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SURFACE VEHICLE RECOMMENDED PRACTICE

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(R) EMISSIONS TERMINOLOGY AND NOMENCLATURE

1. *Scope*—This SAE Recommended Practice applies to nomenclature of emissions and emissions reduction apparatus as applied to various engines and vehicles. Modifying adjectives are omitted in some cases for the sake of simplicity. However, it is considered good practice to use such adjectives when they add to clarity and understanding.

1.1 **Purpose**—This document was prepared to standardize terminology and nomenclature in order to facilitate clearer understanding for engineering discussions, comparisons, and the preparation of technical papers.

2. *References*

2.1 **Applicable Documents**—The following publication forms a part of this specification to the extent specified herein.

2.1.1 ASTM PUBLICATION—Available from ASTM, 1916 Race Street, Philadelphia, PA 19103.

ASTM D 323—Test Method for Vapor Pressure of Petroleum Products (Reid Distillation)

3. *Auxiliary Air Systems*

3.1 **Air Distribution Manifold**—The manifolding which distributes and proportions air to the individual exhaust ports.

NOTE—The manifolding may consist of external tubing or integral passageways.

3.2 **Air Injection Relief Valve**—A pressure relief valve, usually integral with the air pump or air pump diverter valve, which limits the maximum delivery pressure of the injected air.

3.3 **Air Injection Tube**—A tube projecting into the exhaust manifold or passage through the cylinder head which directs injected air from the air distribution manifold to the vicinity of each exhaust valve.

3.4 **Air Pump Diverter Valve**—A valve which interrupts the delivery of air to exhaust ports--typically during vehicle deceleration in order to prevent engine backfires.

3.5 **Air Switching Valve**—A valve which directs auxiliary air from a location upstream of the three-way catalyst to a location downstream of the three-way catalyst.

NOTE—This provides optimum oxidation catalyst light-off while protecting three-way efficiency after warm-up.

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3.6 **Bypass Valve**—See 3.4.

3.7 **Gulp Valve**—A valve that briefly admits a metered flow of air to the intake manifold after a sudden closure of the throttle.

NOTE—This prevents an over-rich mixture being caused when high vacuum evaporates any liquid fuel in the manifold.

3.8 **Pulse Air System**—A system which uses sub-ambient pressure pulses in the exhaust system or crankcase to introduce ambient air into the exhaust system for the purpose of oxidizing HC and CO.

4. Exhaust Treatment Systems

4.1 **Base Metal Catalyst**—A catalyst in which the active catalytic material is one or more non-noble metals such as copper or chromium.

4.2 **Benzo(a)pyrene (BaP)**—See 5.4.

4.3 **Blow-off**—The dislodging of particulates in a trap caused by flow or backpressure.

NOTE—This is more prevalent in wire mesh than in the blockable monolith catalyst.

4.4 **Bypass Valve**—A valve used to isolate the diesel particulate trap during regeneration.

NOTE—The valve that switches the exhaust gas to another trap or expels raw exhaust into the atmosphere.

4.5 **Catalyst**—A substance that accelerates a chemical reaction but which itself undergoes no permanent chemical change.

NOTE—For automotive emission control applications, catalysts are classified as oxidation catalysts (oxidize HC and CO), reduction catalysts (reduce NOx), or three-way catalysts (oxidize HC and CO and reduce NOx simultaneously).

4.6 **Catalyst Assembly**—See 4.8.

4.7 **Catalyst Poisoning**—The deterioration of catalyst efficiency when foreign material such as lead, phosphorus, or sulfur is introduced to the catalytic converter, lessening or eliminating the chemical action of the catalysts on the exhaust pollutants.

4.8 **Catalytic Converter**—An assembly, including such major components as structural shell, substrate, and the catalyst material. Depending on the type of catalyst--oxidation, reduction, or three-way, this assembly decreases HC and CO emissions or NOx emission, or all three simultaneously.

4.9 **Catalytic Efficiency**—See 4.12.

