

State of California  
**AIR RESOURCES BOARD**

**CALIFORNIA CERTIFICATION AND INSTALLATION PROCEDURES FOR MEDIUM-  
AND HEAVY-DUTY VEHICLE HYBRID CONVERSION SYSTEMS**

Adopted: September 1, 2017

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## **1. APPLICABILITY**

- (a) Applicability. The “California Certification and Installation Procedures for Medium- and Heavy-Duty Vehicle Hybrid Conversion Systems” (these procedures) are the certification and installation procedures that shall apply for approval of systems that convert the following non-hybrid base vehicles and engines to operate as a hybrid:
- (1) A 2007 and subsequent model year (MY) California-certified base vehicle between 6,001 to 8,500 pounds gross vehicle weight rating (GVWR), where the conversion achieves at least 35 miles all-electric range (AER);
  - (2) A 2007 and subsequent MY California-certified non-hybrid base vehicle between 8,501 to 14,000 pounds GVWR; and
  - (3) A 2010 and subsequent MY base engine that is California-certified for installation in a vehicle over 8,500 pounds GVWR.
- (b) Purpose. A certification of a hybrid conversion system issued pursuant to these procedures is to have the effect of a certification issued pursuant to California Health and Safety Code Section 43006, and the effect of an exemption issued pursuant to California Vehicle Code Section 27156.

## **2. DEFINITIONS, ACRONYMS AND ABBREVIATIONS**

The definitions and abbreviations set forth in California Code of Regulations, title 13, section 2208 (13 CCR 2208) and Title 40, Code of Federal Regulations, Part 1065, Subpart K, as amended on October 25, 2016, which is hereby incorporated by reference herein, apply to these test procedures unless otherwise noted below.

- (a) “55 Mile Per Hour (mph) Cruise Cycle” means the procedure described in Title 40, Code of Federal Regulations, Part 1037, Section 1037.510(a), as amended on September 15, 2011, which is hereby incorporated by reference herein.
- (b) “Applicant” or “manufacturer” means any person who manufactures a hybrid conversion system intended for sale or installation in California.
- (c) “Average Driving Speed” means the distance traveled during the test cycle divided by the test cycle time, excluding any time during which the vehicle operates at zero miles per hour (i.e., idles or is otherwise at rest).
- (d) “Authorized Installer” means any individual or entity that equips a vehicle or engine with a hybrid conversion system with the authorization of the party that holds the California Air Resources Board (ARB) Executive Order for such hybrid conversion system.

- (e) "Base engine" means a California-certified configuration of a motor vehicle engine prior to any modifications necessary for the engine to operate as a hybrid.
- (f) "Base vehicle" means a California-certified configuration of a motor vehicle prior to any modifications necessary for the vehicle to operate as a hybrid.
- (g) "California Unified Cycle" or "LA-92" means the test procedure described in paragraph (c) of Title 40, Code of Federal Regulations, Part 86, Appendix I, as amended on October 25, 2016, which is hereby incorporated by reference herein.
- (h) "Coefficient of Variation" or "CV" for a data set is the normalized measure of the dispersion of a probability distribution, calculated as the ratio of the standard deviation to the mean.
- (i) "Conversion system manufacturer" or "converter" means a person or entity that manufactures or assembles a hybrid conversion system intended for sale in California.
- (j) "Drivability" means the smooth delivery of sufficient and reliable power for the intended vehicle type and duty cycle, as demanded by the driver.
- (k) "Engine automatic stop-start system" means a mechanism that automatically turns off the internal combustion engine when the vehicle is stopped, such as at a traffic light, and restarts when the vehicle operator pushes the accelerator.
- (l) "Federal Test Procedure" or "FTP-75" means the exhaust emission test described in Title 40, Code of Federal Regulations, Part 1066, Section 1066.801(c), as amended on February 19, 2015, which is hereby incorporated by reference herein.
- (m) "Hybrid conversion system" or "conversion system" means a package of energy storage and delivery, ignition, emission control, on-board diagnostics (OBD), and engine components that are modified, removed, or added during the process of modifying a base engine or vehicle to operate as a hybrid.
- (n) "Orange County Bus Cycle" means the test procedure described in Society of Automotive Engineers (SAE) International 2711: Recommended Practice for Measuring Fuel Economy and Emissions of Hybrid-Electric and Conventional Heavy-Duty Vehicles (SAE J2711), issued September 2002, which is hereby incorporated by reference herein.
- (o) "Positive Kinetic Energy" or "PKE" means  $(1/\text{total distance}) * \sum[(\text{velocity}(i)^2) - (\text{velocity}(i-1)^2)]$  summed over samples where  $\text{velocity}(i) > \text{velocity}(i-1)$ , for velocity

data collected on the interval of  $i = 1$  to  $n$  number of time samples, evaluated on a one hertz basis in feet/second<sup>2</sup>.

- (p) “Transient Portion of the Heavy Heavy-Duty Truck 5 Mode Cycle” means the test procedure described in Title 40, Code of Federal Regulations, Part 1037, Appendix I, as amended on September 15, 2011, which is hereby incorporated by reference herein.
- (q) “Urban Dynamometer Driving Schedule” means the test procedure described in paragraph (a) of Title 40, Code of Federal Regulations, Part 86, Appendix I, as amended on October 25, 2016, which is hereby incorporated by reference herein.
- (r) “US-06 Supplemental Federal Test Procedure” or “US-06” means the test procedure described in paragraph (g) of Title 40, Code of Federal Regulations, Part 86, Appendix I, as amended on October 25, 2016, which is hereby incorporated by reference herein.
- (s) “Useful life” means the duration, expressed in miles or operating hours, of the longest regulatory durability period for the new vehicle or engine emission standards to which the base vehicle or engine was certified.
- (t) “Valid warranty claim” means a request from an end user, authorized installer, or distributor to the applicant for an inspection, repair, adjustment, replacement, or modification of a specific part or component of the hybrid conversion system or the base engine or vehicle, for which the applicant is invoiced for compensation pursuant to the warranty provisions in Section 10 of these procedures, and compensation is actually provided, excluding warranty repairs made solely for customer satisfaction purposes (i.e., good faith repairs).
- (u) “Warrantable condition” means any condition of a hybrid conversion system or base engine that triggers the responsibility of the conversion system manufacturer or authorized installer to take corrective action.
- (v) “Warranted part” means any part installed on a hybrid conversion system, or part installed during a hybrid conversion system warranty repair, which affects any regulated emissions from a previously-certified vehicle test group or engine family.
- (w) “Warranty period” means the period of time, mileage, and/or operating hours, as identified in Section 10, Table 1 of these procedures, that the certified hybrid conversion system or any part thereof is covered by the warranty provisions.
- (x) “Zero-emission power take-off” or “electric power take-off” (ePTO) means a method for taking power from an on-vehicle source (typically a battery) that produces no emissions of regulated pollutants and which can be used to power a

non-vehicular device that is permanently connected to the vehicle and is not used to propel the vehicle.

### **3. GENERAL REQUIREMENTS**

In addition to all other provisions and requirements imposed by these procedures, the following general requirements shall apply:

- (a) Emission Performance Criteria.
  - (1) When installed and operated on vehicles and engines belonging to proposed base vehicle test groups and engine families and evaluated in accordance with these procedures, the hybrid conversion system must be demonstrated to:
    - (A) achieve at least a ten percent carbon dioxide (CO<sub>2</sub>) emission reduction;
    - (B) not increase exhaust emissions of oxides of nitrogen (NO<sub>x</sub>), hydrocarbons (HC), carbon monoxide (CO) or particulate matter (PM); and
    - (C) not increase evaporative emissions.
  - (2) The Executive Officer may conduct independent emission testing to evaluate whether a hybrid conversion system meets the emission or other criteria of these procedures. If such testing demonstrates that the hybrid conversion system fails to meet the emission or other eligibility criteria of these procedures, the Executive Order for the hybrid conversion system may be revoked, and the conversion system may be subject to recall proceedings pursuant to Section 11 of these procedures. Further, if such tests or other evidence provides the Executive Officer with reason to suspect that the hybrid conversion system will adversely affect durability of the vehicle emission control system, the manufacturer must, within 30 days of notice, or by another mutually agreed upon date, submit durability data, in a format to be determined by the Executive Officer, demonstrating that the durability of the vehicle emission control system is not affected.
  - (3) No component or calibration of the hybrid conversion system that could affect emission performance may be adjustable by the authorized installer or the vehicle operator.

(b) Emission Control Labels.

