pressure to mole fraction of gas in solution is a constant.

DISCUSSION—In non-ideal systems the fugacity is used to replace the pressure, but the systems within the scope of this test method can be considered ideal within the limits of the accuracy statement.

[D02.11] D2779

**Hertzian contact area, *n***—the apparent area of contact between two nonconforming solid bodies pressed against each other, as calculated from Hertz' equations of elastic deformation. [D02.G0] D5706, [D02.L0] D6425, [G02] G40

**Hertzian contact area, *n***—apparent area of contact between two nonconforming solid bodies pressed against each other, as calculated from Hertz's equations of elastic deformation published in 1881. [D02.L0] D7421

**Hertzian contact pressure, *n***—the magnitude of the pressure at any specified location in a Hertzian contact area, as calculated from Hertz' equations of elastic deformation. [D02.G0] D5706, [G02] G40

**Hertzian contact pressure, *n***—magnitude of the pressure at any specified location in a Hertzian contact area, as calculated from Hertz's equations of elastic deformation. The Hertzian contact pressure can also be calculated and reported as maximum value  $P_{\max}$  in the centre of the contact or as  $P_{\text{average}}$  as average over the total contact area. [D02.L0] D7421

**Hertz line, *n***—a line of plot on logarithmic paper, where the coordinates are scar diameter in millimetres and applied load in kilograms-force (or newtons), obtained under static conditions. [D02.L0] D2783

**Hertz scar diameter, *n***—the average diameter, in millimetres, of an indentation caused by the deformation of the balls under static load (prior to test). It may be calculated from the equation

$$D_h = 8.73 \times 10^{-2} (P)^{1/3}$$

where:

$D_h$  = Hertz diameter of the contact area, and

$P$  = the static applied load.

[D02.L0] D2783

**homogeneity**—the uniformity of the characteristics of the packaged material across the entire packaging run determined for the purpose of demonstrating the suitability of the batch for its intended purpose.

DISCUSSION—There are two homogeneity testing cases; one in which the material is ampulized as a reference material at the time of ampulization, and one in which the material is not.

(1) *reference material at time of ampulization*—The material to be ampulized is a reference material that has accepted true or consensus values. Ampulization of a reference material would require homogeneity testing in order to assess the variability caused by the ampulization process on the true or consensus values for the reference material.

(2) *not a reference material at time of ampulization*—The material to be ampulized is *not* a reference material at the time of ampulization but is intended to have characterization and assignment of true or consensus values at some future date. Rigid homogeneity testing is not required on such a material at the time of ampulization since the true or consensus values have not yet been determined. However, ampules must be retained at the beginning, middle, and end of the ampulization process. It is recommended that qualitative testing be done on at least one sample from each of the beginning, middle, and end of the ampulization process. The remaining ampules should then be retained

for future homogeneity testing to determine quantitative or consensus values. [D02.04] D6596

**homogeneity**, *n*—the ability of a test oil itself to remain the same in appearance throughout (uniform) after submission to a series of temperature changes. [D02.B0] D6922

**hot-flame reaction**, *n*—a rapid, self-sustaining, luminous, sometimes audible, reaction of the sample or its decomposition products with the atmosphere.

**hot sticking**, *n*—of *piston rings*, a condition in which the ring is stuck in its groove while the engine is running, normally indicated by varnish or other deposits on the outer face of the ring, by signs of blowby on the piston skirt, or both. [D02.B0] D4857

**hot-stuck piston ring**, *n*—in *internal combustion engines*, a piston ring that is stuck when the piston and ring are at room temperature, and inspection shows that it was stuck during engine operation. [D02.B0] D6593, D6984, D7320

DISCUSSION—The portion of the ring that is stuck cannot be moved with moderate finger pressure. A hot-stuck piston ring is characterized by varnish or carbon across some portion of its face, indicating that portion of the ring was not contacting the cylinder wall during engine operation. [D02.B0] D6593, D7320

**hot tack**, *n*—the cohesive strength during the cooling stage before solidification of a heat seal bond formed by a wax-polymer blend. [D02.10] D3706

**house fuel**, *n*—for *engine operation*, a fuel that does not contain metallic additives used for engine warm-up and all non-octane rating engine operation. [D02.J0] D6812

**house fuel**, *n*—for *octane rating*, an unleaded, straight hydrocarbon fuel used for engine warm-up and all non-octane rating testing. [D02.J0] D6424

**HPC**, *n*—heterotrophic plate count [D02.14] D6974

**hydraulic fluid**, *n*—liquid used in hydraulic systems for transmitting power. [D02.N0] D6080

**hydraulic fluid**, *n*—a liquid used in hydraulic systems for lubrication and transmission of power. [D02.N0] D7044

**hydrolytic stability**, *n*—the resistance of a material to permanent changes in properties due to reaction with water.

**ignition delay**, *n*—that period of time, expressed in degrees of crank angle rotation, between the start of fuel injection and the start of combustion. [D02.01] D613

**immediate seizure region**, *n*—that region of the scar-load curve characterized by seizure or welding at the startup or by large wear scars.

DISCUSSION—Under conditions of this test method, the immediate seizure region is shown by line CD. Also, initial deflection of indicating pen on the optional friction-measuring device is larger than with nonseizure loads. [D02.G0] D2596

**IMO**, *n*—International Maritime Organization [D02.E0] D6985

**impervious carbon**, *n*—the same as impervious graphite with the exception that the base stock has not been graphitized. [D02.F0] C709

**impervious graphite**, *n*—manufactured graphite that has been impregnated with a resinous material to make the final article impervious to liquids in the recommended operating range. [D02.F0] C709

**impregnation**, *n*—partial filling of the open pore structure with another material. [D02.F0] C709

**incipient seizure or initial seizure region**, *n*—that region at which, with an applied load, there is a momentary breakdown of the lubricating film.

DISCUSSION—This breakdown is noted by a sudden increase in the measured scar diameter, shown in Fig. 1 as line BC, and a momentary deflection of the indicating pen of the optional friction-measuring device. [D02.G0] D2596

**increment**, *n*—a portion of a material to be combined with other portions of the same material to provide a larger sample which will represent the whole material. [D02.05] D4296

**index of refraction**, *n*—see **refractive index**.

**indicated mean effective pressure**, *n*—for *spark-ignition engines*, the measure of engine power developed in the engine cylinder or combustion chamber. [D02.01] D909

**inductively coupled plasma**, *n*—a high temperature discharge generated by passing an ionizable gas through a magnetic field induced by a radio frequency coil surrounding the tubes that carry the gas. [D02.03] D7111

**inHg**, *n*—inches of mercury [D02.J0] D6812

**inhibition load XX (ILXX)**, *n*—a statistically or graphically estimated loading rate of test material that is expected to cause a XX % inhibition of a biological process (such as growth or reproduction) which has an analog as opposed to a digital measure.

DISCUSSION—An example of a digital measure would be alive or dead. This terminology should be used for hydraulic fluids instead of the standard inhibition concentration (ICXX) when the hydraulic fluid is not completely soluble under test conditions. [D02.N0] D6046

DISCUSSION—An example of a digital measure would be alive/dead. This terminology (ILXX) should be used instead of the standard ICXX when the test material is not completely soluble at the test treat rates. [D02.12] D6081

**inhibition load XX (ILXX)**, *n*—a statistically or graphically estimated loading rate of test material that is expected to cause a XX % inhibition of a biological process (such as growth or reproduction) of a representative subpopulation of organisms under specified conditions and is expressed as an analog as opposed to digital measure.

DISCUSSION—An example of a digital measure would be alive/dead. This terminology (ILXX) should be used instead of the standard ICXX when the test material is not completely soluble at the test treat rates. [D02.12] D6384

**initial boiling point (IBP)**, *n*—the point at which a cumulative volume count equal to 0.5 % of the total volume count under the chromatogram is obtained. [D02.04] D3710

**initial boiling point (IBP)**, *n*—the corrected thermometer reading that is observed at the instant the first drop of condensate falls from the lower end of the condenser tube. [D02.08] D86

**initial boiling point (IBP)**, *n*—corrected temperature reading at the instant of the first detection of condensate in the receiver. [D02.08] D7344

**injection timing (injection advance)**, *n*—that time in the combustion cycle, measured in degrees of crank angle, at

- which fuel injection into the combustion chamber is initiated. [D02.01] D613
- inoculum**, *n*—spores, bacteria, single celled organisms or other live materials that are introduced into a test medium. [D02.N0] D6006, D6046
- inoculum**, *n*—living spores, bacteria, single celled organisms, or other live materials that are introduced into a test medium. [D02.12] D6384
- inorganic sulfate**, *n*—sulfate species present as sulfuric acid, ionic salts of this acid, or mixtures of these.
- DISCUSSION—Specifically in this test method, inorganic sulfate is present as sulfate in ethanol. [D02.03] D7318
- insolubles**, *n*—*in lubricating grease analysis*, the material remaining after the acid hydrolysis, water extraction, and solvent extraction of soap-thickened greases.
- DISCUSSION—Consisting of such products as graphite, molybdenum disulfide, insoluble polymers, and so forth. [D02.G0] D128
- in-statistical-control**, *adj*—process, analytical measurement system, or function that exhibits variations that can only be attributable to common cause. [D02.94] D7372
- instrument response time**, *n*—the time required for an indicating or detecting device to undergo a defined displacement following an abrupt change in the property being measured.
- intake manifold pressure**, *n*—*for supercharged engines*, the positive pressure in the intake manifold. [D02.01] D909
- integrated tester**, *n*—automated, or semi-automated stand alone instrument utilizing multiple technologies to provide diagnostic recommendations (on-site or in-line) for condition monitoring of in-service lubricants. [D02.96] D7416
- intermediate sample**—a sample, representative of a gross sample, upon which no analysis is to be performed, yet required for generation of analysis samples after undergoing further division and reduction. [D02.05] D6969
- intermittent analyzer unit cycle time**—the time interval between successive updates of the analyzer output. [D02.25] D7278
- internal reflux**, *n*—the liquid normally running down inside a distillation column. (Synonym—*reflux*.)
- internal reflux**—the liquid normally running down inside the column.
- DISCUSSION—In the case of an adiabatic column when distilling a pure compound, the internal reflux is constant from top to bottom and is equal to the reflux at the reflux divider. When distilling crude petroleum, the fractionation occurring in the dynamic holdup will cause a temperature gradient to be established with attendant greater amount of internal reflux at the bottom of the column. [D02.08] D2892
- invert emulsion layer**, *n*—interface between the water phase and fuel phase of a fuel water sample which consists of water micelles dispersed in the fuel. [D02.14] D7463
- IP**—abbreviation for Institute of Petroleum.
- isothermal secant bulk modulus**—the product of original fluid volume and the slope of the secant drawn from the origin to any specified point on the plot of pressure versus volume change divided by volume at constant temperature. [D02.11] D6793
- isothermal tangent bulk modulus**—the product of fluid volume at any specified pressure and the partial derivative of fluid pressure with respect to volume at constant temperature. [D02.11] D6793
- isotropic**, *adj*—*in carbon and graphite technology*, having an isotropy ratio of 0.9 to 1.1 for a specific property of interest. [D02.F0] C709
- isotropic nuclear graphite**, *n*—graphite in which the isotropy ratio based on the coefficient of thermal expansion (25–500°C) is 1.00–1.10. [D02.F0] C709
- isotropy ratio**, *n*—*in carbon and graphite technology*, the ratio of a given property value in the against grain direction to its corresponding value in the with grain direction (for example, the ratio of coefficients of thermal expansion). [D02.F0] C709
- jet fuel**, *n*—any liquid suitable for the generation of power by combustion in aircraft gas turbine engines.
- DISCUSSION—Different grades are characterized primarily by volatility ranges and by freezing points.
- kinematic viscosity**, *n*—the ratio of the viscosity to the density of a liquid.
- DISCUSSION—Kinematic viscosity is a measure of the resistance to flow of a liquid under gravity. [D02.N0] D6080
- kinematic viscosity**, *n*—the ratio of the viscosity to the density of a liquid. It is a measure of the resistance of flow of a liquid under gravity. In the SI, the unit of kinematic viscosity is the metre squared per second; for practical use, a submultiple (millimetre squared per second) is more convenient. The centistoke (cSt) is 1 mm<sup>2</sup>/s and is often used. [D02.07] D4741
- kinematic viscosity**, *n*—a measure of the resistance to flow of a fluid under gravity. [D02.07] D7109
- kinematic viscosity ( $\nu$ )**, *n*—the ratio of the dynamic viscosity ( $\eta$ ) to the density ( $\rho$ ) of a liquid.
- DISCUSSION—For gravity flow under a given hydrostatic head, the pressure head of a liquid is proportional to its density ( $\rho$ ). Therefore the kinematic viscosity ( $\nu$ ) is a measure of the resistance to flow of a liquid under gravity. [D02.07] D7042
- kinetic coefficient of friction**, *n*—the coefficient of friction under conditions of macroscopic relative motion between two bodies. [D02.L0] D2714, D3704
- kinetic friction**, *n*—the force that resists motion when a surface is moving with a uniform velocity; it is, therefore, equal and opposite to the force required to maintain sliding of the surface with uniform velocity. [D02.10] D2534
- knock**, *n*—*in a spark ignition engine*, abnormal combustion, often producing audible sound, caused by autoignition of the air/fuel mixture. [D02.01] D2699, D2700, [D02.B0] D6593
- knock**, *n*—*in an aircraft spark-ignition engine*, abnormal combustion caused by autoignition of the air/fuel mixture. [D02.J0] D6424
- knock condition**, *n*—*for octane rating*, when the knock intensity in any cylinder is light knock or greater as described in Annex A1. [D02.J0] D6424
- knock intensity**, *n*—*for knock testing*, a measure of the level of



knock.

[D02.01] D2699, D2700

**knock-limited power curve**, *n*—for supercharge method knock rating, the non-linear standard knock intensity characteristic of a primary reference fuel blend or a sample fuel, expressed as indicated mean effective pressures, over the range of fuel-air ratios from approximately 0.08 to approximately 0.12.

[D02.01] D909

**knock number**, *n*—for octane rating, a numerical quantification of knock intensity.

[D02.J0] D6424

**knockmeter**, *n*—for knock testing, the 0 to 100 division indicating meter that displays the knock intensity signal from the detonation meter.

[D02.01] D2699, D2700

**lag phase**, *n*—the period of diminished physiological activity and cell division following the addition of microorganisms to a new culture medium.

[D02.12] D6139

**lag time**, *n*—time required for material to travel from point A to point B in the total analyzer system (points A and B are user-defined).

[D02.25] D7453

**lamination**, *n*—line of demarcation or elongated void generally parallel to the principal grain direction of a carbon or graphite body.

[D02.F0] C709

**last nonseizure load**, *n*—the last load at which the measured scar diameter is not more than 5 % greater than the compensation value at that load.

DISCUSSION—Shown in Fig. 1 as Point B. [D02.G0] D2596

**lethal load XX (LLXX)**, *n*—a statistically or graphically estimated loading rate of test material that is expected to be lethal to XX % of a group of organisms under specified conditions for a specified time.

DISCUSSION—This terminology should be used for hydraulic fluids instead of the standard lethal concentration (LCXX) when the hydraulic fluid is not completely soluble under test conditions.

[D02.N0]

D6046

**lethal load XX (LLXX)**, *n*—a statistically or graphically estimated loading rate of test material that is expected to be lethal to XX % of a representative subpopulation of organisms under specified conditions.

DISCUSSION—This terminology should be used instead of the standard LCXX when the material is not completely soluble at the test treat rates.

[D02.12] D6081

**lethal load XX (LLXX)**, *n*—a statistically or graphically estimated loading rate of test material that is expected to be lethal to XX % of a subpopulation of organisms under specified conditions.

DISCUSSION—This terminology should be used for lubricants instead of the standard LCXX to designate that the material is not completely soluble at the test treat rates.

[D02.12] D6384

**light distillate**, *n*—in the petroleum industry, a distillate whose entire boiling range is below about 250°C (about 480°F).

DISCUSSION—Light distillates, such as naphtha or gasoline-range components, will have flash points at or below about 35°C (about 95°F), and thus can present greater hazards during storage and handling than materials with higher flash points, such as middle and heavy distillates.

DISCUSSION—Light distillate shall not be used to mean *light* middle

distillate. (See **middle distillate**.)

**light-duty**, *adj*—in internal combustion engine operation, characterized by average speeds, power output, and internal temperatures that are generally much lower than the potential maximums.

[D02.B0] D4485, D5966

**light-duty engine**, *n*—in internal combustion engine types, one that is designed to be normally operated at substantially less than its peak output.

[D02.B0] D4485, D5966

DISCUSSION—This type of engine is typically installed in automobiles and small trucks, vans, and buses.

[D02.B0] D4485

**line sample**, *n*—process material that can be safely withdrawn from a sample port and associated facilities located anywhere in the total analyzer system without significantly altering the property of interest.

[D02.25] D7453

**linear thermal expansion**—the change in length per unit length resulting from a temperature change. Linear thermal expansion is symbolically represented by  $\Delta L/L_0$ , where  $\Delta L$  is the length change of the specimen ( $L_1 - L_0$ ),  $L_0$  and  $L_1$  are the specimens lengths at reference temperature  $T_0$  and test temperature  $T_1$ , respectively. Linear thermal expansion is often expressed as a percentage or in parts per million (such as  $\mu\text{m/m}$ ).

[D02.05] D6745

**linearly mixable**, *adj*—a property is deemed to be linearly mixable in a mass or volume measurement unit if the property of the mixed material can be calculated from the quantities and properties of the materials used to produce the mixture.

DISCUSSION—The general equations describing this linearly mixable attribute are as follows:

$$P_{MIXED} = \frac{A_1 \cdot P_1 + A_2 \cdot P_2 + A_3 \cdot P_3 + A_4 \cdot P_4 + \dots + A_N \cdot P_N}{A_1 + A_2 + A_3 + A_4 + \dots + A_N}$$

$$A_{MIXED} = A_1 + A_2 + A_3 + A_4 + \dots + A_N$$

where:

$A_N$  = quantity of material N,  
 $P_N$  = property of material N,  
 $P_{MIXED}$  = property of mixed material, and  
 $A_{MIXED}$  = quantity of mixed material.

