Designation: D4175 – 17a

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

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*This standard has been approved for use by agencies of the U.S. Department of Defense.*

## 1. Scope*

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

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

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

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

## 2. Terminology

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

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

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

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

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

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

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

where $T$ is the transmittance.

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

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

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

where $T$ is the transmittance.

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

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

$$a = Af/bc$$

where:

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

**[D02.04] D2008**

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

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

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

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

quality is at the specification limit.

**[D02.94] D3244**

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

DISCUSSION—In the context of this test method, accepted reference value is understood to apply to the ignition delay of specific reference materials determined under reproducibility conditions by collaborative experimental work. **[D02.01] D6890, [D02.94] D6299, D6792**

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**

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**

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

**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**

**ACERT—**Advanced Combustion Emission Reduction Technology **[D02.B0] D8047**

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

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

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

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

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

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

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

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

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

**ACM—**Alkyl Acrylate Copolymer **[D02.B0] D8047**

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

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

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

$$OR = Z\exp(-E_a/\mathrm{R}T)$$

where:

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

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

$$\log_{10}(OR) = \log_{10} Z - E_a/(2.303\,\mathrm{R}T)$$

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

calculated from weight-normalized oxidation rates, $OR_w$). **[D02.F0] D7542**

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

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

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

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

**acute 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**

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

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

**adenosine triphosphate,** *n*—molecule comprised of a purine and three phosphate groups, that serves as the primary energy transport molecule in all biological cells. **[D02.14] D7463**

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

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

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

**adjustment,** *n*—operation of bringing the portable digital density meter to a state of performance suitable for its use, by setting or adjusting the instrument constants. **[D02.04] D7777**

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

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

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

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

**agglomerate,** *n—in manufactured carbon and graphite product technology*, 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 $CaCO_3$L.

DISCUSSION—As A.I. decreases, water becomes more corrosive. At A.I. $\geq$ 12, water is noncorrosive. At 10 $\leq$ A.I. < 12, water is moderately corrosive. At A.I. < 10, water is strongly corrosive. **[D02.14] D6469**

**air-fuel ratio,** *n—in internal combustion engines*, the mass ratio of air-to-fuel in the mixture being induced into the combustion chambers. **[D02.B0] D6593, D6709, D6837, D7589**

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

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

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

DISCUSSION—Aliphatic compounds can be straight or branched chains and saturated or unsaturated. The term aliphatic ether, as used in this specification, refers only to the saturated compounds. **[D02.A0] D5797**

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

**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 = [141.5/relative density 60/60 °F] – 131.5

No statement of reference temperature is required, since 60 °F is included in the definition. **[D02.02] D287**

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

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

**apparent viscosity,** *n—of a lubricating grease*, the ratio of shear stress to shear rate calculated from Poiseuille's equation, and is measured in poises. **[D02.G0] D1092**

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

**[D02.14] D7060, D7061, D7827**

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

**[D02.14] D7112, D7157**

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

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

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

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

**assignable cause,** *n*—a factor that contributes to variation and that is feasible to detect and identify.

**[D02.94] D6299, D7372**

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

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

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

**ASTM supercharge octane number of a fuel below 100,** *n*—the whole number nearest the percentage by volume of *iso*octane (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 *iso* octane, expressed in millilitres per U.S. gallon. **[D02.01] D909**

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

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

**ATR,** *n*—attenuated total reflectance **[D02.04] D7861**

**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. **[Subcommittee D02.01]**

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

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

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

**automotive,** *adj*—descriptive of equipment associated with self-propelled machinery, usually vehicles driven by internal combustion engines.
**[D02.B0] D4485, D6709, D6837, D6894, D7216, D7589**

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

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

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

**aviation gasoline,** *n*—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**

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

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

**aviation gasoline fuel,** *n*—fuel possessing specific properties suitable for operating aircraft powered by reciprocating spark-ignition engines. **[D02.J0] D7719**

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

DISCUSSION—The abbreviation BXX represents a specific blend concentration in the range B6 to B20, where XX is the percent volume of biodiesel in the fuel blend. **[D02.E0] D7467**

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

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

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

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

DISCUSSION—All bacteria are members of the biological diverse kingdoms *Prokaryota* and *Archaebacteriota*. Individual taxa within these kingdoms are able to thrive in environments ranging from sub-zero temperatures, such as in frozen foods and polar ice, to superheated waters in deep-sea thermal vents, and over the pH range <2.0 to >13.0. Potential food sources range from single carbon molecules (carbon dioxide and methane) to complex polymers, including plastics. Oxygen requirements range from obligate anaerobes, which die on contact with oxygen, to obligate aerobes, which die if oxygen pressure falls below a species specific threshold.
**[D02.14] D6469**

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

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

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

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

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

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

number or product identification number, or both. **[D02.P0] D6074**

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

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

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

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**

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

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

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

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

**between-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] D3764, D6122**

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

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

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

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

**bias,** *n*—a systematic error that contributes to the difference between a population mean of the measurements or test results and an accepted reference or true value. **[D02.94] D6299, D7372**

**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**

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

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

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

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

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

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

DISCUSSION—Biocides are further classified as bactericides (kill bacteria), fungicides (kill fungi), and microbiocides (kill both bacteria and fungi). They are also referred to as *antimicrobials*. **[D02.14] D6469**

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

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

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

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

**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 B100. **[D02.E0] D396, D975, D7467, [D02.08] D93, [D02.14] D7501, [D02.01] D7170, [D02.04] D7806, D7861**

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*—blend of biodiesel fuel with diesel fuel oils.

DISCUSSION—In the abbreviation, BXX, the XX represents the volume percentage of biodiesel fuel in the blend. **[D02.01] D7170, [D02.E0] D396, D975, D6751**

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

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

DISCUSSION—In the abbreviation BXX, the XX represents the volume percentage of biodiesel fuel in the blend. **[D02.04] D7371, D7806, D7861, [D02.08] D93**

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

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

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

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

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

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

**biomass,** *n*—biological material including any material other than fossil fuels which is or was a living organism or component or product of a living organism. **[D02.12] D5864, [D02.14] D6469, [D02.J0] D7719**

**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**

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

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

**blind reference oil,** *n*—a reference oil, the identity of which is unknown by the test facility.

DISCUSSION—This is a coded reference oil which is submitted by a source independent from the test facility. **[D02.B0] D6483, D6709, D6750, D7156, D7422, D7468, D7484**

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

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

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

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

**BOT—**Beginning of Test **[D02.B0] D8047**

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

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

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

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

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

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

**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**

**BSOC,** *n*—break specific oil consumption. **[D02.B0] D6750**

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

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

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

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

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

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

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

**butanol,** *n—for the purposes of this method*, butanol or butyl alcohol refers to one of three structural isomers of butanol—1-butanol, 2-butanol, and 2-methyl-1-propanol. This test method has not been evaluated for use with the butanol isomer 2-methyl-2-propanol. **[D02.04] D7875**

**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*—green petroleum coke that has been thermally treated to drive off the volatile matter and to develop crystalline structure. **[D02.05] D5004**

**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, D6376, D6791**

**calibrate,** *v*—to determine the indication or output of a device (e.g., thermometer, manometer, engine) with respect to that of a standard. **[D02.B0] D5862, D5966, D5967, D6618, D6794, D6795, D6837, D6984, D7320, D7468**

**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*—operation that establishes the relationship between the reference density of standards and the corresponding reading of the instrument.

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

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

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

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

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

**calibration 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, D7589**

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

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

**calibration standard,** *n*—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. **[D02.03] D7578, D7740**

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

**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, D6795**

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

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

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

**[D02.B0] D5862, D6618, D6681, D6750, D6794, D6795, D6894, D7156, D7216, D7422, D7456, D7484, D7603**

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**

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

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

**CARB—**California Air Resources Board **[D02.B0] D8047**

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

DISCUSSION—The residue is not composed entirely of carbon but is a coke that can be further changed by carbon pyrolysis. **[D02.06] D4530**

**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**

**Cat—**abbreviation for Caterpillar (trademarked) **[D02.B0] D8047**

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

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

**cathode block,** *n*—one manufactured unit used as a negative carbon electrode. **[D02.05] D6354**

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

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

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

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

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

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

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

**certificate of analysis (COA),** *n*—a document provided by a supplier to a customer giving results from analyses of required parameters to show how the material is in conformance with the product specifications or not. **[D02.94] D7776**

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

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

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

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

DISCUSSION—In the context of this test method, cetane number is that defined by Test Method D613/IP 41. **[D02.01] D6890, D7170**

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

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

**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**

**characteristic,** *n*—property of items in a sample or population which, when measured, counted or otherwise observed, helps to distinguish between the items. **[D02.96] D7720**

**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**

**Check Fuel,** *n—for quality control testing*, a spark-ignition engine fuels of selected characteristics having an octane number accepted reference value ($O.N._{ARV}$) 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**

**check standard,** *n*—material having an assigned (known) value (reference value) used to determine the accuracy of the measurement system or instrument. This standard is not used to calibrate the measurement instrument or system. **[D02.03] D7578**

**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 is exposed to different treat rates of a test material and is observed for a period of time that 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'Eclairage. **[D02.05] D6045, [E12] E284**

**CIELAB color scales,** *n*—CIE 1976 $L^*$, $a^*$, $b^*$ opponent-color scales, in which $a^*$ is positive in the red direction and negative in the green direction; $b^*$ is positive in the yellow direction and negative in the blue direction; and $L^*$ is positive in the lightness direction and negative in the darkness direction. **[D02.C0] D7843, [E12] E308**

**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° angle on the retina; commonly called the "2° 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**

**clear-and-bright** (also termed *clean-and-bright*)**,** *n*—a condition in which the fuel contains no visible water drops or particulates and is free of haze or cloudiness. **[D02.14] D4860**

**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*, 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**

**COAT—**Caterpillar-C13 Oil-Aeration Test

**coefficient of friction, (μ)—**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,** μ *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. **[D02.G0] D5706, [D02.L0] D2714, D3702, D3704**

**coefficient of friction μ 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**

**coefficient of friction, μ or *f*,** *n—in tribology*, the dimensionless ratio of the friction force (*F*) between two bodies to the normal force (*N*) pressing these bodies together. **[D02.G0] D7420, D7594**

**coke,** *n*—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 outside of the ring during operation. **[D02.B0] D6593, D6984, D7320**

**colony,** *n*—a discreet visible aggregate of microorganisms that develops when a viable microorganism, or particle containing viable microorganisms, is introduced into a gelbased nutritive culture medium and reproduces there.

DISCUSSION—A period of incubation is necessary to allow sufficient reproduction. This test method utilizes a reactive compound that shortens the time for colonies to become visible and stains them so that they appear as red or purple spots.

DISCUSSION—Typically, bacterial colonies become visible to the naked eye only after the colony contains ≥109 individual cells. Consequently, the time required for a colony to become visible is dependent on the organism's generation (doubling), which can range from <30 min to >1 week. **[D02.14] D7978**

**colorimetric analysis,** *n*—photometric analysis method of using absorption of monochromatic light in the visible spectrum. **[D02.F0] C560**

**colorimetry,** *n*—the science of color measurement. **[D02.C0] D7843, [E12] E284**

**combustion,** *n*—chemical reaction by which graphite is combined in a controlled manner with pure oxygen in a high temperature furnace for analytical purposes. **[D02.F0] C816**

**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, D4863**

**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, D7827**

**compatibility,** *n—of crude oils and of heavy fuel oils*, the ability of two or more crude oils or fuel oils to be blended together within specified ratios without evidence of separation, such as flocculation or separation of asphaltenes. **[D02.14] D7112**

**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. **[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**

**component,** *n*—of a hydraulic system, an individual unit, excluding piping, comprising one or more parts designed to be a functional part of a fluid power system, for example, cylinder, motor, valve, or filter. **[D02.N0] D7721**

**component incipient failure,** *n*—moment a component begins to deteriorate or undergo changes that will eventually lead to the loss of its design function.

DISCUSSION—This moment may not be easily detectable because of sensitivity limitations of monitoring instrumentation or a lack of measurable change in performance characteristics or both. **[D02.96] D7874**

**composite sample,** *n*—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**

**composite sample—**a thoroughly mixed gross sample. **[D02.05] D4296**

**compression ratio (CR),** *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*—property of solid material that indicates its ability to withstand a uniaxial compressive load. **[D02.F0] C709, C695**

**condition monitoring,** *n*—a field of technical activity in which selected physical parameters associated with an operating machine are periodically or continuously sensed, measured, and recorded for the interim purpose of reducing, analyzing, comparing, and displaying the data and information so obtained, and for the ultimate purpose of using interim result to support decisions related to the operation and maintenance of the machine. **[D02.96] D7917**

**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, D1403, 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**

**contamination,,** *n*—any process which introduces contaminants into the fuel. **[D02.E0] D2880**

**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**

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

DISCUSSION—For example, typical three-sigma limits carry a risk of 0.135 % of being out of control (on one side of the center line) when the process is actually in control and the statistic has a normal distribution. **[D02.96] D7720**

**conventional-fuel vehicle,** *n*—a vehicle designed to operate on spark-ignition engine fuel that complies with Specification D4814. **[D02.A0] D7794**

**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**

**copper corrosion,** *n*—effect of a chemical attack on copper metal by a lubricant causing various levels of tarnishing and change in appearance.

DISCUSSION—Acidic and other aggressive species, often sulfur-based, in a lubricant can attack copper or copper alloys present in bearings or other lubricated surfaces. The presence of this antagonistic interaction is often apparent in a well-defined series of color changes. **[D02.G0] D4048**

**core sample—**the portion of graphite obtained from an electrode by use of a sampling device. **[D02.F0] C783**

**corrected area slice,** *n—in gas chromatography*, an area slice corrected for baseline offset, by subtraction of the corresponding area slice in a previously recorded blank (non-sample) analysis. **[D02.04] D7798**

**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, D6984, D7320**

**crack extension resistance, $K_R[FL^{-3/2}]$, $G_R[FL^{-1}]$, or $J_R[FL^{-1}]$,** *n*—measure of the resistance of a material to crack extension expressed in terms of the stress-intensity factor, *K*, strain energy release rate, *G*, or values of *J* derived using the J-integral concept. **[D02.F0] D7779**

**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] D7347**

**critical temperature,** *n*—highest temperature at which a gaseous fluid can be converted to a liquid by means of compression. **[D02.04] D7347**

**criticality number, C,** *n*—product of the severity (*S*) and occurrence (*O*) numbers for a given failure mode's causes and effects. **[D02.96] D7874**

**crosshead,** *n*—an overhead component, located between the rocker arm and each intake-valve and exhaust-valve pair, that transfers rocker arm travel to the opening and closing of each valve pair.

DISCUSSION—Each cylinder has two crossheads, one for each pair of intake valves and exhaust valves. **[D02.B0] D7484**

**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. **[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*.) **[D02.14] D7996**

**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**

**culture medium,** *n*—solid, semi-solid, or liquid preparations that contain nutrients that support microbial growth, and usually other chemical agents that can inhibit or stimulate growth by specific microorganisms or that can indicate the presence of all culturable or specific microorganisms. **[D02.14] D7978**

**cumulative corrected area,** *n—in gas chromatography*, the accumulated sum of corrected area slices from the beginning of the analysis through to a given retention time, ignoring any non-sample areas (for example, solvent peak area). **[D02.04] D7798**

**cumulative distribution,** *n*—representation of the total fraction of the population, expressed as either mass-, volume-, area-, or number-based, that is greater than or less than discrete size values. **[D02.96] D7720**

**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**

**cut point carbon fraction interval,** *n*—the percent mass obtained between two selected n-paraffins of the interval. The cut point carbon fraction interval as used in this test method is defined as the percent mass obtained between the end of one n-paraffin peak to the end of the next n-paraffin peak, thus a temperature interval is not used to determine the cut points but rather the end points sequential of a n-paraffin peak pair. **[D02.04] D8003**

**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, D2885**

**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**

**D1265 cylinder,** *n*—a container used for storage and transportation of a sample obtained at pressures above atmospheric pressure as described in Practice D1265. **[D02.04] D8003**

**data set,** *n*—logical collection of data that supports a user function and could include one or more data tables, files, or sources.