The emission control label requirements in California Code of Regulations, title 13, section 1965 apply to hybrid conversion systems, with the following additions:

- (1) The hybrid conversion system manufacturer must provide a durable and legible supplemental Emission Control Information Label (supplemental label), which must be affixed in a permanent manner to each converted vehicle in a location where it can be seen by a person viewing the original Emission Control Information Label. The label and the method by which it is affixed to the vehicle must be designed to withstand, for the converted vehicle's or engine's useful life, environmental conditions in the area where the label is attached. Environmental conditions must include, but are not limited to, exposure to engine fuels, lubricants, and coolants.
- (2) The label required pursuant to Section 3(b)(1) of these procedures must show the following:
  - (A) Vehicle Information: The base vehicle or engine MY, as applicable; the hybrid conversion system Executive Order number; the hybrid conversion system manufacturer name, address and telephone number; a manufacturer statement that the converted vehicle or engine complies with California emission requirements; a list of any parts that were added or removed during installation of the hybrid conversion system; and any changes in tune-up specifications required for the hybrid conversion system;
  - (B) Installation Information: The hybrid conversion system authorized installer name, address, and telephone number; the date of installation; and the installation mileage (i.e., the vehicle odometer reading taken on the date the hybrid conversion system was installed); and
  - (C) Warranty Information: The warranty expiration date and the warranty expiration mileage (i.e., the mileage at which the hybrid conversion system warranty expires).

(c) Drivability.

The drivability of a vehicle equipped with a hybrid conversion system must not be degraded in such a way as to encourage consumer tampering or create a safety hazard. The Executive Officer's determination about whether drivability is acceptable will be based on his or her engineering evaluation of the hybrid conversion system described in the application for certification and on reports or

observations that a hybrid conversion system similar in design to the system for which certification is sought has encountered drivability degradation issues. To verify that the drivability of a converted vehicle is acceptable, the Executive Officer may require that an independent laboratory evaluate drivability. The cost of this evaluation shall be borne by the applicant.

(d) Anti-Backsliding.

Notwithstanding the provisions of these procedures, the Executive Officer reserves the right to require a hybrid conversion system to meet more stringent emissions compliance, diagnostics, warranty, and other requirements if the hybrid conversion system is subject to such requirements by the United States Environmental Protection Agency (U.S. EPA) at the time the manufacturer applies to the Executive Officer for hybrid conversion system certification.

(e) Owner's Manual.

The manufacturer must provide to the purchaser an owner's manual containing at least the following information for each hybrid conversion system installed:

- (1) A brief description of the hybrid conversion system, including major components and their theory of operation and proper operating procedures;
- (2) Battery maintenance best practices and charging procedures and protocols, if applicable;
- (3) A listing of necessary hybrid system service and service intervals, as well as tune-up data, which differ from the service requirements specified by the base vehicle's or engine's original manufacturer;
- (4) A statement that the converted vehicle is subject to all in-use vehicle inspection and maintenance programs applicable to its size, type and class. Owner's manuals for gasoline-powered vehicles and for vehicles below 14,001 pounds GVWR must indicate that the vehicle is subject to California Smog Check at a Smog Check Referee Center;
- (5) The name, physical address, e-mail address, phone number, and website, if available, of the conversion system manufacturer and authorized installer, as well as a list of the names, addresses, and phone numbers of the major dealers who supply parts for, or service, the proposed hybrid conversion system;
- (6) All information necessary for the proper and safe operation of the converted vehicle, including information on the safe handling of the battery system, and emergency procedures to follow in the event of battery



leakage or other malfunctions that may affect the safety of the vehicle operator, emergency personnel, or laboratory personnel; and

- (7) The product warranty statement required pursuant to Section 10(c) of these procedures.

- (f) Installation.

The manufacturer must have a written contractual relationship with its hybrid conversion system installer(s). The hybrid conversion system manufacturer must provide its authorized installer(s) with specific, written instructions and training regarding installation procedures for its conversion system, as needed to comply with the diagnostics, labeling, and other requirements of these procedures. A copy of said written contract with its authorized installer(s) and required installation procedures must be provided by the manufacturer to the Executive Officer within thirty days upon request.

- (g) Funding Program Disclosure Requirements.

When applying for public incentive funding for a Tier 1 or Tier 2 certified hybrid conversion system, the conversion system manufacturer must disclose, in writing as part of its funding application or request to the potential funding entity, the current level of ARB hybrid conversion system certification (Tier 1 or Tier 2) and the applicable California sales limits identified in that certification for the hybrid conversion system. Such disclosure must indicate whether requested incentive funding is intended to fund a volume of hybrid conversion systems that is allowed by the current ARB certification pursuant to these procedures, or a volume that cumulatively would exceed what is allowed by the current ARB certification pursuant to these procedures.

- (h) Battery Disposal.

The manufacturer must provide written information regarding proper disposal of the hybrid vehicle battery to dealers and purchasers of the hybrid conversion systems, and provide a copy of this written information to the Executive Officer, along with a description of how this information will be conveyed, as part of its hybrid conversion system certification application.

#### **4. TIER 1 CERTIFICATION REQUIREMENTS**

- (a) Tier 1 Emission Compliance.

- (1) Exhaust Emissions. A manufacturer must provide an engineering evaluation demonstrating that its proposed hybrid conversion system, when properly installed on the proposed base engine(s) or vehicle(s),

meets the exhaust emission performance criteria of Sections 3(a)(1)(A) and (B) of these procedures. The Executive Officer shall evaluate said demonstration for approval based upon his or her engineering judgement regarding data and other information provided by the manufacturer, including engine or vehicle certification data, and other pertinent information regarding the operating principles of the base engine(s) or vehicle(s) and the proposed hybrid conversion system.

- (2) Evaporative Emissions. The following requirements apply to a hybrid conversion system for a gasoline-, liquefied petroleum-, or alcohol-fueled base vehicle with a GVWR over 6,000 pounds.
  - (A) Except as provided in Sections 4(a)(2)(B) through 4(a)(3) of these procedures, the manufacturer must demonstrate that the converted vehicle meets the two-day diurnal plus hot soak evaporative emissions standard (Two-Day Diurnal Standard) to which the base engine or vehicle was originally certified in accordance with the “California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles” (Evaporative Test Procedures), as amended on September 2, 2015, which is hereby incorporated by reference herein. For a charge-depleting hybrid that does not utilize a non-integrated refueling canister-only system (NIRCOS) and that is unable to sufficiently purge the evaporative emission canister normally during the exhaust test step of the two-day diurnal evaporative emissions test, the purge may be manually started for one manufacturer-defined canister purge event during the exhaust test step, but the manufacturer must demonstrate to the Executive Officer prior to evaporative testing that the purge event implemented during the evaporative test is no more effective than the converted vehicle’s in-use evaporative emission control strategy, considering factors such as purge frequency, timing, and duration; flow rates; and available working capacity following a purge event. The manufacturer, at its discretion, may add diurnal cycles to the two-day diurnal evaporative emissions test to generate supporting data for a particular in-use evaporative emission control strategy.
  - (B) Heavy-Duty Conversions. A manufacturer of a hybrid conversion system for a base vehicle of 14,001 pounds or greater GVWR may provide an engineering evaluation demonstrating that the conversion system does not increase evaporative emissions from the base vehicle in lieu of the two-day diurnal evaporative emissions test. The Executive Officer shall evaluate said demonstration based upon data and the converted vehicle’s in-use evaporative emission control strategy considering factors such as

purge frequency, timing, and duration; flow rates; available working capacity following a purge event, etc.

- (C) Non-Integrated Refueling Canister-Only Systems. In addition to the Two-Day Diurnal Standard, a hybrid conversion system that converts the evaporative emission control system of the base vehicle or engine to a NIRCOS must also demonstrate that the converted vehicle meets the applicable refueling emission standard in accordance with the “California Refueling Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles” (Refueling Test Procedures), as amended on September 2, 2015, which is hereby incorporated by reference herein. For such converted vehicles, evaporative emission demonstration testing may be performed in accordance with the appropriate procedures specifically set forth for vehicles with a NIRCOS.
  - (D) Except as provided in Section 4(a)(2)(C) of these procedures, the manufacturer of a hybrid conversion system that modifies the original configuration of the evaporative emission control hardware or componentry must comply with the provisions set forth in Section 4(a)(2)(A) and, additionally, demonstrate that the converted vehicle meets all other evaporative emission standards to which the base engine or vehicle was originally certified in accordance with the Evaporative Test Procedures or Refueling Test Procedures, as applicable, including the three-day diurnal plus hot soak standard, canister bleed standard, and refueling standard. The manufacturer, at its discretion, may add diurnal cycles to applicable evaporative emission tests to generate supporting data for a particular in-use evaporative emission control strategy.
- (3) Compression-Ignition Engines and Sealed Fuel Systems. A converted vehicle with a compression-ignition engine or a sealed fuel system that can demonstrate no evaporative emissions is exempt from evaporative emissions testing pursuant to Sections 4(a)(2)(A) through (C) of these procedures. This demonstration may be based upon an engineering evaluation of the base vehicle and hybrid conversion system and data submitted by the conversion system manufacturer, and must indicate that the converted vehicle has no evaporative-related emissions under normal operation. Any such demonstration must be approved by the Executive Officer in order for the converted vehicle to be exempt from evaporative emission testing.
- (b) For hybrid conversion systems that achieve less than 35 miles AER and meet the minimum eligibility requirements of Sections 3 and 4 of these procedures, a

manufacturer may receive one or more Tier 1 Executive Orders, collectively authorizing installation and California sale of a total of 10 units.

