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Measurement of Fuel Evaporative Emissions from Gasoline Powered Passenger Cars and Light Trucks by the Trap Method — SAE J170 JUN83

SAE Recommended Practice
Last Revised June 1983

THIS IS A PREPRINT WHICH IS SUBJECT TO REVISIONS AND CORRECTIONS. THE FINAL VERSION WILL APPEAR IN THE 1984 EDITION OF THE SAE HANDBOOK.

The Engineering Resource For Advancing Mobility

PREPRINT

MEASUREMENT OF FUEL EVAPORATIVE EMISSIONS FROM GASOLINE POWERED PASSENGER CARS AND LIGHT TRUCKS BY THE TRAP METHOD—SAE J170 JUN83

SAE R c mm nd d Practic

Report of the Automotive Emissions and Air Pollution Committee, approved May 1970, last revised by the Automotive Emissions Committee June 1983.

ϕ *Scope*—The highly preferred SAE Recommended Practice for measuring evaporative emissions from fuel systems of passenger cars and light trucks is the enclosure technique detailed in SAE J171. The sensitivity and accuracy of the enclosure technique is superior to that of the trap method. This recommended practice is retained for historical reference and for use with older vehicles imported into the United States of America. In addition, this trap method is referenced in SAE J171a for making running loss measurements which cannot practically be made in an enclosure. Emissions are measured during a sequence of laboratory tests that simulate typical vehicle usage in a metropolitan area during summer months:

(1) A 1 h soak representing one diurnal cycle in which temperature ϕ of fuel in the vehicle's tank is raised from 60 to 84°F (15.6 to 28.9 °C).

(2) A 7.5 mile (12.1 km) run on a chassis dynamometer.

(3) A 1 h hot soak immediately following the 7.5 mile (12.1 km) run.

The method for measuring weight of fuel vapors emitted during the test employs activated carbon traps connected to the fuel system at locations where vapors are expected to escape. Vapors from these openings are adsorbed by the traps, and the gain in weight of the traps represents the fuel evaporative emissions.

The test sequence and method for measuring emissions are applicable to vehicles either with or without systems or devices to control fuel evaporative emissions. Although they have been used successfully with a wide ϕ range of vehicles equipped with a variety of control devices, they should not be applied indiscriminately to new or unique vehicles or fuel systems. For example, based on experience that temperature excursions of the fuel tank in parked vehicles follow those of ambient air, the test sequence prescribes heating of the fuel tank to simulate a diurnal soak. Any control system designed to alter the relation between fuel and ambient temperatures will not be properly evaluated in the test sequences prescribed.

The recommended practice includes the following sections:

1. Definitions
2. Test Fuel
3. Test Facilities and Equipment
4. Measurement Method
5. Preparation of Test Vehicle and Fuel System
6. Test Sequence
7. Information and Data to be Recorded
8. Presentation of Data

1. Definitions—The following definitions apply to the terms used:

ϕ **1.1 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 300 lb (136 kg).

1.2 Evaporative Emissions—Fuel vapors emitted into the atmosphere from the vehicle.

1.3 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.

1.4 System or Device—Any vehicle modifications that control or reduce the amount of fuel vapors emitted from the vehicle.

1.5 Controlled Vehicle—A vehicle equipped with systems or devices to reduce the amount of evaporative emissions.

1.6 Hot Soak Losses—Fuel vapors emitted during a specified period beginning immediately after the engine is turned off.

1.7 Diurnal Breathing Losses—Fuel vapors emitted as a result of a specified increase in fuel tank temperature in a specified time.

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

1.9 Tank Fuel Volume—40% of nominal tank capacity, rounded ϕ to the nearest whole U. S. gallon (multiple of 3.80).

The ϕ symbol is for the convenience of the user in locating areas where technical revisions have been made to the previous issue of the report. If the symbol is next to the report title, it indicates a complete revision of the report.

