

Environmental Protection Agency

§ 86.1232-96

§ 86.1231-90 Vehicle preparation.

(a) Prepare the fuel tank(s) for recording the temperature of the prescribed test fuel at the approximate mid-volume of the fuel when the tank is 40 percent full.

(b) Provide additional fittings and adapters, as required, to accommodate a fuel drain at the lowest point possible in the tank(s) as installed on the vehicle.

(c)(1) Any vapor storage device which absorbs HC vapors and/or CH₃OH vapors and subsequently releases them to the engine induction system during vehicle operation shall be subjected to a minimum of 30 load-purge cycles or the equivalent thereof (4,000 miles or more of actual in-use vehicle service accumulation shall be considered equivalent). One load-purge cycle shall be accomplished by conducting one of the following procedures:

(i) *Vehicle procedure.* Park a fully-warm vehicle (a vehicle that has been driven for at least 15 minutes) for a time period of at least 3 hours. Fill the fuel tank(s) to the prescribed "tank fuel volume" with specified test fuel (§ 86.1213) at room temperature. Then drive the vehicle through at least one cycle of the HDV reference (transient) urban dynamometer driving schedule.

(ii) *Laboratory procedure.* Flow vapors (gasoline or methanol, as appropriate) into a pre-purged vapor storage device until at least 10 percent of the input HC or CH₃OH mass flow rate is passing through the device. Purge the device with a volume of air which is at least as great as, and which has a temperature no higher than that which would be drawn through the device if it were installed on the test vehicle and the vehicle was operated according to the HDV reference (transient) urban dynamometer driving schedule. The vapor flow rate, the method used to generate the vapors, the air flow rate, and the air temperature shall be recorded. If pre-blended gas is used, then the composition and characteristics of the gas shall be recorded.

(2) Ten load-purge cycles accumulated immediately prior to testing shall be conducted according to the method in paragraph (c)(1)(i) of this section. The preceding 20 cycles (minimum) shall be conducted according to

either of the methods in paragraph (c)(1) (i) or (ii) of this section.

[54 FR 14568, Apr. 11, 1989]

§ 86.1231-96 Vehicle preparation.

(a) For gasoline- and methanol-fueled vehicles prepare the fuel tank(s) for recording the temperature of the prescribed test fuel, as described in § 86.1207-96(e).

(b) Provide additional fittings and adapters, as required, to accommodate a fuel drain at the lowest point possible in the tank(s) as installed on the vehicle.

(c) For preconditioning that involves loading the evaporative emission canister(s) with butane, provide valving or other means as necessary to allow purging and loading of the canister(s).

(d) For vehicles to be tested for running loss emissions, prepare the fuel tank(s) for measuring and recording the temperature and pressure of the fuel tank as specified in § 86.1207-96 (e) and (f). Measurement of vapor temperature is optional during the running loss test. If vapor temperature is not measured, fuel tank pressure need not be measured.

(e) For vehicles to be tested for running loss emissions, prepare the exhaust system by sealing or plugging all detectable sources of exhaust gas leaks. The exhaust system shall be tested or inspected to ensure that detectable exhaust hydrocarbons are not emitted into the running loss enclosure during the running loss test.

[58 FR 16056, Mar. 24, 1993, as amended at 60 FR 43904, Aug. 23, 1995]

§ 86.1232-96 Vehicle preconditioning.

(a) Fuel tank cap(s) of gasoline- and methanol-fueled vehicles shall be removed during any period that the vehicle is parked outdoors awaiting testing, to prevent unusual loading of the canisters. During this time care must be taken to prevent entry of water or other contaminants into the fuel tank. During storage in the test area while awaiting testing, the fuel tank cap(s) may be in place. The vehicle shall be moved into the test area and the following operations performed.

(b)(1) *Gasoline- and methanol-fueled vehicles.* Drain the fuel tank(s) and fill

with test fuel, as specified in § 86.1213, to the “tank fuel volume” defined in § 86.082-2. The fuel cap(s) shall be installed within one minute after refueling.

(2) *Gaseous-fueled vehicles.* Vehicle fuel tanks are to be filled with fuel that meets the specifications in § 86.113. Fuel tanks shall be filled to a minimum of 75% of service pressure for natural gas-fueled vehicles or a minimum of 75% of available fill volume for liquefied petroleum gas-fueled vehicles. Prior draining of the fuel tanks is not called for if the fuel in the tanks already meets the specifications in § 86.113.

