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REPORTING ON EMISSION TESTING FOR IN-USE LIGHT-DUTY TRUCKS AND PASSENGER VEHICLES —SAE J1712 AUG95

SAE Recommended Practice

Report of the SAE Light-Duty In-Use Emission Standards Committee approved August 1995.

1. Scope—This SAE Recommended Practice applies to the reporting of laboratory and test site data from the gaseous and evaporative emission tests of in-use light-duty trucks and passenger vehicles. This document describes the reporting of procedures, fuel specifications, and vehicle information necessary to compare the results of in-use tests. Any variations in vehicles, instrumentation, test equipment, or test program purpose should be adequately described.

1.1 Purpose—This document is intended as a guide for the reporting of gaseous and evaporative emissions from in-use light-duty trucks and passenger vehicles. This guide is intended to be used as an aid in establishing new databases. It should not be inferred that existing databases be reconfigured to meet the recommendations contained herein.

2. References

2.1 Applicable Documents—The following publications form a part of this specification to the extent specified herein.

2.1.1 ASTM PUBLICATIONS—Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM D 86—Method for Distillation of Petroleum Products
ASTM D 93—Test Methods for Flash Point by Pensky-Martens Closed Tester
ASTM D 95—Test Method for Water in Petroleum Products and Bituminous Materials by Distillation
ASTM D 97—Test Methods for Pour Point of Petroleum Oils
ASTM D 129—Test Method for Sulfur in Petroleum Products (General Bomb Method)
ASTM D 323—Test Method for Vapor Pressure of Petroleum Products (Reid Method)
ASTM D 381—Test Method for Existent Gum in Fuels by Jet Evaporation
ASTM D 445—Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and the Calculation of Dynamic Viscosity)
ASTM D 524—Test Method for Ramsbottom Carbon Residue of Petroleum Products
ASTM D 613—Test Method for Ignition Quality of Diesel Fuels by the Cetane Method
ASTM D 891—Test Methods for Specific Gravity of Liquid Industrial Chemicals
ASTM D 976—Methods for Calculated Cetane Index of Distillate Fuels
ASTM D 1078—Test Method for Distillation Range of Volatile Organic Liquids
ASTM D 1142—Test Method for Water Vapor Content of Gaseous Fuels by Measurement of Dew-Point Temperature
ASTM D 1267—Test Method for Vapor Pressure of Liquified Petroleum (LP) Gases (LP-Gas Method)
ASTM D 1319—Test Method for Hydrocarbon Types in Liquid Petroleum Products by Fluorescent Indicator Adsorption
ASTM D 1401—Test Method for Water Solubility of Petroleum Oils and Synthetic Fluids
ASTM D 1613—Test Method for Acidity in Volatile Solvents and Chemical Intermediates Used in Paint, Varnish, Lacquer, and Related Products
ASTM D 1688—Test Methods for Copper in Water
ASTM D 1744—Test Method for Water in Liquid Petroleum Products by Karl Fischer Reagent
ASTM D 1837—Test Method for Volatility of Liquefied Petroleum (LP) Gases
ASTM D 1838—Test Method for Copper Strip Corrosion by Liquefied Petroleum (LP) Gases
ASTM D 1945—Method for Analysis of Natural Gas by Gas Chromatography
ASTM D 1946—Method for Analysis of Reformed Gas by Gas Chromatography
ASTM D 2158—Test Method for Residues in Liquefied Petroleum (LP) Gases
ASTM D 2163—Method for Analysis of Liquefied Petroleum (LP) Gases and Propene Concentrates by Gas Chromatography
ASTM D 2276—Test Methods for Particulate Contaminant in Aviation Turbine Fuels
ASTM D 2386—Test Method for Freezing Point of Aviation Fuels
ASTM D 2500—Test Method for Cloud Point of Petroleum Oils
ASTM D 2533—Test Method for Vapor Liquid Ratio of Spark-Ignition Engine Fuels
ASTM D 2598—Practice for Calculation of Certain Physical Properties of Liquefied Petroleum (LP) Gases from Compositional Analysis
ASTM D 2622—Test Method for Sulfur in Petroleum Products (X-Ray Spectrographic Method)
ASTM D 2650—Test Method for Chemical Composition of Gases by Mass Spectrometry
ASTM D 2699—Test Method for Knock Characteristics of Motor Fuels by the Research Method (Not Available as Separate Reprint)
ASTM D 2700—Test Method for Knock Characteristics of Motor and Aviation Fuels by the Motor Method (Not Available as Separate Reprint)
ASTM D 2709—Test Method for Water and Sediment in Distillate Fuels by Centrifuge
ASTM D 2713—Test Method for Dryness of Propane (Valve Freeze Method)
ASTM D 2784—Test Method for Sulfur in Liquefied Petroleum Gases (Oxy-Hydrogen Burner or Lamp)
ASTM D 2988—Test Method for Water-Soluble Halide Ion in Halogenated Organic Solvents and Their Admixtures
ASTM D 3120—Test Method for Trace Quantities of Sulfur in Light Liquid Petroleum Hydrocarbons by Oxidative Microcoulometry
ASTM D 3221—
ASTM D 3229—Test Method for Low Levels of Lead in Gasoline by X-Ray Spectrometry
ASTM D 3237—Test Method for Lead in Gasoline by Atomic Absorption Spectrometry
ASTM D 3545—Test Method for Alcohol Content and Purity of Acetate Esters by Gas Chromatography
ASTM D 3703—Test Method for Peroxide Number of Aviation Turbine Fuels
ASTM D 4052—Test Method for Density and Relative Density of Liquids by Digital Density Meter
ASTM D 4176—Test Method for Free Water and Particulate Contamination in Distillate Fuels (Clear and Bright Pass/Fail Proceedings)
ASTM D 4294—Test Method for Sulfur in Petroleum Products by Non-Dispersive X-Ray Fluorescence Spectrometry
ASTM D 4629—Test Method for Organically Bound Trace Nitrogen in Liquid Petroleum Hydrocarbons by Oxidative Combustion and Chemiluminescence Detection
ASTM D 4806—Specification for Denatured Fuel Ethanol to be Blended with Gasoline as an Automotive Spark-Ignition Engine Fuel
ASTM D 4814—Specification for Automotive Spark-Ignition Engine Fuel
ASTM D 4815—Test Method for Analysis of C_1 to C_4 Alcohols and MTBE in Gasoline by Gas Chromatography
ASTM D 4953—Method for Vapor Pressure of Gasoline and Gasoline-Oxygenate Blends (Dry Method)
ASTM E 203—Test Method for Water Using Karl Fischer Reagent