DISCUSSION—The material being mixed can be from the same process stream over time.

[D02.25] D6624

**liquefied petroleum gas (LPG)**, *n*—a mixture of normally gaseous hydrocarbons, predominantly propane or butane or both, that has been liquefied by compression or cooling, or both, to facilitate storage, transport, and handling.

**liquefied petroleum gases (LPG)**, *n*—narrow boiling range hydrocarbon mixtures, consisting mainly of propane or propylene, or both (**Warning**—Extremely flammable. Harmful if inhaled), butanes and butylenes, or both; in which the concentration of hydrocarbon compounds with boiling point greater than 0°C is less than 5 % by liquid volume, and whose vapor pressure at 37.8°C (100°F) is not greater than 1550 kPa.

[D02.08] D6897

**liquid**, *adj*—describing a state of matter that shows free flow and has a definite volume and indefinite shape, as determined by its container.

**DISCUSSION**—Sometimes a liquid is called a fluid, as in hydraulic fluid, a liquid.

**DISCUSSION**—A quantity of solid particles, powders, or pellets, for example, fluidized catalyst beds, can also flow like a liquid in the presence of an applied force. The state of the individual particles, nevertheless, remains as a solid.

**liquid, n**—substance (matter) in a liquid state (see **liquid, adj.**)

**load-carrying capacity, n**—of a lubricating grease, the maximum load or pressure that can be sustained by a lubricating grease without failure of the sliding contact surfaces as evidenced by seizure or welding. **[D02.G0] D2509**

**load-wear index** (or the load-carrying property of a lubricant), *n*—an index of the ability of a lubricant to minimize wear at applied loads. Under the conditions of this test, specific loadings in kilograms-force (or newtons) having intervals of approximately 0.1 logarithmic units, are applied to the three stationary balls for ten runs prior to welding. The load-wear index is the average of the sum of the corrected loads determined for the ten applied loads immediately preceding the weld pair. **[D02.L0] D2783**

**load-wear index, n**—an index of the ability of a lubricant to prevent wear at applied loads. (Synonym—*load-carrying property of a lubricant.*)

**loading rate, n**—the ratio of test material to aqueous medium used in the preparation of a water accommodated fraction (WAF) and in interpretation of the results of a toxicity study with a poorly water soluble lubricant or lubricant component. **[D02.N0] D6046**

**loading rate, n**—the ratio of test material to aqueous medium used in the preparation of WAF, WSF, or mechanical dispersion and in the interpretation of the results of a toxicity study with a poorly water-soluble lubricant or lubricant component. **[D02.12] D6081**

**log phase, n**—the period of growth of microorganisms during which cells divide at a positive constant rate. **[D02.12] D6139**

**longitudinal sonic pulse, n**—a sonic pulse in which the displacements are in the direction of propagation of the pulse. **[D02.F0] C709**

**long-term storage, n**—storage of fuel for longer than 12 months after it is received by the user. **[D02.E0] D6985**

**lot, n**—a definite quantity of a product or material accumulated under conditions that are considered uniform for sampling purposes. **[D02.94] D6299, [E11] E456**

**lot**—a quantity of calcined petroleum coke to be represented by a gross sample. **[D02.05] D6969**

**low resolution nuclear magnetic resonance (NMR) spectroscopy, n**—a form of NMR spectroscopy using a simple NMR analyzer that employs a low magnetic field and consequentially low NMR frequency. An example is proton NMR below 60 MHz. Resolution is expressed as time at half height of signal and is typically 1 millisecond (ms) or less. **[D02.03] D7171**

**low-temperature torque, n**—the torque in g-cm required to restrain the outer ring of a No. 6204 size open ball bearing lubricated with the test grease while the inner ring is rotated at  $1 \pm 0.05$  r/min at the test temperature. **[D02.G0.05] D1478**

**low-volume connector, n**—a special union for connecting two

lengths of tubing 1.6-mm inside diameter and smaller; sometimes referred to as a zero dead-volume union.

**[D02.04] D7059**

**LPG**—abbreviation for liquefied petroleum gas.

**LTMS, n**—Lubricant Test Monitoring System

**DISCUSSION**—An analytical system in which ASTM calibration test data are used to manage lubricant engine test precision. **[D02.B0] D6709**

**lubricant, n**—any material interposed between two surfaces that reduces the friction or wear between them. **[D02.G0] D1831**

**lubricant, n**—any material interposed between two surfaces that reduces the friction or wear, or both, between them. **[D02.B0] D5862, D6837, D6984, D7320**

**lubricant, n**—any material interposed between two surfaces that reduces friction or wear between them.

**DISCUSSION**—In this test method, the lubricant is an oil which may or may not contain additives such as foam inhibitors. **[D02.12] D6082**

**lubricant, n**—in manual transmission and final drive axles, lubricating oil. **[D02.B0] D5704**

**lubricant base stock, n**—a liquid that may be used alone as a lubricant, but normally is used as a major ingredient in formulated lubricants.

**lubricant test monitoring system (LTMS), n**—an analytical system in which ASTM calibration test data are used to manage lubricant test precision and severity (bias). **[D02.B0] D6984, D7320**

**LTMS date, n**—the date the test was completed unless a different date is assigned by the TMC. **[D02.B0] D6984, D7320**

**LTMS time, n**—the time the test was completed unless a different time is assigned by the TMC. **[D02.B0] D6984, D7320**

**lubricating grease, n**—a semi-fluid to solid product of a thickener in a liquid lubricant. **[D02.G0] D4049**

**DISCUSSION**—The dispersion of the thickener forms a two-phase system and immobilizes the liquid lubricant by surface tension and other physical forces. Other ingredients are commonly included to impart special properties. **[D02.G0.06] D6138**

**lubricating grease, n**—a semi-fluid to solid product of a dispersion of a thickener in a liquid lubricant. **[D02.G0] D128, D217, D1831, D7342**

**DISCUSSION**—The qualifying term, lubricating, should always be used. The term, grease, used without the qualifier refers to a different product, namely certain natural or processed animal fats, such as tallow, lard, and so forth. **[D02.G0] D128**

**DISCUSSION**—The dispersion of the thickener forms a two-phase system and immobilizes the liquid lubricant by surface tension and other physical forces. Other ingredients are commonly included to impart special properties. **[D02.G0] D217, D1831, D2265, D7342**

**lubricating oil, n**—a liquid lubricant, usually comprising several ingredients, including a major portion of base oil and minor portions of various additives. **[D02.B0] D5966, D6750, D6984, D7320**

**lubricity**, *n*—a qualitative term describing the ability of a lubricant to minimize friction between and damage to surfaces in relative motion under load. [D02.B0] **D4857, D4863**

**luciferase**, *n*—general term for a class of enzymes that catalyze bioluminescent reactions. [D02.14] **D7463**

**luciferin**, *n*—general term for a class of light-emitting biological pigments found in organisms capable of bioluminescence. [D02.14] **D7463**

**lugging**, *adj*—*in internal combustion engine operation*, characterized by a combined mode of relatively low-speed and high-power output. [D02.B0] **D4485**

**luminometer**, *n*—instrument capable of measuring light emitted as a result of non-thermal excitation. [D02.14] **D7463**

**luminometer number**, *n*—a measure of the flame temperature in a wick lamp burning the candidate material as fuel at a specified flame radiation level in the green-yellow band of the visible spectrum.

**machinability**, *n*—a measure of the ease with which a material can be shaped with the aid of cutting or abrasive tools. [D02.F0] **C709**

**machinery health**, *n*—qualitative expression of the operational status of a machine subcomponent, component, or entire machine, used to communicate maintenance and operational recommendations or requirements in order to continue operation, schedule maintenance, or take immediate maintenance action.

**manufactured carbon**, *n*—a bonded granular carbon body whose matrix has been subjected to a temperature typically between 900 and 2400°C. [D02.F0] **C709**

**manufactured graphite**, *n*—a bonded granular carbon body whose matrix has been subjected to a temperature typically in excess of 2400°C and whose matrix is thermally stable below that temperature. [D02.F0] **C709**

**MAP**, *n*—manifold absolute pressure [D02.J0] **D6812**

**MAT**, *n*—manifold absolute temperature [D02.J0] **D6812**

**material safety data sheet, (MSDS)**, *n*—a fact sheet summarizing information about material identification; hazardous ingredients; health, physical, and fire hazards; first aid; chemical reactivities and incompatibilities; spill, leak, and disposal procedures; and protective measures required for safe handling and storage. [D02.B0] **D6984, D7320**

**maximum fill density (reduced fill density)**—the volume of a container occupied by the sample, usually expressed as a percentage of the total capacity. [D02.H0] **D3700**

**maximum pore diameter**, *n*—*in gas diffusion*, the diameter of a capillary of circular cross section which is equivalent (with respect to surface tension effects) to the largest pore of the diffuser under consideration.

DISCUSSION—The pore dimension is expressed in micrometres in this test method. [D02.06] **D892**

**maximum pore diameter**, *n*—*in gas diffusion*, the diameter of a capillary of circular cross-section which is equivalent (with respect to surface tension effects) to the largest pore of the diffuser under consideration. The pore dimension is expressed in micrometers (µm). [D02.06] **D6082**

**MEA**, *n*—malt extract agar [D02.14] **D6974**

**mean coefficient of linear thermal expansion (CTE)**—the linear thermal expansion per change in temperature; the mean coefficient of linear thermal expansion is represented by:

$$\bar{\alpha}_{T_1} = \frac{\Delta L/L_0}{\Delta T} = \frac{1}{L_0} \cdot \frac{\Delta L}{\Delta T} = \frac{1}{L_0} \frac{L_1 - L_0}{T_1 - T_0}$$

DISCUSSION—This has to be accompanied by the values of the two temperatures to be meaningful; the reference temperature ( $T_0$ ) is 20°C, and the notation may then only contain a single number, such as  $\bar{\alpha}_{200}$ , meaning the mean coefficient of linear thermal expansion between 20 and 200°C. [D02.05] **D6745**

**mean effective pressure**, *n*—for internal-combustion engines, the steady state pressure which, if applied to the piston during the expansion stroke is a function of the measured power.<sup>5</sup> [D02.01] **D909**

**mean square**, *n*—*in analysis of variance*, a contraction of the expression “mean of the squared deviations from the appropriate average(s)” where the divisor of each sum of squares is the appropriate degrees of freedom. [D02.94] **D6300, D113, D123**

**measurand**, *n*—the measurable quantity subject to measurement. [D02.94] **D6792**

**mechanical dispersion**, *n*—a mixture produced by the application of mechanical shearing forces to a multi-phase system, one component of which is water, so as to distribute one or more of the materials uniformly throughout the mass of the water with the water existing as a continuous phase. [D02.N0] **D6046**

**mechanical dispersion**, *n*—a low energy aqueous medium produced by continuous stirring of the test solution and containing both dissolved and undissolved components of the test material. [D02.12] **D6081**

**melting point (cooling curve) of petroleum wax**, *n*—temperature at which melted petroleum wax first shows a minimum rate of temperature change when allowed to cool under prescribed conditions.

NOTE 1—The so-called “American Melting Point” is arbitrarily 1.65°C (3°F) above the Melting Point (Cooling Curve) of Petroleum Wax. [D02.10] **D87**

**membrane color**, *n*—a visual rating of particulates on a filter membrane against ASTM Color Standards. [D02.J0] **D2276**

**membrane filter**, *n*—a porous article of closely controlled pore size through which a liquid is passed to separate matter in suspension.

DISCUSSION—D02-1012<sup>6</sup> contains information on membrane filters that meet the requirements therein. [D02.J0] **D2276, D5452**

**membrane filter**, *n*—a thin medium of closely controlled pore size through which a liquid is passed and on which particulate matter in suspension is retained. [D02.14] **D6217**

<sup>5</sup> Supporting data (derivation of equations) have been filed at ASTM International Headquarters and may be obtained by requesting Research Report D02-1346.

<sup>6</sup> Supporting data (and a list of suppliers who have provided data indicating their membranes, field monitors, and field monitor castings) have been filed at ASTM International Headquarters and may be obtained by requesting Research Report D02-1012.



**metabolite**, *n*—a chemical substance produced by any of the many complex chemical and physical processes involved in the maintenance of life. [D02.14] D6469

**metallic compounds**—metals may be present as metallic compounds in the fuel as a natural result of the composition of the crude oil and of the refining process. However, unless special precautions are taken, additional metallic compounds can be acquired during distribution and storage. A commercial product pipeline may contain residues of lead-containing gasoline that would then be dissolved by the gas turbine fuel. Tank trucks, railroad tankcars, barges, and tankers may be inadequately cleaned and contain residues of past cargos. Acidic components in saline water salts in the fuel may react with distribution and storage equipment. [D02.E0] D4418

**methanol**, *n*—methyl alcohol, the chemical compound  $\text{CH}_3\text{OH}$ . [D02.A0] D5797, D5798, D5983

**methyl tertiary-butyl ether (MTBE)**, *n*—the chemical compound  $(\text{CH}_3)_3\text{COCH}_2[\text{C}_5\text{H}_{12}\text{O}]$ . [D02.A0] D5983

**MF**, *n*—membrane filter [D02.14] D6974

**microbial activity test**, *n*—any analytical procedure designed to measure the rate or results of one or more microorganism processes.

DISCUSSION—Examples of microbial activity tests include loss or appearance of specific molecules or measuring the rate of change of parameters, such as acid number, molecular weight distribution (carbon number distribution), and specific gravity. [D02.14] D6469

**microbial degradation**, *n*—(Synonym—**biodegradation**.) [D02.12] D6384

**microbial slimes**—may result when conditions are conducive to the growth of microorganisms that are always present. The presence of free water is essential to the growth of many of these microorganisms that grow in tank water bottoms and feed on nutrients in the water or on the hydrocarbons. [D02.E0] D4418

**microbially induced corrosion (MIC)**, *n*—corrosion that is enhanced by the action of microorganisms in the local environment. [D02.14] D6469

**micro separator rating (MSEP)**, *n*—a numerical value indicating the ease of separating emulsified water from a sample by coalescence.

DISCUSSION—This test method uses the same instrument, Micro-Separator, that is used in Test Method D3948. As in Test Method D3948, the MSEP ratings are only valid within the range of 50 to 100. Ratings at the upper end of the range indicate a clean fuel with little or no contamination by surfactants. Thus a fuel with a high MSEP rating is expected to show good water-separating properties when passed through a filter-separator (coalescing-type filter) in actual service. [D02.95] D4175

**Micro-Separator rating (DSEP rating)**, *n*—a numerical value indicating the ease of separating emulsified water from fuel by coalescence as affected by the presence of surface active materials (surfactants) in the fuel. [D02.14] D7261

**micro-separator rating (MSEP rating)**, *n*—a numerical value indicating the ease of separating emulsified water from fuel by coalescence as affected by the presence of surface active materials (surfactants) in the fuel.

DISCUSSION—This test method uses the same instrument, Micro-Separator, that is used in Test Method D3948. As in Test Method D3948, the MSEP ratings are only valid within the range of 50 to 100. Ratings at the upper end of the range indicate a clean fuel with little or no contamination by surfactants. Thus a fuel with a high MSEP rating is expected to show good water-separating properties when passed through a filter-separator (coalescing-type filter) in actual service. [D02.J0] D7224

**middle distillate**, *n*—a generic refinery/supplier term that usually denotes a fuel primarily intended for use in compression ignition/diesel engine applications, and also in non-aviation gas turbine engines and other non-automotive applications such as a burner fuel. [D02.E0] D6985

**middle distillate**, *n*—*in the petroleum industry*, a distillate whose boiling range lies between about 150°C and about 370°C (about 300°F and about 700°F).

DISCUSSION—Typical middle distillates, such as diesel fuels, kerosine, aviation turbine fuels (Jet A and Jet A-1) and home heating oils, will have flash points above 38°C (100°F). The 10 % to 90 % boiling temperatures will tend to lie between about 200°C and 350°C (about 400°F and 660°F).

DISCUSSION—The term *light* middle distillate has been used to indicate products like kerosine and aviation turbine fuel (Jet A and Jet A-1) that are at the lighter end of the middle distillate distillation range of about 150°C to about 300°C (about 300°F to about 570°F).

DISCUSSION—The term distillate is sometimes used to mean middle distillate. This practice is discouraged.

**middle distillate fuel**, *n*—kerosines and gas oils boiling between approximately 150°C and 400°C at normal atmospheric pressure and having a closed-cup flash point above 38°C. [D02.E0] D6751

**miscibility**, *n*—the ability of a reference oil and test oil to form a uniform mixture after blending and not separate into two phases after submission to a series of temperature changes. [D02.B0] D6922

**mixed aniline point**, *n*—the minimum equilibrium solution temperature of a mixture of two volumes of aniline (aminobenzene), one volume of sample, and one volume of *n*-heptane of specified purity.

**mixed aniline point**, *n*—the minimum equilibrium solution temperature of a mixture of two volumes of aniline, one volume of sample, and one volume of *n*-heptane of specified purity. [D02.04] D611

**mixed base**, *adj*—*in lubricating grease*, the description of a thickener system composed of soaps of two metals.

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DISCUSSION—Although mixed-base grease can be made with soaps of more than two metals, in practice, such is rarely, if ever, encountered. All of the soaps need not be thickeners, although the major soap constituent will be one capable of forming a lubricating grease structure. Because the mixed soaps are seldom present in equal amounts. The predominant soap is referred to first.

#### NLGI Lubricating Grease Guide, [D02.G0] D128

**mixed liquor**, *n*—*in sewage treatment*, the contents of an aeration tank including the activated sludge mixed with primary effluent or the raw wastewater and return sludge. [D02.12] D6139, D6384

**mmHg**, *n*—millimetres of mercury [D02.J0] D6812

**mold**, *n*—form of fungal growth, characterized by long strands

of filaments (hyphae) and, under appropriate growth conditions, aerial, spore-bearing structures.