2. Test Fuel—Although any fuel can be used for the test sequence described, the effectiveness of evaporative emission control systems is usually evaluated with a test fuel representative of that commercially available, or expected to be commercially available, during the summer months. If the purpose of the test is to determine the effects of changes in fuel volatility on evaporative emissions, use of noncommercial fuels may be necessary.

2.1 Test Fuel Identification—To properly identify the fuel used—it should be inspected for these properties:

Property	ASTM Test Method
Distillation	D 86
IBP	—
5% Evaporated	—
10%	—
15%	—
20%	—
30%	—
40%	—
50%	—
90%	—
FBP	—
Reid vapor pressure, psi	D 323

A determination of nonreflux batch distillation temperatures may help in understanding the mechanism of carburetor hot soak losses and determination of true vapor pressure may help in understanding the mechanism of fuel tank losses. However, neither of these tests has been standardized by ASTM.

2.2 Fuel Sampling—A sample of test fuel for laboratory inspection should be taken from the fuel source at the start of the test. A 1 pt (0.50) container, precooled to 40°F (4°C) or less, should be used. It ϕ should be bottom filled to overflow and then poured out to 80% capacity. The container should be tightly sealed immediately after filling and stored at 40°F (4°C) or less until fuel inspection tests are made. Alternate sam- ϕ pling procedures may be substituted, but care must be exercised with any sampling procedure to prevent the loss of volatile constituents from the fuel during either sampling or storage.

3. Test Facilities and Equipment—Provisions must be made for controlling the environment of the vehicle, absorbing power, fueling and cooling the vehicle, and heating the fuel tank.

3.1 Environment—Appropriate controls should be provided to maintain temperature between 68–86°F (20–30°C) for the precondition- ϕ ing soak and evaporative emission tests (76–86°F (24.4–30°C) for the ϕ hot soak phase).

3.2 Power Absorption—A chassis dynamometer with power absorption and inertia loading capabilities is required. The dynamometer's power and inertia capacities must be adjustable to absorb road load power at 50 mph (80.5 km/h) and simulate proper vehicle inertia during acceleration.

3.3 Vehicle Cooling—A fixed-speed fan is needed to maintain engine cooling and provide proper fuel tank heating when the vehicle is running on the chassis dynamometer. The fan capacity must be between 5000–5600 ft³/min (142–159 m³/min), and it must have a discharge area between 450–500 in² (2903–3226 cm²).

3.4 Tank-Fuel Heating—An electric heating pad is needed to heat tank fuel during the diurnal soak. This pad should cover 50% or more of the area wetted by the test fuel. A 2000 W heating pad with a variable voltage transformer to regulate heat output should be adequate in most vehicles. Alternate heating methods may be used on vehicles of unusual configuration or if necessary to comply with local laboratory practices. All methods should avoid hot spots in the tank wetted surface which could cause local overheating of the fuel. Heat must not be applied to the vapor in the tank above the liquid fuel. With proper heating of the tank vapor, temperature will not exceed liquid temperature by more than 6°F (3.3°C) at completion of the diurnal soak. Thermocouples and a ϕ multi-channel, potentiometric-type recorder with 1°F (0.5°C) accuracy ϕ and with variable chart speed should be used for monitoring temperatures.

3.5 Fueling—Facilities and safeguards must be provided for draining and refilling vehicle fuel tanks. The work area must be well ventilated. Drain and filling connectors and containers must be grounded to the vehicle tank. If tanks have a suitable drain fitting, they may be drained by gravity. If not, they may be pumped dry through the fill pipes. Many tanks are difficult to drain either way, and care should be taken to insure that the tanks are adequately drained. Facilities must be provided to refill vehicle tanks to the specified tank fuel volume with fuel at a temperature such that, at completion of the fill, the fuel temperature in the tank is 54 ± 4°F (12.2 ± 2.2°C). Test fuel in storage may require special temperature control to comply with this temperature limit. Fuel cannot be reused for emission tests.

4. Measurement Method—The prescribed measurement method provides for connecting activated carbon traps to expected sources of vapor emissions from the vehicle fuel system. Emissions are determined by measuring the increase in weight of the traps and the sum of the increases for all traps represents the total evaporative emissions from all emission sources trapped. Some modifications to the vehicle may be needed for proper trap connections.