4.10 **Catalytic Trap**—A device which can be continuously regenerated utilizing the heat of the exhaust to accelerate a chemical reaction. Regenerations occur randomly.

4.11 **Continuously Regenerating System**—A particulate collection system in which trapped particles are continuously burned off when the engine is operating.

NOTE—This is done without an add-on regeneration mechanism; see Periodically Regenerating Trap Oxidizer, 4.26.

4.12 **Conversion Efficiency**—The percentage of a given exhaust constituent that is changed into chemically different species as a result of the operation of the converter.

4.13 **Converter Bypass**—A method for routing exhaust gas around a catalytic converter typically to prevent converter damage due to excessively high operating temperatures. (See 4.4.)

4.14 **Diesel Particulate Matter**—Emissions consisting mainly of soot and adsorbed H_2O, $SO_4^=$, NO_3^-, $PO_4^{\equiv}$, and adsorbed hydrocarbons.

NOTE—This material has a bulk density approximately 0.066 g/cm^3.

4.15 **Dilution Tunnel**—A device in which the engine exhaust is diluted and mixed with air for collection of exhaust.

4.16 **Dual-Catalyst System**—A system that uses two catalyst beds, one oxidation and one reduction, to decrease the HC, CO, and NOx pollutants in the engine exhaust. These two beds may be packaged together or in two separate containers.

4.17 **Emissions Correction Method (with After Treatment)**—An exhaust emission calculation which weights the regeneration emission test results with the non-regeneration emission test results.

4.18 **Inlet Air Throttle**—A device which would limit the intake air into the combustion chamber, thus raising the temperature of the exhaust to initiate oxidation of the particulate matter in the trap.

4.19 **Mesh Filter**—A trap which depends for its operation on flow through a tortuous path.

NOTE—Impaction and diffusion are the primary trapping mechanisms. Particles impact on filaments and adhere to the surface of the filaments or particles previously collected. Smaller particles migrate to the surface by diffusion and are retained.

4.20 **Monolithic Diesel Particulate Filter**—An extruded cellular ceramic filter with alternate cell channel openings blocked in a checkerboard fashion; the opposite end is similarly blocked but with one cell displaced so that exhaust must flow through porous channel walls.

4.21 **Monolithic Substrate**—A unitary catalyst substrate usually of honeycomb structure.

4.22 **Noble Metal Catalyst**—A catalyst in which the active material is made from a precious metal such as platinum, palladium, rhodium, or ruthenium.

4.23 **Non-regeneration Emissions Test**—A complete emission test which does not include a diesel trap regeneration.

4.24 **Oxidation Catalyst**—A catalyst that promotes the oxidation of HC and CO to form water vapor and carbon dioxide.

4.25 **Pelleted Substrate**—A catalyst substrate having such forms as pebbles, beads, small cylinders, or small spheres.

4.26 **Periodically Regenerating Trap Oxidizer**—A system incorporating an external heating source, such as heaters, burners, or temporary engine modification to increase the exhaust temperature sufficiently to ignite the stored particles.

4.27 **Rare Earth Catalyst**—A catalyst in which the active material is a rare earth element such as lanthanum or cerium.

NOTE—The rare earth elements range in atomic number from 57 to 71.

4.28 **Reduction Catalyst**—A catalyst that promotes the chemical reduction of nitrogen oxides (NOx) by reaction with carbon monoxide (CO), free hydrogen (H_2) or chemical hydrocarbon (HC). The desired products of the reaction are nitrogen gas, carbon dioxide, and water.

4.29 **Regeneration**—The process of burning the accumulated diesel particles to clean the trap.

4.30 **Regeneration Emission Test**—A complete diesel emission test, which includes a particulate trap regeneration.

4.31 **Regeneration Interval**—The interval from the start of a diesel trap regeneration to the start of the next regeneration.

4.32 **Run-Away Regeneration**—The rapid oxidation of the diesel particles causing the temperature to rise uncontrollably and the trap to fail.

4.33 **Simultaneous Oxidation Reduction Catalyst**—See 4.36.