DISCUSSION—In fluids, mold colonies typically appear as soft spheres; termed *fisheyes*. [D02.14] D6469

**molded**, *v*—formed in a closed die by the application of external pressure. [D02.F0] C709

**MON**—*in gasoline knock testing*, abbreviation for Motor octane number.

**monitor**, *n*—something that reminds or warns.

DISCUSSION—A plastic holder for a membrane filter held in a field sampling apparatus. [D02.J0] D2276

**montan wax**, *n*—a wax-like material comprised primarily of montanic acid and its ester, higher aliphatic alcohols, and resins obtained from the solvent extraction of lignite. [D02.G0] D128

**motor octane number**, *n*—*for spark-ignition engine fuel*, the numerical rating of knock resistance obtained by comparison of its knock intensity with that of primary reference fuels when both are tested in a standardized CFR engine operating under the conditions specified in this test method. [D02.01] D2700

**motor octane number of primary reference fuels above 100**, *n*—determined in terms of the number of millilitres of tetraethyl lead in *isooctane*. [D02.J0] D6424

**motor octane number of primary reference fuels from 0 to 100**, *n*—the volume % of *isooctane* (equals 100.0) in a blend with *n*-heptane (equals 0.0). [D02.J0] D6424

**motoring**, *n*—*for the CFR engine*, operation of the CFR engine without fuel and with the ignition shut off. [D02.01] D2699, D2700

**MTBE**—abbreviation for methyl *tert*-butyl ether.

**μ (Greek letter Mu)**—*in statistics*, symbol for true value.

**multiple headspace extraction**, *n*—a technique to determine the total concentration of a gas trapped in a liquid by analysis of successive gas extractions from the vapor space of a closed vessel containing a known amount of the sample. [D02.E0] D6021

**multivariate calibration**, *n*—a process for creating a calibration model in which multivariate mathematics is applied to correlate the absorbances measured for a set of calibration samples to reference component concentrations or property values for the set of samples.

DISCUSSION—The resultant multivariate calibration model is applied to the analysis of spectra of unknown samples to provide an estimate of the component concentration or property values for the unknown sample.

DISCUSSION—Included in the multivariate calibration algorithms are Partial Least Squares, Multilinear Regression, and Classical Least Squares Peak Fitting. [D02.04] D5845, D6277

**multivariate calibration**, *n*—process for creating a model that relates component concentrations or properties to the absorbances of a set of known reference samples at more than one wavelength or frequency.

DISCUSSION—The resultant multivariate calibration model is applied to the analysis of spectra of unknown samples to provide an estimate of

the component concentration or property values for the unknown sample.

DISCUSSION—The multivariate calibration algorithm employed in this test method is partial least square (PLS) as defined in Practices E1655. [D02.04.0F] D7371

**natural graphite**, *n*—*in carbon and graphite technology*, a material consisting predominantly of graphitic carbon, which forms in the earth's crust as the result of igneous or metamorphic processes acting on carbonaceous materials.

DISCUSSION—The degree of crystalline perfection in these materials may vary. Natural graphite may contain significant quantities of gangue materials, either attached to or intercalated with graphitic carbon. [D02.F0] C709

**naturally aspirated aircraft engine**, *n*—aircraft piston engine that breathes without forced means from either turbochargers or superchargers. [D02.J0] D6424

**near-isotropic nuclear graphite**, *n*—graphite in which the isotropy based on the coefficient of thermal expansion (25–500°C) is 1.10–1.15. [D02.F0] C709

**net heat of combustion**,  $Q_n$  (MJ/kg), *n*—the quantity of energy released when a unit mass of fuel is burned at constant pressure, with all of the products, including water, being gaseous.

DISCUSSION—The fuel can be either liquid or solid, and contain only the elements carbon, hydrogen, oxygen, nitrogen, and sulfur. The products of combustion, in oxygen, are carbon dioxide, nitrogen oxides, sulfur dioxide, and water, all in the gaseous state. In this procedure, the combustion takes place at a constant pressure of 0.1012 MPa (1 atm), and 25°C is the initial temperature of the fuel and the oxygen, and the final temperature of the products of combustion. [D02.05] D240

**net heat of combustion**—expressed as megajoules per kilogram. The net heat of combustion at constant pressure of a liquid or a solid fuel containing only the elements carbon, hydrogen, oxygen, nitrogen, and sulfur is the quantity of heat liberated when a unit mass of the fuel is burned in oxygen at a constant pressure of 0.101 MPa (1 atm), the products of combustion being carbon dioxide, nitrogen, sulfur dioxide, and water, all in the gaseous state, with the initial temperature of the fuel and the oxygen and the final temperature of the products of combustion at 25°C. The net heat of combustion<sup>5,7</sup> is represented by the symbol  $Q_n$  and is related to the gross heat of combustion by the following equation:

$$Q_n (\text{net}, 25^\circ\text{C}) = Q_g (\text{gross}, 25^\circ\text{C}) - 0.2122 \times H$$

where:

$Q_n$  (net, 25°C) = net heat of combustion at constant pressure, MJ/kg,

$Q_g$  (gross, 25°C) = gross heat of combustion at constant volume, MJ/kg, and

$H$  = mass % of hydrogen in the sample.

[D02.05] D4809

**Newtonian flow**, *n*—a Newtonian liquid is one that flows immediately on application of even the smallest force, and for which the rate of flow is directly proportional to the force

<sup>7</sup> See Jessup, R. S., "Precise Measurement of Heat of Combustion with a Bomb Calorimeter," *NBS Monograph 7*, U.S. Government Printing Office.

applied. [D02.L0] D5620  
**Newtonian fluid, *n***—a fluid that at a given temperature exhibits a constant viscosity at all shear rates or shear stresses. [D02.N0] D6080

**Newtonian oil or fluid, *n***—an oil or fluid that at a given temperature exhibits a constant viscosity at all shear rates or shear stresses. [D02.07] D3829, D4683, D4684, D4741, D6616

**NIST, *n***—acronym for National Institute of Standards and Technology.

**NLGI, *n***—National Lubricating Grease Institute [D02.G0] D128

**NLGI number, *n***—a numerical scale for classifying the consistency range of lubricating greases and based on the Test Method D217 worked penetration.

**NLGI Lubricating Grease Guide, [D02.G0] D128**

**no-flow point, *n***—the temperature corresponding to a specified degree of blockage of a screen by separated solids.

**no-knock condition, *n***—for *octane rating*, where the knock intensity in all cylinders is less than light knock. Refer to Annex A1 for description of knock intensity. [D02.J0] D6812

**nominal filtration rating, *n***—(Deprecated term) an arbitrary micrometre value for a filter medium indicated by a filter manufacturer.

**nominal filtration rating, *n***—an arbitrary micrometre value indicated by a filter manufacturer. Due to lack of reproducibility this rating is deprecated. [D02.N0] D4174, ANSI B93.2

**nominal geometric surface area**—exposed area (*A*) of the test specimen determined by measuring its diameter (*D*) and height (*H*) before testing and using the formula:

$$A = 2\pi D^2/4 + \pi DH \quad (3)$$

The units of nominal geometric surface area are m<sup>2</sup>. [D02.F0] D7542

**nonaromatics fraction, *n***—portion of the sample eluted with *n*-pentane. The nonaromatics fraction is a mixture of paraffinic and naphthenic hydrocarbons if sample is a straight-run material. If the sample is a cracked stock, the nonaromatics fraction will also contain aliphatic and cyclic olefins. [D02.12] D7373

**noncombustive reaction, *n***—a reaction other than combustion or thermal degradation undergone by certain materials upon exposure to elevated temperatures.

**non-compounded engine oil, *n***—a lubricating oil having a viscosity within the range of viscosities of oils normally used in engines, and that may contain anti-foam agents or pour depressants, or both, but not other additives. [D02.B0] D6709, D6984, D7320

**DISCUSSION**—In this test method noncompounded oil is also known as build-up oil. [D02.B0] D6709

**non-graphitizable carbon, *n***—in *carbon and graphite technology*, a carbon which cannot be transformed into graphitic carbon solely by heat treatment up to 3000°C under inert atmosphere or reduced pressure (also known as a hard carbon). [D02.F0] C709

**non-Newtonian flow, *n***—a non-Newtonian liquid is one whose viscosity depends on the rate of shear. Some will not flow until the force applied is greater than a definite value called the yield point. [D02.L0] D5620

**non-Newtonian oil or fluid, *n***—an oil or fluid that at a given temperature exhibits a viscosity that varies with changing shear stress or shear rate. [D02.07] D3829, D4683, D4684, D6616

**non-Newtonian oil or fluid, *n***—an oil or fluid that exhibits a viscosity that varies with changing shear stress or shear rate. [D02.07] D4741

**non-reference oil, *n***—any oil other than a reference oil, such as a research formulation, commercial oil, or candidate oil. [D02.B0] D5862, D6483, D6594, D6750, D6794, D6795, D6837, D6984, D7156, D7320

**non-soap thickener (synthetic thickener, inorganic thickener, organic thickener), *n***—in *lubricating grease*, any of several specially treated or synthetic materials, excepting metallic soaps, that can be thermally or mechanically dispersed in liquid lubricants to form the lubricating grease structure. NLGI, [D02.G0] D128

**non-standard test, *n***—a test that is not conducted in conformance with the requirements in the standard test method, such as running on an uncalibrated test stand, using different test equipment, applying different equipment assembly procedures, or using modified operating conditions. [D02.B0] D5967, D6709, D7156

**normal distribution, *n***—the distribution that has the probability function:

$$f(\chi) = (1/\sigma)(2\pi)^{-1/2}\exp[-(\chi-\mu)^2/2\sigma^2]$$

where:

$\chi$  = a random variate,

$\mu$  = the mean distribution, and

$\sigma$  = the standard deviation of the distribution.

(Synonym—*Gaussian distribution, law of error.*)

[D02.94] D6300, [D13] D123

**nuclear magnetic resonance (NMR) spectroscopy, *n***—that form of spectroscopy concerned with radio-frequency-induced transitions between magnetic energy levels of atomic nuclei. [D02.03] D7171

**obligate aerobic, *n***—microorganism with an absolute requirement for atmospheric oxygen in order to function.

**DISCUSSION**—Obligate aerobes may survive periods in anoxic environments but will remain dormant until sufficient oxygen is present to support their activity. [D02.14] D6469

**obligate anaerobe, *n***—microorganism that cannot function when atmospheric oxygen is present.

**DISCUSSION**—Obligate anaerobes may survive periods in oxic environments but remain dormant until conditions become anoxic. [D02.14] D6469

**observed dropping point, *n***—the value noted on the thermometer monitoring the internal temperature of the grease test cup when the first drop of material falls from the test cup and reaches the bottom of the test tube. [D02.G0] D2265

**octane number, *n***—for *spark ignition engine fuel*, any one of several numerical indicators of resistance to knock obtained



by comparison with reference fuels in standardized engine or vehicle tests. [D02.01] D2699, D2700, D2885

DISCUSSION—In the context of this test method, octane number is understood to mean the numerical indicator of knock obtained by comparison with primary reference fuels in a standardized CFR engine operating under conditions specified in either the Research, Test Method D2699 or Motor, Test Method D2700, standards. [D02.01] D2885

*research octane number, n*—for spark-ignition engine fuel, the numerical rating of knock resistance obtained by comparison of its knock intensity with that of primary reference fuel blends when both are tested in a standardized CFR engine operating under the conditions specified in this test method. [D02.01] D2699

**odor, n**—of a wax, the numerical rating corresponding to the odor scale description that best fits the sample being tested. [D02.10] D1833

**oil separation, n**—the appearance of a liquid fraction from an otherwise homogeneous lubricating composition. [D02.G0] D1742

**open cell, n**—in carbon and graphite technology, a cell that is not totally enclosed in its walls and hence interconnected with other cells. An open-cell foam is a foam consisting predominantly of open or connected cells. [D02.F0] C709

**operationally valid standard test, n**—in automotive lubricant testing, a standard test that meets operational validity requirements, where specified.

DISCUSSION—Operational validity is determined after a test is completed. Requirements can include (1) mid-limit ranges for the average values of primary and secondary parameters that are narrower than the specified control ranges, (2) allowable deviations for primary and secondary parameters from the specified control ranges, (3) downtime limitations, and (4) special parameter limitations.

**operator, n**—a person who normally and regularly carries out a particular test. [D02.94] D3244

**orientation (of a crystal), n**—the angular position of a crystal described by the angles which certain crystallographic axes make with the frame of reference. [D02.F0] C709

**orientation (of a grain), n**—the angular position of a grain described by the angles which a defined set of axes of the grain make with the stated frame of reference. Generally used to characterize the axis of the grain that has the largest physical extent, for example, in a grain of needle coke. [D02.F0] C709

**orientation (of an object), n**—the angular position of an object described by the angles which a defined set of axes or surfaces of the object make with the frame of reference. [D02.F0] C709

**Ostwald coefficient, n**—the solubility of a gas, expressed as the volume of gas dissolved per volume of liquid when both are in equilibrium at the specified partial pressure of gas and at the specified temperature. [D02.11] D2779, D3827

**out of specification data, n**—in data acquisition, sampled value of a monitored test parameter that has deviated beyond the procedural limits. [D02.B0] D6593

**outgaging, n**—practice of removing a portion of liquid contents from a conventional sampling cylinder after filling to provide expansion room. [D02.D0] D5273

**outlier, n**—a result far enough in magnitude from other results to be considered not a part of the set. [D02.94] D6300, D6792, RR: D02–1007<sup>8</sup>

**oxic, adj**—an environment with a sufficient partial pressure of oxygen to support aerobic growth. [D02.14] D6469

**oxidation, n**—of engine oil, the reaction of the oil with an electron acceptor, generally oxygen, which can produce deleterious acidic or resinous materials often manifested as sludge formation, varnish formation, viscosity increase, or corrosion, or a combination thereof. [D02.B0] D6681, D7156

**oxidation, n**—of engine oil, the reaction of the oil with an electron acceptor, generally oxygen, that can produce deleterious acidic components often manifested as sludge formation, varnish formation, viscosity increase, or corrosion, or combination thereof. [D02.B0] D6984, D7320

**oxidation of carbon, n**—the chemical combination of carbon with oxygen or oxygen-containing compounds. [D02.F0] C709

**oxidative combustion, n**—process in which a sample undergoes combustion in an oxygen rich environment at temperatures greater than 650°C and compounds decompose to carbon dioxide, water, and elemental oxides. [D02.03] D6920

**oxygenate, n**—an oxygen-containing, ashless, organic compound, such as an alcohol or ether, which may be used as a fuel or fuel supplement. [D02.A0] D4806, D4814, D5983, [D02.08] D323, D4953

**oxygenate, n**—an oxygen-containing organic compound, which may be used as a fuel or fuel supplement, for example, various alcohols or ethers. [D02.04] D5845, D6277, [D02.01] D2699, D2700

**P**—in electromagnetics, symbol for radiant power.

**particle sizing, v**—segregation of granular material into specified particle size ranges. [D02.F0] C709

**particulate, adj**—of or relating to minute separate particles.

DISCUSSION—Solids generally composed of oxides, silicates, and fuel insoluble salts. [D02.J0] D2276, D5452

**particulate solids**—may enter a fuel from the air (suspended dirt and aerosols) or from the distribution and storage systems (rust, corrosion products, gasket debris, and so forth). [D02.E0] D4418

**peak EGT, n**—for octane rating, as the mixture is manually leaned from a state rich of stoichiometric, the exhaust gas temperature will increase with the removal of excess fuel. As the mixture is continually leaned, a peak temperature will be attained, after which continued leaning will result in lower exhaust gas temperatures. [D02.J0] D6424

**penetration, n**—of lubricating grease, the depth that the standard cone, when released to fall under its own weight for 5 s, enters the sample. [D02.G0] D1831, D7342

<sup>8</sup> Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report D02-1007.

**penetration, *n***—of a propellant or of petrolatum, the depth, in tenths of a millimetre, that a standard cone penetrates the sample under prescribed conditions of weight, time, and temperature.

**penetration, *n***—of petroleum wax, the depth, in tenths of a millimetre, to which a standard needle penetrates into the wax under defined conditions. [D02.10] D1321

**penetration, *n***—the depths to which one material extends into or penetrates another. [D02.F0] C709

**penetration of petrolatum, *n***—the depth, in tenths of a millimetre, that a standard cone will penetrate the sample under fixed conditions of mass, time, and temperature. [D02.10] D937

**penetrometer, *n***—an instrument that measures the consistency or hardness of semiliquid to semisolid materials by measuring the depth to which a specified cone or needle under a given force falls into the material. [D02.G0] D217, D1403, [D02.10] D1321

DISCUSSION—In this test method, either a standard penetrometer 6.2 or an optical penetrometer cone A1.3 can be used to determine the consistency of lubricating greases. The penetrating force is determined by the mass of the cone and the shaft. [D02.G0] D217

DISCUSSION—In this test method, a standard penetrometer needle (6.3) is used to determine the hardness of petroleum wax. The penetration force is determined by the total mass (100 g) of the needle, plunger, and 50 g weight. [D02.10] D1321

DISCUSSION—In these test methods, either a one-quarter scale cone (A1.1) or a one-half scale cone (A1.3) can be used to determine the consistency of lubricating greases. The penetration forces are determined by the respective masses of the cones and shafts. [D02.G0] D1403

**pentane insolubles, *n***—in used oil analysis, separated matter resulting when a used oil is dissolved in pentane. [D02.06] D893, D4055, D7317

DISCUSSION—In this test method, the separation is effected by centrifugation. [D02.06] D893

DISCUSSION—In this method, the separation is effected by filtration through a membrane. [D02.06] D4055

DISCUSSION—In this test method, the separation is effected by paper filtration. [D02.06] D7317

**peptization, *n***—of asphaltenes in crude oils or heavy fuel oils, the dispersion of asphaltenes to produce a colloidal dispersion. [D02.14] D7060, D7061

**percent evaporated, *n***—in batch distillation, the sum of the percent recovered and the percent loss.

**percent evaporated, *n***—the sum of the percent recovered and the percent loss. [D02.08] D86, D7344

**percent loss, *n***—in batch distillation, 100 minus the percent total recovery.

**percent loss (or observed loss), *n***—one hundred minus the percent total recovery. [D02.08] D86, D7344

**corrected loss, *n***—percent loss corrected for barometric pressure. [D02.08] D86

**percent recovered, *n***—the volume of condensate observed in the receiving cylinder, expressed as a percentage of the charge volume, associated with a simultaneous temperature reading. [D02.08] D86

**percent recovery, *n***—the maximum percent recovered, as

observed in accordance with 10.18. [D02.08] D86  
**corrected percent recovery, *n***—the percent recovery, adjusted for the difference between the observed loss and the corrected loss, as described in Eq. 8. [D02.08] D86

**percent total recovery, *n***—the combined percent recovery and residue in the flask, as determined in accordance with 11.1. [D02.08] D86

**percent residue, *n***—the volume of residue in the flask, measured in accordance with 10.19, and expressed as a percentage of the charge volume. [D02.08] D86

**permanent shear stability index (PSSI), *n***—a measure of the irreversible decrease, resulting from shear, in an oil's viscosity contributed by an additive.