- (1) As of January 1, 2022, a manufacturer is ineligible to submit an application for Tier 1 certification of a hybrid conversion system that does not achieve at least 35 miles AER.
  - (2) Tier 1 Executive Orders for hybrid conversion systems that do not achieve at least 35 miles AER expire as of January 1, 2027, and additional units of a hybrid conversion system covered by such an Executive Order may not be installed or sold after January 1, 2027.
- (c) For hybrid conversion systems that achieve at least 35 miles AER and meet the minimum eligibility requirements of Sections 3 and 4 of these procedures, a manufacturer may receive one or more Tier 1 Executive Orders collectively authorizing installation and California sale of a total of 25 units.
- (1) As of January 1, 2025, a manufacturer is ineligible to submit an application for Tier 1 certification of a hybrid conversion system that achieves at least 35 miles AER.
  - (2) Tier 1 Executive Orders for hybrid conversion systems that achieve at least 35 miles AER expire as of January 1, 2030, and additional units of Tier 1-certified hybrid conversion systems may not be installed or sold after January 1, 2030.
- (d) Reporting Requirements. A manufacturer must collect the following information, which must be current as of the hybrid conversion system installation date, regarding each unit sold of a Tier 1 or Tier 2 certified hybrid conversion system. This information must be kept for at least five calendar years from the hybrid conversion system's installation date and must be provided to the Executive Officer within thirty days upon request:
- (1) Vehicle make, model, model year, identification number (VIN), and license plate number;
  - (2) Vehicle owner's physical address, e-mail address, phone number, and whether they are personal or business;
  - (3) Vehicle operator's name and physical address (if different than the vehicle owner), and whether they are personal or business;
  - (4) Conversion system authorized installer name, physical address, e-mail address, phone number, and whether they are personal or business;

- (5) Location, date, and odometer reading at time of hybrid conversion system installation; and
  - (6) ARB certification tier (i.e., Tier 1 or 2).
- (e) Tier 1 OBD Requirements. If the base vehicle or engine to be converted was originally certified with an OBD system pursuant to California Code of Regulations, title 13, section 1968.2 (13 CCR 1968.2) or 1971.1 (13 CCR 1971.1), respectively, all OBD requirements remain applicable to the base engine or vehicle, with the exception of the provisions described in Sections 4(e)(1) through (5) of these procedures, below. As such, the manufacturer must demonstrate that the proper function of the OBD system must not be impaired as a result of the installation and operation of the hybrid conversion system. This includes, but is not limited to, demonstrating that the converted vehicle's or engine's OBD system implements required monitors for applicable added or modified electronic hardware or emission controls and complies with standardization requirements, and demonstrating that any modifications to the converted vehicle or engine do not impact the original vehicle's OBD system. In addition, the manufacturer must perform all required demonstration and production vehicle and engine testing.
- (1) Monitoring Requirements. For all converted engines or vehicles, the manufacturer is required to implement an Engine Manufacturers Diagnostics (EMD) system on the hybrid system that meets the requirements described in 13 CCR 1971.1(d)(7.1.4).
  - (2) Hybrid System Diagnostic Link Connector (HSDLC). If the converted engine or vehicle includes a dedicated HSDLC to communicate with the hybrid diagnostic system, the HSDLC must be distinguished from the base engine's or vehicle's OBD system Diagnostic Link Connector (DLC) by locating the HSDLC in the vehicle interior to the right of the centerline of the vehicle.
  - (3) Monitoring Conditions. A 2013 or subsequent model year heavy-duty engine conversion certified pursuant to these procedures to an in-use monitoring performance ratio (IUMPR) of 0.100 in accordance with 13 CCR 1971.1(d)(3.2.2) shall not be considered nonconforming if the data collected from the engine in the test sample group indicate that the average in-use monitoring performance ratio for one or more of the monitors in the test sample group is less than 0.100. Similarly, a 2007 or subsequent model year light- or medium-duty vehicle conversion certified to an in-use monitoring performance ratio specified in 13 CCR 1968.2(d)(3.2) shall not be considered nonconforming if the IUMPR derived from data collected from the engine or vehicle is less than the specified level of 13 CCR 1968.2(d)(3.2).

- (4) Modifications to the Base Engine, Base Engine's OBD System, or Base Engine or Vehicle Aftertreatment System. Any modifications that are made as part of the aftermarket conversion to a previously certified HD OBD or OBD II certified engine's or vehicle's OBD system, engine, or aftertreatment system require revalidating the impacted system and the affected monitors' performance. Any modifications made to the base engine's or vehicle's certified OBD system may only be made for the purpose of preventing false malfunction determinations that could otherwise occur as a result of the integration of the hybrid conversion system hardware and software, and such modifications may only be made to the extent necessary to achieve this purpose or to ensure that the certified base engine's or vehicle's OBD system is still capable of detecting when the base engine's or vehicle's monitored systems have a total lack of function. All modifications are subject to Executive Officer approval. The Executive Officer may grant approval upon the manufacturer demonstrating that the modifications do not make the base engine's or vehicle's OBD system more susceptible to false malfunction determinations and do not prevent the certified base engine's or vehicle's OBD system from detecting when the base engine's or vehicle's monitored systems and components have a total lack of function. The revalidation testing must be similar in scope to the verification of monitoring requirements described in 13 CCR 1971.1(l)(2) for heavy-duty engines and 13 CCR 1968.2(j)(2) for light- and medium-duty engines or vehicles. Emission test data are not required. Before conducting validation testing, manufacturers must submit a plan to the Executive Officer for review and approval that details the monitors to be tested, the test vehicle description, the testing methodology, the timeline to collect the data, and the reporting format.
- (5) Production Engine/Vehicle Evaluation Testing Verification of Standardized Requirements. The hybrid conversion system manufacturer must conduct and report testing as described in 13 CCR 1971.1(l)(1) for heavy-duty engines and 13 CCR 1968.2(j)(1) for light- and medium-duty vehicles, except as described in Sections 4(e)(5)(A) and 4(e)(5)(B) of these procedures.
- (A) Test Vehicle Selection Criteria. In lieu of the test vehicle selection criteria specified in 13 CCR 1971.1(l)(1.2.1) through (1.2.3) for heavy-duty engines, the manufacturer must test at least one of each base vehicle and hybrid conversion system combination certified pursuant to Section 4 of these procedures.
- (B) The testing and reporting of the test results must be completed and submitted to the Executive Officer before approval can be granted.

- (f) Meeting the requirements of Section 4 of these procedures may necessitate modification of the original vehicle or engine OBD system. The manufacturer must fully document and describe all modifications affecting OBD compliance, including added, modified, or removed original vehicle hardware (e.g., components, wiring) or software (e.g., programming, calibration), in the hybrid conversion system certification application.