DISCUSSION—Herein a data set is a population of values for a measurand from within a particular measurand set and covering an equipment population. **[D02.96] D7720**

**dead crude oil,** *n*—crude oil with sufficiently low vapor pressure that, when exposed to normal atmospheric pressure at room temperature, does not result in boiling of the sample.

DISCUSSION—These crudes will have vapor pressures below atmospheric pressure at room temperature.

DISCUSSION—A crude oil is normally considered "live" until the vapor pressure can be established using Test Methods D6377, D6378, or D7975. Sampling and handling of dead crude oils can usually be performed without concern in open, non-pressurized sample containers, such as cans, bottles, and other atmospheric containers as described in Practice D4057 (API *MPMS* Chapter 8.1). **[D02.02] D8009**

DISCUSSION—The term 'stabilized crude oil' is frequently used for a dead crude oil that has been produced by 'flashing off' (distilling) light components from a live crude oil. **[D02.14] D7621**

**dead crude oil,** *n*—a term usually employed for crude oils that, when exposed to normal atmospheric pressure at room temperature, will not result in actual boiling of the sample.

DISCUSSION—These crudes will have vapor pressures below atmospheric pressure at room temperature. **[D02.04] D8003**

**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 of crude petroleum,** *n*—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 $C_2$ to $C_4$ hydrocarbons and less than 5 % of the $C_5$ hydrocarbons initially present in the sample. **[D02.08] D2892**

**decomposition,** *n—of a hydrocarbon*, pyrolysis or cracking of a molecule yielding smaller molecules with lower boiling points than the original molecule. **[D02.08] D86, D7344**

**decomposition point,** *n—in distillation,* the corrected temperature reading that coincides with the first indications of thermal decomposition of the specimen. **[D02.08] D86, 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, one less than the number of independent results.

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**

**denaturants,** *n*—materials added to ethanol to make it unsuitable for beverage use under a formula approved by a regulatory agency to prevent the imposition of beverage alcohol tax.

DISCUSSION—Denaturants are only those materials added by the denaturer to comply with the approved formula; any materials absorbed later are not denaturants. **[D02.A0] D4806, D5798**

**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, D5798, [D02.B0] D7563**

**denatured fuel ethanol—**fuel ethanol made unfit for beverage use by the addition of denaturants under formula(s) approved by the applicable regulatory agency to prevent the imposition of beverage alcohol tax. **[D02.A0] D4806**

**density,** *n*—for a quantity of a homogeneous substance, the ratio of its mass to its volume. The density varies as the temperature changes and is, therefore, generally expressed as the mass per unit of volume at a specified temperature. **[D02.02] D4057**

**density,** *n*—mass per unit volume at a specified temperature. **[D02.04] D4052, [D02.04] D1217, D1480, D1481**

**density,** *n*—mass per unit volume of the test liquid at a given temperature.

DISCUSSION—In SI notation, the unit of density is the kilogram per cubic metre. However, for practical use, gram per cubic centimetre is customarily used and is equivalent to $10^{3}$ kg/m$^3$. **[D02.07] D4741, D5481**

**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**

**density—**the mass per unit volume. **[D02.N0] D6080**

**density,** *n*—the mass per unit volume at a given temperature.

DISCUSSION—Standard units of density are kg/m$^3$ (SI unit) or mg/cm$^3$. Less preferred units, for example, kg/L or g/mL, are still in use. **[D02.04] D7777**

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

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

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

**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**

**derivitization reagent,** *n*—a saturated solution of phenylboronic acid (PBA) in solvent. Acetone and 2,2-dimethoxypropane have been used successfully. Gentle warming at 50 °C will hasten dissolution. Solution is stable for three months at room temperature if kept away from moisture. **[D02.04] D7922**

**design function,** *n*—function or task that the system or component should perform. **[D02.96] D7874, D7973**

**detection ability number, D,** *n*—ranking number that describes the ability of a specific fluid test to successfully detect a failure mode's causes or effects. A scale is used to grade detection ability numbers. **[D02.96] D7874, D7973**

**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**

**detection limit,** *n*—concentration of an analyte that results in a signal intensity that is some multiple (typically two) times the standard deviation of the background intensity at the measurement wavelength. **[D02.03] D7740**

**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, D2885**

**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, D2885**

**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 crankcase engine oils,** *n*—an engine oil used in the crankcase of the internal combustion diesel engine.

DISCUSSION—It may contain additives to enhance certain properties. Inhibition of engine rusting, deposit formation, valve train wear, oil oxidation, and foaming are examples. **[D02.96] D7899**

**diesel engine,** *n*—a reciprocating or rotary engine in which ignition of the main fuel charge, as it is introduced to the combustion chamber, shall be by the heat of compression of the charge of combustion air, during regular operation of the engine from idle speeds up to full speed, regardless of whether miscellaneous methods to augment such heat of compression are used to facilitate starting of the engine under normal conditions or under low ambient temperature conditions or low intake air temperature conditions.

DISCUSSION—Engines that are designed to operate with a continuously hot spot or bulb or other device to facilitate ignition or combustion, or both, of low cetane fuels, or any fuels slow to ignite or to burn, or both, shall be considered to be diesel engines for purposes of this test method. **[D02.96] D7899**

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

**diesel fuel,** *n*—petroleum-based middle distillate fuel. **[D02.04] D7371, D7861**

**diesel fuel oil,** *n*—a petroleum-based diesel fuel, as described in Specification D975. **[D02.04] D7806**

**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 contact thermometer (DCT),** *n*—an electronic device consisting of a digital display and associated temperature sensing probe. **[D02.07] D445, D2532**

DISCUSSION—This device consists of a temperature sensor connected to a measuring instrument; this instrument measures the temperature-dependent quantity of the sensor, computes the temperature from the measured quantity, and provides a digital output, or display of the temperature, or both. This device is sometimes referred to as a *digital thermometer*. **[D02.07] D3829**

DISCUSSION—Portable electronic thermometers (PET) is an acronym sometimes used to refer to a subset of the devices covered by this definition. **[D02.07] D445**

DISCUSSION—This device consists of a temperature sensor connected to a measuring instrument; this instrument measures the temperature-dependent quantity of the sensor, computes the temperature from the measured quantity, and provides a digital output or display, or both, of the temperature. The temperature sensing probe is in contact with the material whose temperature is being measured. This device is sometimes referred to as a *digital thermometer*.
**[D02.07] D4684, D6821, D6896; [D02.05] D61**

**digital contact thermometer (DCT) ,** *n*—an electronic device consisting of temperature measuring sensor in contact with the material that provides an output to a digital display of the measured value.

DISCUSSION—This device consists of a temperature sensor connected to a measuring instrument; this instrument measures the temperature-dependent quantity of the sensor, computes the temperature from the measured quantity, and provides a digital output. This digital output goes to a digital display and/or recording device that may be internal or external to the device. These devices are sometimes referred to as a "digital thermometer". **[D02.07] D2162**

**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, D2885**

**dilution factor,** *n*—ratio of sample weight of the aliquot taken to the final diluted volume of its solution.

DISCUSSION—The dilution factor is used to multiply the observed reading and obtain the actual concentration of the analyte in the original sample. **[D02.03] D7740**

**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).

**direct or open split interface,** *n*—any GC/MS interface used to maintain atmospheric pressure at capillary column outlet. **[D02.04] D7845**

**dispersant,** *n—in engine oil*, an additive that reduces deposits on oil-wetted engine surfaces primarily through suspension of particles. **[Subcommittee D02.B0]**

**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**

**dissolved water,** *n*—water in solution in petroleum and petroleum products. **[D02.02] D4057**

**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*—the temperature of the saturated vapor measured in the head just above the fractionating column.

DISCUSSION—It is also known as the head temperature or the vapor temperature. **[D02.08] D2892**

**distribution,** *n—as used in statistics*, a set of all the various values that individual observations may have and the frequency of their occurrence in the sample or population. **[D02.96] D7720**

**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 distillation*, the corrected temperature reading at the instant the last drop of liquid evaporates from the lowest point in the flask. **[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, D2625**

**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.A0] D4814, [D02.08] D4953**

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

**dynamic,** *adj—in petroleum products*—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**

**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] 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 fuel-air ratio for maximum knock,** *n—for knock testing*, the changing of the mixture of fuel and air for engine combustion determined by continually varying fuel level in the carburetor delivery components, through the maximum knock intensity so that the observed peak knock intensity value can be selected as maximum knock intensity reading. **[D02.01] D2885**

**dynamic hold-up,** *n—in column distillation*, the quantity of liquid held up in the column under normal operating conditions. **[D02.08] D2892**

**dynamic holdup,** *n—in D86 distillation*, 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—in distillation*, amount of material present in the distillation column, and in the condenser during the distillation. **[D02.08] D7344**

**dynamic viscosity (η),** *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, D7945**

**dynamic viscosity (η),** *n*—the ratio between the applied shear stress and rate of shear of a liquid; commonly known as a fluid resistance to flow. **[D02.96] D7973**

**ecotoxicity,** *n*—the propensity of a material to produce adverse behavioral, biochemical, or physiological effects in non-human organisms or populations. **[D02.N0] D6046, [D02.12] D6081**

**effect(s) of failure,** *n*—potential outcome(s) of each failure mode on the system or component. **[D02.96] D7874, D7973**

**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 treat 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 rubber-like property of substantially recovering its size and shape after removal of a deforming force. **[D02.B0] D7216, [D02.G0] D4289**

**elastic modulus,** *n*—the ratio of stress to strain, in the stress range where Hooke's law is valid. **[D02.F0] C769**

**ELC—**Extended-Life Coolant (trademark of Caterpillar) **[D02.B0] D8047**

**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.[2] **[D02.05] D6120**

**electrode graphite,** *n*—a type of manufactured graphite with less restrictive controls on homogeneity and purity, commonly produced to carry current in electric arc furnaces, as a consumable item in electrical discharge machining, and as a structural material in plastic-injection molds. **[D02.F0] C1025**

**electrographite,** *n—in carbon and graphite technology,* 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**

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

**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, [D02.02] D4057**

**end point (EP) or final boiling point (FBP),** *n*—maximum corrected temperature 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 dispersive X-ray spectrometry,** *n*—XRF spectrometry applying energy dispersive selection of radiation.
**[D02.03] D7751**

**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 octane requirement—**one full number greater than the maximum 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 98 and 99 motor octane numbers. The test engine does not knock on a primary reference fuel with a 100 motor octane number. The maximum motor octane number that results in knock is 99 so the motor octane requirement is 100. If a test engine knocks on a reference fuel with a 3-amine number and does not knock on a fuel with a 4-amine number, then the engine requirement is a 4-amine number. **[D02.J0] D6812**

**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, D6894, D7216, D7563, D7589**

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, D6618, D6750, D6794, D6795, D6894, D7216, D7563, D7589, [D02.96] D7899**

**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—Entrained air (or gas) may form micro size bubbles in liquids that are not uniformly dispersed and that may coalesce to form larger bubbles below or at the surface which break or form foam.
**[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**

**entrained water,** *n*—water suspended in the petroleum and petroleum products. Entrained water includes emulsions but does not include dissolved water. **[D02.02] D4057**

**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**

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**

**EOAT—**Engine-Oil Aeration Test **[D02.B0] D8047**

**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-air ratio for maximum knock,** *n—for knock testing*, the changing of the mixture of fuel and air for engine combustion determined by making incremental step changes in fuel-air ratio, observing the equilibrium knock intensity for each step and selecting the fuel-air ratio which produces the highest knock meter reading. **[D02.01] D2885**

**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**

**equivalent spherical diameter (ESD),** *n*—the equivalent spherical diameter of an irregularly shaped object is the diameter of a sphere of equivalent volume.

DISCUSSION—Metallic particles used to test and calibrate inductive wear debris sensors are manufactured as spheres. A range of diameters, from smallest to largest sizes investigated, is utilized to vet the sensor's capabilities and calibrate it. Spheres ranging from ~40 µm to 1000 µm are used for this exercise. In vivo ferrous and non-ferrous debris will rarely be spherical; however all particles detected and counted are deemed to be spheres for reporting purposes, with the reasonable assumption that the ESD mass will be close to the equivalent mass of the non-spherical particle measured. **[D02.96] D7917**

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

**estimator,** *n*—a well-defined function that is dependent on the observations in a sample. The resulting value for a given sample may be an estimate of a distribution parameter (a point estimate) associated with the underlying population. The arithmetic average of a sample is, for example, an estimator of the distribution mean. **[D02.96] D7846**

**ET—**Engine Technician **[D02.B0] D8047**

**ethanol,** *n*—ethyl alcohol, the chemical compound $C_2H_5OH$. **[D02.A0] D4806, D5798, D6423**

**ethanol,** *n*—chemical compound $C_2H_5OH$. **[D02.J0] D7618**

**ethanol fuel blend,** *n*—a high concentration ethanol-based fuel for flexible-fuel spark-ignition engines and vehicles. **[D02.A0] D7794**

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

**ethyl tertiary-butyl ether (ETBE),** *n*—chemical compound $CH_3CH_2OC(CH_3)_3$.

**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] D6975, D7468**

**exhaust gas recirculation (EGR),** *n*—the mixing of exhaust gas with intake air to reduce the formation of nitrogen oxides ($NO_x$). **[D02.B0] D6987, D7156, D7422**

**existent inorganic sulfate,** *n*—inorganic sulfate species actually present in the sample at the time of analysis with no oxidation treatment.

DISCUSSION—Specifically in this test method, inorganic sulfate is present as sulfate in ethanol. **[D02.03] D7318**

**extension rod,** *n*—tool used to extend the depth at which a sample is taken with an active grease-sampling device.

DISCUSSION—The extension rod may also be used to remotely actuate an active grease-sampling device. **[D02.G0] D7718**

**extra-cellular,** *adj*—molecules or substances that are either excreted by living cells or released from microbial cells that have lysed in the sample.

DISCUSSION—Extra-cellular ATP is ATP that has been released from microbial cells that have either fully or partially lysed in the sample, the upstream fluid (fuel or water phase), or both.

DISCUSSION—Lysis can occur due to natural life cycle process, antimicrobial treatment or a combination of these factors. Extra-cellular ATP can under certain circumstances persist for periods greater than 24 h after cell lysis depending on physical/chemical conditions. **[D02.14] D7687**

**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. **[D02.L0] D6425**

**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**

**FAEE,** *n*—fatty acid ethyl esters **[D02.04] D7861**

**failure-developing period, FDP,** *n*—period from component's incipient failure to functional failure. **[D02.96] D7874, D7973**

**failure mode,** *n*—physical description of the manner in which a failure occurs. **[D02.96] D7874, D7973**

**failure mode and effect analysis, FMEA,** *n*—analytical approach to determine and address methodically all possible

system or component failure modes and their associated causes and effects on system performance.