DISCUSSION—PSSI is a property calculated for a single component. Viscosity Loss (q.v.) is a property measured for a finished oil.

[D02.07] D6022

**permeability, *n***—a property measured by the rate of passage of a fluid under a pressure gradient through a material. [D02.F0] C709

**permeability, *n***—in gas diffusion, the flow of gas, through the gas diffuser.

DISCUSSION—In this test method, the permeability is measured at a pressure of 2.45 kPa (250 mm of water) in millilitres per minute.

[D02.06] D892

**permeability, *n***—in gas diffusion, the rate of a substance that passes through a material (diffuser) under given conditions. [D02.06] D6082

**peroxide number, *n***—the milliequivalents of constituents in 1000 g of wax that will oxidize potassium iodide. [D02.10] D1832

**petroleum coke, *n***—a solid, carbonaceous residue produced by thermal decomposition of heavy petroleum fractions or cracked stocks, or both. [D02.05] D2638, D5003, D5004, D6376, D6791

**petroleum distillate, *n***—Synonym—distillate.

**phase separation, *n***—the formation of two layers, a lower aqueous constituent and an upper hydrocarbon constituent, separated by either a common boundary or a layer of emulsion.

DISCUSSION—Test specimens having droplets clinging to the sides of the container or collected on its bottom, that are visible to the unaided eye, are considered to be phase separated. [D02.A0] D6422

**picosiemens per metre, *n***—the unit of electrical conductivity is also called a conductivity unit (CU). A siemen is the SI definition of reciprocal ohm sometimes called mho.

$$1 \text{ pS/m} = 1 \times 10^{-12} \Omega^{-1} \text{ m}^{-1} = 1 \text{ cu} = 1 \text{ picomho/m}$$

[D02.J0] D2624, D4308

**pitting, *n***—on ring and pinion gears, small irregular cavities in the tooth surface, resulting from the breaking out of small areas of surface metal. [D02.B0] D6121, D7450

**platinum resistance thermometer, *n***—temperature measuring device with platinum wire, whose electrical resistance changes in relation to temperature. [D02.08] D6897

**PLOQ, *n***—pooled limit of quantitation. [D02.94] D6259

**plugging, *n***—the restriction of a flow path due to the accumulation of material along the flow path boundaries.

[D02.B0] D5862

**polarization X-ray fluorescence**, *n*—typically a polarization EDXRF instrument is used. In difference to direct excitation EDXRF spectrometry, polarization X-ray fluorescence uses polarized radiation for excitation. Combined with Cartesian geometry (of excitation, sample and detection system) this results in a significant improvement of the detection limit compared to direct excitation EDXRF.<sup>4</sup> [D02.03] D7220

**polars**, *n*—in *high performance liquid chromatography*, components that may contain organically bonded nitrogen, oxygen and oxidized sulfur components and are more strongly retained than aromatic hydrocarbons.

DISCUSSION—In this HPLC method, polars are backflushed with the aromatics and the two cannot be distinguished. Generally present in very small amounts, such as < 1 mass %. [D02.04.0C] D7419

**pooled limit of quantitation**, *n*—level of property or concentration of analyte above which quantitative test results can be obtained with a specified degree of confidence. See 3.2.1 for acronym. [D02.94] D6259

**pore**, *n*—see **void**. [D02.F0] C709

**pore**, *n*—in *carbon and graphite technology*, in a carbon or graphite foam, a passage that interconnects two cells. [D02.F0] C709

**pore count**, *n*—in *carbon and graphite technology*, in open-cell foams, the number of pores aligned in one plane in one linear inch, as determined by stereoscopic image analysis. [D02.F0] C709

**porosity**, *n*—the percentage of the total volume of a material occupied by both open and closed pores. [D02.F0] C709

**pour point**, *n*—in *petroleum products*, the lowest temperature at which movement of the test specimen is observed under prescribed conditions of test. [D02.07] D97, D5949

**power curve**, *n*—for *supercharge method knock rating*, the characteristic power output, expressed as indicated mean effective pressure, over a range of fuel-air ratios from approximately 0.08 to approximately 0.12, when a supercharge test engine is operated on *isooctane* plus 6 ml of tetraethyllead per U.S. gallon under standard conditions at a constant intake manifold pressure of 40 in. of Hg (134.3 kPa) absolute. [D02.01] D909

**preadaptation**, *n*—the incubation of an inoculum in the presence of the test substance which is done prior to the initiation of the test and under conditions similar to the test conditions.

DISCUSSION—The aim of preadaptation is to improve the precision of the test method by decreasing variability in the rate of biodegradation produced by the inoculum. Preadaptation may mimic the natural processes which cause changes in the microbial population of the inoculum leading to more rapid biodegradation of the test substance, but it is not expected to change the final degree of biodegradation.

[D02.12] D6006

**pre-adaptation**, *n*—the pre-incubation of an inoculum in the presence of the test material and under conditions similar to the test conditions.

DISCUSSION—The aim of pre-adaptation is to improve the precision of the test method by decreasing variability in the rate of biodegradation produced by the inoculum. Pre-adaptation may mimic the natural

processes which cause changes in the microbial population of the inoculum leading to more rapid biodegradation of the test material but not to a change in the final extent of biodegradation. [D02.N0] D6046

**pre-adaptation**, *n*—the incubation of an inoculum in the presence of the test material which is done prior to the initiation of the test and under conditions similar to the test conditions. [D02.12] D6384

**pre-column**, *n*—a polydimethylsiloxane WCOT column used to isolate the methanol and 1-propanol and several light hydrocarbons from the higher boiling portion of the crude oil sample for transfer to the analytical column for further separation and quantification. [D02.04] D7059

**pre-condition**, *n*—the pre-incubation of an inoculum under the conditions of the test in the absence of the test material. [D02.12] D6139

**precision**, *n*—the closeness of agreement between test results obtained under prescribed conditions. [D02.94] D6299, D6792, [E11] E456

**precision**, *n*—the degree of agreement between two or more results on the same property of identical test material. In this practice, precision statements are framed in terms of *repeatability* and *reproducibility* of the test method.

DISCUSSION—The testing conditions represented by repeatability and reproducibility should reflect the normal extremes of variability under which the test is commonly used. Repeatability conditions are those showing the least variation; reproducibility, the usual maximum degree of variability. Refer to the definitions of each of these terms for greater detail. [D02.94] D6300

**precision**, *n*—the degree of agreement between two or more results on the same property of identical test material. In this practice, precision statements are framed in terms of the repeatability and reproducibility of the test method. [D02.94] D3244

**preferred orientation**, *n*—in *manufactured carbon and graphite product technology*, an alignment in the crystal or defect structure of a body leading to variations in physical properties as a function of direction; normally referenced to an orthogonal system where one of the axes is the working direction. [D02.F0] C709

**pre-flame reaction**, *n*—in *fuel testing*, a slow, nonluminous reaction of the sample or its decomposition products with the atmosphere in the combustion chamber.

**preignition**, *n*—in *a spark-ignition engine*, ignition of the mixture of fuel and air in the combustion chamber before the passage of the spark. [D02.B0] D4857, D4858

**pressure drop**—the difference between the pressure measured in the condenser and the pressure measured in the distillation flask.

DISCUSSION—It is expressed in kilopascals (mm Hg) per metre of packed height for packed columns, or kilopascals (mm Hg) overall for real plate columns. It is higher for aromatics than for paraffins, and for higher molecular weights than for lighter molecules, at a given boilup rate. [D02.08] D2892

**PRE**, *n*—primary reference fuel [D02.J0] D6812

**primary biodegradation**, *n*—degradation of the test material



by microorganisms resulting in a change in the test material's physical or chemical properties, or both. [D02.12] D6384, [D02.N0] D6046

DISCUSSION—The extent to which the results of a primary biodegradation test correspond to the biological conversion of the test material will depend on the attribute which is being measured. [D02.N0] D6046

**primary biodegradation, *n***—degradation of the test substance resulting in a change in its physical or chemical properties, or both. [D02.12] D6006

**primary biodegradation test, *n***—a test that monitors the disappearance of a test material by measuring some physical attribute of the material.

DISCUSSION—The extent to which the results of a primary biodegradation test correspond to the biological conversion of the test material will depend on the attribute which is being measured. An example of a measurement of a physical attribute is infrared (IR) measurement of the C-H bond of a methylene carbon at  $2930\text{ cm}^{-1}$  for the CEC (Coordinating European Council) biodegradation test. [D02.12] D6384

**primary biodegradation test, *n***—a test which follows the disappearance of a test substance by measuring some attribute of the substance.

DISCUSSION—The extent to which the results of a primary biodegradation test correspond to the biological conversion of the test substance will depend on the attribute which is being measured. [D02.12] D6006, [D02.N0] D6046

**primary reference fuel blends above 100 octane, *n***—the millilitres per U.S. gallon of tetraethyllead in *isooctane* that define octane numbers above 100 in accordance with an empirically determined relationship. [D02.01] D2699, D2700

**primary reference fuel blends below 100 octane, *n***—the volume % of *isooctane* in a blend with *n*-heptane that defines the octane number of the blend, *isooctane* being assigned as 100 and *n*-heptane as 0 octane number. [D02.01] D2699, D2700

**primary reference fuels, *n***—for knock testing, *isooctane*, *n*-heptane, volumetrically proportioned mixtures of *isooctane* with *n*-heptane, or blends of tetraethyllead in *isooctane* that define the octane number scale. [D02.01] D2699, D2700

**primary reference fuels, *n***—for knock testing, volumetrically proportioned mixtures of *isooctane* with *n*-heptane, or blends of tetraethyllead in *isooctane* which define the supercharge rating scale. [D02.01] D909

**primary reference fuels, *n***—for octane rating, blended fuels of reference grade *isooctane* and *n*-heptane. [D02.J0] D6424

**primary test method (PTM), *n***—ASTM or other established standard test method that produces results accepted as the reference measure of a property. [D02.25] D7453

**proficiency testing, *n***—determination of a laboratory's testing capability by evaluating its test results in interlaboratory exchange testing or crosscheck programs.

DISCUSSION—One example is the ASTM D02 committee's proficiency testing programs in a wide variety of petroleum products and

lubricants, many of which may involve more than a hundred laboratories. [D02.94] D6792

**proficiency testing, *n***—determination of a laboratory's testing capability by participation in an interlaboratory crosscheck program. [D02.94] D7372

**programmable temperature vaporizer (PTV), *n***—a temperature programmable injector similar to a cool-on-column injector except that the sample is injected cool into a glass liner or insert instead of the WCOT (3.1.5) column and then the temperature is programmed in a manner similar to the on-column injector.

DISCUSSION—The liner may be replaced, as necessary, to remove non-volatile materials. This injector may be operated in low split mode or direct (no splitting) mode. [D02.04] D7059

**propene concentrate, *n***—in liquefied natural gas technology, concentrate containing more than 50 % propene. (Synonym—*propylene*.)

**propylene concentrate**—concentrate containing more than 90 % propylene. [D02.D0] D4864

**propylene concentrate, *n***—hydrocarbon product containing more than 50 % propylene.

DISCUSSION—Grades of propylene concentrates listed in this guide are: polymer, 99.0 % minimum propylene content; chemical, 92.0 %; and refinery, 60 %. [D02.D0] D5273

**psig, *n***—pounds per square inch gage [D02.J0] D6812

**PSSI**—in viscometry, abbreviation for permanent shear stability index.

**pulse travel time ( $T_t$ ), *n***—the total time, measured in seconds, required for the sonic pulse to traverse the specimen being tested, and for the associated electronic signals to reverse the circuits of the pulse-propagation circuitry. [D02.F0] C709

**purchaser, *n***—of an ASTM test, a person or organization that pays for the conduct of an ASTM test method on a specified product.

DISCUSSION—The preferred term is *purchaser*. Deprecated terms that have been used are *client*, *requester*, *sponsor* and *customer*.

[D02.B0] D6202, D6750, D6837

**purge volume**—the combined volume of the full analyzer sampling and conditioning systems. [D02.25] D7278

**pyrogen free, *n***—free of substances which can induce fever. [D02.14] D7463

**pyrolysis, *n***—chemical decomposition of organic materials by heating in the absence of oxygen. [D02.06] D7579

**pyrolysis liquid biofuel, *n***—liquid product from the pyrolysis of biomass.

DISCUSSION—Pyrolysis liquid biofuel is comprised of a complex mixture of the decomposition products of ligno-cellulosic biomass including highly oxygenated organic compounds. It is produced from the pyrolysis of biomass, followed by the rapid condensation of its vapors. [D02.06] D7579

**pyrolysis solids, *n***—solid particles contained within the pyrolysis liquid biofuel.

DISCUSSION—Pyrolysis solids consists of ash and char. [D02.06] D7579

**pyrolytic graphite**, *n*—in carbon and graphite technology, an artifact consisting predominantly of graphite which was deposited as a solid on a hot surface by cracking of gaseous or liquid hydrocarbons. [D02.F0] C709

**quality assurance, QA**, *n*—a system of activities, the purpose of which is to provide to the producer and user of a product, measurement, or service the assurance that it meets the defined standards of quality with a stated level of confidence.

DISCUSSION—Quality assurance includes quality planning and quality control. [D02.94] D6792

**quality control, QC**, *n*—a planned system of activities whose purpose is to provide a level of quality that meets the needs of users; also the uses of such a system. [D02.94] D6792

**quality control sample, QC sample**, *n*—for use in quality assurance program to determine and monitor the precision and stability of a measurement system; a stable and homogeneous material having physical or chemical properties, or both, similar to those of typical samples tested by the analytical measurement system. The material is properly stored to ensure sample integrity, and is available in sufficient quantity for repeated long-term testing. [D02.94] D6792, [D02.01] D6890, D7170

**quality index (QI)**, *n*—a mathematical formula that uses data from controlled parameters to calculate a value indicative of control performance. [D02.B0] D6984, D7320

**quartz combustion tube devitrification**, *n*—process in which samples containing alkali-metals (that is, elements from the Periodic Table Group IA, for example, sodium, potassium, etc.) or alkaline earth (that is, elements from the Periodic Table Group IIA, for example, calcium, magnesium, etc.) will cause quartz to devitrify (that is, become milky white and brittle) at elevated temperatures.

DISCUSSION—It is suggested that the quartz combustion tube temperature be kept <1200°C in order to minimize or eliminate the possibility of quartz combustion tube devitrification from occurring. [D02.03] D6920

**quenching oil**, *n*—oil used for cooling metals during a heat-treating operation.

**R**—in a distillation column, abbreviation for reflux ratio.

**r**—in statistics, abbreviation for repeatability.

**R**—in statistics, abbreviation for reproducibility.

**Ra**, *n*—in measuring surface finish, the arithmetic average of the absolute distances of all profile points from the mean line for a given distance. [D02.G0] D5706, D5707

**Ra (C.L.A.)**, *n*—in measuring surface finish, the arithmetic average of the absolute distances of all profile points from the mean line for a given distance.

DISCUSSION—C.L.A. means center line average, and it is the synonym to Ra. [D02.L0] D7421

**radiant energy**, *n*—energy transmitted as electromagnetic waves. [D02.04] D1840, D2008

**radiant power, P**, *n*—the rate at which energy is transported in a beam of radiant energy. [D02.04] D1840, D2008

**radio frequency**, *n*—the range of frequencies between 3 kHz and 300 GHz. [D02.03] D7111

**random error**, *n*—the chance variation encountered in all test

work despite the closest control of variables. [D02.94] D6300, RR:D02–1007<sup>8</sup>

**rate of change (or slope)**, *n*—the change in temperature reading per percent evaporated or recovered, as described in 13.2. [D02.08] D86

**rate of shear (shear rate)**, *n*— in liquid flow, the velocity gradient across the liquid. [D02.07] D7483

**raw petroleum coke**, *n*—petroleum coke that has not been calcined. [D02.05] D5003, D6376

**reactivity**, *n*—rate at which another material will form compounds with carbon or graphite. [D02.F0] C709

**reading**, *n*—in data acquisition, the reduction of data points that represent the operating conditions observed in the time period as defined in the test procedure. [D02.B0] D6593

**ream of paper (news and wrapping)**, *n*—500 sheets each 610 by 914 mm (24 by 36 in.). [D02.10] D2423

**receiver**, *n*—any individual or organization who receives or accepts the product delivered by the supplier. [D02.94] D3244

**reclaiming**, *n*—the use of cleaning methods during recycling primarily to remove insoluble contaminants, thus making the oil suitable for further use. The methods may include settling, heating, dehydration, filtration, and centrifuging. [D02.P0] D6448, D6823

**recycle delay**, *n*—NMR spectrometer parameter setting for the time delay that allows magnetization recovery. [D02.03] D7171

**recycling**, *n*—in petroleum technology, the acquisition of oil that has become unsuitable for its intended use, and processing it to regain useful materials. [D02.P0] D6448, D6823

**reference fluid**, *n*—a reference fluid base to which prescribed quantities of a known surface active agent have been added.

DISCUSSION—The known surface active agent is typically bis-2-ethylhexyl sodium sulfosuccinate, commonly referred to as AOT, dissolved in toluene. [D02.14] D7261

**reference fuels above 100**, *n*—for octane rating, blended fuels of reference grade *isooctane* and 3-methylphenylamine.