## **5. TIER 2 CERTIFICATION REQUIREMENTS**

- (a) Tier 2 Emission Compliance. In order to receive a Tier 2 Executive Order, a hybrid conversion system must meet the exhaust emission performance criteria of Sections 3(a)(1)(A) and (B) of these procedures and demonstrate no increase in evaporative emissions pursuant to Sections 4(a)(2) and (3) of these procedures.
- (b) A manufacturer may receive Tier 2 Executive Orders collectively authorizing installation and California sale of a total of 500 units, not including the ten units authorized for sale pursuant to Tier 1 Executive Orders, for hybrid conversion systems that achieve less than 35 miles AER and meet the requirements of Sections 3 and 5 of these procedures.
  - (1) As of January 1, 2022, a manufacturer is ineligible to apply for Tier 2 certification of a hybrid conversion system that does not achieve at least 35 miles AER.
  - (2) Tier 2 Executive Orders for hybrid conversion systems that do not achieve at least 35 miles AER expire as of January 1, 2027, and additional units of such systems may not be installed or sold after January 1, 2027.
- (c) A manufacturer may receive Tier 2 Executive Orders collectively authorizing installation and California sale of a total of 1,000 units, not including the 25 units authorized for sale pursuant to Tier 1 Executive Orders, for hybrid conversion systems that achieve at least 35 miles AER and meet the requirements of Sections 3 and 5 of these procedures.
  - (1) As of January 1, 2025, a manufacturer is ineligible to apply for Tier 2 certification of a hybrid conversion system that achieves at least 35 miles AER.
  - (2) Tier 2 Executive Orders for hybrid conversion systems that achieve at least 35 miles AER expire as of January 1, 2030, and additional units of such systems may not be installed or sold after January 1, 2030.

- (d) A hybrid conversion system is not required to have first received a Tier 1 Executive Order to be eligible for a Tier 2 Executive Order, as long as the system meets the Tier 2 certification requirements of these procedures.
- (e) Reporting Requirements. A manufacturer must collect the information required of Tier 2-certified systems pursuant to Section 4(d) of these procedures, and an application for Tier 2 certification of a hybrid conversion system must include the information identified in Section 4(d) of these procedures for each of its Tier 1-certified hybrid conversion systems sold or leased in California as of 90 days prior to the Tier 2 application submittal date.
- (f) Tier 2 On-Board Diagnostics Requirements. For a Tier 2-certified hybrid conversion system, the manufacturer must comply with all the Tier 1 OBD requirements set forth in Section 4(e) of these procedures and the following requirements.
  - (1) Monitoring Conditions. In addition to the monitoring conditions set forth in Section 4(e)(3) of these procedures, the conversion system manufacturer is required to investigate the cause for IUMPR performance that does not meet the required IUMPR specified in 13 CCR 1968.2(d)(3.2) for light- and medium-duty vehicles or engines and 13 CCR 1971.1(d)(3.2.2) for heavy-duty engines, and develop a plan to improve the IUMPR performance to meet the required IUMPRs in time for Tier 3 certification. A report detailing the issue and describing the IUMPR improvement plan must be submitted to the Executive Officer within one year after ARB certification of the hybrid conversion system;
  - (2) OBD System Readiness Status Demonstration. In accordance with Society of Automotive Engineers (SAE) International J1979, "E/E Diagnostic Test Modes," revised August 2014; SAE International J1939, "Serial Control and Communications Heavy Duty Vehicle Network – Top Level Document," revised August 2013; SAE International J1979-DA, "Digital Annex of E/E Diagnostic Test Modes," revised June 2014; and SAE International J1939-73, "Applications Layer – Diagnostics," revised July 2013, which are all hereby incorporated by reference herein, a manufacturer must demonstrate for all heavy-duty engine families that the OBD system readiness status can be set to indicate "complete" with no false detections of malfunctions since the fault memory was last cleared for each of the installed monitored components and systems identified in 13 CCR 1971.1(h)(4.1). Similarly, in accordance with SAE International J1979, a manufacturer must demonstrate for all light- and medium-duty vehicles that the OBD system readiness status can be set to indicate "complete" with no false detections of malfunctions since the fault memory was last cleared for each of the installed monitored components and systems identified in 13 CCR 1968.2(g)(4.1);



- (3) Modifications to the Base Engine's OBD System. The requirement for modifications to the base engine's OBD system set forth in Section 4(e)(4) of these procedures applies, except that hybrid conversion systems being carried over from a previously approved Tier 1 system are exempt from further revalidation testing as long as the diagnostic system and vehicle are unchanged from the Tier 1 approved system and vehicle, and the manufacturer attests in the conversion system's Tier 2 certification application that the diagnostic system and vehicle are unchanged;
- (4) Monitoring System Demonstration Requirements. OBD system demonstration requirements, described in 13 CCR 1971.1(i) for heavy-duty engines and 13 CCR 1968.2(h) for light- and medium-duty engines and vehicles, are applicable except for the following allowances:
- (A) Number and Selection of Test Engines or Vehicles. The selection of test engines or vehicles must be based on the criteria described in sections III.A. through B. of the "Procedures for Exemption of Add-On and Modified Parts," amended June 1, 1990, which is hereby incorporated by reference herein;
- (B) Monitors Required for Testing. To the extent feasible, hybrid conversion system manufacturers must demonstrate a maximum of three major monitors that are subject to the OBD system demonstration testing requirements of 13 CCR 1971.1(i)(3) or 13 CCR 1968.2(h)(3) and (h)(4). The monitors to be tested shall be selected by the Executive Officer after the conversion system manufacturer has completed its allotment of Tier 1 vehicles or by the date in which the Tier 2 certification application is submitted, whichever comes first; and
- (C) Testing Protocol. Prior to conducting the demonstration test, conversion manufacturers must submit a test plan to the Executive Officer for review and approval that specifies the types and number of converted vehicles to be tested; the test procedures, including the pre-conditioning cycles, test cycles and fault implantation method; the implanted malfunction description (e.g., empty catalyst can); the timeline to collect the data; and the reporting format in which the manufacturer will submit a plan for providing emission test data to the Executive Officer for approval. The manufacturer may not begin testing until the Executive Officer approves the test plan. Once the manufacturer receives Executive Officer approval of the test plan, testing may begin for each monitor to be tested with the following steps:

- (i.) Clear OBD Information. The OBD information must be cleared prior to implanting the threshold for each monitor to be demonstrated.
- (ii.) Threshold Part. The threshold part for demonstrating the monitor must be implanted prior to demonstration testing. The threshold part developed for the demonstration must be representative of a part that has deteriorated to a point where it has minimal or no ability to perform its intended function (e.g., a total restriction of the exhaust gas recirculation (EGR) valve when demonstrating EGR flow functionality).
- (iii.) Drive Cycles. The demonstration for heavy-duty vehicles may be conducted either over the road or on a chassis dynamometer. Demonstration on a chassis dynamometer must be performed on either the heavy-duty vehicle urban dynamometer driving schedule (UDDS) (Title 40, Code of Federal Regulations, Part 86, Appendix I, as amended on October 25, 2016, which is hereby incorporated by reference herein) or on the heavy-duty transient test cycle (Title 40, Code of Federal Regulations, Part 1037, Appendix I). Demonstration for medium-duty vehicles on a chassis dynamometer will be performed on the urban dynamometer driving schedule (UDDS) (paragraph (a) of Title 40, Code of Federal Regulations, Part 86, Appendix I). Manufacturers may request Executive Officer approval to utilize a different chassis dynamometer cycle for demonstration testing. In evaluating the manufacturer's request, the Executive Officer shall consider the degree to which a drive cycle reflects the anticipated duty cycle of the converted vehicle. Emission measurements are not required. The route used for on-road testing must be provided in the test report.
- (iv.) Evaluation Protocol. The demonstration testing must continue until the fault code associated with the malfunction is stored and the malfunction indicator light (MIL) illuminates. Multiple drive cycles may be necessary to illuminate the MIL.
- (v.) Test Data Collection. OBD system data for each monitor demonstration must be recorded after each drive cycle and provided to the Executive Officer with a report summarizing the results of the demonstration testing. The report must be submitted by the conversion manufacturer and approved by the Executive Officer to receive Tier 2 approval. For heavy-duty vehicle conversions, data requirements are

described in 13 CCR 1971.1(i)(4.3). For light- and medium-duty vehicle conversions, data requirements are described in 13 CCR 1968.2(h)(5.3).