DISCUSSION—This approach can be used to evaluate designs and track risk-reducing improvements to equipment reliability.

**[D02.96] D7874, D7973**

**failure modes, effects, and criticality analysis, FMECA,** *n*—extension to FMEA that involves ranking the risk associated with failure modes to allow prioritization and selection of an appropriate maintenance strategy.

DISCUSSION—A metric-describing criticality is determined by the product of a severity number (*S*) and its occurrence number (*O*) for each given failure mode's causes and effects. **[D02.96] D7874**

**FAME,** *n*—a biodiesel composed of long chain fatty acid methyl esters derived from vegetable or animal fats.

**[D02.04] D7806**

**FAME,** *n*—fatty acid methyl esters, also known as biodiesel.

DISCUSSION—Used as a component in automotive diesel fuel and the potential source of contamination in aviation turbine fuel due to multi-fuel tankers and pipelines. **[D02.J0] D7797; [D02.14] D7963**

**FDM—**Flow and Density Meter **[D02.B0] D8047**

**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**

**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, D7096**

**final boiling point (FBP),** *n—in gas chromatography*, the temperature (corresponding to the retention time) at which a cumulative corrected area count equal to 99.5 % of the total sample area under the chromatogram is obtained.

**[D02.04] D7798**

**finished fuel,** *n*—a homogeneous mixture of blendstocks and fuel additives meeting all specification and regulatory requirements for its intended use at the location where sold.

**[D02.A0] D4814**

**fire point,** *n—in petroleum products*, the lowest temperature of the test specimen, adjusted to account for variations in atmospheric pressure from 101.3 kPa, at which application of an ignition source causes the vapors of a test specimen to ignite and sustain burning for a minimum of 5 s under specified conditions of test. **[D02.08] D92**

**fire-resistant fluid,** *n*—hydraulic liquid that has greater fire-resistance than mineral oil as determined with an acknowledged standard.

DISCUSSION—Acknowledged standards include FM 6930, ISO 12922, and 30 CFR Part 35. **[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—***in flash point test methods,* the lowest temperature of the test specimen, adjusted to account for variations in atmospheric pressure from 101.3 kPa, at which application of an ignition source causes the vapors of a specimen of the test specimen 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**

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— 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, [D02.02] D4057**

**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, D7094**

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

**flexural strength—**a measure of the ultimate load carrying capacity of a specified beam in bending. **[D02.F0] D7972**

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

**flexural strength,** *n*—property of a solid material that indicates its ability to withstand a flexural or transverse load, obtained through a measurement of the ultimate load-carrying capacity of a specified beam in bending. **[D02.F0] C651**

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

DISCUSSION—A floating piston cylinder is used to collect a sample of liquid under pressure without the formation of a gaseous phase which can result in changes in the composition of the liquid sample. **[D02.H0] D3700, [D02.08] D6849**

**floating piston (variable volume) cylinder (FPC),** *n*—a high pressure sample container, with a free floating internal piston that effectively divides the container into two separate compartments. **[D02.02] D4057**

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

**flocculation,** *n—of asphaltenes in crude oils or heavy fuel oils*, the aggregation of colloidally dispersed asphaltenes into larger, visible masses that may or may not settle. **[D02.14] D7112, D7827**

**flood point,** *n—in distillation*, the point at which the velocity of the upflowing vapors obstructs the down-coming reflux and the column suddenly fills with liquid. **[D02.08] D2892**

**flow line,** *n*—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,** *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.

**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**

**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] D892, D6082, [D02.B0] D6894**

**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] D7419**

**formulation,** *n*—the specific chemical composition used in manufacturing a seal elastomer or a reference oil. **[D02.B0] D7216**

**Fourier transform infrared (FT-IR) spectrometry,** *n*—a 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, E2412**

**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 carboxcylic acid(s) present in the product.

DISCUSSION—Some greases are made with a slight excess of carboxcylic 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 carboxcylic acid(s), it is expressed as free oleic acid and as a mss % of the total grease composition. **[D02.G0] D128**

**free glycerin,** *n*—a measure of the amount of glycerin remaining in the fuel. **[D02.E0] D6751**

**free piston ring,** *n—in internal combustion engines*, a piston ring that will fall in its groove under the force of 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 determination of this condition, the ring may be touched slightly to overcome static friction.
**[D02.B0] D6984, D7320**

**free water,** *n*—undissolved water present in a hydrophobic material.

DISCUSSION—Free water in fuel such as hydrocarbon diesel fuel can be present as a suspended haze, as droplets on the walls of the vessel, or as a separate layer on the bottom of the vessel. **[D02.14] D7463**

**free water,** *n*—water in excess of that soluble in the fuel at the temperature of the test and appearing in the fuel as a haze, cloudiness, droplets, or water layer. **[D02.14] D4860**

DISCUSSION—Note that when there is a water layer in a biodiesel fuel blend, there can be water-soluble components present in the free water.
**[D02.14] D2709**

**free water,** *n*—water that exists as a separate phase.
**[D02.02] D4057**

**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, D7153, D7154**

**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 ($Fe_2O_3$) 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. **[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 blending dispenser,** *n*—a device for measuring and dispensing fuel, conforming to the standards established by the applicable regulatory jurisdictions, that can volumetrically combine two different base products into newly formed blended products that may be dispensed through a single hose or multiple hose dispenser configuration.
**[D02.A0] D7794**

**fuel contaminant,** *n*—material not intended to be present in a fuel, whether introduced during manufacture, handling, distribution or storage, that makes the fuel less suitable for the intended use.

DISCUSSION—Contaminants, which can be soluble in the fuel or insoluble (suspended liquid droplets or solid or semi-solid particles), can be the result of improper processing or contamination by a wide range of materials including water, rust, airblown dust, deterioration of internal protective coatings on pipes or vessels and products of fuel degradation and microbial growth.

DISCUSSION—Solid or semisolid contaminants can be referred to as silt or sediment. **[D02.E0] D2880**

**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 dilution,** *n*—the amount, expressed as a percentage, of engine fuel found in the in-service lubricating oil.
**[D02.96] D7593**

**fuel diluent,** *n*—in service oil analysis, is the unburned fuel components that enter the engine crankcase causing dilution of the oil. **[D02.96] D7593**

**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 economy,** *n—in internal combustion engines*, the efficient use of gasoline.

DISCUSSION—Determined by comparing the rate of fuel consumption of a test oil with that displayed by baseline oil. **[D02.B0] D7589**

**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*—blend of ethanol and hydrocarbons of which the ethanol portion is nominally 75 to 85 volume % denatured ethanol. **[D02.04] D6423, [D02.08] D86, [D02.B0] D7563**

**fuel methanol (M99),** *n*—methyl alcohol produced for the purpose of blending with gasoline to make a fuel for spark-ignition internal combustion engines.

DISCUSSION—Fuel methanol is typically produced with 99 % by volume methyl alcohol. **[D02.04] D7920**

**fuel methanol (M99),** *n*—methanol with small/trace alcohol and hydrocarbon impurities. **[D02.A0] D5797**

**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, D2885**

DISCUSSION—In the context of this test method, the fuel-air ratio for maximum knock intensity can be determined manually or by the automated analyzer system. **[D02.01] D2885**

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

**functional failure,** *n*—inability of the component or system to perform its required design function. **[D02.96] D7874**

**functional properties,** *n*—those properties of the mineral or synthetic 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*—a state of matter that shows free flow, has neither a definite shape nor a definite volume, and tends to expand indefinitely to fill any space available, irrespective of its quantity. **[Coordinating Subcommittee D02.95]**

**gaseous,** *adj*—describing material exhibiting free flow, with neither a definite shape nor a definite volume, and tending to expand indefinitely to fill any space available, irrespective of its quantity. **[Coordinating Subcommittee D02.95]**

**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, D5798**

**gasoline blendstock,** *n*—a liquid hydrocarbon component suitable for use in spark-ignition engine fuels.

DISCUSSION—Examples of gasoline blendstock include natural gasoline, raffinate, reformate, conventional gasoline blendstock for oxygenate blending (CBOB), and reformulated gasoline blendstock for oxygenate blending (RBOB). **[D02.A0] D4806**

**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-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, D4814.**

**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-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**

**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,** *n*—the amount, expressed as a percentage, of glycol found in the in-service lubricating oil. The most common glycol formulated into antifreeze is ethylene glycol (CAS# 107-21-1) with some antifreeze also containing 1,2-propanediol also known as propylene glycol (CAS# 57-55-6). Another glycol such as 1,3-propanediol (CAS# 504-63-2) is detected by this test method but is not commonly used in antifreeze formulations. **[D02.04] D7922**

**glycols,** *n*—the summed amount of individual glycols found in the in-service lubricating oil. **[D02.04] D7922**

**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 submissions 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*—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*, 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*, 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*—allotropic crystalline form of the element carbon, occurring as a mineral, commonly consisting of a hexagonal array of carbon atoms (space group P $6_3$/mmc) but also known in a rhombohedral form (space group R 3m). **[D02.F0] C709**

**graphite,** *n—in carbon and graphite technology*, 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*, 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**

**graphite furnace,** *n*—electrothermal device for atomizing the metal constituents. **[D02.03] D7740**

**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*, 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*, 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°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**

**graphitizing (nuclear grade) isotropic/near-isotropic coke—**a coke, which under reflected light microscopy, shows a fine mosaic texture where the individual microscopic domains show optical activity as the stage is rotated when both the polarizer and analyzer are in a crossed position in the optical path of the microscope.

DISCUSSION—The isotropic coke with optical domains of ~20 micons is, crucially, a coke that develops three-dimensional order on heat treatment to temperatures >2400 °C, and hence may be described as graphitic. Furthermore, graphite produced from such a coke exhibits a CTE in the range of $3.5 \times 10^{e-6}$ to $5.5 \times 10^{e-6}$ (25 °C to 500 °C), and is isotropic in the sense that the ratio of the ag/wg CTE (25 °C to 500 °C) is yielding between 1.00 and 1.10. Similarly, graphite produced from a near-isotropic coke is defined as yielding graphite wehre the ag/wg CTE (25 °C to 500 °C) is between 1.10 and 1.15. The precursors to a graphitizing isotropic coke form fluid mesophase on thermal conversion to a solid graphitizable carbon.

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

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

**gross heat of combustion,** Qg (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 °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 °C. Gross heat of combustion is represented by the symbol $Q_g$.[3]

DISCUSSION—Users of this test method desiring to calculate $\Delta H°$ 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,[4] 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,** *n*—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, [D02.14] D7501**

**ground,** *v*—to connect electrically with earth. **[D02.14] D7321**

**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**

**guide tables,** *n—for knock testing*, the specific relationship between cylinder height (compression ratio) and octane number at standard knock intensity. **[D02.01] D2885**

**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**

**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.B0] D7216, [D02.G0] D4289**

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

**HATR,** *n*—horizontal attenuated total reflectance **[D02.04] D7861**

**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**

**heart-cut,** *n—in gas chromatography*, a procedure in which the analyte in question is transferred from one column to a different column, usually of the opposite polarity. **[D02.04] D7920**

**heating block,** *n*—aluminum block used to hold samples inside the HPA autoclave/pressure chamber. **[D02.03] C1234**

**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 $mm^2/s$, 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

[3] 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.

[4] 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, Books & Journals.

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 $mm^2/s$, inclusive. **[D02.E0] D6021**

**heavy-duty,** *adj—in internal combustion engine operation*, characterized by average speeds, power output, and internal temperatures that are generally close to the potential maximums. **[D02.B0] D4485, D5862, D5967, D6894, D7156, D7422, D7468, D7484**

**heavy-duty engine,** *n—in internal combustion engine types*, one that is designed to allow operation continuous at or close to its peak output. **[D02.B0] D4485, D5862, D5967, D6750, D6894, D7156, D7422, D7468**

**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] D7451**

**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.L0] D2779**

**Hertzian contact area,** *n*—the apparent area of contact between two nonconforming solid bodies pressed against each other, as calculated from Hertz's equations of elastic deformation. **[D02.G0] D5706, D7594, [D02.L0] D6425**

**Hertzian contact area,** *n*—apparent area of contact between two nonconforming solid bodies pressed against each other. **[D02.L0] D7755**

**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 $P_{average}$ as average over the total contact area. **[D02.G0] D5706, [D02.L0] D7421**

**Hertz 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 static conditions. **[D02.L0] D2783**

DISCUSSION—Shown in Fig. 1 as a *hertz line*. **[D02.G0] D2596**

**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 in kilograms-force.

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

**higher alcohols,** *n*—aliphatic alcohols of the general formula $C_nH_{2\ n+1}OH$ with *n* being 2 to 8. **[D02.A0] D5797**

**high pressure cylinder,** *n*—a receptacle used for storage and transportation of a sample obtained at pressures above atmospheric pressure. **[D02.02] D4057**

**high pressure sample cylinder,** *n*—a container used for storage and transportation of a sample obtained at pressures above atmospheric pressure. **[D02.H0] D1265**

DISCUSSION—This type of sample cylinder, sometimes called a 'standard 80 % fill cylinder,' when used for LPG typically contains both liquid and vapor phase material. **[D02.08] D6849**

**hollow cathode lamp,** *n*—device consisting of a quartz envelope containing a cathode of the metal to be determined and a suitable anode. **[D02.03] D7740**

**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 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 ring is characterized by varnish or carbon across a 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**

**HPA-TC controller,** *n*—computer interface between HPA autoclave and an IBM-compatible computer. **[D02.03] C1234**

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

**hydrocarbon oil,** *n*—a homogeneous mixture with elemental composition primarily of carbon and hydrogen that may also contain sulfur, oxygen, or nitrogen from residual impurities and contaminants associated with the fuel's raw materials and manufacturing processes and excluding added oxygenated materials.

DISCUSSION—Neither macro nor micro emulsions are included in this definition since neither are homogeneous mixtures.

DISCUSSION—Examples of excluded oxygenated materials are alcohols, esters, ethers, and triglycerides.

DISCUSSION—The hydrocarbon oil may be manufactured from a variety of raw materials, for example, petroleum (crude oil), oil sands, natural gas, coal, and biomass. Appendix X3 discusses some matters for consideration regarding the use of fuel oils from feedstocks other than petroleum.

**[D02.E0] D396, D975, D2880**

**hydraulic fluid,** *n*—a fluid 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, D6080**

**hydraulic system,** *n*—fluid power system that is an arrangement of interconnected components which generates, transmits, controls and converts fluid power energy. **[D02.N0] D7721**

**hydride generation,** *n*—device to atomize some metals which form gaseous hydrides. **[D02.03] D7740**

**hydrocarbon,** *n*—a compound composed solely of hydrogen and carbon. **[D02.A0] D5798**

**hydrodynamic lubrication (HD)—**lubrication regime where the load carrying surfaces are separated by a relatively thick film of lubricant formed by a combination of surface geometry, surface relative motion, and fluid viscosity. **[D02.96] D7973**

**hydromechanical motor efficiency,** *n*—ratio of the actual torque to the derived torque. **[D02.N0] D7721**

**hydromechanical pump efficiency,** *n*—ratio of the derived displacement to absorbed hydraulic torque. **[D02.N0] D7721**

**hydrometer reading,** *n*—n—the point on the hydrometer scale at which the surface of the liquid cuts the scale.

DISCUSSION—Discussion—In practice for transparent fluids this can be readily determined by aligning the surface of the liquid on both sides of the hydrometer and reading the Hydrometer scale where these surface readings cut the scale (Hydrometer Reading – Observed). For nontransparent fluids the point at which the liquid surface cuts the Hydrometer scale cannot be determined directly and requires a correction (Meniscus Correction). The value represented by the point (Meniscus Reading) at which the liquid sample rises above the main surface of the liquid subtracted from the value represented by where the main surface of the liquid cuts the Hydrometer scale is the amount of the correction or Meniscus correction. This meniscus correction is documented and then subtracted from the value represented by the Meniscus Reading to yield the Hydrometer Reading corrected for the Meniscus (Hydrometer Reading – Observed, Meniscus Corrected).