DISCUSSION—This practice describes reference fuels above 100 MON in terms of *isooctane*/3-methylphenylamine. Alternate reference fuels may be used if appropriate, for example, MON in Test Method D2700, Section 8, mixtures of tetraethyl lead and reference grade *isooctane*. Care should be exercised to ensure the reference fuel does not adversely contaminate the engine and influence the results. [D02.J0] D6812

**reference fuel framework**, *n*—for supercharge method knock rating, the graphic representation of the knock-limited power curves for the specified primary reference fuel blends of *isooctane* + *n*-heptane and *isooctane* + TEL (mL/U.S. gal) that defines the expected indicated mean effective pressure versus fuel-air ratio characteristics for supercharge test engines operating properly under standardized conditions. [D02.01] D909

**reference material (RM)**, *n*—a material or substance of which one or more properties are sufficiently well established to enable the material to be used for the calibration of an apparatus, the assessment of a method, or the assignment of values to similar materials. [D02.04] D6596

**reference material, RM,  $n$** —a material with accepted reference value(s), accompanied by an uncertainty at a stated level of confidence for desired properties, which may be used for calibration or quality control purposes in the laboratory.

DISCUSSION—Sometimes these may be prepared “in-house” provided the reference values are established using accepted standard procedures. [D02.94] D6792

**reference oil,  $n$** —an oil of known performance characteristics, used as a basis for comparison. [D02.B0] D5862, D6483, D6594, D6750, D6794, D6795, D6837, D6891, D6984, D7156, D7320

DISCUSSION—Reference oils are used to calibrate testing facilities, to compare the performance of other oils, or to evaluate other materials (such as seals) that interact with oils. [D02.B0] D5862, D6483, D6594, D6750, D6794, D6795, D6891, D6984, D7156, D7320

**reference viscosity,  $n$** —the viscosity of Newtonian standard reference fluids certified at each of several temperatures by the supplier.

**refinery,  $n$** —a plant at which gasoline or diesel fuel is produced.

DISCUSSION—This definition is from CFR 40 Part 80.2. In the federal definition, a plant not only covers the conventional refinery, but also covers oxygenate blending and other facilities where gasoline is produced. [D02.A0] D4814

**reflux ratio, R,  $n$** —in a distillation column, the ratio of the condensate at the head of the column that is returned to the column (*reflux*) to that withdrawn as product.

**reflux ratio, R,  $n$** —the ratio of reflux to distillate.

DISCUSSION—The vapor reaching the top of the column is totally condensed and the resulting liquid is divided into two parts. One part  $L$  (reflux), is returned to the column and the other part,  $D$  (distillate), is withdrawn as product. The reflux ratio ( $R = L/D$ ), can vary from zero at total takeoff ( $L = 0$ ) to infinity at total reflux ( $D = 0$ ). [D02.08] D2892

**refractive dispersion,  $n$** —the difference between the refractive indexes of a substance for light of two different wavelengths, both indexes being measured at the same temperature. For convenience in calculations, the value of the difference thus obtained is usually multiplied by 10 000. [D02.04] D1218

**refractive index,  $n$** —the ratio of the velocity of light (of specified wavelength) in air, to its velocity in the substance under examination. This is the relative index of refraction. If absolute refractive index (that is, referred to vacuum) is desired, this value should be multiplied by the factor 1.00027, the absolute refractive index of air.

**refractive index,  $n$** —the ratio of the velocity of light (of specified wavelength) in air, to its velocity in the substance under examination. It may also be defined as the sine of the angle of incidence divided by the sine of the angle of refraction, as light passes from air into the substance. This is the relative index of refraction. If absolute refractive index (that is, referred to vacuum) is desired, this value should be multiplied by the factor 1.00027, the absolute refractive index of air. The numerical value of refractive index of

liquids varies inversely with both wavelength and temperature. [D02.04] D1218

**Reid vapor pressure (RVP),  $n$** —resultant total pressure reading, corrected for measuring error, of a specific empirical test method (Test Method D323) for measuring the vapor pressure of gasoline and other volatile products. [D02.08] D323

**relative density,  $n$** —the ratio of the density of a material at a stated temperature to the density of water at a stated temperature. [D02.04] D4052

**relative density (specific gravity),  $n$** —the ratio of the mass (weight in vacuo) of a given volume of material at a temperature,  $t_1$ , to the mass of an equal volume of water at a reference temperature,  $t_2$ ; or it is the ratio of the density of the material at  $t_1$  to the density of water at  $t_2$ . When the reference temperature is 4.00°C, the temperature at which the relative density of water is unity, relative density (specific gravity) and density are numerically equal. [D02.04] D1217, D1480

**relative density (specific gravity),  $n$** —the ratio of the mass of a given volume of liquid at a specific temperature to the mass of an equal volume of pure water at the same or different temperature. Both reference temperatures shall be explicitly stated.

DISCUSSION—Common reference temperatures include 60/60°F, 20/20°C, 20/4°C. The historic deprecated term “specific gravity” may still be found. [D02.02] D1657

**relative light unit (RLU),  $n$** —instrument-specific unit of measurement reflecting the number of photons emitted by the Luciferin-Luciferase driven hydrolysis of ATP to AMP plus pyrophosphate.

DISCUSSION—RLU is not an SI unit, however, RLU are proportional to ATP concentration. [D02.14] D7463

**relative molar response,  $n$** —the measured area of a compound divided by the moles present in the synthetic mixture relative to an arbitrarily chosen component. [D02.04] D3710

**relative volume response factor (RVRF),  $n$** —the volume response factor of a component  $i$  relative to the volume response factor of  $n$ -heptane. [D02.04] D7096

**relaxation time constant ( $T_1$ ),  $n$** —a numerical value which is a measure of magnetization relaxation time following an excitation pulse of an NMR spectrometer. [D02.03] D7171

**repeatability,  $n$** —the quantitative expression of the random error associated with a single operator in a given laboratory obtaining repetitive results by applying the same test method with the same apparatus under constant operating conditions on identical test material within a short interval of time on the same day. It is defined as the difference between two such results at the 95 % confidence level. [D02.94] D6792

DISCUSSION—Interpret as the value equal to or below which the absolute difference between two single test results obtained in the above conditions may expect to lie with a probability of 95 %.

DISCUSSION—The difference is related to repeatability standard deviation but is not the standard deviation or its estimate. [D02.94] D6300

**repeatability (r),  $n$** —quantitative expression of the random



error associated with a single operator in a given laboratory obtaining replicate results with the same apparatus under constant operating conditions on identical test material within a short period of time. It is defined (3.1.8.1) as that difference between two such single results as would be exceeded in the long run in only 1 case in 20 in the normal and correct operation of the test method (3.1.8.3). (This is known as the 95 % confidence level.)

**DISCUSSION**—The repeatability and reproducibility values should have been determined according to the methods described in ASTM Research Report D02-1007, Manual on Determining Precision data for ASTM Methods of Petroleum Products and Lubricants,<sup>6</sup> Practice D6300, or ISO 4259.

**DISCUSSION**—Not all standards organizations define repeatability and reproducibility in precisely these same terms, and attention should always be paid to definitions before comparing precision values quoted.

**DISCUSSION**—This difference is related to the repeatability or the reproducibility standard deviation but is not the standard deviation.

**[D02.94] D3244**

**repeatability conditions, *n***—conditions where mutually independent test results are obtained with the same test method in the same laboratory by the same operator with the same equipment within short intervals of time, using test specimens taken at random from a single sample of material.

**[D02.94] D6299, [E11] E456, E177**

**repeatability conditions, *n***—conditions under which test results are obtained with the same test method in the same laboratory by the same operator with the same equipment in the shortest practical period of time using test units or test specimens taken at random from a single quantity of material that is as nearly homogeneous as possible (see 10.3 of Practice E691).

**DISCUSSION**—The *same operator, same equipment* requirement means that for a particular step in the measurement process the same combination of operator and equipment is used for every test result. Thus, one operator may prepare the test specimens, a second measure the dimensions, and a third measure the mass in a test method for measuring density.

**DISCUSSION**—By *in the shortest practical period of time* is meant that the test results, at least for one material, are obtained in a time period not less than in normal testing and not so long as to permit significant change in test material, equipment, or environment. See Terminology E456.

**[D02.94] D6259**

**repeatability conditions, *n***—conditions where independent test results are obtained with the same method on identical test items in the same laboratory by the same operator using the same equipment within short intervals of time.

**[D02.25] D3764, [D02.01] D2699**

**DISCUSSION**—In the context of this test method, a short time interval between two ratings on a sample fuel is understood to be not less than the time to obtain at least one rating on another sample fuel between them but not so long as to permit any significant change in the sample fuel, test equipment, or environment.

**[D02.01] D2699, D2700**

**representative sample, *n***—a part of a homogeneous material, or a part of the composited and mixed portions of a material, which carries all the true properties and physical characteristics of the whole material.

**[D02.05] D4296**

**reproducibility, *R, n***—quantitative expression of the random

error associated with operators working in different laboratories, each obtaining single results on identical test material when applying the same method.

**reproducibility, *n***—a quantitative expression of the random error associated with different operators from different laboratories, using different apparatus, each obtaining a single result by applying the same method on an identical test sample. It is defined as the 95 % confidence limit for the difference between two such single and independent results.

**[D02.94] D6792**

**DISCUSSION**—Interpret as the value equal to or below which the absolute difference between two single test results on identical material obtained by operators in different laboratories, using the standardized test may be expected to lie with a probability of 95 %.

**DISCUSSION**—The difference is related to the reproducibility standard deviation but is not the standard deviation or its estimate.

**DISCUSSION**—In those cases where the normal use of the test method does not involve sending a sample to a testing laboratory, either because it is an in-line test method or because of serious sample instabilities or similar reasons, the precision test for obtaining reproducibility may allow for the use of apparatus from the participating laboratories at a common site (several common sites, if feasible). The statistical analysis is not affected thereby. However, the interpretation of the reproducibility value will be affected and therefore the precision statement shall, in this case, state the conditions to which the reproducibility value applies.

**[D02.94] D6300**

**reproducibility, *n***—quantitative expression of the random error associated with operators working in different laboratories, each obtaining single results on identical test material when applying the same method. It is defined (3.1.8.1) as that difference between two such single and independent results as would be exceeded in the long run in only 1 case in 20 in the normal and correct operation of the test method. See 3.1.8.3.

**[D02.94] D3244**

**reproducibility conditions, *n***—conditions under which test results are obtained in different laboratories with the same test method, using test specimens taken at random from the same sample of material.

**[D02.94] D6299, [E11] E456,**

**E177**

**reproducibility conditions, *n***—conditions where test results are obtained with the same method on identical test items in different laboratories with different operators using different equipment.

**[D02.25] D3764, [D02.01] D2699, D2700**

**re-refining, *n***—the use of refining processes during recycling to produce high quality base stocks for lubricants or other petroleum products. Re-refining may include distillation, hydrotreating, or treatments employing acid, caustic, solvent, clay, or other chemicals, or combination thereof.

**[D02.P0] D6823**

**residual fuel, *n***—a liquid fuel containing bottoms remaining from crude distillation or thermal cracking; sometimes referred to as heavy fuel oil.

**DISCUSSION**—Residual fuels comprise Grades 4, 5, and 6 fuel oils, as defined in Specification D396.

**[D02.07] D97**

**residual fuel oil, *n***—any liquid or liquefiable petroleum product having a kinematic viscosity at 100°C between 5.0 and 50.0 mm<sup>2</sup>/s, inclusive, burned for the generation of heat in a furnace or firebox or for the generation of power in an

- engine. [D02.E0] D6021
- residual fuel oil**, *n*—a fuel oil comprising a blend of viscous long, short, or cracked residue from a petroleum refining process and lighter distillates blended to a fuel oil viscosity specification. [D02.E0] D5705
- residuum**, *n*—a liquid or semi-liquid product obtained as residue from the distillation of petroleum and consisting primarily of asphaltic hydrocarbons.
- DISCUSSION—Also known as asphaltic oil, asphaltum oil, liquid asphalt, black oil, petroleum tailings, and residual oil. [D02.G0] D128
- response factor**, *n*—a constant of proportionality that converts area to liquid volume. [D02.04] D3710
- rest conductivity**, *n*—the reciprocal of the resistivity of uncharged fuel in the absence of ionic depletion or polarization.
- DISCUSSION—It is the electrical conductivity at the initial instant of current measurement after a dc voltage is impressed between electrodes, or a measure of the average current when an alternating current (ac) voltage is impressed. [D02.J0] D2624
- result**, *n*—the value obtained by following the complete set of instructions of a test method.
- result**, *n*—the value obtained by following the complete set of instructions of a test method. It may be obtained from a single determination or several determinations, depending on the instruction of the test method. [D02.94] D3244
- reticulated foam**, *n*—*in carbon and graphite technology*, a foam with a ligamentous structure rather than a spherical pore structure. [D02.F0] C709
- RF**, *n*—reference fuel above 100 [D02.J0] D6812
- ridging**, *n*—*on ring and pinion gears*, an alteration of the tooth surface to give a series of parallel raised and polished ridges running diagonally in the direction of sliding motion, either partially or completely across the tooth surfaces of gears. [D02.B0] D6121, D7450
- rifle**—a manual sample divider which splits the sample stream into a number of alternate elements. [D02.05] D6969
- rippling**, *n*—*on ring and pinion gears*, an alteration of the tooth surface to give an appearance of a more or less regular pattern resembling ripples on water or fish scales. [D02.B0] D6121, D7450
- RON**—*in gasoline knock testing*, abbreviation for Research octane number.
- rosin oil**, *n*—a viscous, oily liquid obtained as a condensate when the residue (rosin) from turpentine production is subjected to dry, destructive distillation.
- DISCUSSION—Also used to describe specially compounded oils having a rosin base. [D02.G0] D128
- Rpk**, *n*—Reduced peak height according to DIN EN ISO 13565-2:1998. Rpk is the mean height of the peak sticking out above the core profile section. [D02.L0] D7421
- rpm**, *n*—revolutions per minute [D02.J0] D6812
- running torque**, *n*—the 15-s average value of the torque after rotation for a specified period of time (60 min). [D02.G0.05] D1478
- rust**, *n*—*of ferrous alloys*, a corrosion product consisting primarily of hydrated iron oxides. [D02.B0] D6557
- rust (coatings)**, *n*—*of ferrous alloys*, a corrosion product consisting of hydrated iron oxides. [D02.B0] D7320
- rust (coatings)**, *n*—the reddish material, primarily hydrated iron oxide, formed on iron or its alloys, resulting from exposure to humid atmosphere or chemical attack. [D02.B0] D6984
- Ry**, *n*—*in measuring surface finish*, the vertical distance between the top of the highest peak and the bottom of the deepest valley in one sampling length. [D02.G0] D5706, D5707
- Ry**, *n*—*in measuring surface finish*, the vertical distance between the top of the highest peak and the bottom of the deepest valley in one sampling length of the roughness profile. [D02.L0] D6425
- Rz**, *n*—*in measuring surface finish*, the average of all *Ry* values (peak to valley heights) in the assessment length. [D02.L0] D6425
- Rz (DIN)**, *n*—*in measuring surface finish*, the average of all *Ry* values (peak to valley heights) in the assessment length. [D02.G0] D5706, D5707
- S(numerical specification maximum)**—indicates the maximum sulfur content, in weight ppm (µg/g), allowed by this specification. [D02.E0] D7467
- SA**, *n*—abbreviation for severity adjustment. [D02.B0] D6984, D7320
- SAE**—abbreviation for Society of Automotive Engineers, Inc.
- salt water**, *n*—the aerobic, aqueous compartment, characteristically with a salinity equal to or greater than five parts per thousand. [D02.12] D6384
- sample**, *n*—a part taken as representative of a whole material. [D02.05] D4296
- sample conditioning unit lag time**, *n*—time required for material to flow from the sample conditioning unit inlet to the analyzer unit inlet. [D02.25] D7453
- sample division**—the process whereby a sample is reduced in mass without change in particle size. [D02.05] D6969
- sample fast cycle loop**, *n*—a system that continually and rapidly transports a representative sample of process material from the sample probe past the sample supply line and returns the remaining material to the process.
- sample fast loop lag time*, *n*—time required for material to transport from the product takeoff point of the sample loop to the sample conditioning unit inlet. [D02.25] D7453
- sample preparation**—the process that may include drying, crushing, division, and mixing of a gross sample for the purpose of obtaining an unbiased analysis sample. [D02.05] D6969
- sample reduction**—the process whereby a sample is reduced in particle size by crushing or grinding without significant change in chemical properties. [D02.05] D6969
- sample system lag time**—the time required to transport a representative sample from the process tap to the analyzer. [D02.25] D7278
- saponification**, *n*—the interaction of fats, fatty acids, or esters generally with an alkali to form the metallic salt, which is commonly called soap.

DISCUSSION—Soap thickeners are most often made by in situ saponification in the lubricating grease base oil. However, the use of pre-formed soaps is also common; dispersion is effected by mechanical means and usually with heat. [D02.G0] D128

**saponification number**, *n*—*in petroleum technology*, the number of milligrams of potassium hydroxide that is consumed by 1 g of oil under the conditions of the test.

**saponification number**, *n*—the number of milligrams of potassium hydroxide consumed by 1 g of a sample under the conditions of the test.

DISCUSSION—The value of the saponification number in these test methods can be affected by the presence of other alkali-reactive species, as described in Note 1. [D02.06] D94

**saponify**, *v*—to hydrolyze a fat with alkali to form an alcohol and the salt of a fatty acid. [D02.06] D94

**saturates**, *n*—hydrocarbon components that are not retained strongly by the specified polar columns when heptane is used as the mobile phase.