4.1 Canister—The canister shown in Fig. 1 has been used successfully and is strongly recommended. It is a cylindrical container of 300 ± 25 mL capacity and has a length-to-diameter ratio of 1.4 ± 0.1. An inlet tube, 5/16 in (7.9 mm) ID and 1 in (25.4 mm) long, is sealed into the top of the canister at its center. A similar outlet tube is sealed into the wall 1/4 in (6.4 mm) from the bottom of the canister. Wads of loosely packed glass wool, retained by wire screens of 7 mm mesh, are placed in the inlet and outlet tubes to prevent loss of carbon. If properly sealed, the canister should withstand air pressure of 2 psi (14 kPa) without evidence of leakage when immersed in water for 30 s.

4.2 Carbon—The activated carbon should meet these specifications:

Surface area, min: 1000 m^2/g (N_2, BET method).[1]

Adsorption capacity, min (carbon tetrachloride): 60% wt.

Volatile material including absorbed water vapor: None.

Screen size analysis:

1.7–2.4 mm: 90% min

1.4–3.0 mm: 100%

Immediately before adding to the trap, the carbon should be oven dried for 3 h at 300°F (150°C).

4.3 Trap Preparation—To prepare the trap for a test, the inlet tube is capped, and the canister is filled with 150 ± 10 g activated carbon that has just been oven dried. It is then closed immediately and allowed to cool while vented through a drying tube on the outlet. The drying tube consists of a transparent cylinder 3/4 in (19.05 mm) ID and 6 in (152.4 mm) long, filled with 8 mesh indicating dessicant, held in place by loose wads of glass wool. The dessicant should be replaced when its color change shows it three-quarters spent. After the carbon has cooled to room temperature, the drying tube is removed and the outlet tube is sealed. The trap is weighed to the nearest 50 mg on a balance capable of weighing to ±10 mg, and this "tare weight" is recorded on the canister body. Tare weight must always be determined with the trap at room temperature because activated carbon adsorbs nitrogen as a function of temperature, and the weight of the trap can change slightly as it cools.

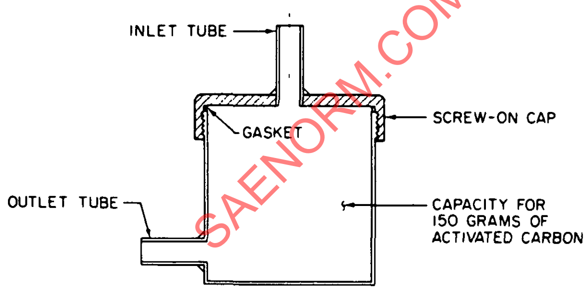

FIG. 1—RECOMMENDED TRAP DESIGN

4.4 Connecting Tubing—Tubing for connecting the traps to the fuel system vents should be of stainless steel or aluminum, Teflon (or equivalent) 5/16 in (7.9 mm) ID. Joints between the collecting tubes, connections to traps, and connections to fittings on the fuel system of the vehicle should be made with heavy wall, fuel resistant, 5/16 in (7.9 mm) ID flexible rubber vacuum hose. Other tubing may be used for joints, but extreme care must be exercised to prevent the joints from loosening due to excessive heat, or kinking due to twisting or flexing of the collection tubing, particularly in the engine compartment and in areas not readily visible during the test sequence. Care should be taken to avoid inhibiting the proper functioning of the engine, engine cooling systems, and emission control systems when locating collection traps. The connections should be butt jointed, with minimum rubber hose exposed to fuel vapor. Airtight flexible tubing, 5/16 in (7.9 mm) ID, should be attached to the outlet end of the drying tube to equalize collection system pressure. (See Fig. 2.)