- (5) Production Engine or Vehicle Evaluation Testing. The production evaluation testing described in 13 CCR 1971.1(l)(1) and (l)(3) and 13 CCR 1968.2(j)(1) and (j)(3) is required to be revalidated for Tier 2 approval. Systems that are being carried over from a previously approved Tier 1 system are exempt from further production engine or vehicle evaluation testing as long as the diagnostic system and vehicle are unchanged from the Tier 1-approved system and vehicle and the manufacturer attests in the conversion system's certification application that the diagnostic system and vehicle are unchanged;
- (A) Verification of Standardized Requirements. The requirement for production engine or vehicle evaluation testing described above in Section 4(e)(5) of these procedures applies.
- (B) Verification and Reporting of In-use Monitoring Performance. For the in-use monitoring performance testing described in 13 CCR 1971.1(l)(3) for heavy-duty engines and 13 CCR 1968.2(j)(3) for light- and medium-duty vehicles, conversion manufacturers must submit a plan to the Executive Officer for review and approval that describes the types and number of conversion vehicles to be tested, the sampling method, the timeline to collect the data, and the reporting format. The hybrid conversion system manufacturer must submit the plan within 30 days after its first 50 California-certified hybrid conversion systems have been installed on an eligible base vehicle or engine. As part of this plan, the manufacturer must submit data to the Executive Officer for at least five of these vehicles. The Executive Officer shall approve the plan upon determining that the plan provides for effective collection of data from a sample of vehicles that, at a minimum, is 5 of the 50 or more converted hybrid vehicles produced for sale in California; the plan will likely result in the collection and submittal of data within the required time frame; the plan will generate data that are representative of California drivers and temperatures; and the plan does not, by design, exclude or include specific vehicles in an attempt to collect data only from vehicles with the highest in-use performance ratios. Conversion manufacturers must collect and report the data to the Executive Officer within 12 months after the 50th conversion system has been installed per test group or engine family. Failure to collect and submit the required data and/or failure to comply with the in-use performance ratios defined in 13 CCR 1971.1(d)(3.2) and 13 CCR 1968.2(d)(3.2) may result in withdrawal of the exemption and vehicle recall.

- (g) Tier 3 OBD System Compliance Plan. A manufacturer must submit a plan to meet the requirements of Section 6(e) of these procedures to the Executive Officer for approval as part of its Tier 2 certification application. The plan must include supporting data and engineering evaluations that describe the OBD system's current state of compliance relative to Section 6(e) requirements, and the necessary improvements that are required for full Tier 3 compliance. The Executive Officer shall approve the plan if it is determined the manufacturer has demonstrated a good-faith effort to meet Tier 3 OBD requirements in full by evaluating and planning for implementation of the required diagnostic monitoring technology.

## **6. TIER 3: FINAL CERTIFICATION REQUIREMENTS**

- (a) Tier 3 Emission Compliance. In order to receive a Tier 3 Executive Order, a hybrid conversion system must meet the exhaust emission performance criteria of Sections 3(a)(1)(A) and (B) of these procedures, and demonstrate no increase in evaporative emissions pursuant to Sections 4(a)(2) and (3) of these procedures.
- (b) A manufacturer shall receive a Tier 3 Executive Order authorizing installation and California sale of its hybrid conversion system upon successful demonstration to the Executive Officer that the system meets the requirements of Sections 3 and 6 of these procedures.
- (c) A hybrid conversion system is not required to have received Tier 1 or Tier 2 Executive Orders prior to being eligible for a Tier 3 Executive Order, as long as it meets the Tier 3 certification requirements of these procedures.
- (d) Data Reporting. An application for a Tier 3 certification of a hybrid conversion system that has previously received Tier 1 or Tier 2 certification pursuant to Sections 4 or 5 of these procedures must include the information identified in Section 4(d) for the conversion manufacturer's Tier 1- or Tier 2-certified systems sold or leased in California. Such information must be current as of 90 days prior to the Tier 3 application submittal date.
- (e) Tier 3 On-Board Diagnostics Requirements. All Tier 2 OBD requirements described above in Section 5(f) of these procedures must be met. Additionally, the following requirements must also be met:
  - (1) Monitoring Requirements. Added electronic hybrid components/systems that either provide input (directly or indirectly) to or receive commands from the on-board hybrid system computer(s) and meet the definition of a comprehensive component according to 13 CCR 1971.1 for heavy-duty engines, or 13 CCR 1968.2 for medium-duty vehicles or engines, must comply with the monitoring requirements of 13 CCR 1971.1(g)(3) or 13

CCR 1968.2(e)(15) or (f)(15), depending on the vehicle or engine being converted;

- (2) Monitoring Conditions. The monitoring conditions described in 13 CCR 1971.1(d)(3.2.2) for heavy-duty vehicles and 13 CCR 1968.2(d)(3.2) for light- and medium-duty vehicles are applicable;
- (3) Hybrid System Diagnostic Link Connector (HSDLC). If the vehicle includes a dedicated HSDLC to communicate with the hybrid diagnostic system, the HSDLC must be distinguished from the base vehicle's OBD system DLC by locating the HSDLC in the vehicle interior to the right of the centerline of the vehicle;
- (4) OBD System Modifications. The requirement for modifications to the base engine's OBD system described above in Section 5(f)(3) of these procedures applies with the following exceptions: affected monitors that are subject to the OBD system demonstration testing requirements of 13 CCR 1971.1(i)(3) or 13 CCR 1968.2(h)(3) and (h)(4) have to be revalidated according to the aforementioned sections, as applicable, except that in lieu of a full useful life test vehicle, the test vehicle may be a low-mileage vehicle that is fitted with bench-aged or road-aged parts; and
- (5) Monitoring System Demonstration Requirements. Except as described in Sections 6(e)(5)(A) through (D) of these procedures, below, the OBD system demonstration requirements that are described in Section 5(f)(4) of these procedures are applicable to Tier 3 vehicles.
  - (A) Monitors Required for Testing.
    - (i.) Chassis-Dynamometer Certified Vehicles. For converted engines, or vehicles with engines that were originally certified to chassis-dynamometer emission standards, hybrid conversion system manufacturers must demonstrate a maximum of five major monitors that are subject to the OBD system demonstration testing requirements of 13 CCR 1968.2(h)(3) for gasoline/spark-ignited vehicles, and of 13 CCR 1968.2(h)(4) for diesel/compression-ignition vehicles, as applicable.
    - (ii.) Engine-Dynamometer Certified Vehicles. For converted engines or vehicles with engines that were originally certified to engine-dynamometer emission standards, hybrid conversion system manufacturers must demonstrate all monitors described in the OBD system demonstration testing requirements of 13 CCR 1971.1(i)(3) or 13 CCR 1968.2(h)(3) and (h)(4), as applicable. The monitors to be tested are subject to the OBD system

demonstration testing requirements of 13 CCR 1971.1(i)(2) or 13 CCR 1968.2(h)(2), except that, in lieu of a full useful life test vehicle, the test vehicle may be a low-mileage vehicle that is fitted with bench-aged or road-aged parts of key emission control components to represent a full useful life vehicle. The aged components should, at a minimum, include aftertreatment components and sensors, fuel injectors, and fuel pumps. The aging plan for the test vehicle must be submitted to the Executive Officer for review and approval as a portion of the demonstration test plan described in Section 6(e)(5)(C) of these procedures, below. The Executive Officer shall approve the aging plan if it is determined through engineering judgement that the test vehicle reasonably represents a full useful life vehicle.

(B) Monitor Selection.

- (i.) Chassis-Dynamometer Certified Vehicles. For converted vehicles that were originally certified to chassis-dynamometer emission standards, the maximum of five monitors to be tested shall be selected by the Executive Officer after the conversion system manufacturer has completed its allotment of Tier 2 vehicles, or after the manufacturer has informed the Executive Officer of its intent to request Tier 3 approval of its conversion system, whichever is earlier.
- (ii.) Engine-Dynamometer Certified Vehicles. For converted engines or vehicles with engines that were originally certified to engine-dynamometer emission standards, all monitors described in 13 CCR 1971.1(i)(3) or 13 CCR 1968.2(h)(3) and (h)(4) that are included in the original equipment manufacturer's OBD system are required to be demonstrated.

(C) Demonstration Test Plan. Prior to conducting the demonstration tests, conversion manufacturers must submit a test plan to the Executive Officer for review and approval that describes the types and number of conversion vehicles to be tested; vehicle aging methods; the test procedures, including the pre-conditioning cycles, test cycles, and fault implantation method; the threshold part development; the timeline to collect the data; and the reporting format in which the manufacturer shall submit a plan for providing emission test data to the Executive Officer for approval. The manufacturer must not begin testing until after the Executive Officer approves the demonstration test plan.