DISCUSSION—Generally, these consist of paraffins and cycloparaffins. [D02.04.0C] D7419

**Saybolt color**, *n*—an empirical definition of the color of a clear petroleum liquid.

**Saybolt color**, *n*—the name of an empirical scale for expressing of the color of a clear petroleum liquid based on a scale of -16 (darkest) to +30 (lightest) and determined by Test Method D156. [D02.05] D6045

**scoring**, *n*—*in tribology*, a severe form of wear characterized by the formation of extensive grooves and scratches in the direction of sliding. [D02.B0] D5862, D6593, D6984, D7320, [G02] G40

**scoring**, *n*—the formation of severe scratches in the direction of sliding.

DISCUSSION—Scoring may be due to local solid phase welding or to abrasion. The term scuffing is sometimes used as a synonym for scoring. [D02.B0] D4998

**scoring**, *n*—*on ring and pinion gears*, the rapid removal of metal from the tooth surfaces caused by the tearing out of small contacting particles that have welded together as a result of metal-to-metal contact. The scored surface is characterized by a matte or dull finish. [D02.B0] D6121, D7450

**scrape sample**, *n*—a portion of residue removed from a surface by forceful strokes of an instrument such as a spatula. [D02.14] D7464

**scratches**, *n*—the result of mechanical removal or displacement, or both, of material from a surface by the action of abrasive particles or protuberances sliding across the surfaces. [D02.L0] D5182

**scratching**, *n*—the formation of fine lines in the direction of sliding that may be due to asperities on the harder slider or to hard particles between the surfaces or embedded in one of them.

DISCUSSION—Scratching is considered less damaging than scoring or scuffing. [D02.B0] D4998

**scuff**, **scuffing**, *n*—*in lubrication*, damage caused by instantane-

ous localized welding between surfaces in relative motion which does not result in immobilization of the parts.

[D02.B0] D4863, D5862, D6593

**scuffing**, *n*—*in lubrication*, damage caused by instantaneous localized welding between surfaces in relative motion that does not result in immobilization of the parts. [D02.B0.01] D6593

**scuffing**, *n*—*in lubrication*, surface damage resulting from localized welding at the interface of rubbing surfaces with subsequent fracture in the proximity of the weld area.

[D02.B0] D6984, D7320

**scuffing**, *n*—localized damage caused by the occurrence of solid phase welding between sliding surfaces, without local surface melting.

DISCUSSION—The term **scoring** is sometimes used as a synonym for scuffing. [D02.B0] D4998

**scum**, *n*—layer thicker than film (up to 1 mL in volume) or that adheres to the wall of the glass test tube, or both. [D02.14] D7451

**seizure**, *n*—*in lubrication*, welding between surfaces in relative motion that results in immobilization of the parts. [D02.B0] D4857

**seizure or welding**, *n*—localized fusion of rubbing metal, usually indicated by streaks of transferred metal, increased friction and wear, or unusual noise and vibration.

[D02.G0] D2509

**semi-solid**, *n*—material that is seemingly a solid, except that it deforms slowly under a gravitational force, and it can be made to flow by this force or a greater force.

DISCUSSION—*In the petroleum industry*, grease, petrolatum, asphalt, and other very viscous materials are recognized as semi-solids. (Synonyms—*semi-liquid* and *semi-fluid*.)

**shear**, *adj*—a relative movement of molecules or molecular aggregates that occurs in flowing liquids. A shear flow is one in which the spatial velocity gradient is perpendicular to the direction of flow.

DISCUSSION—Not all flow geometries meet this definition. [D02.07] D6022

**shear**, *v*—to subject a liquid to shear flow.

DISCUSSION—Shearing an oil can sometimes cause scission of certain molecular species, resulting in a decrease in viscosity. Not all oils exhibit this response. Common ways of shearing oils to elicit this effect include injection through a small orifice and flow through gears or bearings. Irradiation with sonic energy can also decrease the viscosity of some oils. [D02.07] D6022

**shear degradation**, *n*—the decrease in molecular weight of a polymeric thickener (VI improver) as a result of exposure to high shear stress. [D02.N0] D6080

**shear rate**, *n*—*in fluid flow*, the velocity gradient across the fluid.

**shear rate**, *n*—the velocity gradient in fluid flow. [D02.N0] D6080

**shear rate**, *n*—the rate at which a series of adjacent layers of grease move with respect to each other; proportional to the linear velocity of flow divided by the capillary radius, and is thus expressed as reciprocal seconds. [D02.G0] D1092



**shear rate**,  $n$ —the velocity gradient in fluid flow. The SI unit for shear rate is the reciprocal second ( $s^{-1}$ ). [D02.07]

**D4683, D4741, D6616**

**shear rate**—the velocity gradient in fluid flow. For a Newtonian fluid in a concentric cylinder rotary viscometer in which the shear stress is measured at the inner cylinder surface (such as this apparatus, described in 6.1), and ignoring any end effects, the shear rate is given as follows:

$$G_r = \frac{2(\Omega)R_s^2}{R_s^2 - R_r^2}$$

$$= \frac{4(\pi)R_s^2}{t(R_s^2 - R_r^2)}$$

where:

$G_r$  = shear rate at the surface of the rotor in reciprocal seconds,  $s^{-1}$ ,

$\Omega$  = angular velocity, rad/s,

$R_s$  = stator radius, mm,

$R_r$  = rotor radius, mm, and

$t$  = time in seconds for one revolution of the rotor.

DISCUSSION—For the specific apparatus being described in 6.1.1,

$$G_r = 63/t$$

[D02.07] **D4684**

**shear stability**,  $n$ —the resistance of a polymer-thickened fluid to shear degradation. [D02.N0] **D6080**

**shear stress**,  $n$ —the force per unit area in the direction of the flow.

DISCUSSION—The SI unit for shear stress is the pascal (Pa).

[D02.07] **D7483**

**shear stress**,  $n$ —the motivating force per unit area for fluid flow. [D02.N0] **D6080**

**shear stress**,  $n$ —the motivating force per area for fluid flow.

The area is the area of shear. In the SI, the unit for shear stress is the Pascal (Pa). [D02.07] **D4683, D4741**

**shear stress**—the motivating force per unit area for fluid flow.

The *area* is the area under shear. [D02.07] **D6616**

**shear stress**—the motivating force per unit area for fluid flow.

For the rotary viscometer being described, the rotor surface is the area under shear or the shear area.

$$T_r = 9.81 M (R_o + R_r) \times 10^{-6}$$

$$S_r = \frac{T_r}{2(\pi)R_r^2 h} \times 10^9$$

where:

$T_r$  = torque applied to rotor, N·m,

$M$  = applied mass, g,

$R_o$  = radius of the shaft, mm,

$R_r$  = radius of the string, mm,

$S_r$  = shear stress at the rotor surface, Pa, and

$h$  = height of the rotor, mm.

DISCUSSION—For the dimensions given in 6.1.1,

$$T_r = 31.7 M \times 10^{-6}$$

$$S_r = 3.5 M$$

[D02.07] **D4684**

**shelf life**,  $n$ —the period of time, under specified storage

conditions, for which the reference material (RM) will possess the same properties or true values, within established acceptance limits. [D02.04] **D6596**

**shock treatment**,  $n$ —the addition of an antimicrobial agent sufficient to cause rapid and substantial (several orders of magnitude) reductions in number of living microbes in a fluid or system receiving that concentration. [D02.14]

**D6469**

**SI**—abbreviation for Le Système International d'Unités (SI), The International System of Units (SI): The Modern Metric System.

**SIG**, *adj*—stay-in-grade

DISCUSSION—Capability of multiviscosity-graded oil to stay in grade under test conditions. [D02.B0] **D6709**

**single base**, *adj*—*in lubricating grease*, relating to a thickener comprised of soaps of only one metal. [D02.G0] **D128**

**site precision**,  $n$ —2.77 times the standard deviation of results obtained under site precision conditions. [D02.25] **D3764**

**site precision (R')**,  $n$ —the value below which the absolute difference between two individual test results obtained under site precision conditions may be expected to occur with a probability of approximately 0.95 (95 %). It is defined as 2.77 times the standard deviation of results obtained under site precision conditions. [D02.94] **D6792**

**site precision conditions**,  $n$ —conditions under which test results are obtained by one or more operators in a single site location practicing the same test method on a single measurement system using test specimens taken at random from the same sample of material over an extended period of time spanning at least a 15 day interval. [D02.94] **D6792, D6792, D6792**

DISCUSSION—A measurement system may comprise multiple instruments being used for the same test method. [D02.25] **D3764**

**skinnogen**,  $n$ —(Synonym—**biofilm**.)

DISCUSSION—Generally applied to a biofilm formed at the fuel-water interface. [D02.14] **D6469**

**slice time**,  $n$ —the retention time at the end of a given area slice. [D02.04] **D7096**

**slice width**,  $n$ —the fixed duration (1 s, or less) of the retention time intervals into which the chromatogram is divided. It is determined from the reciprocal of the frequency used in the acquisition of data. [D02.04] **D7096**

**sludge**,  $n$ —*in internal combustion engines*, a deposit, principally composed of insoluble resins and oxidation products from fuel combustion and the lubricant, that does not drain from engine parts but can be removed by wiping with a cloth. [D02.B0] **D5967, D6593, D7156**

**sludge**,  $n$ —a precipitate or sediment from oxidized mineral oil and water. [D02.09] **D4310**

**sludge**,  $n$ —*in manual transmissions and final drive axles*, a deposit principally composed of the lubricating oil and oxidation products that do not drain from parts but can be removed by wiping with a cloth. [D02.B0] **D5704**

**smoke point**,  $n$ —the maximum height of a smokeless flame of fuel burned in a wick-fed lamp.

**soap**,  $n$ —*in lubricating grease*, a product formed in the

saponification (neutralization) of fats, fatty acids, or esters by inorganic bases. [D02.G0] D128

**soft carbon**, *n*—see **graphitizable carbon**. [D02.F0] C709

**solid**, *adj*—describing a state of matter characterized by imperceptible flow under moderate stress, a definite capacity for resisting forces that tend to deform it, and, under ordinary conditions, retaining a definite size and shape.

DISCUSSION—A quantity of solid particles, powders, or pellets, for example, fluidized catalyst beds, can also flow like a liquid in the presence of an applied force. The state of the individual particles, nevertheless, remains as a solid.

**solid**, *n*—substance (matter) in a solid state (see **solid**, *adj*).

**solidification point**, *n*—of *petroleum wax*, that temperature in the cooling curve of the wax where the slope of the curve first changes significantly as the wax sample changes from a liquid to a solid state.

**solidification point of petroleum wax**, *n*—that temperature in the cooling curve of the wax where the slope of the curve first changes significantly as the wax sample changes from a liquid to a solid state. [D02.10] D3944

**solubility parameter**, *n*—of *liquids*, the square root of the heat of vaporization minus work of vaporization (cohesive energy density), per unit volume of liquid, at 298 K.

**soluble oil**, *n*—an oil-rich concentrate that will mix with water to form an emulsion imparting such properties as lubrication, cooling, and corrosion inhibition.

**sonication**, *n*—the act of subjecting a material to the shearing forces of high-frequency sound waves.

DISCUSSION—Sonication of a two phase liquid system may result in the dispersal of one phase as fine droplets in the other phase.

[D02.N0] D6006, [D02.12] D6384

**soot**, *n*—in *internal combustion engines*, sub-micron size particles, primarily carbon, created in the combustion chamber as products of incomplete combustion. [D02.B0] D5862, D6750

**sour**, *v*—to increase the concentration of hydrogen sulfide. [D02.14] D6469

**Soxhlet apparatus**, *n*—a device, usually of glass, used to extract soluble material from a mixture of soluble and insoluble (generally solid) materials, by passing a volatile solvent through the sample and recirculating the solvent by refluxing. [D02.G0] D128

**spalling**, *n*—on *ring and pinion gears*, the breaking out of flakes of irregular area of the tooth surface, a condition more extensive than pitting. [D02.B0] D6121, D7450

**spark plug fouling**, *n*—deposition of essentially non-conducting material onto the electrodes of a spark plug that may, but will not necessarily, prevent the plug from operating. [D02.B0] D4857, D4858

**spark plug whiskering, or spark plug bridging**, *n*—a deposit of conductive material on the spark plug electrodes that tends to form a bridge between them, thus shorting out the plug. [D02.B0] D4857, D4858

**spatulate**, *n*—to mix or blend by spreading and folding with a flat thin, usually metal, tool. [D02.G0] D6185

**special-duty propane**—a high-quality product composed chiefly of propane, which exhibits superior antiknock char-

acteristics when used as an internal combustion engine fuel. [D02.H0] D1835

**specimen**, *n*—a piece or portion of a sample used to make a test. [D02.B0] D6594

**specular gloss**, *n*—in *waxed paper and paperboard technology*, the degree to which a surface simulates a mirror in its capacity to reflect incident light.

**specular gloss**, *n*—the degree to which a surface simulates a mirror in its capacity to reflect incident light. [D02.10] D1834

**specific gravity**, *n*—*deprecated term*, the ratio of the density of a substance to that of a reference substance such as water (for solids and liquids) or hydrogen (for gases) under specified conditions (see **relative density**).

**split/splitless injector**, *n*—a heated capillary inlet or sample introduction system that allows controlled splitting of the injected sample into two unequal portions, the smaller of which goes to the capillary column, and the greater to a vent.

DISCUSSION—When the vent is closed, the entire sample enters the capillary column and the inlet is operated as a *splitless* injector. When the vent is open, the inlet is operated in the *split* mode and only a portion of the sample reaches the capillary column. The ratio of the split between the capillary column and the vent is calculated as described in 3.1.7.2. [D02.04] D7059

**split ratio**, *n*—in capillary gas chromatography, the ratio of the total flow of carrier gas to the sample inlet versus the flow of the carrier gas to the capillary column, expressed by:

$$\text{split ratio} = (S + C)/C$$

where:

*S* = flow rate at the splitter vent, and

*C* = flow rate at the column outlet.

[D02.04] D7059

**sponsor**, *n*—of *an ASTM test method*, an organization that is responsible for ensuring supply of the apparatus used in the test procedure portion of the test method.

DISCUSSION—In some instances, such as a test method for chemical analysis, an ASTM working group can be the *sponsor* of a test method. In other instances, a company with a self-interest may or may not be the *developer* of the test procedure used within the test method, but is the *sponsor* of the test method. [D02.B0] D6594, D6750

**spread**, *n*—in *knock measurement*, the sensitivity of the detonation meter expressed in knockmeter divisions per octane number. [D02.01] D2699, D2700

**SRV**, *n*—Schwingung, Reibung, Verschleiss, (German); oscillating, friction, wear, (English translation). [D02.G0] D5707

**stability reserve**, *n*—in *petroleum technology*, the property of an oil to maintain asphaltenes in a peptized state and prevent flocculation of the asphaltenes.

DISCUSSION—An oil with a low stability reserve is likely to undergo flocculation of asphaltenes when stressed (for example, extended heated storage) or blended with a range of other oils. Two oils each with a high stability reserve are likely to maintain asphaltenes in a peptized state and not lead to flocculation when blended together. [D02.14] D7060, D7061

**stability testing, *n***—tests required to demonstrate the chemical stability of the ampulized reference material (RM) for the purpose of determining the shelf life of the RM. [D02.04] D6596

**stable engine conditions, *n***—for octane rating, cylinder head temperatures change less than 5°C (9°F) during a 1 min period. Any changes or minor adjustments to throttle, mixture, or engine conditions mandate restarting the clock for determining stable conditions. [D02.J0] D6424

**standard, *n***—a physical or chemical reference used as a basis for comparison or calibration. [D02.03] D7111

**standard deviation, *n***—the most usual measure of the dispersion of observed values or results expressed as the positive square root of the variance. [D02.94] D6300, [E11] E456

**standard knock intensity, *n***—for knock testing, that level of knock established when a primary reference fuel blend of specific octane number is used in the knock testing unit at maximum knock intensity fuel-air ratio, with the cylinder height (dial indicator or digital counter reading) set to the prescribed guide table value. The detonation meter is adjusted to produce a knockmeter reading of 50 for these conditions. [D02.01] D2699, D2700

**standard knock intensity, *n***—for supercharge method knock testing, trace or light knock as determined by ear.

DISCUSSION—Light knock intensity is a level definitely above the commonly defined least audible “trace knock”; it is the softest knock that the operator can definitely and repeatedly recognize by ear although it may not be audible on every combustion cycle (intermittent knock). The variations in knock intensity can occasionally include loud knocks and very light knocks. These variations can also change with mixture ratio; the steadiest knock typically occurring in the vicinity of 0.09 fuel-air ratio. [D02.01] D909

**standard oxidation temperature (SOT)**—temperature in degrees Celsius at which a sample would reach the standard oxidation rate, that is, it would lose by oxidation 1% of its initial weight in 24 h.

DISCUSSION—In this procedure, SOT is estimated by plotting the decimal logarithm of oxidation rate data determined at several temperatures against the reciprocal of the absolute temperature (in Kelvin) of the measurement. The plot should yield a straight line. The temperature at which the line predicts a rate corresponding to 1% weight loss in 24 h (equivalent to  $SOR_w = 4.17 \times 10^{-4} \text{ g g}^{-1} \text{ h}^{-1}$ ) is the standard oxidation temperature (SOT). [D02.F0] D7542

**standard test, *n***—a test on a calibrated test stand, using the prescribed equipment that is assembled according to the requirements in the test method, and conducted according to the specified operating conditions.

DISCUSSION—The specified operating conditions in some test methods include requirements for determining a test’s operational validity. These requirements are applied after a test is completed, and can include (1) mid-limit ranges for the average values of primary and secondary parameters that are narrower than the specified control ranges for the individual values, (2) allowable deviations for individual primary and secondary parameters from the specified control ranges, (3) downtime limitations, and (4) special parameter limitations. [D02.B0] D6750, D7156

**standard test, *n***—a test on a calibrated test stand, using the prescribed equipment according to the requirements in the

test method, and conducted according to the specified operating conditions.

DISCUSSION—The specified operating conditions in some test methods include requirements for determining a test’s operational validity. These requirements are applied after a test is completed and can include (1) mid-limit ranges for the average values of primary and secondary parameters that are narrower than the specified control ranges for the individual values, (2) allowable deviations for individual primary and secondary parameters for the specified control ranges, (3) downtime limitations, and (4) special parameter limitations. [D02.B0] D7422

**starting torque, *n***—the maximum torque measured at the start of rotation. [D02.G0.05] D1478

**state of matter, *n***—condition in which a substance (matter) exists, as a gas, liquid, or solid.

DISCUSSION—Gas, liquid, and solid are the primary states of matter encountered in the petroleum industry. However, greases, petrolatum, and other very viscous materials are often described as semi-solids (semi-liquids or semi-fluids) because they retain their shapes for extended periods, but can be caused to flow when a force is applied, as is a grease gun. The existence of other physical states of matter, such as plasma and supercritical fluid, is also recognized, as is their application in instrumental and other analyses.

