APPENDIX I

TECHNICAL SUPPORT DOCUMENT FOR PROPOSED AMENDMENTS RELATED TO EVAPORATIVE AND ON ROAD VAPOR RECOVERY TEST PROCEDURES

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A. Additional Evaporative Emissions Technical Background

1. Evaporative Emissions Test Procedures

The Air Resources Board (ARB) first required compliance with motor vehicle evaporative emissions standards and test procedures in 1970. The current evaporative emission requirements were adopted under the second generation of California's Low Emission Vehicle emission regulations (LEV II evap), and were phased in over the 2004 – 2006 model-years. These LEV II evap requirements apply to 2001 and subsequent model gasoline-, alcohol-, and liquefied petroleum-fueled passenger cars, light-duty trucks, medium-duty vehicles, heavy-duty vehicles[1], and HEVs. The standards and test procedures do not apply to diesel- and dedicated compressed natural gas-fueled vehicles and HEVs with sealed fuel systems that have no evaporative emissions. The LEV II evap regulations ensure that evaporative emissions are controlled to "near-zero" levels and that this control will be effective for the useful life of the vehicle. As an option, manufacturers may also certify to California's unique "zero fuel" evaporative emission standard giving manufacturers the opportunity to generate credits to satisfy their Zero-Emission Vehicle requirements.

Compliance with the LEV II evap standards is demonstrated by measuring the vehicle's evaporative emissions over simulated "real-world" conditions. For example, evaporative emissions are measured in an enclosed environmental chamber in which the vehicle is subjected to temperatures swings that are intended to simulate exposure to several hot summer days (i.e., diurnals). Evaporative emissions are also measured during simulated driving conditions (i.e., running losses), and immediately after the engine is shut down (i.e., hot soak). Compliance is demonstrated using a series of two specific test procedure sequences: 1) Three-Day Diurnal plus High-Temperature Hot Soak and Running Loss (3D+HS); and, 2) Supplemental Two-Day Diurnal plus Hot Soak (2D+HS) ("California Evaporative Emission Standards and Test Procedures For 2001 and Subsequent Model Motor Vehicles," adopted August 5, 1999 [hereinafter referred to as "Evap Test Procedures"]; section I.E.1.(d)). Although each test procedure has its own compliance objective, there is some evaluation overlap between them. For example, both the 2D+HS and 3D+HS tests evaluate canister capacity, permeation control, and canister purge capacity. However, while the 3D+HS test's main objective is to demonstrate that the evaporative emission control system has the ability to capture and hold vapors over a three-day period, the 2D+HS test's main objective is to demonstrate that the system has the ability to adequately purge captured vapors when the vehicle is driven for only a short duration.

[1] Incomplete medium-duty vehicles and heavy-duty vehicles, over 14,000 pounds gross vehicle weight rating, are certified to the applicable evaporative emission standards solely on the basis of an engineering evaluation of the system and data which may be partly derived from evaporative control systems certified for use on light- and medium-duty vehicles.

Both of these procedures involve prescribed methods to suitably condition and stabilize the evaporative emission control system components (e.g., preconditioning of the canister and the vehicle fuel system, fuel tank drain and fills, dynamometer test cycles, etc.) prior to the actual emission tests. Canister preconditioning involves artificially purging and loading vapors into a canister under specific flow rates and in amounts that simulate “real-world” conditions. Certification compliance is also demonstrated by properly aging evaporative emission control system components to the required useful life in advance of any certification tests.

The evaporative certification data submitted by manufacturers are subject to confirmation when requested by the ARB (i.e., confirmatory testing). In addition, a manufacturer-administered in-use compliance program (i.e., the In-Use Verification Program or [IUVP][2]) requires manufacturers to procure and emission test a specified number of in-use vehicles on an “as received” basis at certain mileage intervals. Under the IUVP, vehicles must show compliance with the 3D+HS and 2D+HS emission standards; failure to demonstrate compliance may subject the manufacturer to remedial action. In addition, ARB may conduct its own in-use compliance test program of vehicles that have been identified to have a higher probability of non-compliance.

In order to reduce the testing burden on manufacturers without any reduction in the stringency of the emission standards, the Board adopted certain minor technical “streamlining” amendments to the Evap Test Procedures in June 2006. One of these amendments included a waiver of the requirement for demonstrating compliance with the 2D+HS standard, although this allowance was made available to only integrated evaporative emission control systems.