4.5 Location of Trap Connections—Typical trap connections are shown in Fig. 2 for a fuel system vented to the atmosphere solely through the air cleaner. Vehicles with certain types of fuel evaporative control systems may have only this one vent, but vehicles with other systems may have additional openings, for example, fuel system pressure or vacuum relief valves or vapor-storage device vents, where fuel vapors may escape to the atmosphere either by design or component malfunction. If the control system has other openings, traps must also be connected to them. For any system, however, a trap must be installed at least on the engine intake air cleaner assembly.

If the trap method is to be used on a vehicle without any evaporative emission control system, the location of all openings designed to vent fuel vapors to the atmosphere must be determined by inspection of the fuel system, and traps must be connected to all of the openings. The traps must remain connected during all phases of the test when it is expected that vapors can be emitted. Special adaptors or devices may be needed to connect to external carburetor bowl vents.

Certain vehicles may be equipped with a more complex air cleaner assembly than that shown in Fig. 2. Those with inlet air temperature controls, for example, require effective plugging of both the hot and cold air inlet ducts during the soak portions of the test.

Air cleaners with a full or partial circumferential cold air inlet must be sealed by inserting a material impervious to fuel vapors.

With all air cleaner types, the fitting for collecting vapors must be positioned in the same horizontal plane as the lowest point of the air inlet. If the air cleaner has a separate inlet duct(s), the fitting must be positioned on the underside and close to the inlet opening in the duct as shown in Fig. 2.

Fuel tank venting systems, including the fuel tank cap, must be suitably modified to insure that all vapors are routed to traps. Usually existing tank vents can be plugged, and vapors collected through a modified tank cap with a 5/16 in (7.9 mm) ID fitting for attaching the vapor collection tubing.

Traps should be installed as closely as possible to the vapor source. They must be placed lower than the vapor source to induce flow of vapors by gravity, but not disturb the function of the fuel system components. Traps must not be exposed to heat from the engine. The lines and any manifold systems used to connect multiple vents to a single trap should be checked to make sure there are no sharp bends in the connection lines. All lines must have a continuous fall between the fuel system and the trap. The pressure equalization tube must be routed from the trap outlet tube to a location as close as possible to the vapor connection vapor source.

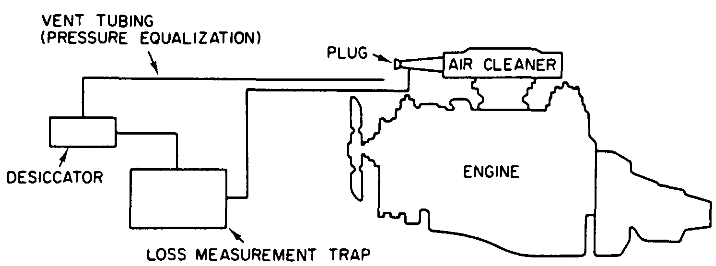

FIG. 2—TYPICAL TRAP INSTALLATION

In all cases, the modifications and connections to the fuel system, connecting tubes, traps, and other equipment must not disturb the normal functioning of the fuel system components.

4.6 Number of Traps Needed—On vehicles without evaporative emission control systems, multiply traps may be necessary in series to insure that the vapor adsorption capacity of the trap(s) is not exceeded during the test.

[1] Brunauer, Emmett and Teller. *Journal of the American Chemical Society*, Vol. 60, 1938, p. 309.

A properly prepared trap should absorb fuel vapors equal to at least 10% of the dry weight of the carbon in the trap. This rule should be used to determine the number of traps required; but for the initial tests, it is good practice to use one additional trap in series. The last trap in the series should show no measurable gain in weight. Once the safe vapor adsorption capacity of the traps has been established and the weight of fuel vapors to be trapped have been confirmed by one or more tests, it may be possible to reduce the number of traps in subsequent tests.

4.7 Weighing of Traps—Within 12 h of a scheduled test, the tare weight of the trap must be checked. If it has changed by more than 0.5 g, the trap must be redried to constant weight by passing 1 L/min of dry nitrogen heated to 275°F (135°C) through the trap via the inlet until weighings made at 30 min intervals do not vary by more than 0.1% of the gross weight. A drying tube is connected to the outlet and when the trap and its contents have cooled to room temperature, a new tare weight is recorded on the canister. (This procedure may also be used to purge trap for reuse.)