**[D02.02] D287**

**hydrophilic particles,** *n*—compounds such as ATP, $NAD^+$, $NADP^+$, NADH, NADPH, enzymes, free fatty acids, preservatives, biocides, salts, as well as microorganisms or other articles are often dispersed or distributed in hydrophobic liquid matrices such as crude oil, vegetable oil, petrol, and kerosine. **[D02.14] D7463**

**ice-point bath,** *n*—physical system containing ice and water assembled to realize the ice point as a reference temperature, or to establish a constant temperature near 0 °C. **[D02.91] D7962**

**ICP-AES—**Inductively Coupled Plasma Atomic Emission Spectrometry **[D02.B0] D8047**

**ICP-AES,** *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 gas. The light emitted by this process is measured at fixed wavelengths specific to elements of interest and converted to their concentrations in a sample. **[D02.94] D7776, [D02.03] D7876**

**ID—**Internal Diameter **[D02.B0] D8047**

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

**impervious carbon,** *n*—manufactured non-graphitized structural carbon that has been impregnated with a resinous material to make the final article impervious to liquids in the recommended operating range. **[D02.F0] C662**

**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**.

**inert gas,** *n*—a gas that does not react with its surroundings. **[D02.02] D4057**

**inerting,** *v*—a procedure used to reduce the oxygen content of the vapor spaces by introducing an inert gas such as nitrogen or carbon dioxide or a mixture of gases such as processed flue gas. **[D02.02] D4057**

**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**

**inductive debris sensor,** *n*—a device that creates an electromagnetic field as a medium to permit the detection and measurement of metallic wear debris.

DISCUSSION—A device that detects metallic wear debris that causes fluctuations of the magnetic field. A device that generates a signal proportional to the size and presence of metallic wear debris with respect to time. **[D02.96] D7917**

**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] D6081, 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—in D86 distillation*, the corrected temperature reading 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—in D7344 distillation*, corrected temperature reading at the instant of the first detection of condensate in the receiver. **[D02.08] D7344**

**initial boiling point (IBP),** *n*—the point at which a cumulative volume count equal to 0.5 % of the total volume counts under the chromatogram is obtained. **[D02.04] D7096**

**Initial Boiling Point (IBP),** *n—in gas chromatography*, the temperature (corresponding to the retention time) at which a cumulative corrected area count equal to 0.5 % of the total sample area under the chromatogram is obtained. **[D02.04] D7798**

**initial pH (i-pH),** *n*—the measure of the hydrogen ion (H+) concentration when a fixed sample amount of lubrication oil is dissolved into a fixed volume of solvent and using a specified detection system.

DISCUSSION—This test method expresses the amount of dissociated acidic components as i-pH of a sample in a mixture of toluene and propan-2-ol to which a small amount of water has been added.

DISCUSSION—The measured i-pH is called initial since the original definition of the pH-scale depends on aqueous solutions. Its application to organic solutions will not give stable electrode potential for all types of samples. A potential reading after a defined time is used in those cases instead. **[D02.06] D7946**

**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 ($SO_4^{-2}$) species present as sulfuric acid, ionic salts of this acid, or mixtures of these. **[D02.03] D7318**

**in-service lubricating grease,** *n*—lubricating grease that has been applied as a lubricant to a gear, bearing, or drive screw for any period of time. **[D02.G0] D7718**

**in-service oil,** *n*—lubricating oil that is present in a machine that has been at operating temperature for at least one hour. **[D02.96] D7593, [D02.04] D7922**

**in-service oil,** *n*—lubricating oil that is present in a machine that has been at operating temperature for at least one hour (for example, an engine, gearbox, transformer, or turbine). **[D02.C0] D7843**

**in-service viscosity—**the viscosity of fluid during operation of a hydraulic pump or circuit components. **[D02.N0] D6080**

**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**

**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,** *n*—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**

**intermediate sample container,** *n*—a container into which all or part of the sample from a primary container (receiver) is transferred for transport, storage, or ease of handling. **[D02.02] D4057**

**intermittent analyzer unit cycle time—**the time interval between successive updates of the analyzer output. **[D02.25] D7278**

**internal reflux—***in distillation*, the liquid normally running down inside the column. **[D02.08] D2892**

**internal standard (IS),** *n*—a high purity compound not present in the sample which is added to the sample and used to calculate quantitatively the component of interest.

DISCUSSION—The internal standard is added in a constant amount to all calibration standards. **[D02.04] D7920**

**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 °C to 500 °C) is 1.00 to 1.10. **[D02.F0] C709**

**isotropy ratio,** *n—in carbon and graphite technology*, 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*—common language for aviation turbine fuel as defined by specifications of national and international standards bodies and accepted by the international aviation industry. **[Subcommittee D02.J0]**

**kinematic viscosity,** *n*—a measure of the resistance to flow of a fluid under gravity. **[D02.07] D7109**

**kinematic viscosity,** *n*—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.

DISCUSSION—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] D4741**

**kinematic viscosity,** *n*—the ratio of the dynamic viscosity to the density of a liquid.

DISCUSSION—For gravity flow under a given hydrostatic head, the pressure head of a liquid is proportional to its density. Therefore, kinematic viscosity is a measure of the resistance to flow of a liquid under gravity. **[D02.N0] D6080**

**kinematic viscosity (v),** *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 (v) is a measure of the resistance to flow of a liquid under gravity. **[D02.07] D7042, D7945**

**kinematic viscosity,** *n*—the ratio of the viscosity to the density of the fluid.

DISCUSSION—Kinematic viscosity is a measure of a fluid's resistance to flow under the force of gravity. In the SI, the unit of kinematic viscosity is the metre squared per second ($m^2/s$); for practical use, a submultiple (millimetre squared per second, $mm^2/s$) is more convenient. The centistoke (cSt) is 1 $mm^2/s$ and is often used. **[D02.07] D5481**

**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, D2885, [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, D2885**

**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, D2885**

DISCUSSION—In the context of this test method, the knock intensity signal may also be displayed using digital or recording instrumentation. **[D02.01] D2885**

**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. **[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 ends,** *n*—hydrocarbon components that cannot be maintained as a liquid at atmospheric pressure at temperatures greater than 0 °C.

DISCUSSION—This includes any materials that have atmospheric boiling points below 0 °C including methane, ethane, propane, butane.

DISCUSSION—Fixed gases, such as CO, $CO_2$, $H_2$, $H_2S$, $N_2$, and $O_2$, will also contribute to the composition and vapor pressure of the sample.

**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 μm/m). **[D02.05] D6745**

**linearly mixable,** *adj*—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:

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

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

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 gases,** *n*—narrow boiling range hydrocarbon mixtures consisting mainly of propane or propylene, or both, and butanes or butylenes, or both, plus limited amounts of other hydrocarbons and naturally occurring non-hydrocarbons. **[D02.H0] D1267, [D02.02] D4057**

**liquefied petroleum gas, (LP Gas, LPG),** *n*—a narrow boiling range mixture of hydrocarbons consisting of propane, propylene, butanes and butylenes, individually or in specified combinations, with limited amounts of other hydrocarbons and naturally occurring non-hydrocarbons.

DISCUSSION—LPG is typically maintained in a liquid state by containing it within a closed container or storage tank that can withstand the vapor pressure of the LPG at ambient temperature, or at a low temperature in refrigerated storage. **[D02.08] D6849**

**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**

**LPG (liquefied petroleum gas),** *n*—narrow boiling range hydrocarbon mixtures consisting mainly of propane or propylene, or both, and butanes or butylenes, or both, plus limited amounts of other hydrocarbons and naturally-occurring non-hydrocarbons. **[D02.02] D4057**

**liquid,** *adj*—describing material exhibiting free flow, a definite volume and indefinite shape, as determined by its container, and difficult to compress.

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.

**[Coordinating Subcommittee D02.95]**

**liquid,** *n*—a state of matter characterized by the material flowing freely, with a definite volume but indefinite shape which is determined by its container, and which is difficult to compress.

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.

**[Coordinating Subcommittee D02.95]**

**live crude oil,** *n*—crude oil with sufficiently high vapor pressure that it would boil if exposed to normal atmospheric pressure at room temperature.

DISCUSSION—Sampling and handling of live crude oils requires a pressurized sample system and pressurized sample containers to ensure sample integrity and prevent loss of volatile components. **[D02.04] D8003**

DISCUSSION—Sampling and handling of samples of live crude oils will necessitate the use of the closed sample container to maintain sample integrity and preclude the use of open sample containers, such as cans, bottles, and other atmospheric containers.

DISCUSSION—Samples and bulk storage (tank) liquids may or may not appear to boil visibly (rolling) but vaporization (off-gassing) is occurring. **[D02.02] D8009**

**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.

DISCUSSION—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 corrected loads determined for the ten applied loads immediately preceding the weld point. **[D02.G0] D2596, [D02.L0] D2783**

**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*—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**

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

**lower control limit,** *n*—minimum value of the control chart statistic that indicates statistical control. **[D02.96] D7720**

**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 ± 0.05 r/min at the test temperature. **[D02.G0] 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] D217, D1831, D7420, D7594**

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*—any material interposed between two surfaces that reduces the friction or wear, or both, between them. **[D02.B0] D5862, D6185, D6837, D6894, D6984, D7320, D7589; [D02.G0] D5706; [D02.L0] D6425**

**lubricant condition monitoring,** *n*—a field of technical activity in which selected physical parameters associated with an operating machine are periodically or continuously sensed, measured, and recorded for the interim purpose of reducing, analyzing, comparing, and displaying the data and information so obtained and for the ultimate purpose of using interim result to support decisions related to the operation and maintenance of the machine. **[D02.96] D7919**

**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] D6138, D7420**

**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, D7594**

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, D5706, D6185, D7342, D7594**

**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**

**lubricity—**qualitative term describing the ability of a fluid to minimize friction between, and damage to, surfaces in relative motion under load.

DISCUSSION—In this test method, the lubricity of a fluid is defined in terms of a wear scar, in millimeters, produced on a loaded stationary ball from contact with a fluid-wetted rotating cylindrical test ring operating under closely defined and controlled conditions. **[D02.J0] D5001**

**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**

**LVF,** *n*—linear variable filter **[D02.04] D7861**

**lysis,** *n*—disintegration or destruction of whole bacterial cells. **[D02.14] D7687**

**machinability,** *n*—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. **[D02.96] D7624, D7917, D7919**

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

**manufactured graphite,** *n*—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**

**marker peak (MP),** *n*—a marker peak is a chromatographic peak used to differentiate sections of a chromatogram by retention time.

DISCUSSION—For example, components that elute before this marker peak may be considered "fuel," while components that elute after this marker peak would be considered "oil." This marker peak retention time could also serve as the timing for physical changes in the chromatographic system, such as the time to initiate a valve change or a back-flush. **[D02.96] D7593**

**mass fraction of B, $w_B$,** *n*—mass of a component B in a mixture divided by the total mass of all the constituents of the mixture.

DISCUSSION—Values are expressed as pure numbers or the ratio of two units of mass (for example, mass fraction of lead is $w_B = 1.3 \times 10^{-6}$ = 1.3 mg/kg). **[D02.B0] D8047**

**mass response factor (MRF),** *n*—constant of proportionality that converts area to mass percent. **[D02.04] D5501, D7920**

**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.

DISCUSSION—Some regulatory agencies use the expressions "maximum fill density" and "reduced fill density." **[D02.H0] D3700**

**maximum fill density (reduced fill density),** *n*—the volume of a container occupied by the sample, usually expressed as a percentage of the total capacity. Transportation legislation such as U.S. CFR 49, Canadian Transportation of Dangerous Goods Regulations, and IATA regulations limit the percent fill of containers used for shipping LPG and may quote this requirement as a reduced fill density or maximum fill density (normally 80 % maximum liquid fill at 15°C). Lower percent fill (lower fill density) may be required if sampling at lower temperatures. **[D02.02] D4057**

**maximum fill volume (reduced fill volume),** *n*—the volume of a container that may be safely occupied by the liquid sample, usually expressed as a percentage of the total capacity.

DISCUSSION—Some regulatory agencies use the expressions 'maximum fill density' and 'reduced fill density.' **[D02.08] D6849**

**maximum pore diameter,** *n—in gas diffusion*, the diameter of a circular cross-section of a capillary is equivalent to the largest pore of the diffuser under consideration.

DISCUSSION—The pore dimension is expressed in micrometres (μm). **[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 °C 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.[5] **[D02.01] D909**

**mean square,** *n— in analysis of variance*, sum of squares divided by the degrees of freedom. (ISO 4259) **[D02.94] D6300**

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

**measurand,** *n*—particular quantity subject to measurement.

DISCUSSION—In industrial maintenance a measurand is sometimes called an *analysis parameter*.

DISCUSSION—Each measurand has a unit of measure and has a designation related to its characteristic measurement. **[D02.96] D7720**

**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

[5] Supporting data (derivation of equations) have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR:D02-1346.

minimum rate of temperature change when allowed to cool under prescribed conditions.

DISCUSSION—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, [D02.C0] D7843**

**membrane filter,** *n*—a porous article of closely controlled pore size through which a liquid is passed to separate matter in suspension. **[D02.14] D6217, [D02.C0] D7843**

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

**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**

**metallic wear debris,** *n*—in tribology, metallic particles that have become detached in wear or erosion processes.

DISCUSSION—This practice declares 40 µm ESD as the lower limit of detection for inductive debris sensors. This has not been shown to be a limiting factor for this real-time monitoring. **[D02.96] D7917**

**methanol,** *n*—methyl alcohol, the chemical compound $CH_3OH$. **[D02.A0] D5797, D5798, D5983**

**methanol,** *n*—chemical compound $CH_3OH$. **[D02.J0] D7618**

**methanol fuel blend,** *n*—a fuel consisting primarily of a mixture of methanol with gasoline.

DISCUSSION—Typically methanol fuel blends are 70 % to 85 % by volume, identified as M70 to M85. **[D02.04] D7920**

**methanol fuel blend (M51–M85),** *n*—a blend of methanol and hydrocarbons of which the methanol portion is nominally 51 % to 85 % by volume.

DISCUSSION—In the abbreviation, MXX, the XX represents the volume percentage of methanol in the fuel blend. **[D02.A0] D5797**

**methyl tertiary-butyl ether (MTBE),** *n*—the chemical compound $(CH_3)_3COCH_3[C_5H_{12}O]$. **[D02.A0] D5983**

**methyl tertiary-butyl ether (MTBE),** *n*—chemical compound $CH_3OC(CH_3)_3$. **[D02.J0] D7618**

**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**

**microfluidic device,** *n*—a chromatographic switching valve constructed with micro channels, usually having five ports and to which the columns, restrictors and auxiliary pressure devices are connected in order to carry out a heart-cut.