2. Onboard Refueling Vapor Recovery Emission Test Procedures

The California Onboard Refueling Vapor Recovery (ORVR) test procedures (with amendments) are patterned after the federal ORVR provisions (“California Refueling Emission Standards and Test Procedures For 2001 and Subsequent Model Motor Vehicles,” adopted August 5, 1999, [hereinafter “ORVR Test Procedures”]; Introductory Paragraph). The main objective of the ORVR test is to demonstrate the system’s ability to ensure that hydrocarbon vapors do not escape to the atmosphere during the refueling process. However, as with the 2D+HS and 3D+HS evaporative tests, the ORVR test procedures also have some evaluation overlap of other evaporative emission control system characteristics, such as canister capacity. The ORVR emission standards for California are applicable to passenger cars, light-duty trucks, and medium-duty vehicles with a gross vehicle weight rating less than 8,501 pounds. Test

[2] The In-Use Verification Program was adopted as part of the Compliance Assurance Program (“CAP 2000”) amendments included in the LEV II rulemaking.

preparations involve steps for stabilizing the ORVR emission control system, including purging and loading the canister, in a manner similar to the evaporative emission test sequences. The ORVR certification requirements are also subject to confirmatory testing, and in-use compliance testing.

Both integrated and non-integrated systems demonstrate ORVR emission compliance by a single test sequence. However, the test sequence has some procedural differences that apply to each system. In particular, the test sequence for a non-integrated system allows for more vehicle driving and hence, more canister purging, prior to the ORVR test itself. Staff believes that this allowance for more non-integrated system purging is due to the long-held expectation that non-integrated systems would be configured with two separate canisters, and need to purge them both with the same amount of engine-produced vacuum that previously had been used to purge only one canister. The vehicle driving distance is based on the number of UDDSs[3] that the vehicle drives in order to consume 85 percent of its fuel tank capacity (i.e., “drivedown”). For integrated system vehicles the amount of driving is much less and fixed; the distance is dictated by the miles driven over the Federal Test Procedure (FTP) and the Running Loss tests. Thus, a canister on a non-integrated system vehicle will be purged much more than will one on an integrated system vehicle because a non-integrated system vehicle will be driven over a much greater distance.

3. Test Procedures – Canister Preconditioning

A carbon canister must be conditioned properly prior to any testing to ensure accurate and representative test results. The Evap Test Procedures specify particular methods for preconditioning a canister for each type of test. For instance, the 3D+HS test sequence prescribes a series of repeated vapor-load-and-purge steps that are performed on the canister to establish an “in-use” state (i.e., stabilization). This stabilization step is then followed by a prescribed injection, or “loading,” of a specific amount of vapor into the canister. Thus, the stabilization and loading steps together form the canister preconditioning process. In the case of 3D+HS testing, the prescribed canister-loading uses the “most stringent” condition of one and one-half times the particular working capacity of the canister (U.S. EPA 2002), as well as the slowest rate of flow in to the canister in order for greater diffusion of vapors to occur within the canister’s activated carbon pores. The 2D+HS test canister preconditioning differs in that the stabilization step is not performed, and a less stringent loading condition is used. That loading condition uses a fast vapor flow rate for filling the canister to its nominal working capacity, as gauged by an overflowing breakthrough of excess vapors measuring two grams (i.e., a “two-gram breakthrough”). Note that these two different preconditioning procedures are followed when testing a vehicle with an integrated evaporative system, However, non-integrated system

[3] A “Uniform Urban Dynamometer Schedule,” or “UDDS.” is the first two phases of the four-phase, exhaust test FTP that is required for HEVs.

refueling canisters are preconditioned according to the two-gram breakthrough method when performing the 2D+HS, 3D+HS, and ORVR tests.

4. Hybrid-Electric Vehicle Evaporative Emission Characteristics

The emission characteristics of HEVs differ from conventional vehicles. For instance, exhaust emission control is easier with HEVs than with conventional vehicles because HEV engines are smaller and operate at the most efficient speed and load settings. From an overall emissions impact perspective, HEVs are also superior to that of conventional vehicles because their electric motors are capable of powering the vehicle. However, this beneficial emissions impact characteristic has a negative consequence when controlling evaporative emissions because the canisters are purged only during engine use. Thus, with less engine operation than conventional vehicles, HEVs are more challenged to adequately purge their canisters, and so it is possible that they may not adequately control their evaporative emissions. This concern can be more problematic if HEVs are driven for several days without ever activating their engines, a potentially common occurrence. Without any engine activation over a period of several days, there would not be any opportunity for purging the canisters. Eventually, the canisters would reach a state of saturation, and the evaporative vapors could breakthrough on a continuing basis.