4.34 **Space Velocity**—The exhaust flow in m^3/s (ft^3/h), measured at standard temperature and pressure (1 atm and 25 °C), divided by the catalyst volume in m^3 (ft^3) equals the space velocity.

4.35 **Substrate**—A thermally stable material, usually catalytically inert, to which the active catalyst is affixed, imbedded, or in some other way joined. Pellets and monolith represent two physical forms of substrate.

4.36 **Three-Way Catalyst**—A catalyst that simultaneously oxidizes HC and CO and reduces NOx exhaust emissions.

NOTE—For maximum conversion efficiencies, the engine must operate over a very narrow range of air/fuel ratios near stoichiometric conditions.

4.37 **Trap Oxidizer System**—An emission control system which consists of a trap to collect diesel particulate matter and a mechanism to oxidize the accumulated particles.

4.38 **Trap Regeneration Cycle**—The cycle pertaining to diesel particulate traps, consisting of trap regeneration.

4.39 **Trigger to Regeneration**—Signal to start the regeneration process.

NOTE—This can be the exhaust backpressure, total number of engine revolutions, or mileage accumulation.

4.40 **Washcoat**—A material applied to the substrate by the catalyst manufacturer to provide increased surface area for depositing the catalyst.

5. Chemical Terms

5.1 **Alcohol**—A compound having the general formula ROH where R represents a hydrocarbon radical.

5.2 **Aldehyde**—A compound having the general formula R · CHO, where R represents a hydrogen atom (H) or a hydrocarbon radical.

5.3 **Amines**—A compound having the general formula RNH_2.

5.4 **Aromatic**—A hydrocarbon containing one or more rings with general formula $C_nH_m (n \geq m)$.

5.5 **Esters**—A compound having the general formula RCOOR´.

5.6 **Ethers**—A compound having the general formula ROR´.

5.7 **Hydrocarbon**—An organic compound composed of only carbon and hydrogen.

NOTE—The term is sometimes used to denote any combustion products that can be measured with a flame ionization detector.

5.8 **Methane**—The simplest hydrocarbon, with formula CH_4.

5.9 **Naphthene (Cycloparaffin)**—A hydrocarbon having a ring-type structure with only single bonds between the carbon atoms and with general formula C_nH_{2n}.

5.10 **Olefin**—A hydrocarbon having an open chain structure containing one or more carbon-carbon double bonds. The general formula for an olefin containing one double bond is C_nH_{2n}.

5.11 **Organic Acids**—A compound having the general formula RCOOH.

5.12 **Oxides of Nitrogen (NOx)**—The sum total of nitric oxide (NO) and nitrogen dioxide (NO_2) in a gas sample; expressed as equivalent NO_2.

5.13 **Paraffin**—A hydrocarbon having an open chain or branching chain structure and containing only single carbon-carbon bonds, with general formula C_nH_{2n+2}.

5.14 **Polynuclear Aromatic Hydrocarbons (PNA, PAH)**—Relatively high molecular weight aromatics consisting of three or more fused rings. They are often formed in combustion processes and often emitted as a component of soot particles. The PNA benzo(a)pyrene is often cited as a potent human carcinogen.

5.15 **Stoichiometric**—The exact, chemically correct, proportion of substances that will combine and react to completion without excess of any reactant.

NOTE—An example is the ratio of air and hydrocarbon fuel which ideally combines to yield only N_2, CO_2, and H_2O.

5.16 **Sulfate**—A compound containing the sulfate ion, $SO_4^=$.

NOTE—Exhaust constituents referred to as sulfate emissions may include sulfuric acid, its anhydride (sulfur trioxide) and metallic sulfates, all of which can be measured as sulfate ion.

6. *Engine Hardware*

6.1 **Adaptive Memory**—A feature often used in electronic feedback air/fuel control systems electronic control strategy. Air/fuel ratio values are dynamically updated during engine operation and used as reference parameters to control other engine operating functions, i.e., timing, mixture, throttle modulation.