2.2 Related Publications—The following publications are provided for information purposes only and are not a required part of this document.

2.2.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J1145—Emissions Terminology and Nomenclature
SAE J1724—Vehicle Electronic ID Standards
SAE J1930—Electrical Electronic Systems Diagnostic Terms, Definitions, Abbreviations, and Acronyms
SAE J1892—Recommended Practice for Bar-Coded Vehicle Emissions Conformance Label

2.2.2 U.S. GOVERNMENT PUBLICATIONS—Available from The Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

US Code of Federal Regulations—Title 40 Part 86, Subpart B

US EPA Standardized Engine and EVAP Family Names for the appropriate vehicle model year

US EPA Manufacturer Guidance Letters dated: 6/12/87 and 12/18/87 (evaporative emission test practices)

3. Definitions

PCV Filter—Positive Crankcase Ventilation Filter

ECM—Engine Control Module

PROM—Programmable Read Only Memory

MAP Sensor—Manifold Air Pressure Sensor

BARO Sensor—Barometric Pressure Sensor

TPS—Throttle Position Sensor

FTP—Federal Test Procedure (Referenced to US EPA Procedures)

4. Technical Requirements

4.1 Electronic Data Storage Techniques and Format—To facilitate the use of data, a document describing the database structure is recommended. This document should include the following:

a. Data field names (including their sequence, if applicable).

b. The delimiter used to separate data fields (e.g., comma (,), carat (^), at (@), etc.) Because commas are frequently used in narrative data fields, some other character like the at (@) character which is not frequently used within data fields is preferred to avoid the problem of inadvertent delimiters.

c. File names for relational databases that distribute the data over a number of different files.