- (D) Durability Data Vehicle Test Procedures. Once the test plan is approved under Section 6(e)(5)(C), testing must proceed according to the following requirements:
  - (i.) Chassis-Dynamometer Certified Vehicles. For converted vehicles that were originally certified to chassis-dynamometer emission standards, demonstration testing must follow the testing procedures described in 13 CCR 1968.2(h)(5) for light- and medium-duty vehicles.
  - (ii.) Engine-Dynamometer Certified Vehicles. For converted engines or vehicles with engines that were originally certified to engine dynamometer emission standards, demonstration testing must follow the testing procedures described above in Section 5(f)(4)(C) of these procedures.
- (6) Production Engine or Vehicle Evaluation Testing. Except as provided in Sections 6(e)(6)(A) and (B) of these procedures below, production evaluation testing, described in 13 CCR 1971.1(l)(1) through (3) and 13 CCR 1968.2(j)(1) through (3), needs to be revalidated, and the data collected and reported to the Executive Officer before Tier 3 approval is granted.
  - (A) When performing production evaluation testing pursuant to 13 CCR 1971.1(l)(2) and 13 CCR 1968.2(j)(2), testing only has to be conducted on the monitors for the hybrid conversion system components described in Section 6(e)(1) of these procedures.
  - (B) Conversion systems that are being carried over from a previously approved Tier 1 or Tier 2 system are exempt from further production engine or vehicle evaluation testing as long as the diagnostic system and vehicle are unchanged from the Tier 1 or Tier 2 approved system and vehicle, and the manufacturer attests in its hybrid conversion system application that the diagnostic system and vehicle are unchanged.

## **7. HYBRID TECHNOLOGY EMISSION TEST PROCEDURES**

- (a) General Requirements.
  - (1) A hybrid conversion of an ARB-certified vehicle between 6,001 and 14,000 pounds GVWR, or an ARB-certified engine installed in a vehicle between 6,001 and 14,000 pounds GVWR, must demonstrate compliance with the exhaust emission requirements of Sections 3(a)(1)(A) and (B) of these procedures pursuant to Section 7(d) of these procedures.

- (2) A hybrid conversion of an ARB-certified engine installed in a vehicle over 14,000 pounds GVWR must demonstrate compliance with the exhaust emission requirements of Sections 3(a)(1)(A) and (B) of these procedures pursuant to either Section 7(c) or Section 7(d) of these procedures.
- (3) In lieu of exhaust emission testing of PM pursuant to Section 7(c) or (d) of these procedures, a manufacturer must provide an engineering evaluation demonstrating that hybridization of the base engine or vehicle will not increase PM emissions. The Executive Officer shall evaluate this demonstration based upon data and other information provided by the manufacturer, including engine certification data, and his or her engineering evaluation of whether hybridization of the applicable base engine or vehicle is likely to increase PM emissions from the base engine's or vehicle's pre-converted configuration.
- (4) A manufacturer wishing to repeat an emissions test as a result of failing to meet these procedures' emission criteria must first submit a new Hybrid Technology Emission Test Plan for Executive Officer approval. Such a plan must provide for retesting of all required pollutants, and must include a detailed description of what changes are proposed in subsequent emission testing to address the hybrid vehicle's failure to meet these procedures' emission criteria.

(b) Hybrid Technology Emission Test Plan.

The manufacturer must submit a proposed Hybrid Technology Emission Test Plan at least sixty days prior to the proposed commencement of emission testing, and may not commence emission testing until the proposed plan has been approved in writing by the Executive Officer. The Hybrid Technology Emission Test Plan and emission testing conducted pursuant to such plan must comply with all applicable requirements of these procedures. The plan must include provisions for collecting data that can be used to accurately assess the in-use impact of converting the applicable base engine or vehicle. The Executive Officer will determine if the Hybrid Technology Emission Test Plan, based upon his or her engineering judgement, complies with requirements of these procedures and enables collection of accurate data that are likely to reflect the in-use emission impact of converting the applicable base engine or vehicle with the proposed hybrid system. An applicant must adhere to the Executive Officer-approved Hybrid Technology Emission Test Plan when conducting emission testing pursuant to these procedures.

The Hybrid Technology Emission Test Plan must be provided in a format approved by the Executive Officer. At a minimum, the Hybrid Technology Emission Test Plan must include the following elements:



- (1) Contact Information. Identification of the contact person, phone number, physical address, and e-mail address of the responsible party submitting the application, and whether they are business or personal;
- (2) Proposed Logistical Information. Proposed test date(s), location(s) or test facilities, and entity conducting the testing. Only emission testing conducted on approved dates and as otherwise described in this section will be considered valid for the purposes of these procedures. ARB reserves the right to have its employee(s) or representative(s) present during emission testing;
  - (A) Should emission testing on a date identified in the Executive Officer-approved Hybrid Technology Emission Test Plan be infeasible due to unforeseen vehicle or equipment malfunction or ambient conditions that do not meet the minimum criteria of these procedures, the manufacturer may conduct emission testing on an alternate day or days that are within five days of the original Executive Officer-approved test dates if the manufacturer notifies ARB in writing no later than 24 hours after the manufacturer cancels testing on the original test date. Executive Officer approval of emission test data collected on such alternate date(s) shall be contingent upon his or her determination as to whether the manufacturer notified ARB and completed emission testing within the required time, and the manufacturer's demonstration that testing on the original approved dates was infeasible for one or more of the aforementioned reasons. An applicant may also extend emission testing for up to two days immediately following approved test dates (i.e., conduct additional testing) as needed to collect additional valid test data pursuant to these procedures.
- (3) Proposed Base Vehicle Engine Information. Make, model and model year; anticipated mileage at test start; fuel used; displacement (L); aspiration; maximum power (kW) and torque (Nm); emission aftertreatment technology; California NO<sub>x</sub>, HC, CO, and PM certification levels; and family emission limit (FEL), if applicable;
- (4) Proposed Base Vehicle Information. Curb weight, gross vehicle weight rating and test weight; anticipated mileage at test start; drivetrain description; and California NO<sub>x</sub>, HC, CO, and PM certification levels, if applicable;
- (5) Proposed Hybrid Energy Storage System Information. Battery description, including type of battery chemistry, usable energy capacity, battery pack voltage, number of battery modules, and an estimate of battery pack cycle life. The manufacturer must include descriptions of the battery management system and battery pack thermal management strategy (i.e.,

active or passive cooling), and provide the weight of each battery module, the weight of the battery pack (including removable pack structures), and any energy storage device used in addition to, or in lieu of, batteries, such as ultra-capacitors, flywheels, hydraulic assist devices, or other energy storage technologies;

- (6) Proposed Conversion Description (if applicable). A description of the conversion system, including parts removed from the base vehicle, engine control system modifications, all major parts installed, calibration identification(s), and an electronic copy of calibration file(s);
- (7) Additional Requirements. Applicants proposing to conduct emission testing pursuant to Section 7(c) of these procedures must also include the following in their proposed Hybrid Technology Emission Test Plan:
  - (A) Proposed Engine Information. Make, model and model year; anticipated mileage at test start; fuel used; displacement (L); aspiration; maximum power (kW) and torque (Nm); emission aftertreatment technology; California NO<sub>x</sub>, HC, CO, and PM certification level; and family emission limit (FEL), if applicable;
  - (B) Proposed Hybrid Vehicle Information. Base vehicle curb weight, gross vehicle weight rating and test weight; anticipated mileage at test start; drivetrain description(s); and California NO<sub>x</sub>, HC, CO, and PM certification levels, if applicable;
  - (C) Proposed Equipment. Description of the proposed emission test equipment and applicable equipment measurement techniques and calibrations to be used for measuring required engine and vehicle operating parameters, exhaust emissions, and location, elevation, and weather conditions;
  - (D) Proposed Test Route. Proposed test route descriptions, including route distances (in miles) and times (in seconds); average anticipated vehicle speeds (mph); percent at zero-speed (i.e., time during which the vehicle idles or is otherwise at rest); anticipated average PKE (feet per second squared); minimum elevation (feet above sea level); maximum elevation (feet above sea level); and maps of proposed test routes;

- (E) Proposed Cold-Start Strategy. Proposed strategy for evaluating cold-start emissions from the base and hybrid vehicles, pursuant to Sections 7(c) of these procedures;
- (F) Proposed Operation of Mechanical and Electrical Accessories. Description of the base and hybrid vehicles' mechanical and electrical accessories and their proposed usage during emission testing; and
- (G) Proposed Metrics for Defining a Valid Test Run. Proposed maximum allowable variability for the following test run metrics to ensure that all base and hybrid vehicles will be driven over the required test routes as similarly as possible:
  - (i.) For the transient test route, the proposed coefficient of variation (CV) of average driving speed for each of the eight or more total base and hybrid vehicle test runs, and proposed CV for average PKE for the same base and hybrid vehicle test runs;
  - (ii.) For the high-speed route, proposed CV for average driving speed and proposed proximity to 55 mph at which the vehicle spends at least 80 percent of its time; and
  - (iii.) For both routes, proposed criteria for excluding a test run if its time operating at zero-speed differs significantly from that of other vehicles tested over the same route. A vehicle with an engine automatic stop-start system must be emission tested with such system disabled.