The current Evap Test Procedures address these possible canister-breakthrough scenarios by requiring HEV manufacturers to submit an engineering evaluation of canister purge operation demonstrating its ability for controlling breakthrough emissions, including a manufacturer-specified duration between engine activations solely for purging the canister (Evap Test Procedures, sections III.D.10.1.12 through III.D.10.1.14). In practice, such “intrusive” solely canister-purging engine activations are typically unnecessary because other routine engine activations, such as the preparatory warm-up of a catalyst, provides enough engine operating time to effectively purge the canisters.

Off-vehicle charge capable HEVs[4] (i.e., those that “plug-in”) may present a more severe canister-breakthrough situation than do other HEVs. For instance, in the real world, it is possible that off-vehicle charge capable HEV owners may recharge on a regular basis such that the battery energy “state-of-charge” (or “SOC”) is always at the highest level prior to each commute. This routine practice without any engine operating time could last for weeks, months, or even longer. In this situation, evaporative vapors would tend to accumulate in the canister and eventually breakthrough.

[4] Staff is using the more common term of PHEV for readability. The use of PHEV is not meant to restrict the use of the vehicles to receive charging only from the grid, as with the PHEV definition used in Pavely. To address this restriction, staff refers to these vehicles as OVCC HEVs through out the test procedures and regulatory text.

Depending on the particular HEV design and driving characteristics, blended mode off-vehicle charge capable HEVs would also have canister purging concerns because their engine use could vary greatly, which would mean that the canister purging could also vary greatly.

5. Non-Integrated Refueling Canister-Only Systems

A "non-integrated refueling canister-only" evaporative emission control system, such as the system introduced by Toyota, exhibits a unique process of engine operation, canister purge, and fuel consumption and replenishment that is effectively self-balancing. Specifically, the engine vacuum purges the canister as the engine operates and consumes fuel; as fuel is consumed, the tank empties, creating more vapor space inside the tank; and, refueling the tank generates and displaces new vapors in the tank which are routed to and stored in the canister. Thus, with non-integrated refueling canister-only systems, only refueling vapors are routed to the canister. Evaporative diurnal vapors are never routed to the canister because they are instead always stored inside of the fuel tank until the vehicle is driven, at which time they are routed directly to the engine to be combusted.

B. Description of the Proposed Amendments

1. Clarification of Sealed Fuel Systems

The motor vehicle evaporative emission control standards and test procedures are currently are not applicable to, "…hybrid-electric vehicles that have sealed fuel systems which can be demonstrated to have no evaporative emissions…" (Title 13, California Code of Regulations (CCR), §1976(b)(1)). This applicability exemption was included when the HEV emission control measures were adopted initially in conjunction with other "first generation" Low Emission Vehicle amendments (or "LEV I") in January 1993. However, the evaporative emission regulations do not include a definition of a truly "sealed fuel system"; this omission causes some ambiguity with respect to the exemption.

In order to function, non-liquid fuel systems that store and meter fuel under very high pressures, such as compressed natural gas (CNG) systems, must be designed so that they are, in effect, "perfectly" sealed. Because these systems must be leak-free in order to function, and because they do not have truly "evaporative" emissions, they are exempted from the evaporative emission control standards and test procedures. Other highly pressurized, non-liquid fuels, such as hydrogen, would be expected to use perfectly sealed designs, and consequently they would also be exempted from the evaporative emission control requirements. In general, highly pressurized, non-liquid fuel systems that are perfectly sealed should be exempted from the evaporative emission control standards and test procedures.

