(4) The Administrator may also choose to conduct or require the conduct of additional preconditioning to insure that the evaporative emission control system is stabilized in the case of gasoline-fueled and methanol-fueled vehicles, or to insure that the exhaust system is stabilized in the case of petroleum-fueled, natural gas-fueled, liquefied petroleum gas-fueled and methanol-fueled diesel vehicles.

(i) *Gasoline-fueled and methanol-fueled vehicles.* (A) The additional preconditioning shall consist of an initial one hour minimum soak and, one, two, or three driving cycles of the UDDS, as described in (a)(2) of this section, each followed by a soak of at least one hour with engine off, engine compartment cover closed and cooling fan off.

(B) The vehicle may be driven off the dynamometer following each UDDS for the soak period.

(ii) *Petroleum-fueled diesel vehicles, natural gas-fueled and liquefied petroleum gas-fueled vehicles.* The preconditioning shall consist of either of the following:

(A) The additional preconditioning described in paragraph (a)(4)(i) of this section; or

(B) For abnormally treated vehicles, as defined in §86.085–2, two Highway Fuel Economy Driving Schedules, found in part 600 appendix I, run in immediate succession, with the road load power set at twice the value obtained from §86.129–80.

(b) Within five minutes of completion of preconditioning, the vehicle shall be driven off the dynamometer and parked. The vehicle shall be stored for not less than 12 hours nor for more than 36 hours prior to the cold start exhaust test. (Gasoline-fueled and methanol-fueled vehicles undergo a one-hour diurnal heat build prior to the cold start exhaust test. A wait of up to one hour is permitted between the end of the diurnal heat build and the beginning of the cold start exhaust test. See §86.130 and Figure B79–5.)

(c) Vehicles to be tested for evaporative emissions shall be processed in accordance with procedures in §§86.133 through 86.138. Vehicles to be tested for exhaust emissions only shall be processed according to §86.133 through §86.137.

[54 FR 14527, Apr. 11, 1989, as amended at 59 FR 48509, Sept. 21, 1994]

§86.132–96 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 §86.113, 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 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)(1) Gasoline- and methanol-fueled vehicles shall be soaked for at least 6 hours after being refueled. Petroleum-fueled diesel vehicles and 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 Urban Dynamometer Driving Schedule (UDDS), specified in §86.115 and appendix I of this part.

(2) Once a test vehicle has completed the refueling and vehicle soak steps specified in paragraphs (b) and (c)(1) 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) For unusual circumstances where the need for additional preconditioning is demonstrated by the manufacturer, such preconditioning may be allowed with the advance approval of the Administrator.

(e) The Administrator may also choose to conduct or require to be conducted additional preconditioning to ensure that the evaporative emission control system is stabilized in the case of gasoline-fueled and methanol-fueled vehicles, or to ensure that the exhaust system is stabilized in the case of petroleum- and methanol-fueled diesel vehicles. The preconditioning shall consist of one of the following:

(1) *For gasoline- and methanol-fueled vehicles.* (i) Additional preconditioning shall consist of no more than 50 miles of mileage accumulation under typical driving conditions, either on the road or on a dynamometer.

(ii) In the case of repeat testing on a flexible-fueled vehicle, in which the test fuel is changed, the following preconditioning procedure shall be used. This additional preconditioning allows the vehicle to adapt to the new fuel before the next test run.

(A) Purge the vehicle's evaporative canister for 60 minutes at 0.8 cfm.

(B) Drain the fuel tank(s) and fill with 3 gallons of the test fuel.

(C) Start the vehicle and allow it to idle for 1 minute.

(D) Drain the fuel tank(s) and fill with the new test fuel to the "tank fuel volume" defined in §86.082–2. The average temperature of the dispensed fuel shall be less than 60 °F.

(E) Conduct a heat build according to the procedure specified in §86.133–90.

(F) The vehicle shall be placed, either by being driven or pushed, on a dynamometer and operated through one UDDS, specified in §86.115 and appendix I of this part.

(G) Following the dynamometer drive, the vehicle shall be turned off for 5 minutes, then restarted and allowed to idle for 1 minute. The vehicle shall then be turned off for 1 minute, and allowed to idle again for 1 minute.

(H) After the vehicle is turned off the last time, it may be tested for evaporative and exhaust emissions, starting with paragraph (a) of this section.

(2) *For petroleum-fueled diesel, methanol-fueled diesel, and gaseous-fueled vehicles.* The preconditioning shall consist of either of the following:

(i) An initial one hour minimum soak and, one, two, or three driving cycles of the UDDS, 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 following each UDDS for the soak period; or

(ii) For abnormally treated vehicles, as defined in §86.085–2 or §86.1803–01 as applicable, two Highway Fuel Economy Driving Schedules, found in 40 CFR part 600, appendix I, run in immediate succession, with the road load power set at twice the value obtained from §86.129–80.