At the end of the collection sequence, the traps are removed and the trap inlet and outlet capped with the same caps used in determining the initial tare weight. The traps may heat as they adsorb hydrocarbons and after they have cooled to room temperature, they are weighed to the nearest 50 mg and the gross weight recorded on the canister.

The tare weight of the trap(s) is subtracted from the gross weight of the trap(s). The difference between gross and tare weights, or the sum of the differences in weights if more than one trap was used, is recorded as grams of evaporative emissions.

5. Preparation of Test Vehicle and Fuel System—Some suggestions on vehicle preparation follow, but it may be necessary to expand or modify them for individual cases.

5.1 Instrumentation—Tank fuel temperature must be monitored continuously during all sequences of the test. A thermocouple to read tank fuel temperature must be located near the geometric center of the tank fuel liquid. Additional thermocouples, fuel system pressure taps, etc., may be installed on the test vehicle provided they do not affect operation of the vehicle or function of the evaporative control system.

5.2 Air Cleaner—The air cleaner inlet(s) must be sealed during the soak sequence of the test.

5.3 Visual Inspection—After instruments have been installed, the engine should be started and run for approximately 5 min. The vehicle should be inspected for liquid fuel or oil leaks while the engine is running. Leaks must be repaired and all traces of fuel spillage removed.

5.4 Fuel System Pressure Test—A pressure test of the fuel tank assembly, filler cap, filler pipe, fuel lines, fuel vapor lines, and other components should be made to insure the integrity of the fuel system and to check performance of any pressure control device(s) of the evaporative control system. It should precede any test series to insure that vapor from unexpected openings will not affect the accuracy of the test.

Dry nitrogen is preferred for pressure testing, but air can be used. Pressures must not significantly exceed the maximum designed operating pressures of the fuel system. Usually, a loss of pressure of less than 10% of the initial stabilized system pressure in 30 min is adequate evidence of fuel system integrity.

No pressure test should be made if it might adversely affect the subsequent performance of the evaporative control system. If the evaporative control system employs a vapor storage device, the pressure test must not either purge or load the device.

5.5 Loading Evaporative Control Systems—If a vehicle is equipped with an evaporative emission control system, before any tests are made the control system must be properly "loaded" by operating the vehicle until the amount of hydrocarbons retained in the control system is at equilibrium. Surveys of driving practices have indicated that typical vehicle use in a metropolitan area consists of three to four 7.5 mile (12.1 km) trips per day, and, of course, three or four hot soaks and one diurnal soak daily.

Some vapor storage devices—such as charcoal absorbers—have the capacity to retain more vapors (as might be emitted during diurnal or hot soak phases) that can be purged during a single 7.5 mile (12.1 km) trip. Systems using these devices are called "accumulative." Present experience indicates that systems using the engine crankcase as an absorber are not accumulative; usually, this system will purge all stored vapors in one trip. However, in either system, but especially in an accumulative system, vapor loading too high at the start of a test could result in unrealistically high emissions. With an accumulative system, vapor loading too low at the start of the test could result in unrealistically low emissions. Several criteria can be used to judge if the control system is properly loaded. Which one should be used depends upon the type of control system and the test objectives.

If the test objectives are to measure evaporative emissions in a sequence representing one diurnal soak, one 7.5 mile (12.1 km) trip, and a 1 h hot soak in which the control system is to be purged of all vapor generated by the diurnal and hot soak phases (that is, purge grams ≧ stored diurnal grams + stored hot soak grams), proper loading of the control system would be obtained by these steps:

For an accumulative system in which the vapor storage device can be weighed:

(1) Weigh the vapor storage device.
(2) Drain and refill the fuel tank.
(3) Perform a diurnal soak.
(4) Push vehicle onto the chassis dynamometer and run dynamometer test equivalent to the 7.5 mile (12.1 km) trip. The engine must be shut down 3 min ± 15 s after the end of the test.
(5) Perform a 1 h hot soak.
(6) Weigh the vapor storage device.
(7) Repeat steps 2 through 6 until the weight of the device is constant within 5.0 g.