(c) Gasoline- and methanol-fueled vehicles shall be soaked for at least 6 hours after being refueled. Gaseous-fueled vehicles shall be soaked for at least 1 hour after being refueled. Following this soak period, the test vehicle shall be placed, either by being driven or pushed, on a dynamometer and operated through one driving schedule, specified in § 86.1215 and appendix I of this part. Once a test vehicle has completed the refueling and vehicle soak steps specified in paragraphs (b) and (c) of this section, these steps may be omitted in subsequent testing with the same vehicle and the same fuel specifications, provided the vehicle remains under laboratory ambient temperature conditions for at least 6 hours before starting the next test. In such cases, each subsequent test shall begin with the preconditioning drive specified in this paragraph. The test vehicle may not be used to set dynamometer horsepower.

(d) [Reserved]

(e) The Administrator may choose to conduct additional preconditioning to ensure that the evaporative emissions control system is stabilized. The additional preconditioning shall consist of an initial one hour minimum soak and one, two or three driving cycles of the dynamometer driving schedule, as described in paragraph (c) of this section, each followed by a soak of at least one hour with engine off, engine compartment cover closed and cooling fan off. The vehicle may be driven off the dynamometer for the soak period that follows each driving cycle.

(f)(1) *Gasoline- and methanol-fueled vehicles.* After completion of the preconditioning drive, the vehicle shall be driven off the dynamometer. The vehicle’s fuel tank(s) shall be drained and then filled with test fuel, as specified in § 86.1213, to the “tank fuel volume” defined in § 86.082-2. The vehicle shall be refueled within 1 hour after completion of the preconditioning drive. The fuel cap(s) shall be installed within 1 minute after refueling. The vehicle shall be parked within five minutes after refueling.

(2) *Gaseous-fueled vehicles.* After completion of the preconditioning drive, the vehicle shall be driven off the dynamometer. Vehicle fuel tanks shall be refilled with fuel that meets the specifications in § 86.1213. Fuel tanks shall be filled to a minimum of 75% of service pressure for natural gas-fueled vehicles or a minimum of 75% of available fill volume for liquefied petroleum gas-fueled vehicles. Prior draining of the fuel tanks is not called for if the fuel in the tanks already meets the specifications in § 86.1213. The vehicle shall be parked within five minutes after refueling, or, in the absence of refueling, within five minutes after completion of the preconditioning drive.

(g) The vehicle shall be soaked for not less than 12 hours nor more than 36 hours between the end of the refueling event and the beginning of the cold start exhaust emission test.

(h) During the soak period for the three-diurnal test sequence described in § 86.1230-96, evaporative canisters, if the vehicle is so equipped, shall be preconditioned according to the following procedure. For vehicles with multiple canisters in a series configuration, the set of canisters must be preconditioned as a unit. For vehicles with multiple canisters in a parallel configuration, each canister must be preconditioned separately. If production evaporative canisters are equipped with a functional service port designed for vapor load or purge steps, the service port shall be used during testing to precondition the canister. In addition, for model year 1998 and later vehicles equipped with refueling canisters, these canisters shall be preconditioned for the three-diurnal test sequence according to the procedure in paragraph

(j)(1) of this section. If a vehicle is designed to actively control evaporative or refueling emissions without a canister, the manufacturer shall devise an appropriate preconditioning procedure, subject to the approval of the Administrator.

(1)(i) Prepare the evaporative emission canister for the canister purging and loading operation. The canister shall not be removed from the vehicle, unless access to the canister in its normal location is so restricted that purging and loading can only reasonably be accomplished by removing the canister from the vehicle. Special care shall be taken during this step to avoid damage to the components and the integrity of the fuel system. A replacement canister may be temporarily installed during the soak period while the canister from the test vehicle is preconditioned.

(ii) The canister purge shall be performed with ambient air of humidity controlled to 50 ± 25 grains per pound of dry air. This may be accomplished by purging the canister in a room that is conditioned to this level of absolute humidity. The flow rate of the purge air shall be maintained at a nominal flow rate of 0.8 cfm and the duration shall be determined to provide a total purge volume flow through the canister equivalent to 300 canister bed volume exchanges. The bed volume is based on the volume of adsorbing material in the canister.

(iii) The evaporative emission canister shall then be loaded by sending to the canister an amount of commercial grade butane vapors equivalent to 1.5 times its nominal working capacity. The canister shall be loaded with a mixture composed of 50 percent butane and 50 percent nitrogen by volume at a rate of 15 ± 2 grams butane per hour. If the canister loading at that rate takes longer than 12 hours, a manufacturer may determine a new rate, based on completing the canister loading in no less than 12 hours. The new rate may be used for all subsequent canister loading according to paragraph (h) of this section. The time of initiation and completion of the canister loading shall be recorded.