(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 §86.113, 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) *Petroleum-fueled diesel vehicles.* Within five minutes after completion after the preconditioning drive, the vehicle shall be driven off the dynamometer and parked.

(3) *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 §86.113. 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. 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 §86.130–96, 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 § 86.130–96, 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 percent 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/refueling 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 §86.113, 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 §86.107–90(a)(4), 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):

$F=T_o+0.4t$; 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 §86.113, 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 exhaust emission test.

(k) The Administrator may conduct the vehicle preparation and preconditioning for measurement of fuel economy or exhaust emissions according to the procedures specified in §§86.132–90 and 86.133–90, in lieu of the procedures specified in this section.

(l) Vehicles to be tested for exhaust emissions only shall be processed according to §§86.135 through 86.137. Vehicles to be tested for evaporative emissions shall be processed in accordance with the procedures in §§86.133 through 86.138, starting with §86.135.

(m) Vehicles to be tested for evaporative emissions with the supplemental two-diurnal test sequence described in §86.130–96, shall proceed according to §§86.135 through 86.137, followed by the supplemental hot soak test (see

§ 86.138–96(k)) and the supplemental diurnal emission test (see § 86.133–96(p)).

[58 FR 16037, Mar. 24, 1993, as amended at 59 FR 16296, Apr. 6, 1994; 59 FR 48509, Sept. 21, 1994; 60 FR 43895, Aug. 23, 1995; 64 FR 23922, May 4, 1999]

§ 86.133–90 Diurnal breathing loss test.

(a)(1) Following vehicle preparation and vehicle preconditioning procedures described in §§ 86.131 and 86.132 the test vehicle shall be allowed to soak for a period of not less than 12 or more than 36 hours prior to the exhaust emission test. The diurnal test shall start not less than 10 or more than 35 hours after the end of the preconditioning procedure. The start of the exhaust test shall follow the end of the diurnal test within one hour.

(2) Gasoline-fueled and methanol-fueled vehicles to be tested for exhaust emissions only shall undergo the diurnal heat build. Since no evaporative measurements are necessary, an evaporative enclosure is not required.

(b) The evaporative emission enclosure shall be purged for several minutes immediately prior to the test.

NOTE: 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. The concentration provides a 4:1 safety factor of hydrocarbons and methanol against the lean flammability limit.

(c) The FID (or HFID) hydrocarbon analyzer shall be zeroed and spanned immediately prior to the test.

(d) Impingers charged with known volumes of pure deionized water shall be placed in the methanol sampling system (methanol-fueled vehicles only).

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

(f) Immediately prior to the diurnal breathing loss test, the fuel tank(s) of the prepared vehicle shall be drained and recharged with the specified test fuel, § 86.113, to the prescribed "tank fuel volume," defined in § 86.078–2. The temperature of the fuel prior to its delivery to the fuel tank shall be between 45° and 60 °F (7.2 °C and 16 °C). The fuel tank cap(s) is not installed until the diurnal heat build begins.

(g) The test vehicle, with the engine shut off, shall be moved into the evaporative emission enclosure, the test vehicle windows and luggage compartment(s) shall be opened, the fuel tank temperature sensor shall be connected to the temperature recording system, and, if required, the heat source shall be properly positioned with respect to the fuel tank(s) and/or connected to the temperature controller.

(h) The temperature recording system shall be started.

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

(j) When the fuel temperature recording system reaches at least 58 °F (14 °C), immediately:

(1) Install fuel tank cap(s).

(2) Turn off purge blowers, if not already off at this time.

(3) Close and seal enclosure doors.

(k) When the fuel temperature recording system reaches 60°±2 °F (16°±1.1 °C), immediately:

(1) Analyze enclosure atmosphere for hydrocarbons and record. This is the initial (time = 0 minutes) hydrocarbon concentration, C_{HCi}, § 86.143.

(2) Simultaneously with initiation of the hydrocarbon analysis, initiate collection of the methanol sample by drawing a sample from the enclosure through the sampling system for four minutes. This is the initial methanol measurement from which methanol concentration C_{CH3OHi} and mass are calculated. Remove impingers and replace with freshly charged clean impingers which will be used to collect the final methanol sample.

(3) Start diurnal heat build and record time. This commences the 60±2 minute test period.

(l) The fuel shall be heated in such a way that its temperature change conforms to the following function to within ±3 °F (±1.6 °C):

(1) $F = T_o + 0.4t$.

(2) For SI units, $C = T_o + (2/9)t$.

Where:

(3) F = fuel temperature, °F.

(4) C = fuel temperature, °C.

(5) t = time since beginning of test, minutes.

(6) T_o = initial temperature.

After 60±2 minutes of heating, the fuel temperature rise shall be 24°±1 °F (13.4 °C±0.5 °C).