For a nonaccumulative system:

(1) Drain and refill the fuel tank.
(2) Perform a diurnal soak.
(3) Push vehicle onto the chassis dynamometer and run dynamometer test. The engine must be shut down 3 min ± 15 s, after the end of the test.
(4) Perform a 1 h hot soak.

If the test objectives are to measure evaporative emissions in a test sequence representing one diurnal soak, three 7.5 mile (12.1 km) trips, and a hot soak following each trip in which the control system is to be purged of all vapor generated during the diurnal and hot soaks (that is, purge grams per trip = (stored diurnal grams/3) + stored grams per hot soak), proper loading of accumulative control system which can be weighed would be obtained by these steps:

(1) Weigh the vapor storage device.
(2) Drain and refill the fuel tank.
(3) Perform a diurnal soak.
(4) Reweigh the vapor storage device to determine the increase in fuel vapor content (stored grams).
(5) Push vehicle onto the chassis dynamometer and run dynamometer test. The engine must be shut down 3 min ± 15 s after the end of the test.
(6) Weigh the vapor storage device to determine its loss in fuel vapor content (purged grams). Making this measurement interrupts the test sequence, but should not affect test results if it is done quickly (within 1–2 min).
(7) Perform a 1 h hot soak.
(8) Weigh the vapor storage device to determine the increase in fuel vapor content (stored grams).
(9) Repeat these steps, individually and/or in sequence, until it is evident that the purged grams from one dynamometer test run equals or exceeds one-third of the stored diurnal grams and all of the stored hot soak grams.

It is permissible to artificially load the vapor storage device with fuel vapors to shorten the number of tests needed to obtain equilibrium loading of the device.

6. Test Sequence—The test sequence consists of three phases intended to simulate typical vehicle usage in a metropolitan area during the summer months:

(1) A 1 h diurnal soak during which time the tank fuel is heated from 60–84°F (15.6–28.9°C).
(2) A 7.5 mile (12.1 km) run (approximate) conducted on a chassis dynamometer from a "cold" start.
(3) A 1 h hot soak immediately following the 7.5 mile (12.1 km) run.

Evaporative emissions from the vehicle fuel system are measured during each of the three phases. However, measurements during the run phase on a vehicle with an evaporative control system may be omitted if it is apparent that, by system design, all "running losses" will be inducted into the engine.

6.1 Vehicle Temperature Stabilization—Before the test, the vehicle must be soaked (engine off) for a minimum of 11 h at an ambient temperature of 68–86°F (20–30°C) so that all parts stabilize at the prescribed temperature. The vehicle preconditioning and the remaining steps described in this section must be performed in sequence and without interruption. This soak should be limited to not more than 16 h unless the ambient temperature increases beyond that time can be held to less than ϕ 4°F (2.2°C). It is assumed that no significant vapor loading of a storage system, due to tank breathing, occurs during this soak. (After the initial hot soak following any required preconditioning run.)

ϕ **6.2 Tank Refueling**—The fuel tank must be drained and refilled to the tank volume with fresh test fuel. After refueling, temperature of the fuel in the tank must be above 50°F (10°C) and at or below 58°F (14.4°C).

ϕ **6.3 Soak and Run Phases**

ϕ 6.3.1 Installation of Vapor Traps—Immediately after fueling, plug the exhaust pipe(s) and inlet pipe to the air cleaner and connect the vapor collection system to the fuel system vent(s).

ϕ 6.3.2 Diurnal Soak—Heat tank fuel to 60 ± 2°F (15.6 ± 1°C). Heat the tank fuel 24 ± 1°F (13.3 ± 0.5°C) at a constant rate during a period of 60 ± 2 min. The ambient air temperature should be held between 68 and 86°F (20 and 30°C).