**static hold-up or wettage, *n***—the quantity of liquid retained in the column after draining at the end of a distillation.

DISCUSSION—It is characteristic of the packing or the design of the plates, and depends on the composition of the material in the column at the final cut point and on the final temperature. [D02.08] D2892

**storage point, *n***—an indication of the minimum temperature to which an oil should be heated in any part of an oil-handling installation when starting up after a shutdown. It is also an indication of the minimum temperature at which the oil should be stored in a tank fitted with an outflow heater. [D02.07] D3245

**storage stability, *n***—the resistance of fuel to formation of degradation products when stored at ambient temperatures. [D02.E0] D6985

**straight-run gases, *n***—hydrocarbon gases that do not contain unsaturates. [D02.04] D2650

**stripping, *n***—the process whereby volatile fractions are removed from a liquid material.

DISCUSSION—In this test method, lighter components such as water and gasoline are removed by the application of heat while passing an inert gas through the liquid. [D02.06] D3607

**strong surfactants, *n***—in petroleum fuels, surface active materials that disarm filter separator elements.

DISCUSSION—Strong surfactants can be refinery process chemicals left in the fuel or contaminants introduced during transportation of the fuel. [D02.14] D7261

**stuck lifter, *n***—in internal combustion engines, a lifter plunger that does not return to its original position by its own force upon removal from the engine.

**sulfate reducing bacterial (SRB), pl., *n***—any bacteria with the capability of reducing sulfate to sulfide.

DISCUSSION—The term SRB applies to representatives from a variety of bacterial taxa that share the common feature of sulfate reduction



- (SO<sub>4</sub><sup>=</sup> to S<sup>=</sup>). SRB are major contributors to MIC. [D02.14] D6469
- sulfated ash, n**—the residue remaining after the sample has been carbonized, and the residue subsequently treated with sulfuric acid and heated to constant weight. [D02.03] D874
- sum of squares, n**—in analysis of variance, a contraction of the expression “sum of the squared deviations from the appropriate average(s)” where the average(s) of interest may be the average(s) of specific subset(s) of data or of the entire set of data. [D02.94] D6300, [D13] D123
- supercharge performance number, n**—a numerical value arbitrarily assigned to the supercharge ratings about 100 ON. [D02.01] D909
- supercharge rating, n**—the numerical rating of the knock resistance of a fuel obtained by comparison of its knock-limited power with that of primary reference fuel blends when both are tested in a standard CFR engine operating under the conditions specified in this test method. [D02.01] D909
- supercritical fluid, n**—fluid maintained in a thermodynamic state above its critical temperature and critical pressure. [D02.04.0C] D7347
- supercritical fluid chromatography, n**—class of chromatography that employs supercritical fluids as mobile phases. [D02.04.0C] D7347
- supernatant, n**—the liquid above settled solids. [D02.12] D6384
- supplier, n**—any individual or organization responsible for the quality of a product just before it is taken over by the receiver. [D02.94] D3244
- surfactants, n**—surface active molecular species that exhibit both water soluble and oil soluble properties, and affect the physical behavior at the interface between water and oil phases by forming emulsions or changing the wetting characteristics of solid surfaces exposed to water and oil. [D02.J0] D5000
- surfactants, n**—*in petroleum fuels*, surface active materials that could disarm (de-activate) filter separator (coalescing) elements so that free water is not removed from the fuel in actual service.  
DISCUSSION—Technically, surfactants affect the interfacial tension between water and fuel which affects the tendency of water to coalesce into droplets or not. [D02.14] D7261
- surface finish, n**—the geometric irregularities in the surface of a solid material. Measurement of surface finish shall not include inherent structural irregularities unless these are the characteristics being measured. [D02.F0] C709
- surface tension (γ), n**—the specific surface free energy of a liquid gas interface, millinewton per metre (ergs/cm<sup>2</sup>). [D02.11] D3825
- surrogate calibration, n**—a multivariate calibration that is developed using a calibration set which consists of mixtures with pre-specified and reproducible compositions that contain substantially fewer chemical components than the samples which will ultimately be analyzed. [D02.05] D6756
- surrogate method, n**—a standard test method that is based on a surrogate calibration. [D02.05] D6756
- suspended solids (of activated sludge or other inoculum samples), n**—solids present in activated sludge or inoculum samples that are not removed by settling under specified conditions. [D02.12] D6139
- syneresis, n**—of lubricating greases, the separation of liquid lubricant from a lubricating grease due to shrinkage or rearrangement of the structure.  
DISCUSSION—Syneresis is a form of bleeding caused by physical or chemical changes of the thickness. Separation of free oil or the formation of cracks that occur in lubricating greases during storage in containers is most often due to syneresis. [D02.G0] D6185
- synthetic, adj**—*in lubricants*, originating from the chemical synthesis of relatively pure organic compounds from one or more of a wide variety of raw materials.
- system noise, n**—the difference between the maximum and minimum area readings per second for the first 20 area readings in the blank run. [D02.04] D3710
- system response time**—the sum of the analyzer unit response time and the analyzer sample system lag time. [D02.25] D2728
- T**—*in electromagnetics*, symbol for transmittance.
- takeoff power, n**—*for octane rating*, normal or maximum rated power with the engine speed at maximum rated. [D02.J0] D6812
- takeoff rate, n**—the rate of product takeoff from the reflux divider expressed in millilitres per hour. [D02.08] D2892
- takeoff rate, n**—*in column distillation*, the volume of product withdrawn from the reflux divider over a specified period.
- tar, n**—a brown or black, bituminous, liquid or semi-solid comprised primarily of bitumens condensed in the processing of coal, petroleum, oil-shale, wood, or other organic materials. [D02.G0] D128
- tar, n**—a sticky, viscous, brown or black, bituminous material obtained from the destructive distillation of coal or other organic substances.  
DISCUSSION—Although tar can be made from other organic substances, its normal source is bituminous coal. Therefore, its use in referring to petroleum products is discouraged except as a descriptive term.
- target octane number, n**—the research or motor octane number quality desired for a specific product.
- taxa, pl., n**—the units of classification of organisms, based on their relative similarities.  
DISCUSSION—Each *taxonomic unit* (group of organisms with greatest number of similarities) is assigned, beginning with the most inclusive to kingdom, division, class, order, family, genus, and species. Bacteria and fungi are often further classified by strain and biovariation. [D02.14] D6469
- TDC, adj**—top dead center  
DISCUSSION—It is used with the degree symbol to indicate the angular position of the crankshaft from its position at the point of uppermost travel of the piston in the cylinder. [D02.B0] D6709
- TEL**—abbreviation for tetraethyllead (a gasoline antiknock agent).

**temperature lag**, *n*—the offset between the temperature reading obtained by a temperature sensing device and the true temperature at that time. [D02.08] D86

**temperature measurement device**, *n*—a thermometer, as described in 6.3.1, or a temperature sensor, as described in 6.3.2. [D02.08] D86

**temperature reading**, *n*—the temperature obtained by a temperature measuring device or system that is equal to the thermometer reading described in 3.1.19. [D02.08] D86

*corrected temperature reading*, *n*—the temperature reading, as described in 3.1.18, corrected for barometric pressure. [D02.08] D86

**tensile strength**, *n*—a property of solid material that indicates its ability to withstand a uniaxial tensile load. [D02.F0] C709

**terrestrial (or soil) environment**, *n*—the aerobic environmental compartment which is found in and on natural soils. [D02.N0] D6046, [D02.12] D6384

**test oil**, *n*—any oil subjected to evaluation in an established procedure. [D02.B0] D6594, D6837, D6984, D7320

DISCUSSION—It can be any oil selected by the laboratory conducting the test. It could be an experimental product or a commercially available oil. Often, it is an oil that is a candidate for approval against engine oil specifications (such as manufacturers' or military specifications, and so forth). [D02.B0] D6984, D7320

**test parameter**, *n*—a specified component, property, or condition of a test procedure.

DISCUSSION—Examples of *components* are fuel, lubricant, reagent, cleaner, and sealer; of *properties* are density, temperature, humidity, pressure, and viscosity; and of *conditions* are flow rate, time, speed, volume, length, and power. [D02.B0] D 7422

**test procedure**, *n*—one where test parameters, apparatus, apparatus preparation, and measurements are principal items specified. [D02.B0.01] D6984, D7320

**test sample**, *n*—a portion of the product taken at the place where the product is exchanged, that is, where the responsibility for the product quality passes from the supplier to the receiver. In the event that this is not possible, a suitable sampling location should be mutually agreed upon. [D02.94] D3244

**test sample**—the weighed portion of the analysis sample actually used in a test. [D02.05] D4930

**test start**, *n*—introduction of test oil into the engine. [D02.B0] D6709, D6837

**TGF**, *n*—top groove fill [D02.B0] D6750

**theoretical carbon dioxide (ThCO<sub>2</sub>)**, *n*—the amount of CO<sub>2</sub> which could theoretically be produced from the complete biological oxidation of all of the carbon in a test material. [D02.12] D6139

**theoretical CO<sub>2</sub>**, *n*—the amount of CO<sub>2</sub> which could in theory be produced from the complete oxidation of all the carbon in a material. [D02.N0] D6046

**theoretical O<sub>2</sub>(oxygen)**, *n*—the amount of oxygen that is theoretically required to oxidize a material.

DISCUSSION—The appropriate abbreviation is ThO<sub>2</sub>. [D02.12] D6384

**theoretical O<sub>2</sub>**, *n*—the amount of oxygen which would theoretically be required to completely oxidize a material. [D02.N0] D6046

**theoretical plate**, *n*—the section of a column required to achieve thermodynamic equilibrium between a liquid and its vapor.

DISCUSSION—The height equivalent to one theoretical plate (HETP) for packed columns is expressed in millimetres. In the case of real plate columns, the efficiency is expressed as the percentage of one theoretical plate that is achieved on one real plate. [D02.08] D2892

**thermal and oxidative stability**, *n*—*in lubricating oils used for manual transmissions and final drive axles*, a lack of deterioration of the lubricating oil under high-temperature conditions that is observed as viscosity increase of the lubricating oil, insolubles formation in the lubricating oil, or deposit formation on the parts, or a combination thereof. [D02.B0] D5704

**thermal stability**, *n*—the resistance to permanent changes in properties caused solely by heat. [D02.L0] D6743

**thermohydrometer**, *n*—a glass hydrometer with a self-contained mercury thermometer. [D02.02] D1657

**thermometer reading (or thermometer result)**, *n*—the temperature of the saturated vapor measured in the neck of the flask below the vapor tube, as determined by the prescribed thermometer under the conditions of the test. [D02.08] D86

*corrected thermometer reading*, *n*—the thermometer reading, as described in 3.1.19, corrected for barometric pressure. [D02.08] D86

**thickener**, *n*—*in lubricating grease*, a substance composed of finely divided solid particles dispersed in a liquid lubricant to form the product's structure.

DISCUSSION—The thickener can be fibres (such as various metallic soaps) or plates or spheres (such as certain non-soap thickeners), which are insoluble or, at most, only very slightly soluble in the liquid lubricant. The general requirements are that the solid particles be extremely small, uniformly dispersed, and capable of forming a relatively stable, gel-like structure with the liquid lubricant.

[D02.G0] D128, D217, D1742, D1831, D2265, D7342

**thimble**, *n*—*in Soxhlet apparatus*, a closed-end porous cylinder used to hold the material to be extracted, usually made of thick matted filter paper but sometimes made of ceramic. [D02.G0] D128

**thin film fluid lubricant**, *n*—fluid lubricants consisting of a primary liquid with or without additives of lubricating powders and without binders or adhesives, which form a film on one or both surfaces to be lubricated and perform their function after application and after excess material has drained from the application area, and without additional material being supplied by either a continuous or intermittent method. [D02.L0] D5620

**tight piston ring**, *n*—*in internal combustion engines*, a piston ring that will not fall in its groove under its own weight when the piston, with the ring in a horizontal plane, is turned 90° (putting the ring in a vertical plane); by subsequent application of moderate finger pressure, the ring will be displaced. [D02.B0] D5862

**time constant**, *n*—*in data acquisition*, a value which represents a measure of the time response of a system. For a first order system responding to a step change input, it is the time required for the output to reach 63.2 % of its final value.

[D02.B0] D6593

**TIT**, *n*—turbine inlet temperature

[D02.J0] D6812

**TLHC**, *n*—top land heavy carbon

[D02.B0] D6750

**TNTC**, *n*—too numerous to count

[D02.14] D6974

**toluene insolubles**, *n*—that portion of the pentane insolubles not soluble in toluene (methylbenzene).

**toluene insolubles**, *n*—*in used oil analysis*, the portion of pentane insolubles not soluble in toluene. [D02.06] D893

**toluene standardization fuels**, *n*—*for knock testing*, those volumetrically proportioned blends of two or more of the following: reference fuel grade toluene, *n*-heptane, and isooctane that have prescribed rating tolerances for O.N.<sub>ARV</sub> determined by round-robin testing under reproducibility conditions. [D02.01] D2699, D2700

**top size**—the size of the smallest opening of one sieve of a series upon which is cumulatively retained a total of less than 5 % of the sample. This defined top size is not to be confused with the size of the largest particle in a lot.

[D02.05] D6969

**total analyzer system response time**, *n*—time interval between when a step change in property characteristic at the sample loop inlet and when the analyzer output indicates a value *c* corresponding to the 99.5 % of the subsequent change in analyzer results; the total analyzer system response time is the sum of the sample loop lag time, the same conditioning loop lag time, and the total analyzer response time. [D02.25] D6624, D7453

**total fluid constituent**, *n*—*in lubricating grease analysis*, the *n*-hexane-soluble material extracted from the lubricating grease sample.

DISCUSSION—Typical materials include petroleum oil, non-petroleum fluid, soluble fats, and soluble additives. [D02.G0] D128

**total glycerin**, *n*—is the sum of free and bonded glycerin. [D02.04] D6584

**total glycerin**, *n*—the sum of the free glycerin and the glycerin portion of any unreacted or partially reacted oil or fat. [D02.E0] D6751

**total insolubles**, *n*—sum of the adherent and filterable insolubles. [D02.14] D7462

**total n-hexane-insoluble material**, *n*—*in lubricating grease analysis*, that portion of grease (excluding free alkali) that is essentially insoluble in *n*-hexane.

DISCUSSION—Typical materials include thickeners, fillers, inorganic salts, asphaltenes or any combinations of these (also includes insoluble materials found in the analysis of contaminated grease). Free alkali content is generally insignificant. [D02.G0] D128

**total sum of squares (TSS)**, *n*—a statistic used to quantify the information content from the inter-laboratory study in terms of total variation of sample means relative to the standard error of each sample mean. [D02.94] D6708

**toxicity**, *n*—the propensity of a test material to produce adverse behavioral, biochemical, or physiological effects in a living organism. [D02.12] D6081, D6384

**traceability**, *n*—property of the result of a measurement or the value of a standard whereby it can be related to stated references, usually national or international standards, through an unbroken chain of comparisons all having stated uncertainties. [D02.94] D6792

**transmittance**, *n*—*of light*, the fraction of the incident light of a given wavelength that is not reflected or absorbed, but passes through a substance. [D02.14] D7061

**transmittance**, **T**, *n*—the fraction of radiant energy entering a substance that reaches its further boundary.

**transmittance**, **T**, *n*—the molecular property of a substance that determines its transportability of radiant power, expressed by:

$$T = P/P_o$$

where:

*P* = the radiant power passing through the sample, and

*P<sub>o</sub>* = the radiant power incident upon the sample.

[D02.04] D2008

**trap**, *n*—a device utilized to selectively retain specific portions (individual or groups of hydrocarbons or oxygenates) of the test sample and to release the retained components by increasing the trap temperature. [D02.04] D6296

**Tristimulus Values**, *n*—the amounts of three specified stimuli required to match a color.

DISCUSSION—In the CIE system, they are assigned the symbols X, Y, and Z. [D02.05] D6045, [E12] E284

**true value**,  $\mu$ , *n*—*in statistics*, the value towards which the average of single results obtained by *N* laboratories tends, when *N* becomes very large.

**true value** ( $\mu$ ), *n*—for practical purposes, the value towards which the average of single results obtained by *N* laboratories using the same standard test method tends, when *N* becomes very large. Consequently, this definition of true value is associated with the particular test method employed.

[D02.94] D3244

**TSA**, *n*—tryptone soy agar

[D02.14] D6974

**turbocharged/supercharged aircraft engine**, *n*—aircraft piston engine that breathes with forced means from either turbochargers or superchargers. [D02.J0] D6812

**Type I mineral oils**, *n*—oils for steam and gas turbine lubricating systems where the machinery does *not* require lubricants with enhanced load carrying capacity.

DISCUSSION—Type I oils usually are available in ISO VG 32, 46, 68 and 100 (see Classification D2422). Such oils normally contain rust and oxidation inhibitors in addition to other additives as required to meet the specified performance characteristic. Type I oils are generally satisfactory for turbine sets where bearing temperatures do not exceed 110°C. [D02.C0] D4304

**Type II mineral oils**, *n*—oils for steam and gas turbine lubricating systems where the machinery requires enhanced load carrying capacity.

DISCUSSION—Type II oils usually are available in ISO VG 32, 46, 68, 100, and 150. These oils are similar to Type I but contain additional anti-wear additives for use in turbines equipped with a gearbox. Oils ISO VG 68 and above have been used in marine, hydro, or water turbines. [D02.C0] D4304



**Type III mineral oils, *n***—oils for heavy duty gas or combined cycle turbine lubricating systems where the lubricant shall withstand higher temperatures and exhibit higher thermal stability than Type I mineral oils.