6.2 **Air/Fuel Ratio Control Device**—A device that limits the amount of fuel to that which can be burned with the air available during acceleration of a turbocharged diesel engine.

6.3 **Air Gap Pipes**—Double walled exhaust pipes with either an annular air space or other insulating material between two basically concentric pipes.

6.4 **Anti-Diesel Device**—A device to close the throttle further or block the idle fuel within the carburetor when the ignition is turned off.

6.5 **Breakerless Ignition System**—A system which differs principally from a conventional ignition system in the following two ways. First, the conventional cam and breaker points are replaced by a pulse generator. Second, a solid-state electronic device uses the pulse generator signal to switch ignition coil primary current on and off.

6.6 Carburetor Deceleration Combustion Control Valve—See 6.20.

6.7 Closed-Loop Control—See 6.19.

6.8 Coolant Override Valve—See 6.39.

6.9 Deceleration Spark Advance Control—A device that advances spark timing during deceleration.

6.10 Deceleration-Throttle Modulator—A device that regulates the rate of closure of the carburetor throttle.

6.11 Dual Diaphragm Distributor—A distributor with two vacuum diaphragms which can either advance or retard spark timing depending on the vacuum signals applied to it.

NOTE—Spark is often retarded at idle and during deceleration for emission control but advanced for part-throttle fuel economy.

6.12 Electronic Ignition System—See 6.5.

6.13 Exhaust Gas Recirculation (EGR)—A system which returns a portion of the exhaust gases to the combustion chamber. The lower combustion temperatures in turn reduce the formation of oxides of nitrogen.

6.14 EGR Backpressure Controlled—An exhaust gas recirculation control system (pneumatic or electronic) that is also modulated by exhaust system backpressure.

6.15 EGR Control Valve—The valve that controls the amount of recirculated exhaust gas entering the engine induction system.

6.16 EGR Vacuum Amplifier—A device used to amplify relatively weak carburetor signals under certain driving modes to improve the proportionality between the amount of EGR and engine air flow.

6.17 EGR Vacuum Port—The carburetor port or opening from which vacuum to control the EGR system is sensed.

6.18 Exhaust Port Liner—A sheet metal or ceramic component inserted in the exhaust ports for the purpose of reducing heat losses from the exhaust gas.

6.19 Feedback System for Controlling Air/Fuel Ratios—A system which uses a feedback signal generated by an exhaust gas oxygen sensor to control the air/fuel ratio of the combustion mixture.

6.20 Fuel Decel Valve—A valve which uses engine vacuum during deceleration to either open the throttle slightly or to meter an additional amount of air/fuel mixture from the carburetor around the closed throttle blades, thereby providing more complete combustion.

6.21 Heat Shield—A device, usually a sheet metal shield, placed adjacent to a high temperature component (exhaust system) to protect the surrounding environment.

6.22 Insulated Pipes—See 6.3.

6.23 Lean Reactor—A thermal reactor system that typically operates at air/fuel ratios leaner than stoichiometric.

6.24 Oxygen Sensor—A device providing an electrical signal that is a function of the oxygen level in the exhaust gas. The signal is used as an input parameter for feedback air/fuel control systems.

NOTE—Usually mounted in the exhaust manifold with exposure to passing exhaust gas.

6.25 **Positive Crankcase Ventilation (PCV)**—A system that routes gases from the crankcase (blow-by and air) to the air induction system of the engine.

6.26 **PCV Valve**—A valve that regulates the flow of gases from the crankcase into the air induction system.

6.27 **Proportional Exhaust Gas Recirculation**—An EGR system designed to recirculate a fixed percentage (based on engine air flow) of the exhaust gas.

6.28 **Quick-Acting Choke**—An electrical or mechanically operated device designed to shorten the choking period during engine start-up.

6.29 **Quick-Heat Intake Manifold**—An exhaust-heated intake manifold having relatively large crossover passages and, typically, a thin sheet metal section in the plenum floor.