6.3.3 Preparation for Running—At the end of the 1 h diurnal soak, remove plugs from the exhaust pipe(s) and air cleaner. If measurement of "running losses" is unnecessary (because all vapors will be inducted into the engine), disconnect the traps from the air cleaner and seal the trap inlet and outlet tubes. Any other traps connected to the fuel system can also be disconnected if, by design, no vapors can be emitted to the atmosphere during vehicle operation. If desired, fresh traps may be substituted to permit emissions to be measured separately for each phase.

6.3.4 Running Phase—Push test vehicle onto the chassis dynamometer. Time between the end of the diurnal soak and the starting of the engine for this phase should not exceed 15 min.

Run accordingly to dynamometer test procedure in Appendix A. Immediately after completion of the test, the cooling fan should be shut off, but the engine should continue running at idle while the instruments and/or test equipment connections are disengaged from the vehicle. Drive the vehicle off the dynamometer to the "hot soak" area at minimum throttle. Time from completion of the dynamometer test until engine shut down, which begins the hot soak, must be controlled to 3 min ± 15 s.

6.3.5 Hot Soak Phase—Immediately after the engine is shut off, replug the exhaust pipe and carburetor air cleaner inlet. Reconnect any part of the vapor collection system disconnected for the "running loss" test. Soak vehicle with hood down for a period of 1 h at an ambient temperature of 76–86°F (24.4–30°C). Disconnect and weigh the traps. ϕ

7. ***Information and Data to be Recorded***—Details are listed on the sample data sheets in Appendix B.

7.1 Information

Test identification.
Vehicle description.
Engine description.
Fuel system description.

7.2 Data to be Collected

Temperatures.
Trap method records.

8. ***Presentation of Data***

Objective of test.
Description of system under test.
Conclusion from the test.
Discussion of the test and the system.
Test tabulation or plots.

APPENDIX A—CHASSIS DYNAMOMETER TEST PROCEDURE

The vehicle must be nearly level when tested to insure normal fuel distribution. Drive wheel tires may be inflated to a gage pressure of 45 psi (310 kPa) to prevent tire damage.

Except for air-cooled engines, the cooling fan should be positioned between 8–12 in (20–30 cm) from the grill and directed squarely at the radiator. Air-cooled engines may require special positioning of the fan contingent on vehicle configuration. In all cases, the running phase is to be conducted with the hood up. Inertia may be obtained by flywheels or may be simulated electrically or by other means. Equivalent inertia weight and road load horsepower should be adjusted according to Table A-1.

If the equivalent inertia specified is not available on the dynamometer being used, the next higher value (but not more than 250 lb (114 kg) higher) should be used. The dynamometer should be adjusted for the specified power absorption at 50 mph (80.5 km/h) and the setting of the power absorption unit should take into account dynamometer friction. Speed measured from dynamometer rolls should be used for all conditions.

Start the engine according to the manufacturer's recommended procedure including choke setting. More choke, more throttle, etc., may be used to keep the engine running. The initial 20 s idle period begins when the engine starts. For cars equipped with automatic transmissions, the transmission should be placed in "drive" 15 s after the engine is ϕ started. Run the driving schedule described in SAE J171a.

For cars equipped with automatic transmissions, the transmission should remain in "drive" for the entire driving schedule. Wheels should be braked as necessary. For cars equipped with manual transmissions, free-wheeling or overdrive units should be locked out. The vehicle should be driven with the minimum throttle movement required to maintain the desired speed.