DISCUSSION—An auxiliary carrier gas is fed to the device which has two ports of entry such that switching the carrier gas from one port to the other results in changing the direction of the flow of the primary column to either a restrictor or to the analytical column. **[D02.04] D7920**

**Micro-Separometer 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-Separometer rating (MSEP rating),** *n—in the aviation fuel industry*, a numerical value indicating the ease of separating emulsified water from aviation (jet) fuel by coalescence as affected by the presence of surface active materials (also known as surface active agents or surfactants).

DISCUSSION—MSEP ratings obtained using Test A and Test B are termed MSEP-A and MSEP-B, respectively.

DISCUSSION—MSEP ratings are only valid within the range of 50 to 100, with ratings at the upper end of the range indicating a clean fuel with little or no contamination by surfactants, which is expected to show good water-separating properties when passed through a filter-separator (coalescing-type filter) in actual service. **[D02.J0] D3948, D7224**

**micro-separometer 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-Separometer, 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

[6] 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 RR:D02-1012.

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**

**middle distillate fuels,** *n*—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. **[D02.04] D7524**

**Mid-Infrared Spectroscopy,** *n*—uses the mid-infrared region of the electromagnetic spectrum, as described in Terminology E131. **[D02.04] D7806**

**mid-level ethanol fuel blend,** *n*—an automotive spark-ignition engine fuel with an ethanol concentration greater than those suitable for conventional-fuel vehicles and less than the minimum ethanol content limit of Specification D5798.

DISCUSSION—Mid-level ethanol fuel blends are often referred to as EXX, where XX represents the nominal percentage of denatured fuel ethanol. **[D02.A0] D7794**

**minimum immersion length,** *n*—depth that a thermometer should be immersed, in a uniform temperature environment, such that further immersion does not produce a change in indicated temperature greater than the specified tolerance. **[D02.91] D7962**

**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, 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. **NLGI Lubricating Grease Guide**

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**

**modulus of elasticity,** *n*—the ratio of a force applied to a material to the increment of dimensional change along the force axis, commonly defined as the ratio of tensile stress to tensile strain. **[D02.F0] C749**

**modulus of rupture in bending,** *n*—the value of maximum stress in the extreme fiber of a specified beam loaded to failure in bending. **[D02.F0] C1025**

**moisture content,** *n*—percentage content by weight of volatile moisture present in the graphite specimen that has been exposed to ambient conditions. **[D02.F0] C562**

**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—**motor octane number **[D02.J0] D6812**

**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**

**monitor detector,** *n*—a device used to measure the elution of the analyte from the primary column.

DISCUSSION—The monitor detector is used to determine the heart-cut time, that is, the time where the peak of interest begins and where the peak of interest ends. **[D02.04] D7920**

**monochromatic X-radiation,** *n*—an incident X-ray beam on a sample having a selected photon energy with a narrow energy bandwidth of ±5 % relative to the selected energy.

DISCUSSION—Monochromatic X-ray radiation in EDXRF instrumentation can be obtained by using Bragg optics (at an angle of è = 45 ± 5 °, in the low energy range). Bragg optics (monochromators) create very intense mono-energetic radiation. A combination of a selected X-ray tube (typically a Pd or Ag anode) with a highly ordered pyrolytic graphite (HOPG) Bragg optic can be used to create monochromatic radiation of the characteristic radiation of the anode material of the X-ray tube. The use of such radiation for sample excitation

results in increased sensitivity for the determination of sulfur in petroleum products. **[D02.03] D7220**

**monochromator,** *n*—device that isolates a single atomic resonance line from the line spectrum emitted by the hollow cathode lamp, excluding all other wavelengths. **[D02.03] D7740**

**monoglyceride,** *n*—a partially reacted fat or oil molecule with one long chain alkyl ester group on a glycerin backbone. **[D02.E0] D6751**

**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, D2885**

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

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

**motor overall efficiency,** *n*—ratio of the mechanical output power to the power transferred from the liquid at its passage through the motor. **[D02.N0] D7721**

**motor volumetric efficiency,** *n*—ratio of the derived inlet flow rate to the effective outlet flow rate. **[D02.N0] D7721**

**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] D7371**

**MXX,** *n*—an abbreviation that represents a fuel consisting primarily of methanol (methyl alcohol) and hydrocarbons in which 'XX' is the percent by volume of methanol in the blended fuel. **[D02.04] D7920**

**natural gasoline,** *n*—a hydrocarbon blend composed predominately of molecules with 5 to 8 carbon atoms and typically separated from the production flows from natural gas wells or crude oil wells.

DISCUSSION—These hydrocarbon blends may be processed to further remove lighter or heaver hydrocarbons or reduce sulfur content. Other names for this blend include naphtha and field naphtha.

DISCUSSION—Different government regulations may define "natural gasoline" in different ways. Refer to specific regulations. **[D02.A0] D8011**

**natural graphite,** *n—in carbon and graphite technology*, 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 °C to 500 °C) is 1.10 to 1.15. **[D02.F0] C709**

**nebulizer,** *n*—device that generates an aerosol by flowing a liquid over a surface that contains an orifice from which gas flows at a high velocity. **[D02.03] D7740**

**net heat of combustion,** Qn (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[5,7] is represented by the symbol $Q_n$ and is related to the gross heat of combustion by the following equation:

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

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 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,** *n*—an oil that, at a given temperature, exhibits a constant viscosity at all shear rates or shear stresses. **[D02.07] D5133**

**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, D4684, D5841, D6616, D6821, D6896, [D02.N0] D6080**

**Newtonian oil or fluid,** *n*—one that exhibits a constant viscosity at all shear rates. **[D02.07] D5293**

**Newtonian oil or liquid,** *n*—oil or liquid that at a given temperature exhibits a constant viscosity at all shear rates and shear stresses. **[D02.07] D4683, D4741, D5481**

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

**NIST,** *n*—National Institute of Standards and Technology, Gaithersburg, MD. Formerly known as National Bureau of Standards. **[D02.03] D7740**

**nitro-carburization,** *n*—nitro-carburizing is not defined in the ASTM Dictionary of Engineering Science and Technology, but is defined in DIN EN 10025-1:2005. **[D02.G0] D7420**

**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-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*—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:

$$A = 2\pi D^2/4 + \pi DH$$

The units of nominal geometric surface area are $m^2$. **[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**

**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 non-compounded oil is also known as build-up oil. **[D02.B0] D6709**

**non-graphitizable carbon,** *n*—*in carbon and graphite technology*, 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-graphitizing isotropic coke—**a coke, which under reflected light microscopy shows no mosiac texture and no optical activity when both the polarizer and analyzer are in a crossed position in the optical path of the microscope as the stage is rotated.

DISCUSSION—The optically inactive isotropic coke is a coke that does not develop three-dimensional order on heat treatment to temperatures >2400 °C, and hence may not be described as graphitic. The precursors to a non-graphitizing isotropic coke do not form fluid mesophase on thermal conversion to a solid carbon. (There is the exceptional case of anthracite coal which is graphitizable but does not pass through a fluid mesophase stage.)

**non-hydrocarbon,** *n*—compound or compounds composed of carbon, hydrogen and other elements such as oxygen, nitrogen, and sulfur (hetero-molecule). **[D02.J0] D7960**

**non-hydrocarbon,** *n*—a compound or compounds composed of carbon, hydrogen and other elements such as O, N, S, and P. **[D02.J0] D6227, D7719**

**non-Newtonian flow,** *n*—a non-Newtonian liquid is one whose viscosity depends on the rate of shear. Some will not flow

[7] Jessup, R. S., "Precise Measurement of Heat of Combustion with a Bomb Calorimeter," *NBS Monograph 7*, U.S. Government Printing Office.

until the force applied is greater than a definite value called the yield point. **[D02.L0] D5620**

**non-Newtonian fluid—**an oil or fluid that at a given temperature exhibits a viscosity that varies with changing shear stress or shear rate. **[D02.N0] D6080**

**non-Newtonian oil,** *n*—an oil that, at a given temperature, exhibits a viscosity that varies with shear stress or shear rate. **[D02.07] D5133**

**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, D4684, D5841, D6616, D6821, D6896**

**non-Newtonian oil or fluid,** *n*—one that exhibits a viscosity that varies with changing shear stress or shear rate. **[D02.07] D5293**

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

**non-Newtonian oil or liquid,** *n*—oil or liquid that exhibits a viscosity that varies with changing shear stress and shear rate. **[D02.07] D4683**

**nonparametric,** *n*—term referring to a statistical technique in which the probability distribution of the constituent in the population is unknown or is not restricted to be of a specified form. **[D02.96] D7720**

**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, D6557, D6618, D6750, D6794, D6795, D6837, D6894, D6984, D7156, D7216, D7320, D7422, D7468, D7484, D7589**

**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, D7422, D7468, D7484, D7589**

**normal distribution,** *n*—frequency distribution characterized by a bell shaped curve and defined by two parameters: mean and standard deviation. **[D02.96] D7720**

**normal distribution,** *n*—the distribution that has the probability function $x$ such that, if $x$ is any real number, the probability density is:

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

NOTE 1—μ is the true value and σ is the standard deviation of the normal distribution (σ > 0). (ISO 4259) **[D02.94] D6300**

**NPT—**National Pipe Thread **[D02.B0] D8047**

**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**

**OA—**Oil Aeration **[D02.B0] D8047**

**obligate aerobe,** *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*—microrganism 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**

**occurrence number, O,** *n*—ranking number that describes the probability of occurrence of a failure mode's causes and effects over a predetermined period of time based on past operating experience in similar applications. **[D02.96] D7874, D7973**

**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**

**on-board quantity (OBQ),** *n*—the material present in a vessel's cargo tanks, void spaces, and pipelines before the vessel is loaded. On-board quantity may include any combination of water, oil, slops, oil residue, oil/water emulsion, and sediment. **[D02.02] D4057**

**online sensor,** *n*—a monitoring device that can be installed fully in-line or in a bypass loop with the lubrication system.

DISCUSSION—n the former case, the sensor should be capable of allowing the full flow of the lubrication fluid to travel through unimpeded. In the latter case of the bypass loop, care must be taken to ensure a representative sample is flowing through the sensor.
**[D02.96] D7917**

**open cell,** *n—in carbon and graphite technology*, 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**

**open container,** *n*—a container designed for use with samples at atmospheric pressure conditions.
DISCUSSION—This includes glass and plastic bottles. These containers are not suitable for samples expected to have vapor pressures above atmospheric pressure. **[D02.02] D8009**

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

**orientation (of a crystal),** *n*—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*—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*—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**

**outage tube (internal),** *n*—a "cut to length" tube placed inside of the cylinder used as a way to remove excess sample from the cylinder via manual evacuation after the sample cylinder assembly is removed from the sample point.
**[D02.02] D4057**

**outaging,** *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**

**outlying observation,** *n*—observation that appears to deviate markedly in value from other members of the sample set in which it appears, also called *outlier*. **[D02.96] D7720**

**overhead,** *n—in internal combustion engines*, the components of the valve-train located in or above the cylinder head. **[D02.B0] D7484**

**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, [D02.96] D7899**

**oxidation of carbon,** *n*—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 can be used as a fuel or fuel supplement. **[D02.A0] D4806, D4814, D5983, [D02.08] D323, D4953, [D02.J0] D7618**

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

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

**$P_{geom.}$,** *n*—geometric contact pressure describes the load carrying capacity at test end. **[D02.L0] D6425**

**parametric,** *n*—term referring to a statistical technique that assumes the nature of the underlying frequency distribution is known. **[D02.96] D7720**

**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**

**passive grease-sampling device,** *n*—device designed to gather a sample from the equipment by being attached to the grease reservoir at the purge point.
DISCUSSION—This device has also been designed to contain a lubricating grease sample that has been gathered with other methods.
**[D02.G0] D7718**

**passive sampling,** *v*—to use a passive grease-sampling device to collect a purged sample of in-service lubricating grease from a purge path. **[D02.G0] D7718**

**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**

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

DISCUSSION—As an example, a penetration reading of 85 from the indicator scale corresponds to a penetration depth of 8.5 mm. **[D02.10] D1321**

**penetration,** *n*—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 or an optical penetrometer cone 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 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 or a one-half scale cone 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, D7827**

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

**percent loss,** *n—in distillation*, one hundred minus the percent total recovery. **[D02.08] D86, D7344**

*corrected loss, n*—percent loss corrected for barometric pressure.

**percent recovered,** *n—in distillation*, the volume of condensate collected relative to the sample charge.

**percent recovery,** *n—in distillation*, maximum percent recovered relative to the sample charge.

*corrected percent recovery, n—in distillation*, the percent recovery, adjusted for the corrected percent loss.

*percent total recovery, n—in distillation*, the combined percent recovery and percent residue.

**percent residue,** *n—in distillation*, the volume of residue relative to the sample charge.

**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*—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 rate of a substance that passes through a material (diffuser) under given conditions. **[D02.06] D892, D6082**

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

**petroleum coke,** *n*—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**.

**P-F curve,** *n*—illustration of component failure progression (component condition versus time) from incipient failure to functional failure (*F*). **[D02.96] D7874**

**P-F interval,** *n*—period from the point in time in which a change in performance characteristics or condition can first be detected (*P*) to the point in time in which functional failure (*F*) will occur as illustrated on a *P-F* curve. **[D02.96] D7874**

**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**

**photometric analysis,** *n*—analytical chemistry method for quantitative chemical analysis based on the relationship between solution concentrations and the absorption of monochromatic light, as expressed by the Beer law. **[D02.F0] C560**

**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**

**platinum resistance thermometer,** *n*—temperature measuring device constructed with a length of platinum wire, whose electrical resistance changes in relation to temperature. **[D02.08] D6377**

**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**

**P/N—**Part Number (applies only to parts sourced from Caterpillar) **[D02.B0] D8047**

**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] 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. **[D02.94] D6259**

**population,** *n*—the totality of valid observations (performed in a manner that is compliant with the appropriate test standards) about which inferences are made. **[D02.F0] D7846**

**population,** *n*—well defined set (either finite or infinite) of elements. **[D02.96] D7720**

**population mean,** *n*—the average of all potential measurements in a given population weighted by their relative frequencies in the population. **[D02.F0] D7846**

**pore,** *n*—see *void*. **[D02.F0] C709**

**pore,** *n—in carbon and graphite technology, in a carbon or graphite foam,* passage that interconnects two cells. **[D02.F0] C709**

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

**porosity,** *n*—percentage of the total volume of a material occupied by both open and closed pores. **[D02.F0] C709**

**portable manual sampling unit, PSU,** *n*—an intrinsically safe device used in conjunction with a vapor control valve to obtain required cargo samples under closed or restricted system conditions. **[D02.02] D4057**

**pour point,** *n—in petroleum products*, the lowest temperature at which movement of the test specimen is observed under prescribed conditions of the 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 *iso*octane 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 independent test results obtained under stipulated conditions. **[D02.25] D3764**

**precision,** *n*—the closeness of agreement between test results obtained under prescribed conditions. **[D02.94] D6299, D6792; [D02.03] D7740**

**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 test results on the same property obtained using the same test method on 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*, 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**

**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, D4863**

**pressure chamber,** *n*—chamber within the HPA autoclave where heating block filled with samples is placed. The chamber is designed to hold pressures up to 200 bar (197 atm or 2900 lb/in.$^2$) and temperatures up to 320 °C. **[D02.03] C1234**

**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**

**PRF,** *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 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 column,** *n*—in chromatography, a device used to perform a primary separation of a mixture of compounds.