(c) Portable Emission Measurement System (PEMS) Testing.

PEMS emission testing conducted to demonstrate compliance with Sections 3(a)(1)(A) and (B) of these procedures must conform to the requirements of Section 7(c) of these procedures. Unless otherwise indicated in this section, emission test set-up and steps to execute the test process must be performed in accordance with the on-road testing element of SAE International J1526, "Fuel Consumption Test Procedure – Engineering Method" (SAE J1526), revised September 2015, which is hereby incorporated by reference herein. PEMS equipment specifications, measurement principles, verification requirements, and emission measurement, calibration, and verification methodologies are set forth in Title 40, Code of Federal Regulations, Part 1065, Subpart J, as amended on April 28, 2014, which is hereby incorporated by reference herein.

(1) Vehicle Selection and Preparation.

The hybrid vehicle used for emission testing is to be the base engine or vehicle converted with the proposed hybrid system, as identified in the manufacturer's conversion system application, while the vehicle with which its emissions are to be compared must reflect the "pre-converted" base engine or vehicle configuration. For post-transmission hybrids, the manufacturer may propose, as part of its Hybrid Technology Emission Test Plan, to utilize the converted hybrid vehicle with the hybrid system disabled as the base vehicle if it can demonstrate that the engine and vehicle with the hybrid system disabled will operate with the same emission characteristics as the pre-converted vehicle.

- (A) Mileage. Minimum mileage of baseline and hybrid vehicles for testing must be as follows at the time of emission testing:
- (i.) To ensure emission stability, the baseline vehicle and the hybrid vehicle (after installation of the hybrid conversion system) must have accumulated a minimum of 4,000 miles. Vehicles with ePTO may alternately accumulate a minimum of 250 hours of operation prior to testing, if verified by a non-resettable, vehicle-integrated hour meter.
  - (ii.) If the odometer of one vehicle is less than or equal to 5,000 miles, the mileage on all baseline and hybrid vehicles must be within 1,000 miles of each other.
  - (iii.) If the odometer on all vehicles is greater than 5,000 miles but less than or equal to 10,000 miles on one vehicle, the mileage on all vehicles must be within 3,000 miles of each other.
  - (iv.) If the odometer on all vehicles is greater than 10,000 miles but less than or equal to 30,000 miles on one vehicle, the mileage on all vehicles must be within 10,000 miles of each other.
  - (v.) If the odometer is greater than 30,000 miles on all vehicles, the mileage on all vehicles must be within 50,000 miles of each other.
  - (vi.) Neither vehicle may have mileage that exceeds its regulatory useful life.
- (B) Vehicle Test Weight. Heavy-duty vehicles are to be tested at the prescribed weight specified in Section D.1.4.2. of the "California Interim Certification Procedures for 2004 and Subsequent Model Hybrid-Electric and Other Hybrid Vehicles, in the Urban Bus and

Heavy-Duty Vehicle Classes,” as amended on October 21, 2014, which is hereby incorporated by reference herein.

- (C) Vehicle Pre-Conditioning. Vehicle pre-conditioning must be conducted to minimize the possibility of an infrequent diesel particulate filter (DPF) regeneration event during the emission test runs. The pre-conditioning may consist of an active forced DPF regeneration or a passive regeneration method consistent with the engine or aftertreatment manufacturer recommendations. If a DPF regeneration occurs during a test run, the run will be invalid and must be removed from the test data set. If the user lacks the capability to monitor appropriate regeneration messages over the controller area network (CAN) data bus, the exhaust temperature across the DPF should be measured to determine occurrence of an active DPF regeneration, as indicated by a sustained temperature increase across the DPF. Emission results are to be adjusted to account for regeneration events, pursuant to Title 40, Code of Federal Regulations, Part 86, Section 86.004-28(i)(1), as amended on April 28, 2014, which is hereby incorporated by reference herein.

(2) Test Route Selection.

- (A) The hybrid and base vehicles must be emission tested over at least four valid test runs for each of the following two test routes:
  - (i.) A transient test route, with an average driving speed of between 15 and 30 mph and an average positive kinetic energy (PKE) of between 0.85 and 1.50 feet per second squared. This route must be representative of the transient, slower speed operation anticipated for the hybrid vehicle class and vocation, and should avoid freeway driving; and
  - (ii.) A high-speed test route, with the vehicle operating at least 80 percent of the time on the freeway at between 53 and 57 mph. If it is infeasible for the proposed hybrid or base vehicle to meet this criterion, the manufacturer may propose, as part of its Hybrid Technology Emission Test Plan, an alternate proximity around 55 mph that it commits to operate for at least 80 percent of the time during the high-speed test route. The Executive Officer will evaluate an alternate proposed proximity to 55 mph based upon his or her engineering evaluation of data or other information provided by the manufacturer regarding whether the hybrid or base vehicle gearing configuration or other operational limitations

make it infeasible for the hybrid or base vehicle to consistently operate on the freeway within 2 mph of 55 mph.

- (B) For both routes, the manufacturer must also identify approximately what percent of time the vehicles are anticipated to operate at zero-speed (i.e., the vehicle idles or is otherwise at rest).
- (C) All test runs should be at least 20 minutes in duration, with an average grade of less than 5 percent. In identifying a proposed test route, a manufacturer should be cognizant that, everything else being equal, a longer test run is likely to provide reduced variance in average driving speed and average PKE.
- (D) The proposed high-speed test route and proposed transient test route must each begin and end at the same location (i.e., must be a closed circuit or loop), with the exception of cold-start tests, as described in Section 7(c)(3)(C) of these procedures. Multiple “laps” may represent a single test route. For example, a manufacturer may propose its 20 minute transient test route be represented by two ten minute laps over the same circuit. If the proposed test route includes multiple laps, each lap should have a length of at least 5 miles.
- (E) A vehicle incapable of 55 mph operation due to a speed limiter may utilize the vehicle’s maximum operational speed instead of 55 mph for the high-speed route if the vehicle’s maximum operational speed, as defined by the original engine or vehicle manufacturer, is verified by the Executive Officer and approved as part of the proposed Hybrid Technology Emission Test Plan.
- (F) The surface of all roads must be concrete or asphalt, and may not exceed 5,500 feet above sea level at any point. To maximize repeatability, the manufacturer should propose a test route with minimal anticipated traffic and, where possible, use of cloverleaves at turnaround points to allow for consistent operation of the base and hybrid vehicles during turns.
- (G) The manufacturer must respect all local, state, and federal traffic- and safety-related requirements during vehicle testing.
- (H) Nothing in these procedures is to be construed as prohibiting a manufacturer from conducting PEMS testing on a test track rather than on an over-the-road test route. In lieu of the drive cycle selection criteria identified in Sections 7(c)(2)(A)(i.) and (ii.) of these procedures, above, PEMS testing conducted on a test track must

utilize a speed trace to conform to the duty cycles identified in Section 7(d)(2) of these procedures.

(3) Emission Testing.

Unless otherwise indicated in this section, PEMS equipment specifications, measurement principles, verification requirements, and emissions measurement, calibration, and verification methodologies are defined in Title 40, Code of Federal Regulations, Part 1065, Subpart J.

- (A) Overview. For each test run over the high-speed test route and each test run over the transient test route, emissions must be recorded simultaneously on the hybrid and base vehicle, with one vehicle no more than one minute behind the other. For the high-speed route, the vehicles must be spaced at least 1,500 feet apart during freeway operation. The four test runs conducted over the high-speed test route and the four test runs conducted over the transient test route must each include at least one “cold-start” test. Manufacturers should dedicate at least two days to PEMS testing: one day to conduct at least four runs over the transient test route, with the first run of the day to be a cold-start test, and a second day to conduct at least four runs over the high-speed route, with the first run of the day to be a cold-start test.
- (B) Charge-Depleting Hybrid-Electric Vehicles. A charge-depleting hybrid-electric vehicle is to be emission tested in charge-sustaining mode, from the point at which the engine first turns on at the end of the vehicle’s AER. A charge-depleting hybrid-electric vehicle for which the ratio of the miles driven in charge-sustaining mode relative to the miles driven in charge-depleting mode is at least 0.98 must meet the emission test requirements of a charge-sustaining hybrid for the purposes of these procedures.
- (C) Cold-Start Tests. Cold-start tests must include all emissions data from the moment the hybrid and base vehicles are started, including the actual start event. The hybrid and base vehicles must be cold soaked for a minimum of 12 hours at temperatures between 32 and 86 degrees Fahrenheit prior to each cold-start test. The vehicles must remain in the “key off” position for at least one minute, after which the test cycle begins. All test cycles must have a minimum of one minute of idling with continued emission sampling at the end of the cycle before the test cycle terminates, such that the analyzers are not missing emissions that are still in the sampling train. The test route used for each cold-start test run must be the same as that used for the hot-start test runs, with the

exception that the cold-start test may begin at a different location on the test route, if it is infeasible to park the vehicle at the beginning of the test route for the required 12 hour cold soak period.