4.2 Fuels—The following test procedures should be used to document fuel properties:

4.2.1 GASOLINE ENGINES—See Table 1.

TABLE 1—GASOLINE ENGINES TEST PROCEDURES

Test	Test Method
Distillation	ASTM D 86
Reid Vapor Pressure	ASTM D 4953/ASTM D 323
V/L (Calc) @ 4, 10, 20, and 45	ASTM D 4814
Specific Gravity	ASTM D 4052
Lead Content	ASTM D 3237
Sulfur	ASTM D 3120/ASTM D 129
Hydrocarbon Types	ASTM D 1319
Octane Numbers	
RON	ASTM D 2699
MON	ASTM D 2700
Existent Gum	ASTM D 381
Common Ethers/MTBE, C_1-C_5 Oxygenates, Alcohols C_1-C_4	Gas Chromatography/FTIR or ASTM D 4815
Benzene	Gas Chromatography
Peroxide	ASTM D 3703
Silicon	ICP
Water Content	ASTM D 1744
Phosphorus	ASTM D 3231
Particulate Contamination	ASTM D 2276

4.2.2 DIESEL ENGINES—See Table 2.

TABLE 2—DIESEL ENGINES TEST PROCEDURES

Test	Test Method
Flash Point	ASTM D 93
Cloud Point	ASTM D 2500
Carbon Residue	ASTM D 524
Distillation	ASTM D 86
Viscosity-Kinematic @ 40 °C	ASTM D 445
Sulfur	ASTM D 4294
Cetane Number	ASTM D 613
Cetane Index	ASTM D 976
Specific Gravity	ASTM D 4052
Pour Point	ASTM D 97
FIA	ASTM D 1319
Nitrogen	ASTM D 4629
Filterability	ASTM Proposed
Water	ASTM D 95
Demulsification	ASTM D 1401
Water and Sediment	ASTM D 2709
Freezing Point	ASTM D 2386
Water Separation Index	ASTM D 2550
Vapor-Liquid Ratio	ASTM D 2533
Aromatic Content	Gas Chromatography

4.2.3 ETHANOL FUELED ENGINES—See Table 3.

TABLE 3—ETHANOL FUELED ENGINES TEST PROCEDURES

Test	Test Method
Ethanol %	ASTM D 3545
Other Alcohols and Ethers	ASTM D 4815
Vapor Pressure, Dry	ASTM D 4953
Acidity as Acetic Acid	ASTM D 1613
Total Chlorine as Chloride	ASTM D 3120/ASTM D 2988
Copper	ASTM D 1688/ASTM D 4806
Lead	ASTM D 3229
Phosphorus	ASTM D 3231
Sulfur	ASTM D 2622
Gum, Heptane Washed	ASTM D 381
Total Particulates	ASTM D 2276
Water	ASTM E 203
Appearance	ASTM D 4176

4.2.4 METHANOL FUELED ENGINES—See Table 4.

TABLE 4—METHANOL FUELED ENGINES TEST PROCEDURES

Test	Test Method
Methanol %	Determined by distillation
Distillation	ASTM D 1078
Other Alcohols and Ethers	ASTM D 4815
Vapor Pressure, Dry	ASTM D 4953
Specific Gravity	ASTM D 891
Acidity as Acetic Acid	ASTM D 1613
Total Chlorine as Chloride	ASTM D 2988
Lead	ASTM D 3229
Phosphorus	ASTM D 3231
Sulfur	ASTM D 2622
Gum, Heptane Washed	ASTM D 381
Total Particulates	ASTM D 2276
Water	ASTM E 203
Appearance	ASTM D 4176

4.2.5 COMPRESSED NATURAL GAS ENGINES—See Table 5.

TABLE 5—COMPRESSED NATURAL GAS ENGINES TEST PROCEDURES

Test	Test Method
Hydrocarbons (expressed as Mole Percent)	ASTM D 1945
Methane	
Ethane	
C_3 and Higher HC	
C_6 and Higher	
Hydrogen	ASTM D 2650
Carbon Dioxide	ASTM D 2650
Oxygen	ASTM D 1945
Sum of CO_2 and N_2	ASTM D 1945
Water	ASTM D 1142

4.2.6 LIQUEFIED PETROLEUM GAS ENGINES—See Table 6.

TABLE 6—LIQUEFIED PETROLEUM GAS ENGINES TEST PROCEDURES

Test	Test Method
Propane	ASTM D 2163
Vapor Pressure	ASTM D 1267/ASTM D 2598
Volatility Residue	ASTM D 1837
Butane and Heavier	ASTM D 2163
Propane	ASTM D 2163
Residual Matter	ASTM D 2158
Corrosion, Copper Strip	ASTM D 1838
Sulfur	ASTM D 2784
Moisture Content	ASTM D 2713