NOTE—The sheet metal floor may have fins, convolutions, or similar means to obtain a high rate of heat transfer between the crossover exhaust and the intake charge. The objective of these manifolds is to provide rapid intake mixture warmup to promote evaporation of fuel droplets.

6.30 **Reactor Liner**—A sheet metal or ceramic component inserted in the thermal reactor for the purpose of reducing heat losses from the exhaust gas.

6.31 **Rich Reactor**—A thermal reactor system that typically operates in the range of air/fuel ratios richer than stoichiometric.

6.32 **Spark Advance**—The number of degrees before top dead center at which the spark discharge occurs.

6.33 **Spark Delay Device**—Calibrated restrictor in the vacuum advance hose which delays the vacuum spark advance.

6.34 **Spark Port**—The carburetor port from which vacuum to control the distributor spark advance is sensed.

6.35 **Speed Controlled Spark**—A system, generally used with an automatic transmission, that controls the vacuum to the distributor preventing vacuum advance below a selected vehicle speed.

6.36 **Stove**—The portion of the intake manifold which is heated by exhaust gases.

NOTE—This term may also denote a system which heats carburetor inlet air by passing it over the exhaust manifold. May also denote a heat exchanger that supplies hot air to the bimetal coil of an automatic choke (choke stove).

6.37 **Temperature Modulated Air Cleaner**—An inlet air system usually consisting of a stove, tubes, and control valve, for controlling the temperature of the air entering the carburetor within a specified range.

6.38 **Thermal Reactor**—An enlarged exhaust manifold—often with interior flow passages and/or insulation - that permits the combustion process to continue after the exhaust gases leave the engine combustion chambers.

NOTE—The reactor retains the exhaust gases at a high temperature for the time required to oxidize HC and CO.

6.39 **Thermal Vacuum Switch**—A coolant temperature-sensing vacuum control valve that modulates distributor and EGR vacuum to increase spark advance either as an override or protection device.

6.40 **Transmission Regulated Spark**—See 6.41.

6.41 **Transmission Spark Control Valve**—A valve that routes manifold vacuum to the distributor advance unit only when transmission is operating in one or more specific drive gear ratios.

6.42 Vacuum Control Valve—See 6.39.

6.43 Venturi Vacuum Amplifier—A device that amplifies carburetor venturi vacuum in order to modulate manifold vacuum to control the EGR valve.

7. Exhaust Emissions

7.1 Black Smoke—Particles composed primarily of carbon (soot) which are usually less than 1 μm in size resulting from incomplete combustion.

7.2 Brake Specific Emissions—Mass (mass or weight) of pollutant emitted per units of output work (brake horsepower [kW] hour).

7.3 Diesel Smoke—Particles, including aerosols, suspended in the engine's gaseous exhaust stream which absorb and/or scatter light.

7.4 Emission Index, Mass—(Grams) of pollutant emitted per unit mass of fuel burned.

7.5 Exhaust Emissions—Any substance (but normally limited to pollutants) emitted to the atmosphere from any opening downstream from the exhaust port of the combustion chamber of an engine.

7.6 Parts per Million Carbon (ppmC)—The mole fraction times 10^6 of hydrocarbon measured on a methane equivalence basis.

7.7 White and Blue Smoke—Particles composed of essentially colorless liquid (droplets) which reflect and refract the observed light.

NOTE—The observed color results from the refractive index of the liquid in the droplets and the droplet size. White smoke is usually due to droplets resulting from the incomplete burning of fuel droplets at low combustion chamber temperatures. Blue smoke is usually due to droplets resulting from the incomplete burning of fuel or lubricating oil.

8. Evaporative Emissions and Fuel Systems

8.1 Carbon Canister for Evaporative Emissions—A component of an evaporative control system which is used to collect and store evaporative hydrocarbon emissions from the fuel tank and/or carburetor.

8.2 Charcoal Canister—See 8.1.

8.3 Diurnal Breathing Losses—Fuel vapors emitted into the atmosphere as a result of increase in tank temperature.

NOTE—This temperature increase simulates the daily range of ambient temperatures that fuel tanks experience in service.