(iv) The determination of a canister's nominal working capacity shall be based on the average capacity of no

less than five canisters that are in a stabilized condition.

(A) For stabilization, each canister must be loaded no less than 10 times and no more than 100 times to 2-gram breakthrough with a 50/50 mixture by volume of butane and nitrogen, at a rate of 15 grams butane per hour. Each canister loading step must be preceded by canister purging with 300 canister bed volume exchanges at 0.8 cfm.

(B) For determining working capacity, each canister must first be purged with 300 canister bed volume exchanges at 0.8 cfm. The working capacity of each canister shall be established by determining the mass of butane required to load the canister from the purged state so that it emits 2 grams of hydrocarbon vapor; the canister must be loaded with a 50/50 mixture by volume of butane and nitrogen, at a rate of 15 grams butane per hour.

(2) For methanol-fueled and flexible-fueled vehicles, canister preconditioning shall be performed with a fuel vapor composition representative of that which the vehicle would generate with the fuel mixture used for the current test. Manufacturers shall develop a procedure to precondition the evaporative canister, if the vehicle is so equipped, for the different fuel. The procedure shall represent a canister loading equivalent to that specified in paragraph (h)(1) of this section and shall be approved in advance by the Administrator.

(i) [Reserved]

(j) For the supplemental two-diurnal test sequence described in § 86.1230-96, one of the following methods shall be used to precondition evaporative canisters during the soak period specified in paragraph (g) of this section. For vehicles with multiple canisters in a series configuration, the set of canisters must be preconditioned as a unit. For vehicles with multiple canisters in a parallel configuration, each canister must be preconditioned separately. In addition, for model year 1998 and later vehicles equipped with refueling canisters, these canisters shall be preconditioned for the supplemental two-diurnal test sequence according to the procedure in paragraph (j)(1) of this section. Canister emissions are measured to determine breakthrough.

Breakthrough is here defined as the point at which the cumulative quantity of hydrocarbons emitted is equal to 2 grams.

(1) *Butane loading to breakthrough.* The following procedure provides for emission measurement in an enclosure. Breakthrough may also be determined by measuring the weight gain of an auxiliary evaporative canister connected downstream of the vehicle's canister, in which case, the following references to the enclosure can be ignored. The auxiliary canister shall be well purged prior to loading. If production evaporative canisters are equipped with a functional service port designed for vapor load or purge steps, the service port shall be used during testing to precondition the canister.

(i) Prepare the evaporative/refueling emission canister for the canister loading operation. The canister shall not be removed from the vehicle, unless access to the canister in its normal location is so restricted that purging and loading can only reasonably be accomplished by removing the canister from the vehicle. Special care shall be taken during this step to avoid damage to the components and the integrity of the fuel system. A replacement canister may be temporarily installed during the soak period while the canister from the test vehicle is preconditioned.

(ii) The evaporative emission enclosure shall be purged for several minutes. WARNING: If at any time the concentration of hydrocarbons, of methanol, or of methanol and hydrocarbons exceeds 15,000 ppm C the enclosure should be immediately purged. This concentration provides at least a 4:1 safety factor against the lean flammability limit.

(iii) The FID hydrocarbon analyzer shall be zeroed and spanned immediately prior to the canister loading procedure.

(iv) If not already on, the evaporative enclosure mixing fan shall be turned on at this time.

(v) Place the vehicle in a sealed enclosure and measure emissions with a FID.

(vi)(A) For gasoline-fueled vehicles, load the canister with a mixture composed of 50 percent butane and 50 per-

cent nitrogen by volume at a rate of 40 grams butane per hour.

(B) For methanol-fueled and flexible-fueled vehicles, canister preconditioning shall be performed with a fuel vapor composition representative of that which the vehicle would generate with the fuel mixture used for the current test. Manufacturers shall develop a procedure to precondition the evaporative canister, if the vehicle is so equipped, for the different fuel.

(vii) As soon as the canister reaches breakthrough, the vapor source shall be shut off.

(viii) Reconnect the evaporative emission canister and restore the vehicle to its normal operating condition.

(2) *Load with repeated diurnal heat builds to breakthrough.* The following procedure provides for emission measurement in an enclosure. Breakthrough may also be determined by measuring the weight gain of an auxiliary evaporative canister connected downstream of the vehicle's canister, in which case, the following references to the enclosure can be ignored. The auxiliary canister shall be well purged with dry air prior to loading.

(i) The evaporative emission enclosure shall be purged for several minutes. WARNING: If at any time the concentration of hydrocarbons, of methanol, or of methanol and hydrocarbons exceeds 15,000 ppm C the enclosure should be immediately purged. This concentration provides at least a 4:1 safety factor against the lean flammability limit.