4.2.7 HYDROGEN FUELED ENGINES—See Table 7.

TABLE 7—HYDROGEN FUELED ENGINES TEST PROCEDURES

Test	Test Method
Hydrogen	ASTM D 1946
Combined Hydrogen, Water, Oxygen, and Nitrogen	ASTM D 1946/ASTM D 1142
Total Hydrocarbons	ASTM D 1946

4.3 Vehicle Specifications—This section contains checklists and documentation forms designed to record vehicle specifications and vehicle condition at the time of testing. These forms may be used as samples to be tailored by the organization conducting the test to meet specific needs. In general, documentation should include all information which may have a bearing on the magnitude of measured emissions. It is intended that these checklists will serve to document any factors which may affect vehicle emissions and should therefore be recorded prior to any laboratory testing.

4.3.1 VEHICLE IDENTIFIERS—See Figure 1.

VIN		Date of Inspection	
Make		Model	
Model year		Displacement	
Transmission		Engine Family	
Type/Speeds		2, 4, or All Wheel Drive	
Engine Code		Evap Family	
Odometer		Build Date	
Air Conditioning		Traction Control	
Fuel Tank(s) **Number** **Size**	_____ _____		

FIGURE 1—VEHICLE IDENTIFIERS FORM

4.3.2 VEHICLE HISTORY—See Figure 2.

Typical oil change interval _____ Months _____ Miles
Typical oil filter change interval _____ Months _____ Miles
Typical spark plug change interval _____ Months _____ Miles
Typical air filter change interval _____ Months _____ Miles
Typical fuel filter change interval _____ Months _____ Miles

Major modifications to vehicle powertrain (describe): _____

Nonroutine emissions related maintenance/repairs (describe):

Previous Vehicle I/M Emission Testing Results: _____

Trailer Towing (Yes, No) _____
If Yes, Describe: _____

Type of Use
(Personal, Commercial, etc.) _____

Accidents/Repair (Describe) _____

Tire Size/Manufacturer/Pressure _____

FIGURE 2—VEHICLE HISTORY FORM

4.3.3 INSPECTION PROCEDURES AND TEST CONDITIONS

System Component or Item	Minimum Inspection Procedure and Data/Observations (Describe Conditions)	Minimum Description of Action	Parts as Tested
Tires	Size Left Right Front _____ Rear _____	Replaced, Installed Slaves, None	Size: _____ Make: _____ Pressure: _____
Belts	Excessively tight/loose YES NO Damaged: YES NO	Replaced, Adjusted, None	
Oil	Level: OK LOW HIGH Visual Condition (Describe)	Added, Changed, None	
Radiator and Hoses	Visual or Pressure: OK LEAKS DAMAGED (Describe)	Repaired, Replaced, None	

FIGURE 3—INSPECTION PROCEDURES AND TEST CONDITIONS FORM

System Component or Item	Minimum Inspection Procedure and Data/Observations (Describe Conditions)	Minimum Description of Action	Parts as Tested
Radiator Cap	Visual or Pressure: OK LEAKS	Replaced, None	OEM Non OE Unknown
Coolant	Level: OK LOW Freeze Protection Level _____ °F or °C	Qts Added _____	
Air Filter	Visual OK: YES NO	Replaced, None	OEM Non OE Unknown
PCV Valve	Visual/Rattle Test: Sticks/Damaged: YES NO	Replaced, None	OEM Non OE Unknown
PCV Filter	Visual OK: YES NO	Replaced, None	OEM Non OE Unknown
Gas Cap	Visual OK: YES NO Pressure check of fuel system as part of test procedure, OK: YES NO	Replaced, None	OEM Non OE Unknown
Fuel Filler Restrictor	Visual OK: YES NO	Replaced, None	
Fuel Filter	Visual OK: YES NO	Replaced, None	OEM Non OE Unknown
Evaporative System	Visual- Components, hoses OK: YES NO Functional - Purge flow Confirmed: YES NO	Repaired, Replaced, None	
Ignition System	Scope Diagnostic OK: YES NO (Description of Problems)	Components Replaced	OEM Non OE Unknown
Spark Plugs	Visual OK: YES NO (Describe e.g., gap, fouling)	Replaced Cleaned Regapped None	OEM Non OE Unknown
Ignition Wires	Visual OK: YES NO	Replaced, None	OEM Non OE Unknown
Distributor Cap	Visual OK: YES NO	Replaced Cleaned None	OEM Non OE Unknown
Rotor	Visual OK: YES NO	Replaced, None	OEM Non OE Unknown