8.4 Evaporative Emissions—Fuel vapors emitted into the atmosphere from the fuel system, that is, gas tank, carburetor, etc., of the vehicle.

8.5 Fuel Tank Check Valve—A mechanical device at the fuel tank that prevents liquid fuel from entering the evaporative storage system.

8.6 Hot Soak Losses—Fuel vapors emitted from a fuel system during a specified time period beginning immediately after the hot engine is turned off.

8.7 Purge Valve—A vacuum or electrically actuated device in the evaporative emission control system used to release entrapped hydrocarbons to the engine induction system.

8.8 Refueling Emissions—Hydrocarbon emissions that can occur during filling of the vehicle fuel tank.

NOTE—These emissions are made up of displaced fuel tank vapor, entrained droplets in this vapor, liquid spillage, and nozzle drip during insertion and removal of the nozzle from the filler neck.

8.9 Running Losses—Fuel vapors emitted during operation of the vehicle under the specified test schedule.

8.10 Two-Way Bowl Vent—A method of sealing the fuel bowl internal vent (balance tube) when the engine is stopped, in addition to maintaining the fuel bowl external vent path to the vapor canister.

NOTE—Typically electrically, pneumatically, or mechanically operated.

8.11 Vapor Canister—See 8.1.

8.12 Vapor Separator—A trap in the evaporative emission control system to prevent liquid fuel from passing into the vapor storage device. See 8.5.

9. Fuel Systems

9.1 Filler Tube Restrictor—A device in the fuel tank filler pipe that will only admit a small diameter fuel filler nozzle dispensing nonleaded fuel.

9.2 Fuel Filler Cap—The cap on the fuel filler tube which normally provides a positive seal and may contain relief valves for pressure and vacuum venting.

9.3 Fuel System—The combination of fuel tank, fuel lines, pump, filter, and vapor return lines, carburetor or injection components, and all fuel system vents and evaporative emission control systems or devices.

10. General

10.1 Curb Weight—The weight of the vehicle in operational status with all standard equipment, the weight of fuel at normal tank capacity, and the weight of optional equipment.

NOTE—For the purpose of emission testing, the weight of optional equipment with an installation rate of more than 33% is used.

10.2 Diesel Engine—Any compression ignition internal combustion engine using the basic diesel cycle, that is, combustion results from the spraying of fuel into air heated by compression.

10.3 Gas Turbine Engine—Any engine using the basic gas turbine or Brayton cycle consisting of adiabatic compression, constant pressure heating, and adiabatic expansion.

10.4 Gross Vehicle Weight (GVW)—The manufacturer's gross weight rating, consisting of the curb weight plus payload.

10.5 Heavy-Duty Engine—Any engine which the engine manufacturer could reasonably expect to be used for motive power in a heavy-duty vehicle.

10.6 Heavy-Duty Vehicle—Any motor vehicle designed primarily for transportation of property and rated at more than 2722 kg (6000 lb) GVW or designed primarily for transportation of persons and having a capacity of more than 12 persons.

NOTE—EPA defines HDV as over 8500 lb GVW. See 10.4.

10.7 Light-Duty Vehicle—A motor vehicle having a rating of 2722 kg (6000 lb) GVW or less and designed primarily for the transportation of persons on a street or highway and having a capacity of 12 persons or less.

10.8 Light-Duty Truck—A motor vehicle having a rating of 2722 kg (6000 lb) GVW or less and designed primarily for the transportation of property or designed for off-street or off-highway use.

10.9 Loaded Vehicle Weight—The manufacturer's estimated weight of a vehicle in operating condition. For the purpose of emission testing, it is the curb weight of a light-duty vehicle plus 136 kg (300 lb).

10.10 Spark Ignition Engine—Any internal combustion engine using the basic Otto cycle, with combustion initiated by an electric spark.

11. Test Procedure and Equipment

11.1 Analytical Train—The entire system required to obtain and determine a particular constituent in exhaust gas. Typically, this system will include such items as sample piping, particle filter, condenser, sample pump, analytical instrument, and flowmeter.