A different interpretation of a “sealed fuel system” was considered during the LEV II rulemaking. That interpretation was based on the expectation that certain conventional fuel system technologies (i.e., gasoline), such as a negatively and positively pressurized fuel and evaporative system, would be capable of eliminating fuel-related evaporative emissions (ARB 1999). Basically, it was thought that a “zero” level of fuel-related emissions could be achieved by using a more robust fuel tank, along with complex sealing and pressurizing mechanisms (ARB 1998). A system’s ability to provide such control originated from a study which concluded that a sealed negatively pressurized (i.e., vacuum) fuel system could eliminate fuel permeation. The feasibility of this technology for HEVs was then demonstrated by staff using a prototype HEV with a sealed vacuum fuel system. However, subsequent technical reviews determined that this system would not achieve zero-fuel evaporative emissions after all because permeation would not be totally eliminated (Haskew 2003). In actuality, permeation was later recognized to be a function of concentration, and not a function of a pressure. Although current “Partial Zero-Emission Vehicles” (or “PZEVs”) do certify to a nominal zero-fuel evaporative emission level, that permeation control is accomplished by using materials that are highly resistant to permeation, rather than by using sealed pressurized fuel systems[5]. In reality, the design and fabrication costs of a perfectly sealed, gasoline-based fuel system that would have “no evaporative emissions” could be prohibitively high, under the current state of technologies. Thus, the concept of a perfectly sealed fuel system can not be reasonably applied to conventional gasoline-fueled vehicles, including HEVs.

Accordingly, staff proposes that a definition of a “sealed fuel system” be added to the Evap Test Procedures in order to eliminate ambiguity and clarify the intended exempted applications. Specifically, a sealed fuel system would be one that uses non-liquid fuels that are under very high pressures and has no evaporative emissions, by virtue of its design specifications. In addition, in the interest of completeness, staff proposes that the definition be added to the ORVR Test Procedures even though an HEV that is equipped with a sealed fuel system would not be exempted from the refueling emission standards and test procedures.

2. Off-Vehicle Charge Capable Hybrid-Electric Vehicle-Preconditioning

A “vehicle-preconditioning” step is performed as part the exhaust, evaporative, and ORVR test sequences. Its purpose is to properly adapt the vehicle’s engine, fuel, and emission control systems with the applicable test fuel by operating a test vehicle on a dynamometer over a single “Urban Dynamometer Driving Schedule,” or “UDDS.”

[5] “Partial Zero-Emission Vehicles,” or ”PZEVs,” are required to demonstrate compliance with the zero-fuel evaporative emission standard of 0.0 g for total hydrocarbons per test. The upper tolerance of this “nominal” zero standard value is 54 mg of total hydrocarbons per test.

Battery SOC levels for HEVs are initially set prior to the vehicle-preconditioning step, as currently specified in the "California Exhaust Emission Standards and Test Procedures For 2005 and Subsequent Model Zero-Emission Vehicles, and 2001 and Subsequent Model Hybrid-Electric Vehicles, In The Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Class," adopted August 5, 1999 (hereinafter referred to as "HEV Exhaust Test Procedures"; section E.6.1.2). These provisions require that the battery SOC be set at a level that causes the engine to operate for the maximum possible cumulative amount of time during the preconditioning drive. In other words, the battery is set at a "low" energy level in order to force engine operation to ensure proper adaptation with the test fuel. However, an "always plugged-in" off-vehicle charge capable HEV could possibly have a "high" SOC level prior to the vehicle-preconditioning step, which would suppress engine operation and fuel circulation, and thus, inhibit proper vehicle-preconditioning.

Accordingly, staff proposes that the Evap Test Procedures be revised to require that the vehicle conditioning step, for an off-vehicle charge capable HEV, specify that the test vehicle shall be operated continuously on the dynamometer until it reaches its charge-sustaining mode and then for at least one additional UDDS. This requirement will allow for sufficient engine operation to occur and thereby ensure proper test fuel adaptation of the appropriate vehicle systems.

3. Evaporative Testing – "Worst-Case" Battery State-of-Charge Setting

The HEV battery SOC settings used in the 2D+HS and 3D+HS test sequences are specified by reference in the HEV Exhaust Test Procedures. Battery SOC settings are required during testing in order to ensure that the engine emission performance is "reasonably characterized" (ARB 1993). Therefore, the battery SOC settings are currently required to be at the lowest energy level (i.e., the "worst-case" exhaust test condition) so that the engine will operate for the maximum possible cumulative amount of time during the exhaust testing. An additional SOC Criterion testing requirement applies to HEVs operating in a "charge-sustaining" mode during the exhaust testing.