DISCUSSION—The primary column, also known as a monitor column, is used to separate the analyte of interest and to determine the start time and the end time of the heart-cut. **[D02.04] D7920**

**primary reference fuel blends above 100 octane,** *n*—the millilitres per U.S. gallon of tetraethyllead in *iso*octane 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 *iso*octane in a blend with *n*-heptane that defines the octane number of the blend, *iso*octane being assigned as 100 and *n*-heptane as 0 octane number. **[D02.01] D2699, D2700**

**primary reference fuels,** *n—for knock testing, iso* octane, *n*-heptane, volumetrically proportioned mixtures of *iso*octane with *n*-heptane, or blends of tetraethyllead in *iso*octane that define the octane number scale. **[D02.01] D2699, D2700**

**primary reference fuels,** *n—for knock testing*, volumetrically proportioned mixtures of *iso*octane with *n*-heptane, or blends of tetraethyllead in *iso*octane which define the supercharge rating scale. **[D02.01] D909**

**primary reference fuels,** *n—for octane rating*, blended fuels of reference grade *iso*octane and *n*-heptane. **[D02.J0] D6424, D6812**

**primary sample container,** *n*—a container in which a sample is initially collected.

DISCUSSION—Examples of primary sample containers include glass and plastic bottles, cans, core-type thief, and fixed and portable sample containers (receivers). **[D02.02] D4057**

**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**

**probability density function,** *n*—the function *f(x)* is a probability density function for the continuous random variable *X* if:

$$f(x) \geq 0$$

and

$$\int_{-\infty}^{\infty} f(x)\, dx = 1$$

The probability that the random variable *X* assumes a value between *a* and *b* is given by:

$$\Pr(a < X < b) = \int_a^b f(x)\,dx$$

**[D02.F0] D7846**

**process analyzer system,** *n*—see *analyzer*. **[D02.25] D7808**

**production specification,** *n*—ASTM International aviation gasoline standard that specifies the properties, performance, and composition necessary to provide a level of control to support large-scale production, distribution, and the conduct of commerce. **[D02.J0] D7826**

**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**

**prognostics,** *n*—a forecast of the condition or remaining usable life of a machine, fluid, or component part. **[D02.96] D7919**

**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 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 gauge **[D02.J0] D6812**

**PSSI—***in viscometry*, abbreviation for permanent shear stability index.

**pulse travel time ($T_t$),** *n*—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-propogation circuitry. **[D02.F0] C709**

**pump overall efficiency,** *n*—ratio of the power transferred to the liquid, at its passage through the pump, to the mechanical input power. **[D02.N0] D7721**

**pump volumetric efficiency,** *n*—ratio of the effective output flow rate to the derived output flow rate. **[D02.N0] D7721**

**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, D6618, D6750, D6837, D7589**

**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*, 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**

**QI—**Quality Index

**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 homogenous 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] D2699, 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**

**quantity,** *n—in the SI*, a measurable property of a body or substance where the property has a magnitude expressed as the product of a number and a unit; there are seven, well-defined base quantities (length, time, mass,

temperature, amount of substance, electric current, and luminous intensity) from which all other quantities are derived (for example, volume, whose SI unit is the cubic metre).

DISCUSSION—Symbols for quantities must be carefully defined; are written in italic font, can be upper or lower case, and can be qualified by adding further information in subscripts, or superscripts, or in parentheses (for example, $t_{fuel}$ = 40 °C, where $t$ is used as the symbol for the quantity Celsius temperature and $t_{fuel}$ is the symbol for the specific quantity fuel temperature). **[D02.B0] D8047**

**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**

**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.

DISCUSSION—C.L.A. means center line average, and it is a synonym to Ra. **[D02.G0] D5706, D5707, [D02.L0] D7421**

**R-curve,** *n*—plot of stress intensity or strain energy release rate as a function of stable crack extension and provides a measure of crack propagation trend in the material.

**[D02.F0] D7779**

**radiant energy,** *n*—energy transmitted as electromagnetic waves. **[D02.04] D1840, D2008, D2269**

**radiant power, P,** *n*—the rate at which energy is transported in a beam of radiant energy.

**[D02.03] D6732, [D02.04] D1840, D2008, D2269**

**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**

**rate of change (or slope),** *n*—the change in temperature reading per percent evaporated or recovered. **[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**

**rcf—**relative centrifugal force **[D02.14] D2709**

**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 mm by 914 mm (24 in. 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**

**receiver's risk,** *n*—the probability of accepting a product that fails to meet the specification. **[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**

**reconstructed ion chromatogram (RIC),** *n*—a limited mass chromatogram representing the intensities of ion mass spectrometric currents for only those ions having particular mass to charge ratios used in this test method to selectively extract and identify components in the presence of a complex hydrocarbon matrix. **[D02.04] D7845**

**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—in MSEP and DSEP [diesel separability] water separability tests*, a reference fluid base to which a prescribed quantity of a known surface active agent has been added.

DISCUSSION—The known surface active agent is typically bis-2-ethylhexyl sodium sulfosuccinate, commonly referred to as AOT, dissolved in toluene. **[D02.J0] D3948, D7224**

**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 fluid base,** *n—in aviation MSEP water separability tests*, jet fuel that has been cleaned in a prescribed manner to remove all surface-active contaminants (agents), and having a minimum MSEP rating of 97. **[D02.J0] D7224**

**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 *iso*octane + *n*-heptane and *iso*octane + 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 fuels above 100,** *n—for octane rating*, blended fuels of reference grade *iso*octane and 3-methylphenylamine.

DISCUSSION—This practice describes reference fuels above 100 MON in terms of *iso*octane/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 *iso*octane. Care should be exercised to ensure the reference fuel does not adversely contaminate the engine and influence the results. **[D02.J0] D6812**

**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 material, RM,** *n*—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 standard primary procedures with known precision uncertainties. **[D02.03] D7578**

**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, D6894, D6984, D7156, D7216, D7320, D7422, D7468, D7484, D7589, D7603**

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, D6557, D6594, D6618, D6750, D6794, D6795, D6891, D6984, D7156, D7216, D7320, D7422, D7484, D7603**

**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 distillation*, the ratio of the condensate at the head of the column that is returned to the column (*reflux*) to that withdrawn as product. **[D02.08] D2892**

**refractive dispersion,** *n*—the difference between the refractive indices of a substance for light of two different wavelengths, both indices being measured at the same temperature.

DISCUSSION—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. 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] D1747**

**refractive index,** *n*—the ratio of the velocity of light (of specified wavelength) in air, to its velocity in the substance under examination.

DISCUSSION—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**

**refractory elements,** *n*—elements forming difficult-to-dissociate oxides during combustion. **[D02.03] D7740**

**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, [D02.02] D4057**

**relative density,** *n*—the ratio of a given volume of material at 25 °C to the weight of an equal volume of water at the same temperature (specific gravity). **[D02.05] D71**

**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, D1217, D1480, D1481]**

**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 mass response factor (RMRF),** *n*—mass response factor of a component divided by that of another component.

DISCUSSION—In this test method, the mass response factors are relative to that of n-heptane. **[D02.04] D5501**

**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**

**remaining on board, ROB,** *n*—the material remaining in a vessel's cargo tanks, void spaces, and pipelines after the cargo is discharged. Remaining on board quantity may include any combination of water, oil, slops, oil residue, oil/water emulsions, and sediment. **[D02.02] D4057**

**remaining useful life,** *n*—a subjective estimate based upon observations, or average estimates of similar items, components, or systems, or a combination thereof, of the number of remaining time that an item, component, or system is estimated to be able to function in accordance with its intended purpose before replacement. **[D02.96] D7919**

**repeatability,** *n*—difference between two test results, obtained by the same operator with the same apparatus under constant operating conditions on identical test material would, in the long term and correct operation of the test method, exceed the values given only in one case in twenty. **[D02.03] D7740**

**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 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. (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 RR:D02-1007, Manual on Determining Precision data for ASTM Methods of Petroleum Products and Lubricants,[6] 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 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**

**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**

**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.

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, D2885**

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] D613, D2699, D2700, D2885**

**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,** *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 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. **[D02.94] D3244**

**reproducibility,** *n*—difference between two single and independent results, obtained by different operators working in different laboratories on identical test materials, would in the long run, in the normal and correct operation of the test method, exceed the values given only one case in twenty. **[D02.03] D7740**

**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**

**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, D2885**

**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 $mm^2/s$ and 50.0 $mm^2/s$, 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**

**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 (blend stocks) blended to a fuel oil viscosity specification, burned for the generation of heat in a furnace or firebox or for the generation of power in an engine. **[D02.E0] D7621**

**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 resisitivity 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**

**rest conductivity,** *n*—the reciprocal of the resistance of uncharged fuel in the absence of ionic depletion or polarization. It is the electrical conductivity at the initial instant of current measurement after a dc voltage is impressed between electrodes. **[D02.J0] D4308**

**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*, 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**

**riffle,** *n*—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**

**risk priority number (RPN),** *n*—a numeric assessment of risk assigned to FMEA process quantifying failure occurrence, severity of impact, and likelihood detection. **[D02.96] D7973**

**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.G0] D5706, D7420, D7594, [D02.L0] D6425, 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 iron or its alloys*, a corrosion product consisting of hydrated iron oxides, usually reddish in color, but can also be brown-to-black. **[D02.B0] D7320**

**Rvk,** *n*—Reduced valley height according to DIN EN ISO 13565-2:1998. Rvk is the mean depth of the valley reaching into the material below the core profile section.
**[D02.G0] D5706, D7594**

**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, D7594**

**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, D7420, D7594**

**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.

**safety lid vent stack,** *n*—top plate and cylinder that covers the autoclave pressure chamber. **[D02.03] C1234**

**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 collection of measurements or observations taken from a specified population. **[D02.F0] D7846**

**sample,** *n*—a part taken as representative of a whole material. **[D02.05] D4296**

**sample,** *n*—a portion extracted from a total volume that may or may not contain the constituents in the same proportions that are present in that total volume. **[D02.02] D4057**

**sample,** *n*—a portion of carbon obtained from a cathode block. **[D02.05] D6354**

**sample charge,** *n*—the amount of sample used in a test. **[D02.08] D86, D7344**

**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,** *n*—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 loop (fast loop or slip stream),** *n*—a low volume bypass diverted from the main pipeline. **[D02.02] D4057**

**sample preparation,** *n*—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,** *n*—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**

**sample vessel,** *n*—sample container, constructed of quartz or glassy carbon, designed for use in the HPA. **[D02.03] C1234**

**sampling,** *v*—all the steps required to obtain a sample that is representative of the contents of any pipe, tank, or other vessel and to place that sample in a container from which a representative test specimen can be taken for analysis. **[D02.02] D4057**

**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*—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. **[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] D7419**

**saturated hydrocarbons,** *n*—paraffinic and naphthenic compounds. **[D02.04] D7974**

**Saybolt color,** *n*—an empirical definition of the color of a clear petroleum liquid based on a scale of −16 to +30 and determined by Test Method D156. **[D02.05] D7058**

**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] D6593, D6984, D7320**

**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] D4998**

DISCUSSION—When the lubricant film is substantially maintained, a smooth scar is obtained on the test block, but when there is a breakdown of the lubricant film, scoring or surface failure of the test block takes place as shown in Fig. 1. In its simplest and recognized form, scoring is characterized by a wide scar on the test block and by the transfer of metal from the test block to the contacting surface of the test cup. The form of surface failure more usually encountered, however, consists of a comparatively smooth scar, which shows local damage that usually extends beyond the width of the scar. Scratches or striations that occur in an otherwise smooth scar and that do not extend beyond the width of the scar are not considered scoring in this test method. The term scuffing is sometimes used as a synonym for scoring. **[D02.G0] D2509**

**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] 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.B0] D4998, [D02.L0] D5182**

**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] D4863, D4998, D6593, D6618, D6984, D7320**

**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*.)

**severity number, S,** *n*—ranking number that describes the seriousness of the consequences of each failure mode's causes and effects on potential injury, component or equipment damage, and system availability.

DISCUSSION—A scale is used to grade severity numbers. **[D02.96] D7874, D7973**

**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**

DISCUSSION—For a Newtonian fluid in a concentric cylinder rotary viscometer in which the shear stress is measured at the inner cylinder surface, and ignoring any end effects, the shear rate is given as follows:

$$\dot{\gamma} = \frac{2\,\Omega\,R_s^2}{R_s^2 - R_r^2}$$

$$\dot{\gamma} = \frac{4\,\pi\,R_s^2}{t\left(R_s^2 - R_r^2\right)}$$

where:

$\dot{\gamma}$ = 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 for one revolution of the rotor, s.

**[D02.07] D6821, D6896**

**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] D4741, D6616, D5133**

**shear rate,** *n*—velocity gradient in liquid flow in millimetres per second per millimetre (mm/s per mm) resulting from applied shear stress. The System International (SI) unit for shear rate is reciprocal seconds, $s^{-1}$. **[D02.07] D4741**

DISCUSSION—The velocity gradient in the tapered bearing simulator viscometer is constant at any chosen rotor-stator gap and rotor speed. **[D02.07] D4683**

DISCUSSION—The velocity gradient in the Multi-Cell Capillary Viscometer varies across the capillary annulus from a maximum at the wall of the capillary to zero at the center of the capillary annulus. Assuming a parabolic flow profile across the capillary, the apparent shear rate at the capillary wall can be calculated as follows:

$$S_a = 4V/\pi R^3 t$$

where:

$S_a$ = apparent shear rate (at the wall, $s^{-1}$),
$V$ = volume of fluid ($mm^3$) passed through the capillary in time $t$ (s), and
$R$ = capillary radius (mm).

$S_a$ is precise for Newtonian liquids which generate a parabolic flow profile but may be approximate for non-Newtonian liquids that do not necessarily generate a parabolic flow profile. **[D02.07] D5481**

**shear rate,** *n*—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 the apparatus being described), and ignoring any end effects, the shear rate is given as follows:

$$\dot{\gamma} = \frac{2\Omega R_s^2}{(R_s^2 - R_r^2)}$$

$$\dot{\gamma} = \frac{4\pi R_s^2}{t(R_s^2 - R_r^2)}$$

where:

$\dot{\gamma}$ = 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.

For the specific apparatus being described,

$$\dot{\gamma} = \frac{63}{t}$$

**[D02.07] D3829, D4684**

**shear rate—**velocity gradient in liquid flow in millimetres per second per millimetre (mm/s per mm) resulting from applied shear stress; the System International (SI) unit for shear rate is reciprocal seconds, $s^{-1}$.

DISCUSSION—The velocity gradient in the Multi-Cell Capillary Viscometer varies across the capillary annulus from a maximum at the wall of the capillary to zero at the center of the capillary annulus. Assuming a parabolic flow profile across the capillary, the apparent shear rate at the capillary wall can be calculated as follows:

$$S_a = 4V/\pi R^3 t$$

where:

$S_a$ = apparent shear rate (at the wall, $s^{-1}$),
$V$ = volume of fluid ($mm^3$) passed through the capillary in time $t$ (s), and
$R$ = capillary radius (mm).