(ii) The FID hydrocarbon analyzer shall be zeroed and spanned immediately prior to the diurnal heat builds.

(iii) If not already on, the evaporative enclosure mixing fan shall be turned on at this time.

(iv) The fuel tank(s) of the prepared vehicle shall be drained and filled with test fuel, as specified in § 86.1213, to the "tank fuel volume" defined in § 86.082-2. The average temperature of the dispensed fuel shall be 60±12 °F (16±7 °C). The fuel tank cap(s) shall be installed within 1 minute after refueling.

(v) Within one hour of being refueled, the vehicle shall be placed, with the engine shut off, in the evaporative emission enclosure. The fuel tank temperature sensor shall be connected to

the temperature recording system. A heat source, specified in §86.1207-90(d), shall be properly positioned with respect to the fuel tank(s) and connected to the temperature controller.

(vi) The temperature recording system shall be started.

(vii) The fuel may be artificially heated to the starting diurnal temperature.

(viii) When the fuel temperature reaches at least 69 °F (21 °C), immediately turn off purge blower (if not already off); close and seal enclosure doors; and initiate measurement of the hydrocarbon level in the enclosure.

(ix) When the fuel temperature reaches 72±2 °F (22±1 °C), start the diurnal heat build.

(x) The fuel shall be heated in such a way that its temperature change conforms to the following function to within ±4 °F (±3 °C):

$$F = T_o + 0.4t; \text{ or}$$

for SI units,

$$C = T_o + (2/9)t.$$

Where,

F=fuel temperature, °F;

C=fuel temperature, °C;

t=time since beginning of test, minutes; and

T_o=initial temperature in °F (°C for SI units).

(xi) As soon as breakthrough occurs or when the fuel temperature reaches 96 °F (36 °C), whichever occurs first, the heat source shall be turned off, the enclosure doors shall be unsealed and opened, and the vehicle fuel tank cap(s) shall be removed. If breakthrough has not occurred by the time the fuel temperature reaches 96 °F (36 °C), the heat source shall be removed from the vehicle, the vehicle shall be removed (with engine still off) from the evaporative emission enclosure and the entire procedure outlined in paragraph (j)(2) of this section shall be repeated until breakthrough occurs.

(xii) After breakthrough occurs, the fuel tank(s) of the prepared vehicle shall be drained and filled with test fuel, as specified in §86.1213, to the "tank fuel volume" defined in §86.082-2. The fuel shall be stabilized to a temperature within 3 °F of the lab ambient before beginning the driving cycle for the dynamometer run.

(k) The Administrator may conduct the vehicle preparation and preconditioning for measurement of fuel economy or exhaust emissions according to the procedures specified in §§86.1232-90 and 86.1233-90, in lieu of the procedures specified in this section.

(l) Vehicles to be tested for exhaust emissions only shall be processed according to §§86.1235 through 86.1237. Vehicles to be tested for evaporative emissions shall be processed in accordance with the procedures in §§86.1233 through 86.1238, starting with §86.1235.

(m) Vehicles to be tested for evaporative emissions with the supplemental two-diurnal test sequence described in §86.1230-96, shall proceed according to §§86.1235 through 86.1237, followed by the supplemental hot soak test (see §86.1238-96(k)) and the supplemental diurnal emission test (see §86.1233-96(p)).

(n) With prior approval of the Administrator, manufacturers may use an alternative canister loading method in lieu of the applicable canister loading method described in the provisions of §86.1232-96(h), §86.1232-96 (j)(1) and §86.1232-96 (j)(2), provided the alternative method is shown to be equivalent or result in a more fully loaded canister (a canister that has adsorbed an equal or greater amount of hydrocarbon vapors) than the applicable canister loading method required by the provisions of paragraphs (h), (j)(1), and (j)(2) of this section. Additionally, the Administrator may conduct confirmatory certification testing and in-use testing using the alternative canister loading method used by the manufacturer to test applicable certification and/or in-use vehicles or one of the methods outlined in the provisions of paragraphs (h), (j)(1), and (j)(2) of this section.

[58 FR 16056, Mar. 24, 1993, as amended at 59 FR 48524, Sept. 21, 1994; 60 FR 43904, Aug. 23, 1995; 65 FR 59958, Oct. 6, 2000; 70 FR 72928, Dec. 8, 2005]

§ 86.1233-96 Diurnal emission test.

(a)(1) The diurnal emission test for gasoline-, methanol- and gaseous-fueled vehicles consists of three 24-hour test cycles following the hot soak test. Emissions are measured for each 24-hour cycle, with the highest emission level used to determine compliance