However, off-vehicle charge capable HEVs, which have the real-world possibility of always being plugged-in, have the possibility of always starting a commute with a high battery SOC setting. Under these conditions, and depending on the particular type of HEV design, the commute is likely to initially involve little or no engine use, and correspondingly, little opportunity for canister purging. Accordingly, evaporative emissions from off-vehicle charge capable HEVs would be "reasonably characterized" during testing only when the battery SOC settings were similar to those real-world conditions. This means that the battery SOC setting should be at a high level prior to the exhaust emission testing portion of the test sequence when conducting the evaporative emission testing. Setting the battery SOC at the highest allowable level will tend to suppress engine operation during the exhaust test driving, which will also suppress canister purging. Thus, setting the battery SOC at this high level is both more representative of the potential in-use condition, and is the “worst-case” test condition for evaporative emissions testing. Additionally, the requirement to satisfy the SOC Criterion at the end of the exhaust emission testing would be unwarranted since the HEVs would be forced to operate primarily in charge-depleting modes.

Accordingly, staff proposes that, when conducting 2D+HS and 3D+HS evaporative emissions testing of off-vehicle charge capable HEVs, the battery SOC setting be at the maximum level allowed by the manufacturer prior to testing. Additionally, an SOC Criterion requirement would not be applicable. The ARB would reserve the right to conduct certification confirmatory and or in-use compliance tests at either the manufacturer’s SOC setting or at the lowest manufacturer-allowed SOC setting, or at some SOC setting in between them.

4. ORVR Testing – “Worst-Case” Battery State-of-Charge Setting

The potential real-world condition of a “high” battery SOC setting for off-vehicle charge capable HEVs that would occur with evaporative diurnal emissions testing also applies to ORVR emission testing. Accordingly, to ensure that off-vehicle charge capable HEV ORVR emissions are “reasonably characterized” during testing, the battery SOC settings should be consistent with the evaporative diurnal emission test settings. Therefore, staff proposes that when conducting ORVR emission testing of off-vehicle charge capable HEVs, the battery SOC setting shall be at the maximum level allowed by the manufacturer, prior to performing the ORVR testing. The ARB shall be able to set the battery SOC at any level for purposes of conducting certification confirmatory and in-use compliance testing.

For some non-integrated systems of off-vehicle charge capable HEVs, there may be a situation where a high battery SOC setting could possibly delay starting the “canister-purging” mode of engine operation during the vehicle drivedown step. As described earlier this is because the vehicle must consume 85 percent of its fuel capacity. This could unnecessary increase the amount of time required to complete the ORVR testing. In order to decrease the possible testing burden on manufacturers, staff proposes that an alternative method will be allowed for these situations. Specifically, for ORVR testing of non-integrated systems, the battery SOC may be set initially at a “low” level in order to maximize the cumulative amount of engine operation over the shortest period of vehicle driving. Such an allowance shall require prior Executive Officer approval, and the approval shall be based on good engineering practice. This allowance shall not apply to integrated systems because the duration of the canister-purging driving step for integrated systems is a prescribed driving distance, and not dependent on the amount of fuel consumed.

5. Canister-Loading – Non-Integrated Refueling Canister-Only Systems

Currently, the 2D+HS, 3D+HS, and ORVR tests require that non-integrated system refueling canisters be preconditioned using the two-gram breakthrough method. Accordingly, the refueling canister in a non-integrated refueling canister-only system is also required to be preconditioned using the same method. However, manufacturers have commented that the two-gram breakthrough method is not appropriate for non-integrated refueling canister-only systems because that type of loading is not representative of real-world conditions. In real-world use, only fuel vapors that are generated during a refueling event can ever be routed to the canister because of the system's particular design. The canister will never be exposed to any evaporative vapors formed inside the tank during diurnal events. Instead, these diurnal vapors will remain in the tank until they are eventually routed directly to the engine system for combustion while the vehicle is driving. Thus, the refueling canister will never experience the repeated daily loadings of evaporative diurnal vapors that eventually saturate conventional canisters and lead to a continuing breakthrough of vapors. For testing purposes of conventional systems, these vapor saturating conditions are assured by loading the canisters to either the one-and-one-half times working capacity specification or the two-gram breakthrough specification, as applicable. However, in real-world use, the most stringent type of canister-loading that can occur with non-integrated refueling canister-only systems is a complete refilling of a fuel tank with new fuel during a refueling event.