DISCUSSION—Type III oils usually are available in ISO VG 32 and 46. Such oils are normally comprised of a highly refined mineral base oil with suitable rust and oxidation inhibitors in addition to other additives as needed to meet specified performance characteristics. Type III oils are formulated for use in turbine sets where bearing temperatures may exceed 110°C. The turbine lubrication systems using Type III oils may be equipped with a gearbox that may require the selection of oils that contain additional anti-wear additives to impart the specified load carrying capacity. **[D02.C0] D4304**

**ullage, *n***—that volume of a closed system or container which is filled with vapor.

**ultimate biodegradation, *n***—degradation achieved when the test substance is totally utilized by microorganisms resulting in the production of CO<sub>2</sub>, (and possibly methane in the case of anaerobic biodegradation), water, inorganic compounds, and new microbial cellular constituents (biomass or secretions, or both). **[D02.12] D5864**

**ultimate biodegradation, *n***—degradation achieved when a material is totally utilized by microorganisms resulting in the production of carbon dioxide (and possibly methane in the case of anaerobic biodegradation), water, inorganic compounds, and new microbial cellular constituents (biomass or secretions or both). **[D02.N0] D6046**

**ultimate biodegradation test, *n***—a test that estimates the extent to which the carbon in a product has been converted to CO<sub>2</sub> or methane, either directly, by measuring the production of CO<sub>2</sub> or methane, or indirectly, by measuring the consumption of O<sub>2</sub>.

DISCUSSION—The measurement of new biomass is not attempted. **[D02.12] D5864**

**ultimate biodegradation test, *n***—a test which estimates the extent to which the carbon in a material is converted to CO<sub>2</sub> or methane, either directly by measuring the production of CO<sub>2</sub> or methane, or, for aerobic biodegradation, indirectly by measuring the consumption of O<sub>2</sub>.

DISCUSSION—The measurement of new biomass is usually not attempted. **[D02.N0] D6046**

**ultimate tensile strength, *n***—the highest load attained during a tensile test, converted to unit stress based on the original cross-section area of the tensile test specimen. **[D02.F0] C709**

**unleaded aviation gasoline, *n***—gasoline possessing specific properties suitable for fueling aircraft powered by reciprocating spark ignition engines, where lead is not intentionally added for the purpose of enhancing octane performance.

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] D7547**

**unsaponifiable matter, *n***—in lubricating grease, organic materials, either added or found with fatty materials, which do not react during saponification. **[D02.G0] D128**

**unsulfonated residue, *n***—in oils, that portion of an oil

remaining unsulfonated after treatment with concentrated sulfuric acid. **[D02.06] D483**

**used oil, *n***—in petroleum product recycling, oil whose characteristics have changed since being originally manufactured, and which is suitable for recycling. **[D02.P0] D6448, D6823**

**used oil, *n***—any oil that has been in a piece of equipment (for example, an engine, gearbox, transformer, or turbine), whether operated or not. **[D02.B0] D6984, D7320**

DISCUSSION—In this test method, used oil is from a gasoline engine. **[D02.06] D322**

DISCUSSION—Typically, in this test method, the acidity of oxidized hydraulic or steam turbine oils is measured. **[D02.06] D3339**

DISCUSSION—In this test method, the oil can be any oil that has been used for lubrication of a locomotive diesel engine, whether engaged in railroad or other service. **[D02.06] D7317**

**validation, *n***—statistically quantified judgment that the analyzer system or subsystem being assessed can produce predicted PTM results with acceptable precision and bias performance when compared to actual results from a primary test method measurement system for common materials. **[D02.25] D7453**

**valve train, *n***—in internal combustion engines, the series of components, such as valves, crossheads, rocker arms, push rods, and camshaft, that open and close the intake and exhaust valves. **[D02.B0] D7468**

**vapor-liquid ratio, *n***—of a liquid, the ratio, at a specified temperature and pressure, of the volume of vapor in equilibrium with liquid to the volume of liquid sample charged, at 32°F (0°C).

**vapor-liquid ratio (V/L), *n***—of a liquid, the ratio of the vapor volume to the liquid volume of specimen, in equilibrium, under specified conditions. **[D02.08] D6897**

**vapor pressure, *n***—the pressure exerted by the vapor of a liquid when in equilibrium with the liquid. **[D02.H0] D1267, [D02.08] D323, D4953**

**vapor temperature reading, *n***—temperature of saturated vapor measured in the distillation column below the vapor tube, as determined by the prescribed conditions of the test. **[D02.08] D7344**

*corrected vapor temperature reading, *n**—temperature reading, as described in , corrected for barometric pressure. **[D02.08] D7344**

**variance, *n***—a measure of the dispersion of a series of accepted results about their average. It is equal to the sum of the squares of the deviation of each result from the average, divided by the number of degrees of freedom. **[D02.94] D6300, RR:D02–1007<sup>8</sup>**

**variance, between-laboratory, *n***—that component of the overall variance due to the difference in the mean values obtained by different laboratories. **[D02.94] D6300, [ISO/TC 28] ISO 4259**

DISCUSSION—When results obtained by more than one laboratory are compared, the scatter is usually wider than when the same number of tests are carried out by a single laboratory, and there is some variation between means obtained by different laboratories. Differences in operator technique, instrumentation, environment, and sample “as

received” are among the factors that can affect the between laboratory variance. There is a corresponding definition for between-operator variance.

DISCUSSION—The term “between-laboratory” is often shortened to “laboratory” when used to qualify representative parameters of the dispersion of the population of results, for example, as “laboratory variance.” [D02.94] **D6300**

**varnish**, *n*—*in internal combustion engines*, a hard, dry, generally lustrous deposit that can be removed by solvents but not by wiping with a cloth. [D02.B0] **D5967, D6593, D6984, D7156, D7320, D7422**

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

**viable microbial biomass**, *n*—metabolically active (living) micro-organisms [D02.14] **D7463**

**viable titer**, *n*—the number of living microbes present per unit volume, mass, or area.

DISCUSSION—Viable titer is reported in terms of either colony forming units (CFU) or most probable number (MPN) per milliliter, milligram, or centimetre squared. [D02.14] **D6469**

**viscosity**, *n*—the ratio between the applied shear stress and rate of shear. It is sometimes called the coefficient of dynamic viscosity. This value is thus a measure of the resistance to flow of the liquid. The SI unit of viscosity is the pascal second (Pa.s). The centipoise (cP) is one millipascal second (mPa.s) and is often used. [D02.07] **D3829**

**viscosity**—the ratio between the applied shear stress and rate of shear, sometimes called the coefficient of dynamic viscosity. This value is thus a measure of the resistance to flow of the liquid. The SI unit of viscosity is the Pascal second [Pa.s]. A centipoise (cP) is one milliPascal second [mPa.s]. [D02.07] **D4684**

**viscosity**, *n*—the ratio between the applied shear stress and the rate of shear. It is sometimes called the coefficient of dynamic viscosity. This coefficient is a measure of the resistance to flow of the liquid. In the SI, the unit of viscosity is the Pascal-second; often the milliPascal-second or its equivalent the centiPoise is found more convenient.

*apparent viscosity*—the viscosity of a non-Newtonian fluid at a given shear rate or shear stress determined by this test method. [D02.07] **D4683, D6616**

*kinematic viscosity*—ratio of the viscosity (dynamic, absolute) to the density of the liquid. It is a measure of the resistance to flow of a liquid where the shear stress (force causing flow) is applied by gravity. Kinematic viscosity values are thus affected by both the dynamic viscosity (absolute viscosity) of the liquid and its density. In SI, the unit of kinematic viscosity is the metre squared per second, often conveniently expressed as millimetre squared per second and termed the centiStoke. [D02.07] **D4683**

**viscosity**—the ratio of shear stress to shear rate. Viscosity of a liquid is a measure of the internal friction of the liquid in motion. The unit of dynamic viscosity is the pascal second. For a Newtonian liquid, the viscosity is constant at all shear rates. For a non-Newtonian liquid, viscosity will vary depending on shear rate. [D02.10] **D2669**

**viscosity, apparent**—the viscosity determined by this method,

expressed in pascal seconds. Its value may vary with the spindle and rotational speed selected because many hot melts are non-Newtonian. [D02.10] **D2669**

**viscosity index (VI)**, *n*—an arbitrary number used to characterize the variation of the kinematic viscosity of a fluid with temperature. [D02.N0] **D6080**

**viscosity loss (VL)**, *n*—a measure of the decrease in an oil’s viscosity.

DISCUSSION—Viscosity Loss is a property measured for a finished oil. Permanent Shear Stability Index (q.v.) is a property calculated for a single component. Some test methods report VL as a relative change, which is dimensionless (for example, Test Methods D2603, D3945, D5275, D5621). Some test methods and specifications report VL as an absolute change, which has the same dimensions as the viscosity measurements (for example, Specification D4485 and Test Methods D5119 and D5621). [D02.07] **D6022**

**VL**—*in viscometry*, abbreviation for viscosity loss.

**void**, *n*—an unfilled space enclosed within an apparently solid carbon or graphite body. [D02.F0] **C709**

**volatile fuels**—relatively wide boiling range volatile distillate.

DISCUSSION—These are identified as Jet B in Specification D1655 or the military grade known as JP-4. Any fuel or mixture having a flash point less than 38°C must be considered volatile. [D02.J0] **D5452**

**volume count**, *n*—the product of the area under a peak and a response factor. [D02.04] **D3710**

**volume count**, *n*—the product of a slice area (or an area under a peak) and a volume response factor. [D02.04] **D7096**

**volume response factor**, *n*—a constant of proportionality that relates the area under a chromatogram to liquid volume. [D02.04] **D7096**

**waste oil**, *n*—*in petroleum technology*, oil having characteristics making it unsuitable either for further use or for economic recycling. [D02.P0] **D6448, D6823**

**water accommodated fraction (WAF)**, *n*—the predominately aqueous portion of a mixture of water and a poorly water-soluble material which separates in a specified period of time after the mixture has undergone a specified degree of mixing and includes water, dissolved components, and dispersed droplets of the poorly water soluble material.

DISCUSSION—The chemical composition of the WAF depends on the ratio of poorly soluble material to water in the original mixture as well as the details of the mixing procedure. [D02.N0] **D6046**

**water soluble fraction (WSF)**, *n*—the filtrate or centrifugate of the water accommodated fraction which includes all parts of the WAF, except the dispersed droplets of the poorly soluble material. [D02.12] **D6081, D6384**

**wax blocking point**, *n*—the lowest temperature at which film disruption occurs across 50 % of the waxed paper surface when the test strips are separated. [D02.10] **D1465**

**wax loading**, *n*—the weight of wax present primarily as a surface film but including the minor part embedded in the surface fibers of corrugated board. It is expressed as weight per unit area, usually in grams per square metre or pounds per thousand square feet of board. [D02.10] **D3708**

**wax picking point**, *n*—the temperature at which the first film disruption occurs on the waxed paper when test strips are separated. [D02.10] **D1465**

**WDK**, *n*—weighted demerits (1K) [D02.B0] D6750

**WDN**, *n*—weighted demerits (1N) [D02.B0] D6750

**weak surfactants**, *n*—*in petroleum fuels*, surface active materials that do not adversely affect the performance of filter separator elements in actual service.

DISCUSSION—Weak surfactants are typically certain types of additives used in fuels. [D02.14] D7261

**wear**, *n*—damage to a solid surface, generally involving progressive loss of material, due to relative motion between that surface and a contacting substance or substances.

[D02.L0] D2714, D2782, D3704, D5620, [G02] G40

**wear**, *n*—the loss of material from, or relocation of material on, a surface.

DISCUSSION—Wear generally occurs between two surfaces moving relative to each other, and is the result of mechanical or chemical action or a combination of mechanical and chemical actions. [D02.B0]

D5862, D6593, D6709, D6750, D6984, D7156, D7320

**wear**, *n*—the loss of material from two or more surfaces in relative motion. [D02.B0] D5579

**wear**, *n*—the removal of metal from a rubbing surface by mechanical action, or by a combination of mechanical and chemical actions. [D02.G0] D2509

**wear**, *n*—the loss of material from a surface, generally occurring between two surfaces in relative motion, and resulting from mechanical or chemical action or a combination of both. [D02.B0] D7422

**wear**, *n*—*on ring and pinion gears*, the removal of metal, without evidence of surface fatigue or adhesive wear, resulting in partial or complete elimination of tool or grinding marks or development of a discernible shoulder ridge at the bottom of the contact area near the root or at the toe or heel end of pinion tooth contact area (abrasive wear).

[D02.B0] D6121, D7450

**wear rate**, *n*—the rate of material removal or dimensional change due to wear per unit of exposure parameter; for example, quantity of material removed (mass, volume, thickness) in unit distance of sliding or unit time.

[D02.L0] D3702

**weight of applied coating wax**, *n*—the weight of applied coating per unit area of board, usually grams per square metre or pounds per thousand square feet of board covered.

[D02.10] D3522

**weight of wax coating**, *n*—the weight of wax present as a surface film on corrugated paperboard, expressed as weight per unit area, usually grams per square metre or pounds of coating per thousand feet of board covered.

DISCUSSION—This definition excludes any portion of wax that is located below the surface, that may have been permitted to soak into the fibrous paperboard structure. [D02.10] D3521

**weight percent impregnating wax**, *n*—the weight percent of wax in the facing relative to the weight of unwaxed facing measured at 23°C (73°F) and 50 % relative humidity.

[D02.10] D3522

**weight-normalized oxidation rate (OR<sub>w</sub>)**—rate of weight loss due to oxidation of a machined specimen at a given temperature, divided by the initial weight 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 weight-normalized oxidation rate, OR<sub>w</sub>, are:

$$[\text{g}_{(\text{oxidized})}] [\text{g}_{(\text{specimen})}]^{-1} \text{h}^{-1} \text{ (or, equivalent, h}^{-1}\text{)} \quad (4)$$

[D02.F0] D7542

**weight-normalized standard oxidation rate (SOR<sub>w</sub>)**—value of weight-normalized oxidation rate corresponding to 1% weight loss in 24 h (equivalent to  $\text{SOR}_w = 4.17 \times 10^{-4} \text{ g g}^{-1} \text{ h}^{-1}$ ).

[D02.F0] D7542

**weld point**—under the conditions of this test, the lowest applied load in kilograms at which the rotating ball welds to the three stationary balls, indicating the extreme-pressure level of the lubricants-force (or newtons) has been exceeded.

DISCUSSION—Some lubricants do not allow true welding, and extreme scoring of the three stationary balls results. In such cases, the applied load which produces a maximum scar diameter of 4 mm is reported as the weld point. [D02.L0] D2783

**weld point**, *n*—the lowest applied load at which sliding surfaces seize and then weld.

DISCUSSION—Under the conditions of this test, the lowest applied load in kilograms-force (or newtons) at which the rotating ball seizes and then welds to the three stationary balls, indicating the extreme-pressure level of the lubricating grease has been exceeded. See Fig. 1, Point D.

DISCUSSION—Some lubricating greases do not allow true welding, and extreme scoring of the three stationary balls results. In such cases, the applied load which produces a maximum scar diameter of 4 mm is reported as the weld point. [D02.G0] D2596

**wet shear stability**, *n*—*of lubricating grease*, change in consistency of a mixture of sample and small amount of water after a specified amount of working in a grease worker or a roll stability test apparatus. [D02.G0] D7342

**wettage**, *n*—see **static hold-up or wettage**.

**with grain**, *n*—the direction in a body with preferred orientation due to forming stresses that has the maximum *a*-axis alignment as measured in an X-ray diffraction test.

[D02.F0] C709

**worked penetration**, *n*—*of lubricating grease*, the penetration at 25°C (77°F), without delay, of a sample after 60 double strokes in a standard grease worker. [D02.G0] D1831, D7342

**working**, *n*—*of lubricating grease*, the subsection of a sample to the shearing action of the standard grease worker.

[D02.G0] D1831, D7342

**working direction**, *n*—*in manufactured carbon and graphite product technology*, direction of applied force used in forming a solid body; generally the direction of applied molding pressure for a uniaxially molded material and the extrusion direction for an extruded material. [D02.F0] C709

**wppm**, *abbr.*—an abbreviation for part per million by weight.

[D02.12] D6384, [D02.N0] D6046

**WSF**—*in aquatic toxicity testing*, abbreviation for water soluble fraction.

**yield stress**, *n*—*in solids*, the maximum stress that can be applied without causing permanent deformation.



**yield stress**,  $n$ —*in fluids*, the shear stress required to initiate flow.

**zero time ( $T_o$ )**,  $n$ —the travel time (correction factor), measured in seconds, associated with the electronic circuits in the pulse propagation system. **[D02.F0] C709**

**Z-score**,  $n$ —standardized and dimensionless measure of the difference between an individual result in a data set and the arithmetic mean of the dataset, re-expressed in units of standard deviation of the dataset (by dividing the actual difference from the mean by the standard deviation for the data set). **[D02.94] D7372**

**Z'-score**,  $n$ —measure similar to the *Z-score* except that the PT program standard deviation is replaced with one that takes into account the site precision of the laboratory.  $Z'$  is a valid approach when the laboratory's site precision standard

deviation is less than the PT program (that is, these data standard deviation) or stated otherwise when the  $TPI > 1$ .

$$Z' = \frac{(X_i - X)}{\sqrt{\left( (s')^2 + \left( \frac{S_{these\ data}^2}{n} \right) \right)}}$$

where:

- $Z'$  = site precision adjusted *Z-Score*,
- $X_i$  = laboratory's result,
- $X$  = PT average value,
- $s'$  = site precision standard deviation estimate, and
- $S_{these\ data}$  = PT Program standard deviation estimate.

**[D02.94] D7372**

## SUMMARY OF CHANGES

Subcommittee D02.95 has identified the location of selected changes to this standard since the last issue (D4175–09) that may impact the use of this standard. (Approved Oct. 1, 2009.)

(I) Revised **1.1.1**.

Subcommittee D02.95 has identified the location of selected changes to this standard since the last issue (D4175–08a) that may impact the use of this standard. (Approved March 1, 2008.)

(I) Added the following definition: AET.

Subcommittee D02.95 has identified the location of selected changes to this standard since the last issue (D4175–08) that may impact the use of this standard. (Approved Feb. 1, 2008.)

(I) Added the following definitions: gas and gaseous.

Subcommittee D02.95 has identified the location of selected changes to this standard since the last issue (D4175–05<sup>e2</sup>) that may impact the use of this standard. (Approved Jan. 15, 2008.)

(I) Added the following definitions: distillate, fluid (noun and adjective), heavy distillate, light distillate, liquid (noun and adjective), middle distillate, petroleum distillate, semi-solid, solid (noun and adjective), and state of matter.

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