Acceleration modes should be driven with shift speeds recommended by the manufacturer; if not specified, the vehicle should be shifted from first to second gear at 15 mph (24.1 km/h), from second to third gear at 25 mph (40.2 km/h) and if equipped with a 4-speed transmission, from third to fourth gear at 40 mph (64.5 km/h). Fifth gear, if installed, should not be used. Deceleration modes should be driven with the clutch engaged, using brakes or throttle as necessary. The clutch should be depressed when speed drops below 15 mph (24.1 km/h) or when roughness is evident. Ambient air temperature during the chassis dynamometer test should be between 68–86°F (20–30°C). ϕ

TABLE A-1

Loaded Vehicle Weight		Equivalent Inertia Weight		Road Load H rsepower at 50 mph (80.5 km/h)
lb	kg	lb	kg	
Up to 1125	Up to 511	1000	454	5.9
1126–1375	512–624	1000	454	6.5
1376–1625	625–738	1500	681	7.1
1626–1875	739–851	1750	895	7.7
1876–2125	852–975	2000	908	8.3
2126–2375	976–1085	2250	1022	8.8
2376–2625	1086–1195	2300	1135	9.4
2626–2825	1196–1283	2750	1250	9.9
2826–3250	1284–1475	3000	1362	10.3
3251–3750	1476–1700	3500	1585	11.2
3751–4250	1701–1930	4000	1816	12.0
4251–4750	1931–2150	4500	2110	12.7
4751–5250	2151–2380	5000	2270	13.4
5251–5750	2381–2610	5500	2488	13.9
5751 or more	2611 or more	5500	2488	14.4

APPENDIX B—EVAPORATIVE EMISSION TEST DATA

SHEET ________
TEST NO. ________ LAB. NAME ________________ CAR NO. ________
SYSTEM UNDER TEST ________________ FUEL ________
VEH. MFR. ________ MODEL ________ YEAR ________
BODY TYPE ________ TRANS. ________ WEIGHT ________
ODO. ________ AIR CONDITIONER ________ ACC. ________
ENG. MFR. ________ ENG. TYPE ________ NO. CYL. ________
DISPL. ________ CARB. MAKE ____ MODEL AND NO. VENTURI ________
ADV. H.P. ________ MANIF. HEAT ________
FUEL TANK LOCATION AND CONFIGURATION ________________
TANK VENT. SYS. ________________
TANK CAPACITY ________ FILL CAP TYPE ________
CARB. VENT. SYS. ________________
FUEL PUMP TYPE ________ BLEED BACK ________ RETURN LINE ________

TRAP METHOD

		DIURNAL			RUNNING			HOT SOAK		
TANK FUEL TEMP.	DATE									
		TIME	AMB.	TANK	TIME	AMB.	TANK	TIME	AMB.	TANK
	START									
	FINISH									
TRAP WTS.		TANK	CARB.	SYS.	TANK	CARB.	SYS.	TANK	CARB.	SYS.
	TRAP NO.									
	TARE WT.									
	END WT.									
	DIFF.									
CHARCOAL IDENT.						TOTAL EMISSION				

OBSERVER ________________

EVAPORATIVE EMISSION TEST DATA SHEET (1)

SHEET ________
CAR NO. ________

SYSTEM PRE-CONDITIONING RUNS

			DIURNAL			RUNNING			HOT SOAK		
RUN NO.	TANK FUEL TEMP.	DATE									
			TIME	AMB.	TANK	TIME	AMB.	TANK	TIME	AMB.	TANK
		START									
		FINISH									
	CANNISTER WTS.		TANK	CARB.	SYS.	TANK	CARB.	SYS.	TANK	CARB.	SYS.
		WT. START									
		WT. END									
		DIFF.									
RUN NO.	TANK FUEL TEMP.	DATE									
			TIME	AMB.	TANK	TIME	AMB.	TANK	TIME	AMB.	TANK
		START									
		FINISH									
	CANNISTER WTS.		TANK	CARB.	SYS.	TANK	CARB.	SYS.	TANK	CARB.	SYS.
		WT. START									
		WT. END									
		DIFF.									
RUN NO.	TANK FUEL TEMP.	DATE									
			TIME	AMB.	TANK	TIME	AMB.	TANK	TIME	AMB.	TANK
		START									
		FINISH									
	CANNISTER WTS.		TANK	CARB.	SYS.	TANK	CARB.	SYS.	TANK	CARB.	SYS.
		WT. START									
		WT. END									
		DIFF.									

EVAPORATIVE EMISSION TEST DATA SHEET (2)