Nevertheless, staff has concerns over the possibility that even these refueling vapors would ultimately migrate through the interior of the canister and "bleed" out from the canister, particularly out of its fresh air vent on a continuing basis (i.e., "bleed emissions")[6]. In this case, staff initially felt that the current two-gram canister-loading method was still the preferred canister-loading method because its greater stringency provided additional assurance of emission control, especially in light of the potential "never or minimal" canister-purging characteristics of off-vehicle charge capable HEVs. To address these concerns, the Alliance of Automobile Manufacturers provided an engineering evaluation demonstrating the ability for a canister, loaded initially with only refueling vapors, to adsorb further vapor loading even after an additional one-week period. In other words, the canister would be able to adequately control bleed emissions over time because the trapped vapors would tend to migrate deeper in the canister's activated carbon rather than out of the canister's fresh-air vent. A separate engineering evaluation by a manufacturer indicated that some vapor migration outside of the canister did occur; however, the emissions impact was relatively very small.

Accordingly, staff proposes that the canister preconditioning method be revised so that it is more representative of real-world conditions when conducting 2D+HS, 3D+HS, and ORVR testing of off-vehicle charge capable HEVs that are

[6] The "fresh air vent" is a port on the canister that opens to the ambient atmosphere in order to allow fresh air to enter and purge the canister at the appropriate times. This port is typically opened and closed using a solenoid-actuated, one-way check valve.

equipped with non-integrated refueling canister-only systems. Specifically, under a new "fuel-tank-refill" canister-loading method for a non-integrated refueling canister-only system, the refueling canister shall be loaded with only refueling vapors that are volumetrically displaced from the fuel tank as the tank is replenished with new fuel from a 10 percent to a 95 percent level (nominal volumes), similarly as done in ORVR testing. This method represents the "most stringent" canister-loading method for this particular system.

There are two areas of concern with using this new method. The first concern is that any routine fuel draining or filling of the fuel tank during the vehicle-preconditioning steps could unintentionally route vapors to the refueling canister. This would cause the refueling canister to be loaded with more vapors than intended with the new canister-loading method (i.e., causing abnormal purging or loading). Therefore staff proposes that a refueling canister be "isolated" from its system, using any method that does not compromise the integrity of the evaporative emission control system, when performing these routine steps in order to prevent any abnormal purging or loading. To facilitate any ARB certification confirmatory or in-use compliance testing activities, a manufacturer shall include a description of the particular canister isolation method in its certification application. The second concern arises from the inability to vent fuel vapors from the tank to the atmosphere via the isolated refueling canister when the vehicle is refueled. A conventional evaporative emission control system can vent these vapors through its canister; however, these vapors cannot be vented through a refueling canister that is isolated. Accordingly, staff proposes that these vapors be allowed to be routed from the fuel tank directly to the atmosphere when the refueling canister is isolated during a refueling event.

To provide flexibility in implementing this new canister-loading method, staff proposes that modifications may be allowed when approved in advance by the Executive Officer. Lastly, in order to facilitate the implementation and use of this new canister-loading method, staff proposes to add a definition for a "non-integrated refueling canister-only system" to the Evap Test Procedures.

6. Canister-Purging Capability – "Worst-Case" SOC Setting

Staff has concerns about the breadth of the 2D+HS test evaluation for off-vehicle charge capable HEVs. Under the proposed "worst-case" battery SOC setting, canister purging will be either suppressed or reduced during the exhaust FTP driving portion of the test sequence. However, as discussed previously, the main objective of the 2D+HS test is to evaluate the purging capability of the evaporative emission control system during a short driving event. Thus, even though a vehicle may have satisfied the 2D+HS emission standard, it may not necessarily demonstrate that the canister adequately purges during real-world short driving events.

To address this concern, staff proposes to require manufacturers to demonstrate compliance with the 2D+HS emission standard using a “low” battery SOC level in the test sequence in order to maximize the engine operation during the exhaust FTP test. To reduce the burden of performing this demonstration, staff proposes that a manufacturer have the option to conduct an engineering evaluation demonstrating the evaporative emission control system’s capability for sufficiently purging a canister during short driving events. A statement of compliance to this fact shall be included with a manufacturer’s certification application. The engineering evaluation shall be provided to the Executive Officer, if requested. In general, it seems reasonable that manufacturers will have already ascertained a particular system’s performance specifications and capabilities while developing the system. Thus, this information should be readily available.

This information would include, but not be limited to, canister type, canister volume, canister working capacity, fuel tank volume, fuel tank geometry, fuel delivery system, description of the input parameters and software strategy used to control canister purge, and nominal purge flow volume (i.e., amount of bed volumes) achieved by a test vehicle after a completed 2D+HS dynamometer drive cycle.

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