11.2 Batch Sample—A sample taken in a syringe, bag, or other container over a short period of time for analysis.

11.3 Beer Lambert Law—For purposes of diesel smoke measurement, an equation approximating the relationship between the opacity of a smoke plume, the optical path length through the plume, and the opacity of the smoke per unit path length, may be used:

$$\text{Opacity} = 1 - e^{KL} \qquad \text{(Eq.1)}$$

where:

e = base of natural logarithms = 2.718 in
K = attenuation (or extinction) coefficient of the smoke
L = path length through the smoke, in

11.4 Calibration Gas—A gas mixture of known concentration of one constituent used to establish the instrument response for that constituent and usually used in conjunction with other similar calibration gases of differing concentrations to determine the response curve of an analytical instrument.

11.5 Chassis Dynamometer—A laboratory apparatus capable of simulating the road operation of a vehicle. The dynamometer possesses the capability to simulate the inertial, frictional, and wind-resistance forces acting on a moving vehicle.

11.6 Chemiluminescent Analyses—An instrument in which the amount of light or radiation produced by a chemiluminescent reaction is used to determine the amount of a reactant, as with the reaction of nitric oxide and excess ozone.

11.7 **Constant Volume Sampler (CVS)**—A device for diluting the entire flow of exhaust gas with a variable amount of dilution air so as to keep the total volumetric flow rate (at a constant temperature) of dilute exhaust constant and known during a test.

NOTE—Mass emissions of an exhaust constituent can be determined from the time-average constituent concentration in the dilute exhaust, the total volume of dilute exhaust, and the density of the constituent.

11.8 **Continuous Sampling**—A technique in which a portion of the exhaust is continuously withdrawn for immediate analysis.

11.9 **Detector**—That component in an analytical instrument which responds to a particular exhaust gas constituent.

11.10 **Driver's Aid**—An instrument intended to guide the vehicle driver in operating the vehicle in accordance with a specified schedule of speed as a function of time.

11.11 **Dynamic or Continuous Sampling**—A technique in which a portion of the exhaust is continuously withdrawn and pumped through an analytical train.

11.12 **Filter Cell**—That portion of the nondispersive infrared (NDIR) instrument which is filled with a particular gas in order to reduce interference signals.

11.13 **Flame Ionization Detector (FID)**—A device containing a hydrogen-in-air flame that produces an electrical current approximately proportional to the mass of the carbon component of the hydrocarbons entering the flame per unit time.

NOTE—The term FID often refers to the entire analyzer.

11.14 **Gas Chromatogram**—The recorder output versus time of a detector signal from a gas chromatograph, which shows deflections to indicate the presence of separated components of a mixture.

11.15 **Gas Chromatograph**—An instrument commonly used to separate and detect individual gases in complex gaseous mixtures.

NOTE—In automobile exhaust gas analysis such instruments can be used to separate and determine the concentration of individual hydrocarbon species in a complex hydrocarbon mixture.

11.16 **Grab Sample**—See 11.2.

11.17 **Hang-Up**—The absorption and desorption of sample constituents (mainly higher molecular weight hydrocarbons) from the surfaces of a sample system that can cause a delay in instrument response, with initially low concentrations at the detector, followed by higher readings in subsequent tests.

11.18 **Hexane Equivalent Concentration—(ppm hexane)**—The concentration of hexane that would give the same signal as a propane calibrating gas. For nondispersive infrared instruments, hexane equivalent concentration has been established as propane concentration times 0.52. For flame ionization detectors, hexane equivalent concentration times 0.50.

11.19 **Inertia Weights**—A series of rotating disks on a chassis dynamometer used to simulate the inertial mass of a vehicle.

11.20 **Interference**—A false instrument response due to the presence of components other than that which is to be measured.

11.21 **Mode**—A particular operating condition (for example, acceleration, deceleration, cruise, or idle) of a vehicle test schedule.