$S_a$ is precise for Newtonian liquids which generate a parabolic flow profile but may be approximate for non-Newtonian liquids that do not necessarily generate a parabolic flow profile. **[D02.07] D5841**

**shear stability,** *n*—the resistance of a polymer-thickened fluid to shear degradation. **[D02.N0] D6080**

**shear stress,** *n*—force per unit area causing liquid flow over the area where viscous shear is being caused; in SI, the unit of shear stress is the Pascal (Pa). **[D02.07] D4683, D4741**

DISCUSSION—In a capillary viscometer, the significant shear stress is at the wall of the capillary. That is, the total force acting on the area of the capillary annulus divided by the inside area of the capillary through which the liquid flows. The shear stress at the wall does not depend on the nature of the liquid (that is, whether the liquid is Newtonian or non-Newtonian). The shear stress at the capillary wall may be calculated as follows:

$$Z = \mathrm{PR/2L}$$

where:

$Z$ = shear stress (Pa),
$P$ = pressure drop (in Pa),
$R$ = capillary radius, and
$L$ = capillary length (in units consistent with $R$).

**[D02.07] D5481**

**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, D5133**

**shear stress,** *n*—the motivating force per unit area for fluid flow. **[D02.N0] D6080**

DISCUSSION—For the rotary viscometer being described, the rotor surface is the area under shear or the shear area. For this test method, end effects are not considered.

$$T_r = 9.81\ M\ (R_o + R_t) \times 10^{-6}$$

$$\tau = \frac{T_r}{2\ \pi\ R_r^2\ h} \times 10^9$$

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,
$\tau$ = shear stress at the rotor surface, Pa, and
$h$ = height of the rotor face, mm.

**[D02.07] D6821, D6896**

**shear stress—**the motivating force per unit area for fluid flow. The *area* is the area under shear. **[D02.07] D6616**

**shear stress,** *n*—the motivating force per unit area for fluid flow. Area is the area under shear. For the rotary viscometer being described, the rotor surface is the area under shear.

$$T_r = 9.81M(R_o + R_t) \times 10^{-6}$$

$$\tau = \frac{T_r}{2\pi R_r^2 h} \times 10^9$$

where:

$T_r$ = torque applied to rotor, N·m,
$M$ = applied mass, g,
$R_o$ = radius of the shaft, mm,
$R_t$ = radius of the thread, mm,
$\tau$ = shear stress at the rotor surface, Pa, and
$h$ = height of the rotor, mm.

For the dimensions given,

$$T_r = 31.7M \times 10^{-6}$$

$$\tau = 3.5M$$

**[D02.07] D3829, D4684**

**shear stress,** *n*—force per unit area causing liquid flow over the area where viscous shear is being caused; in SI, the unit of shear stress is the Pascal (Pa).

DISCUSSION—In a capillary viscometer, the significant shear stress is at the wall of the capillary. That is, the total force acting on the area of the capillary annulus divided by the inside area of the capillary through which the liquid flows. The shear stress at the wall does not depend on the nature of the liquid (that is, whether the liquid is Newtonian or non-Newtonian). The shear stress at the capillary wall may be calculated as follows:

$$Z = PR/2L$$

where:

$Z$ = shear stress (Pa),
$P$ = pressure drop (in Pa),
$R$ = capillary radius, and
$L$ = capillary length (in units consistent with $R$).

**[D02.07] D5841**

**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**

**sigma,** *n*—a measure of variance; also called standard deviation. **[D02.94] D7776**

**single base,** *adj—in lubricating grease*, relating to a thickener comprised of soaps of only one metal. **[D02.G0] D128**

**site assigned value,** *n*—a value that serves as an agreed-upon reference for comparison, determined from multiple test results obtained under site precision conditions.

DISCUSSION—In the context of this test method, site assigned value is understood to apply to prototype fuel average research or motor octane number determined under site precision conditions using direct comparison delta octane number cycles comparing the prototype fuel to a standard fuel having an accepted reference value octane number. **[D02.01] D2885**

**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, [D02.25] D3764, [D02.01] D2885**

DISCUSSION—A measurement system may comprise multiple instruments being used for the same test method. **[D02.25] D3764**

DISCUSSION—In the context of this test method, application of site precision conditions is primarily applied to the determination of the variability of delta octane average results, obtained by different operators, over different days, for the same fuel pair, using the same comparator. Each delta octane average result is obtained from repetitive comparisons of the same fuel pair under repeatability conditions. **[D02.01] D2885**

**skewness,** *n*—a term relating to the asymmetry of a probability density function. The distribution of failure strength for graphite is not symmetric with respect to the maximum value of the distribution function; one tail is longer than the other. **[D02.F0] D7846**

**skinnogen,** *n*—(Synonym—**biofilm**.)

DISCUSSION—Generally applied to a biofilm formed at the fuel-water interface. **[D02.14] D6469**

**SLBOCLE—**Scuffing Load Ball-on-Cylinder Lubricity Evaluator **[D02.B0] D8047**

**slice rate,** *n—in gas chromatography*, the time interval used to integrate the continuous (analog) chromatographic detector response during an analysis, expressed in Hz.

DISCUSSION—for example, integrations or slices per second. **[D02.04] D7798**

**slice time,** *n—in gas chromatography*, the time duration of the slice, in seconds. The slice time is the time at the end of each contiguous area slice. **[D02.04] D7798**

**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**

**slip tube,** *n*—a graduated hollow rod fitted into a gas-tight housing, the lower end of which is open to the cargo's contents and the upper end is fitted with a valve. **[D02.02] D4057**

**slow crack growth, (SCG),** *n*—sub-critical crack growth (extension) which may result from, but is not restricted to, such mechanisms as environmentally-assisted stress corrosion or diffusive crack growth, usually at constant load. **[D02.F0] D7779**

**sludge,** *n*—a precipitate or sediment from oxidized mineral oil and water. **[D02.09] D4310**

**sludge,** *n*—a precipitate or sediment from oxidized mineral oil that is insoluble in n-heptane. **[D02.09] D7873**

**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, D7422, D7468, D7484, [D02.96] D7899**

**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**

**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 material exhibiting 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.

**[Coordinating Subcommittee D02.95]**

**solid,** *n*—a state of matter characterized by the material exhibiting 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.

**[Coordinating Subcommittee D02.95]**

**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**

**solid particulate,** *n—in liquid fuels*, small solid or semi-solid particles, sometimes referred to as silt or sediment, present in fuel.

DISCUSSION—Some examples of solid particulates are air-blown dust, corrosion by-products, internal protective-coating deterioration, and products of fuel degradation and microbial growth. **[D02.14] D4860**

**soluble oil,** *n*—an oil (such as a mineral oil containing a sulfonated oil or a soap as emulsifier) which, when appropriately mixed with water, forms an aqueous emulsion which may be used, for example, as a cutting fluid, textile lubricant, or a carrier for insecticides; also the emulsion formed from such an oil.

DISCUSSION—The term emulsifiable oil is preferred. **[Subcommittee D02.L0]**

**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 nonconducting material onto the electrodes of a spark plug that may, but will not necessarily, prevent the plug from operating. **[D02.B0] D4857, D4858, D4863**

**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, D4863**

**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 characteristics 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**

**spectrometer,** *n*—instrument used to measure the emission or absorption spectrum emitted by a species in the vaporized sample. **[D02.03] D7740**

**spectrum,** *n*—array of the components of an emission or absorption arranged in the order of some varying characteristics such as wavelength, mass, or energy. **[D02.03] D7740**

**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 concentration,** *n*—the fraction of a cell constituent as determined on a per cell basis.

DISCUSSION—The specific concentration can be expressed as weight to weight, weight to volume or volume to volume basis. Enzymes are commonly reported in terms of their activity relative to a reference standard. **[D02.14] D7847**

**specific gravity,** *n*—historical term, no longer used, which has been replaced by **relative density**. **[D02.02] D287**

**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. **[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, D2885**

**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, D7827**

**stability reserve,** *n—of crude oils, heavy fuel oils, and residual streams containing asphaltenes*, the property of an oil to maintain asphaltenes in a peptized (colloidally dispersed) state and prevent their flocculation when stored or when blended with other oils.

DISCUSSION—An oil with a high stability reserve can be stored for a long period of time or blended with a range of other oils without flocculation of asphaltenes. **[D02.14] D7112**

**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*—measure of the dispersion of a series of results around their mean, equal to the square root of the variance and estimated by the positive square root of the mean square. (ISO 4259) **[D02.94] D6300**

**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 $SOR_w = 4.17 \times 10^{-4}$ g $g^{-1}$ $h^{-1}$) is the standard oxidation temperature (*SOT*). **[D02.F0] D7542**

**standard reference material,** *n*—trademark for reference materials certified by NIST. **[D02.03] D7740**

**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. **[D02.B0] D7156**

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**

**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. **[D02.B0] D7422**

**standpipes,** *n*—the vertical sections of pipe or tubing used for gauging extending from the gauging platform to near the bottom of tanks that are equipped with external or internal floating roofs. Standpipes may also be found on marine vessels. Standpipes are also known as "stilling wells" or "gauge wells." Standpipes without slots do not allow the free flow of product through the standpipe, and are known as solid or unslotted standpipes. **[D02.02] D4057**

**starting torque,** *n*—the maximum torque measured at the start of rotation. **[D02.G0.05] D1478**

**state of statistical control,** *n*—process condition when only common causes are operating on the process. **[D02.96] D7720**

**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**

**statistical bias,** *n*—inherent to most estimates, this is a type of consistent numerical offset in an estimate relative to the true underlying value. The magnitude of the bias error typically decreases as the sample size increases. **[D02.F0] D7846**

**statistical process control (SPC),** *n*—set of techniques for improving the quality of process output by reducing variability through the use of one or more control charts and a corrective action strategy used to bring the process back into a state of statistical control. **[D02.96] D7720**

**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**

**stream sample,** *n*—the material to be evaluated by an analytical measurement system, typically drawn from a flowing stream of either blended spark-ignition engine fuel or process unit material. **[D02.01] D2885**

**stress-intensity factor, K[$FL^{-3/2}$],** *n*—magnitude of the ideal-crack-tip stress field (stress field singularity) for a particular mode in a homogeneous, linear-elastic body. **[D02.F0] D7779**

**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**

**strong surfactant,** *n—in petroleum fuels*, surface active material that disarms filter separator elements, allowing water to pass.

DISCUSSION—Strong surfactants can be refinery process chemicals left in the fuel or contaminants introduced during transportation of the fuel. **[D02.J0] D7224**

**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 ($SO_4^=$ to $S^=$). 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**

**sulfur content,** *n*—percentage content by weight of elemental sulfur present in graphite. **[D02.F0] C816**

**sum of squares,** *n—in analysis of variance*, sum of squares of the differences between a series of results and their mean. **[D02.94] D6300**

**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] D7347**

**supercritical fluid chromatography,** *n*—class of chromatography that employs supercritical fluids as mobile phases. **[D02.04] 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**

**supplier's risk,** *n*—the probability of rejecting a product that meets the specification. **[D02.94] D3244**

**surfactant,** *n—in petroleum fuels*, surface active material (or surface active agent) that could disarm (deactivate) 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. **[D02.J0] D3948, D7224**

**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*—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**

**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, D7058**

**surrogate method,** *n*—a standard test method that is based on a surrogate calibration. **[D02.05] D6756, D7058**

**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**

**switch loading,** *n—of liquid fuels*, the practice of loading low vapor pressure product (for example, diesel fuel) into an empty or near-empty fixed or portable container that previously held a high or intermediate vapor pressure product (such as gasoline or solvent) without prior compartment cleaning treatment and inert gas purging; and the reverse procedure where a high vapor pressure product is added to a container that previously held a low vapor pressure product.

DISCUSSION—Since middle distillate fuels have flash points above 38°C, during normal distribution of these fuels, the atmosphere above the fuels in a container such as a tanker truck, rail car, or barge, is normally below the lower explosive limit, so there is low risk of fire or explosion should an electrostatic discharge (spark) occur. However, when the previous load in the compartment was a volatile, flammable fuel such as gasoline, and if some residual fuel vapor or mist remains in the compartment, and the container has a mixture of air and fuel vapor or mist (that is, not purged with an inert gas), then there is a risk that the atmosphere in the container being filled could be in the explosive range creating a hazard should an electrostatic discharge occur. **[D02.E0] D975**

**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] D7278**

**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— in distillation*, the volume of product withdrawn from the reflux divider over a specified period. **[D02.08] D2892**

**tangential skimming,** *n—in gas chromatography*, integration technique used when a "rider" peak elutes on the tail of a primary peak.

DISCUSSION—Since the majority of the area beneath the rider peak belongs to the primary peak, in tangential skimming the top of the primary peak tail is used as the baseline of the rider peak, and the triangulated area beneath the rider peak is added to the primary peak. **[D02.04] D5501**

**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**

**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—**top dead center **[D02.J0] D6812**

**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 program,** *n*—software program which controls the temperature ramping of the HPA during the run. The program used for preparation of oil samples is shown in Table 2. **[D02.03] C1234**

**temperature reading,** *n*—the temperature obtained by a temperature measuring device or system that is equal to the thermometer reading described. **[D02.08] D86**

*corrected temperature reading, n*—the temperature reading, as described, corrected for barometric pressure. **[D02.08] D86**

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

**tensile strength,** *n*—property of solid material that indicates its ability to withstand a uniaxial tensile load, converted to unit stress based on the original cross-section area of the tensile test specimen. **[D02.F0] C565**

**tensile strength,** *n*—the maximum tensile stress applied in stretching a specimen to rupture. **[D02.B0] D7216**

**terrestrial (or soil) environment,** *n*—the aerobic environmental compartment which is found in and on natural soils. **[D02.N0] D6046, [D02.12] D6384**

**tertiary-butyl alcohol (TBA),** *n*—chemical compound $(CH_3)_3COH$. **[D02.J0] D7618**

**test oil,** *n*—any oil subjected to evaluation in an established procedure. **[D02.B0] D6557, D6594, D6837, D6894, D6984, D7216, D7320, D7468, D7589, D7603**

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, etc.). **[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] D7422**

**test procedure,** *n*—one where test parameters, apparatus, apparatus preparation, and measurements are principal items specified. **[D02.B0] 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 specification,** *n*—ASTM International aviation gasoline standard specifying the properties, performance, and composition necessary to provide a level of control to support the conduct of testing and analysis for development of an ASTM International aviation gasoline production specification. **[D02.J0] D7826**

**test specimen—**an article prepared from a core sample. **[D02.F0] C783**

**test specimen,** *n*—a representative piece of a sample. **[D02.05] D6354; [D02.14] D7463**

**test start,** *n*—introduction of test oil into the engine. **[D02.B0] D6709, D6837, D7589**

**TGF,** *n*—top groove fill. **[D02.B0] D6750**

**theoretical carbon dioxide ($ThCO_2$),** *n*—the amount of $CO_2$ which could theoretically be produced from the complete biological oxidation of all of the carbon in a test material. **[D02.12] D6139**

**theoretical $CO_2$,** *n*—the amount of $CO_2$ which could in theory be produced from the complete oxidation of all the carbon in a material. **[D02.N0] D6046**

**theoretical $O_2$ (oxygen),** *n*—the amount of oxygen that is theoretically required to oxidize a material.

DISCUSSION—The appropriate abbreviation is $ThO_2$. **[D02.12] D6384**

**theoretical $O_2$,** *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,** *n*—a device for determining temperature using one of a variety of different principles.