FIGURE 3—INSPECTION PROCEDURES AND TEST CONDITIONS FORM (CONTINUED)

System Component or Item	Minimum Inspection Procedure and Data/Observations (Describe Conditions)	Minimum Description of Action	Parts as Tested
Glow Plugs	Visual OK: YES NO	Replaced, None	OEM Non OE Unknown
Exhaust System	Damaged: YES NO Leaks: YES NO	Repaired, Replaced, None	OEM Non OE Unknown
Catalytic Converter(s)	Visual - External Damage YES NO	Replaced None	OEM Non OE Unknown
EGR System	Visual OK: YES NO (Components, hoses) Functional valve movement Observed: YES NO	Repaired, Replaced, None	
ECM and PROM	Trouble Codes: _____ PROM ID Code: _____ MIL: ON OFF	Replaced, Other, None	OEM Non OE Unknown
MAP Sensor	Visual OK: YES NO (Component, hoses, wires)	Repaired, Replaced, None	OEM Non OE Unknown
BARO Sensor	Visual OK: YES NO (Component, hoses, wires)	Repaired, Replaced, None	OEM Non OE Unknown
TPS	Visual OK: YES NO (Component, wires)	Repaired, Replaced, None	OEM Non OE Unknown
O_2 Sensor	Visual OK: YES NO (Component, wires)	Repaired, Replaced, None	OEM Non OE Unknown
Fuel System	Type: Carburetor, Throttle Body, Injectors Visual OK: YES NO	Replaced Cleaned None	OEM Non OE Unknown
Air Injection System	Visual - Components, hoses OK: YES NO Functional - Air flow, switching, dump observed: YES NO	Repaired, Replaced, None	

FIGURE 3—INSPECTION PROCEDURES AND TEST CONDITIONS FORM (CONTINUED)

Idle Parameters or Setting	As Received	Spec. (or NA)	Set to (or NA)
Timing			
Idle Speed High (Specify)			
Idle Speed Low (Specify)			
Other: (e.g., TPS)			
Idle HC			
Idle CO			

FIGURE 3—INSPECTION PROCEDURES AND TEST CONDITIONS FORM (CONTINUED)

5. FTP Test Data—This section is to provide a general outline of information which should be recorded during vehicle laboratory/dynamometer testing. Test procedures are at the discretion of the test engineer or may mirror one of the procedures included in the reference section to this document. However, deviations from established procedures should be fully documented.

5.1 Header Information—The following information shall be included in a descriptive header or cover sheet furnished with each FTP database:

a. Facility Description
b. Purpose of Test
c. Name of Test Lab
d. Address of Test Lab
e. Dates of Last Equipment Calibrations or Lab Correlation programs
f. Name and phone number of person to contact for information

5.2 Vehicle Identifiers—Provide a means of relating a specific test record to the test vehicle if the vehicle information and test information are kept in separate files. At a minimum, each record in each file should contain one identical field which is unique for each vehicle tested.

5.3 Emission Standards—Record emission standards applicable to the test vehicle.

5.4 Description of Test Data

a. Vehicle identifier
b. Unique test number
c. Date of test
d. Test weight
e. Horsepower (actual)
f. Fuel fill volume
g. Barometric pressure
h. Humidity
i. Odometer readings (or hours) at each test
j. Composite exhaust emissions (g/mile)
k. Composite evaporative emissions (g/test)
l. Other emissions measured (e.g., speciated HC, aldehydes, etc.)
m. Additional fields to describe changes to the vehicle (from the as received condition) or test conditions including the state of driver selectable options such as traction control, transmission shift points, or power limiting
n. Additional fields to allow recording of additional information (i.e., FTP-Bag results, duration of hot soak, etc.)
o. List any individual vehicle test deviations from established program test procedures