DISCUSSION—A thermometer has two important elements: the temperature sensor, within which some physical change occurs with temperature (for example, the bulb of a liquid-in-glass thermometer, or a thermistor in an electronic thermometer), plus some means of converting this change into a numerical value (for example, the scale on a liquid-in-glass thermometer, or a digital readout in the case of an electronic thermometer). **[D02.10] D938**

**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, 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 fibers (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, D1403, D1742, D1831, D2265, D6185, D7342, D7420, D7594**

**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**

**titration,** *n*—quantitative chemical analysis method used to determine the unknown concentration of a specified element by reacting a solution prepared from the sample to be analyzed with a known concentration and volume of specific reagent. **[D02.F0] C816**

**TLHC,** *n*—top land heavy carbon. **[D02.B0] D6750**

**TMC—**Test Monitoring Center of ASTM **[D02.B0] D8047**

**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 *iso*octane that have prescribed rating tolerances for $O.N._{ARV}$ determined by round-robin testing under reproducibility conditions. **[D02.01] D2699, D2700**

**top size,** *n*—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 ion chromatogram (TIC),** *n*—mass spectrometer computer output representing either the summed intensities of all scanned ion currents or a sample of the current in the ion beam for each spectrum scan plotted against the corresponding spectrum number. **[D02.04] D7845**

**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 sample area,** *n—in gas chromatography*, the cumulative corrected area, from the initial area point to the final area point. **[D02.04] D7798**

**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, [D02.03] D7578**

**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, D7827**

**transmittance, T,** *n*—the ratio of the radiant power transmitted by a material to the radiant power incident upon it. **[D02.03] D6732**

**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
$P_o$ = 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**

**trend analysis,** *n*—monitoring of the level and rate of change over operating time of measured parameters. **[D02.96] D7917**

**trendable,** *adj*—sample of in-service lubricating grease used to trend the physical properties, wear levels, and contaminants in a grease-lubricated component. **[D02.G0] D7718**

**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 (μ),** *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**

**true vapor pressure, TVP,** *n*—the pressure at which the fluid is in equilibrium between its liquid and gas state. **[D02.02] D4057**

**triglyceride burner fuel,** *n*—any triglyceride, including recycled and unused cooking oil, greases, animal fats, and naturally occurring constituents of triglycerides including monoglycerides, diglycerides and free fatty acids, suitable for the generation of heat by combustion in a furnace or firebox as a vapor or a spray or a combination of both with little or no preconditioning other than preheating. **[D02.P0] D7666**

**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 or synthetic oils,** *n*—oils for steam, gas, or combined cycle 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. 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 or synthetic oils,** *n*—oils for steam, gas, or combined cycle 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. Type II oils are generally satisfactory for turbine sets where bearing temperatures do not exceed 110 °C. Oils ISO VG 68 and above have been used in marine, hydro, or water turbines. **[D02.C0] D4304**

**Type III mineral or synthetic 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 or Type II oils.

DISCUSSION—Type III oils usually are available in ISO VG 32 and 46. Such oils are normally comprised of a highly refined mineral or synthetic base oil (API group I, II, III, or IV) 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.

**ullage (outage),** *n*—the volume of available space in a container unoccupied by contents. **[D02.02] D4057**

**ULSD—**Ultra-Low-Sulfur Diesel fuel **[D02.B0] D8047**

**ultimate biodegradation,** *n*—degradation achieved when the test substance is totally utilized by microorganisms resulting

in the production of $CO_2$, (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 $CO_2$ or methane, either directly, by measuring the production of $CO_2$ or methane, or indirectly, by measuring the consumption of $O_2$.

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 $CO_2$ or methane, either directly by measuring the production of $CO_2$ or methane, or, for aerobic biodegradation, indirectly by measuring the consumption of $O_2$.

DISCUSSION—The measurement of new biomass is usually not attempted. **[D02.N0] D6046**

**ultimate elongation,** *n*—the elongation at which rupture occurs in the application of continued tensile stress. **[D02.B0] D7216**

**ultimate tensile strength,** *n*—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**

**ultimate tensile strength,** *n*—the maximum tensile stress applied in stretching a specimen to rupture. **[D02.F0] C565**

**unbiased estimator,** *n*—an estimator that has been corrected for statistical bias error. **[D02.F0] D7846**

**univariate calibration,** *n*—a process for creating a calibration model in which a single measured variable, for example, the absorbance at a particular wavelength, is correlated with the concentration or property values for a set of calibration samples. **[D02.04] D7861**

**unleaded aviation gasoline,** *n*—gasoline intended for use in 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] D7960**

**unleaded hydrocarbon aviation gasoline,** *n*—gasoline intended for use in aircraft powered by reciprocating spark-ignition engines, where lead and lead containing compounds are is not intentionally added for the purpose of enhancing octane performance and which excludes non-hydrocarbons, except for additives approved in this specification. **[D02.J0] D7719**

**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**

**upper control limit,** *n*—maximum value of the control chart statistic that indicates statistical control. **[D02.96] D7720**

**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] D6894, 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**

DISCUSSION—In this test method, the oil can be any oil that has been used for lubrication. **[D02.06] D893**

**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. **[D02.06] D974**

**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, D7484**

**vapor control valve, VCV,** *n*—a valve fitted on a standpipe, expansion trunk, or the deck that permits use of the portable handheld gauging/sampling instruments while restricting the release of vapors into the atmosphere. **[D02.02] D4057**

**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, D7975**

**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, [D02.02] D4057**

**vapor pressure of crude oil ($VPCR_x$),** *n*—the pressure exerted in an evacuated chamber at a vapor-liquid ratio of X:1 by conditioned or unconditioned crude oil, which may contain gas, air, or water, or a combination thereof, where X may vary from 4 to 0.02. **[D02.04] D8003**

**vapor temperature reading,** *n*—temperature of the 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 above, 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**

**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 millilitre, milligram, or centimetre squared. **[D02.14] D6469**

**viscosity,** *n*—ratio of applied shear stress and the resulting rate of shear. It is sometimes called dynamic or absolute viscosity. Viscosity is a measure of the resistance to flow of the liquid at a given temperature. In SI, the unit of viscosity is the Pascal·second (Pa·s), often conveniently expressed as milliPascal·second (mPa·s), which has the English system equivalent of the centipoise (cP).
**[D02.07] D4683, D5841, D4741**

**viscosity,** *n*—that property of a fluid which resists flow.

DISCUSSION—Viscosity is defined as the ratio of the applied shear stress (force causing flow) and the shear rate (resultant velocity of flow per unit distance from a stationary surface wet by the fluid). Mathematically expressed:

$$\text{viscosity} = \text{shear stress/shear rate or, symbolically, } \eta = \tau/\dot{\gamma}$$

in which the symbols in the second portion of Eq 1 are defined by the terms in the first portion of the equation. The SI unit for viscosity used herein is milliPascal seconds (mPa·s). **[D02.07] D5133, D7110**

**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). **[D02.07] D3829, D6896**

**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]. **[D02.07] D4684, D6821**

**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] D6616**

**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, D3236**

**viscosity,** *n*—the property of a fluid that determines its internal resistance to flow under stress, expressed by:

$$\eta = \frac{\tau}{\gamma}$$

where:

$\tau$ = the stress per unit area, and
$\gamma$ = the rate of shear.

DISCUSSION—It is sometimes called the coefficient of dynamic viscosity. This coefficient is thus a measure of the resistance to flow of the liquid. In the SI, the unit of viscosity is the Pascal-second; for practical use, a submultiple (milliPascal-second) is more convenient and is customarily used. The milliPascal second is 1 cP (centipoise). **[D02.07] D5293**

**viscosity—**the ratio between the applied shear stress and the rate of shear.

DISCUSSION—Viscosity is sometimes called the coefficient of dynamic viscosity. This coefficient is a measure of the resistance to flow of the liquid. **[D02.N0] D6080**

**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,** *n*—an arbitrary number used to characterize the variation of the kinematic viscosity of a petroleum product with temperature.

DISCUSSION—For oils of similar kinematic viscosity, the higher the viscosity index the smaller the effect of temperature on its kinematic viscosity.

DISCUSSION—Viscosity index is also used in Terminology D1695 in a definition unrelated to this one. **[D02.07] D2270**

**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*—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 fraction of B, $\varphi_B$,** *n*—volume of component B divided by the total volume of the all the constituents of the mixture prior to mixing.

DISCUSSION—Values are expressed as pure numbers or the ratio of two units of volume (for example, $\varphi_B$ = 0.012 = 1.2 % = 1.2 cL/L). **[D02.B0] D8047**

**volume response factor,** *n*—a constant of proportionality that relates the area under a chromatogram to liquid volume. **[D02.04] D7096**

**wall coated open tubular (WCOT),** *n*—a type of capillary column prepared by coating or bonding the inside wall of the capillary with a thin film of stationary phase. **[D02.04] D7845**

**warning limits,** *n*—limits on a control chart that are two standard errors below and above the center line. **[D02.96] D7720**

**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 predominantly aqueous portion of a mixture of water and a material poorly soluble in water, which separates in a specified period of time after the mixture has undergone a specified degree of mixing and which includes water, dissolved components, and dispersed droplets of the poorly 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, [D02.12] D6081**

**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**

**water tolerance,** *n*—the ability to absorb small quantities of water without creating a separate phase in the fuel.

DISCUSSION—Improved water tolerance is the ability to absorb larger quantities of water without phase separation. **[D02.A0] D4814**

**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**

**strong surfactant,** *n—in petroleum fuels*, surface active material that disarms filter separator elements, allowing water to pass.

DISCUSSION—Strong surfactants can be refinery process chemicals left in the fuel or contaminants introduced during transportation of the fuel. **[D02.J0] D7224**

**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, D3702, D3704, D4172, D5620, D6425**

**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*—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—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**

**wear scar—***in the liquid fuels industry*, average diameter of a worn and abraded area, measured in two specified directions, produced on a test ball under defined conditions.

DISCUSSION—The wear scar generated by Test Method D5001 is often referred to as the BOCLE wear scar. **[D02.J0] D5001**

**Weibull distribution,** *n*—the continuous random variable $X$ has a two-parameter Weibull distribution if the probability density function is given by:

$$f(x) = \left(\frac{m}{\beta}\right)\left(\frac{x}{\beta}\right)^{m-1} \exp\left[-\left(\frac{x}{\beta}\right)^{m}\right] \quad x>0$$

$$f(x) = 0 \quad x \le 0$$

and the cumulative distribution function is given by:

$$F(x) = 1 - \exp\left[-\left(\frac{x}{\beta}\right)^{m}\right] \quad x>0$$

or

$$F(x) = 0 \quad x \le 0$$

where:

$m$ = Weibull modulus (or the shape parameter) (> 0), and
$\beta$ = scale parameter (> 0).

DISCUSSION—The random variable representing uniaxial tensile strength of graphite will assume only positive values, and the distribution is asymmetrical about the population mean. These characteristics rule out the use of the normal distribution (as well as others) and favor the use of the Weibull and similar skewed distributions. If the random variable representing uniaxial tensile strength of a graphite is characterized by Eq 1, Eq 1, Eq 1, and Eq 1, then the probability that the tested graphite will fail under an applied uniaxial tensile stress, σ, is given by the cumulative distribution function:

$$P_f = 1 - \exp\left[-\left(\frac{\sigma}{\sigma_\theta}\right)^{m}\right] \quad \text{for } \sigma>0$$

and

$$P_f = 0 \quad \text{for } \sigma \le 0$$

where:

$P_f$ = the probability of failure, and
$\sigma_\theta$ = the Weibull characteristic strength.

DISCUSSION—The Weibull characteristic strength depends on the uniaxial test specimen (tensile, compression and flexural) and may change with specimen geometry. In addition, the Weibull characteristic strength has units of stress and should be reported using units of MPa or GPa. **[D02.F0] D7846**

**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 applied wax coating,** *n*—the weight of wax that has been applied to the corrugated board as a coating, expressed as weight per unit area, usually grams of coating per square metre or pounds of coating per thousand square feet of board covered.

NOTE 2—When it is known that a wax-coated specimen has no impregnating wax present, this extraction procedure is normally calculated to express the data as "weight of applied wax coating." **[D02.10] D3344**

**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 percent wax content,** *n*—the weight percent of wax present in and on corrugated board relative to the weight of unwaxed board substrate measured at 23 °C (73 °F) and 50 % relative humidity. **[D02.10] D3344**

**weight-normalized oxidation rate ($OR_w$)—**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, $OR_w$ are:

$$\left[g_{(oxidized)}\right]\left[g_{(specimen)}\right]^{-1}\ h^{-1} \text{ (or, equivalent, } h^{-1})$$

**[D02.F0] D7542**

**weight-normalized standard oxidation rate ($SOR_w$)—**value of weight-normalized oxidation rate corresponding to 1% weight loss in 24 h (equivalent to $SOR_w = 4.17 \times 10^{-4}$ g $g^{-1}$ $h^{-1}$). **[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.

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 roll stability,** *n—of lubricating grease*, change in consistency of a mixture of sample and small amount of water after a specified amount of rolling in a roll stability test apparatus. **[D02.G0] D8022**

**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. **[D02.G0] D7342**

**wettage,** *n*—see **static hold-up or wettage**.

**white metal bearing alloys,** *n*—Metal alloys typically consisting of lead (Pb), tin (Sn) or zinc (Zn) with antimony (Sb) (some known as Babbitt) that are applied as a relatively thin surface to hydrodynamic bearings. These relatively soft materials are used to ensure embeddability of hard particle contaminants entrained in the lubricant and to ensure journal protection should oil supply be interrupted. **[D02.96] D7973**

**with grain,** *n*—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 subjection 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.

**Wv,** *n*—Wear volume is the loss of volume to the ball after a test. **[D02.L0] D6425**

**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.

**Young's modulus or modulus of elasticity (E),** *n*—n—the elastic modulus in tension or compression. **[D02.F0] C769**

**zero time ($T_o$),** *n*—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.

$$Z' = \frac{(X_i - X)}{\sqrt{\left((s')^2 + \left(\frac{s^2_{these\ data}}{n}\right)\right)}}$$

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 – 17) that may impact the use of this standard. (Approved July 15, 2017.)

*(1)* Deleted unattributed definitions of instrument response time, liquefied petroleum gas (LPG), lubricant base stock, micro-separometer rating (MSEP), nominal filtration rating, operationally valid standard test, quenching oil, reference viscosity, and saponification number.

Subcommittee D02.95 has identified the location of selected changes to this standard since the last issue (D4175 – 16c) that may impact the use of this standard. (Approved Feb. 1, 2017.)

*(1)* Deleted unattributed definitions of autoignition temperature, handling point, hydrolytic stability, load-wear index, mixed aniline point, no-flow point, relative density (specific gravity), residue, specific gravity, smoke point, and true value.

*(2)* Added attribution to definitions of asphalt, autoignition, and soluble oil.

Subcommittee D02.95 has identified the location of selected changes to this standard since the last issue (D4175 – 16b) that may impact the use of this standard. (Approved Sept. 1, 2016.)

*(1)* Deleted unattributed definition of demulsibility.
*(2)* Revised definition of soluble oil.

*(3)* Included all editorial updates from standards for 2015/2016.

Subcommittee D02.95 has identified the location of selected changes to this standard since the last issue (D4175 – 16a) that may impact the use of this standard. (Approved July 15, 2016.)

*(1)* Deleted unattributed definition of fire point.

Subcommittee D02.95 has identified the location of selected changes to this standard since the last issue (D4175 – 16) that may impact the use of this standard. (Approved July 1, 2016.)

*(1)* Revised the definition of jet fuel and added Subcommittee D02.J0 attribution.
*(2)* Added Subcommittee D02.B0 attribution to dispersant.

*(3)* Deleted the following unattributed definitions: cetane number, dynamic, Fuel C, and luminometer number.