- (i.) Charge-Depleting Hybrids with AER. A cold-start test for a charge-depleting hybrid with AER is to be conducted after the vehicle has transitioned from charge-depleting into charge-sustaining mode, and then been cold soaked for the minimum 12 hour period (without charging the vehicle during the cold soak). Testing must measure and include emission data from the point at which the engine first turns on, including the actual engine start event.
- (D) Hot-Start Tests. The hybrid and base vehicles must be warmed to operating temperature. Once the vehicles are at operating temperature, they must be turned off and remain in the "key off" position for approximately 20 to 30 minutes. The vehicles are to be restarted and idled for one minute, after which the test cycle is to begin and emission measurements are to be taken. At the end of the test cycle, the hybrid and base vehicles are to be returned to the "key off" condition.
- (E) Net Energy Change. Net energy change calculations and variance determinations, and state-of-charge correction procedures must be performed in accordance with SAE International J2711, "Recommended Practice for Measuring Fuel Economy and Emissions of Hybrid-Electric and Conventional Heavy-Duty Vehicles" (SAE J2711), published September 2002, which is hereby incorporated by reference herein.
- (F) Valid Test Run. All vehicles must be driven as similarly as possible over each of the four or more pairs of transient route test runs, and over each of the four or more pairs of high-speed route test runs, respectively. The applicant should use the criteria identified in Sections 7(c)(3)(F)(i.) and (ii.), below, for identifying valid test runs pursuant to these procedures.
  - (i.) The coefficient of variation (CV) of average driving speed and the CV of average PKE for all transient route test runs should not exceed 10 percent; and
  - (ii.) The CV of average driving speed for all high-speed test runs should not exceed 10 percent.



A manufacturer may propose an alternate allowable CV in average driving speed or average PKE as part of its Hybrid Technology Emission Test Plan. The Executive Officer will evaluate proposed alternate allowable CVs in average driving speed or average PKE based upon his or her engineering judgement and data provided by the manufacturer, and make his or her determination as to whether the proposed alternate criteria provide an adequate basis for ensuring the proposed base and hybrid vehicles are being driven as similarly as possible over the proposed test routes, and whether proposed alternate criteria are likely to have an impact on validity of emission test results.

- (G) An emissions run and its data shall be deemed invalid and excluded as follows:
  - (i.) If the CV of average driving speed or CV of average PKE does not meet the criteria identified in Section 7(c)(3)(F)(i.) or (ii.), above, or as otherwise defined in the Executive Officer-approved Hybrid Technology Emission Test Plan, the manufacturer must exclude the test run that is furthest from the mean for the noncompliant statistical set (i.e., average driving speed or average PKE).
  - (ii.) A transient test run for any vehicle is to be excluded if its average driving speed or average PKE is not between 15 and 30 mph or 0.85 and 1.50 feet per second squared, respectively.
  - (iii.) Any test run that does not meet the criteria, as identified in the Executive Officer-approved Hybrid Technology Emission Test Plan, for consistency among runs in percent operation at zero-speed, or for proximity to 55 mph at which each vehicle spends at least 80 percent of its time (during the high-speed route), shall be excluded.
- (H) For each excluded test run, the test run for the corresponding base or hybrid vehicle (i.e., the vehicle with which it was paired during emission testing) must also be excluded, and the test run must be repeated by both vehicles. This process is to be repeated until the average driving speed and average PKE meet the requirements of this section.
- (I) The manufacturer may propose, as part of its Hybrid Technology Emission Test Plan, a statistical method for identifying and excluding measured emission data outliers. The Executive Officer

will evaluate any proposed method for approval based upon the method's adherence to established scientific and statistical principles, his or her determination that the statistical method is to be consistently applied to both high and low emission results, and his or her engineering judgement regarding whether application of the proposed principle is likely to only exclude atypical emission results.

(4) Data Collection and Quality Control.

The data identified in this section must be collected from SAE J1939 broadcast data, analog instrumentation, field records, or manufacturer information/specification sheets for all baseline and hybrid vehicles participating in PEMS testing. If proprietary equipment or information is needed to collect these signals, the applicant must make this equipment or information available to the Executive Officer within ten days upon request if needed for the purposes of confirmatory testing.

The actual signal value must always be used instead of a default or limp home value. For purposes of the calculated load, torque, fuel rate, and exhaust flow parameters, manufacturers must report the most accurate values that are calculated within the applicable electronic control unit (e.g., the engine control module). "Most accurate values," in this context, must be values of sufficient accuracy, resolution, and filtering to be used for the purposes of in-use emission testing with the engine still in a vehicle (e.g., using PEMS). The following data must be collected for both the base and hybrid vehicles during each test run, and be reported to the Executive Officer on a second-by-second interval in a format to be determined by the Executive Officer. A minimum frequency rate of one hertz is required for all position and emissions data collection.

- (A) The following data are to be collected from the engine control module (ECM), or from the sensor if ECM data are not available:
- (i.) Reference Torque;
  - (ii.) Nominal Friction Percent Torque;
  - (iii.) Actual Engine Percent Torque;
  - (iv.) Engine Speed;
  - (v.) Rechargeable Energy Storage System State-of-Charge (if applicable);
  - (vi.) Coolant Temperature;

- (vii.) Engine Fuel Rate;
  - (viii.) Intake Air Flow Rate (may be measured by flow sensor);
  - (ix.) Exhaust Temperature; and
  - (x.) Fault Status;
- (B) The following data are to be collected by a global positioning system (GPS):
- (i.) Vehicle Position (Latitude, Longitude);
  - (ii.) Elevation; and
  - (iii.) Vehicle Speed (Latitude, Longitude, and Elevation as a function of time are to be measured by a GPS, which may also be used to correct or calibrate ECM wheel-based speed);
- (C) Additional required data and measurement techniques are identified below:
- (i.) Exhaust Mass Flow – Exhaust flow sensor (Pitot), other flow meter, or electronic control unit (ECU) broadcast data;
  - (ii.) Exhaust Temperature at Aftertreatment System Inlet and Tailpipe – Temperature sensor;
  - (iii.) Ambient Humidity – Humidity sensor;
  - (iv.) Ambient Temperature – Temperature sensor; and
  - (v.) Ambient Pressure – Pressure sensor;
- (D) The following data and information are to be calculated and reported to ARB for each test run:
- (i.) Cycle time (seconds);
  - (ii.) Maximum vehicle speed (mph);
  - (iii.) Average vehicle speed (mph);
  - (iv.) Time (seconds) and percent of time at the following speeds (in mph): zero-speed; 0+ to 5; 5+ to 10, 10+ to 15; 15+ to 20; 20+ to 25; 25+ to 30; 30+ to 35; 35+ to 40; 40+ to 45; 45+ to 50; 50+ to 55; 55+ to 60; 60+ to 65; 65+;

- (v.) Number of stops;
- (vi.) Average PKE (feet per second<sup>2</sup>);
- (vii.) Fuel economy (miles per gallon);
- (viii.) Plot of second-by-second speed versus time trace for both the hybrid and base vehicle;
- (ix.) Rechargeable Energy Storage System Net Energy Change (if applicable); and
- (x.) Additional data collected pursuant to Section 7(c)(4)(A), (B), or (C), if so requested by the Executive Officer.

(E) Nitric oxide, nitrogen dioxide, total hydrocarbon, CO, and CO<sub>2</sub> emissions are to be measured by the PEMS unit. Fuel consumption of the hybrid and base vehicles is to be calculated based on mass balance of carbon-bearing emission gases, as described in Title 40, Code of Federal Regulations, Part 86, Section 86.144-94, as amended on September 15, 2011, which is hereby incorporated by reference herein, and SAE International J1094, "Constant Volume Sampler System for Exhaust Emissions Measurement," revised September 2011, which is hereby incorporated by reference herein.

(F) The manufacturer must disclose to the Executive Officer data for all emission testing conducted during the official test days identified in the Executive Officer-approved Hybrid Technology Emission Test Plan and all testing conducted on alternate dates conducted pursuant to Section 7(b)(2)(A). This must include all data identified in Section 7(c)(4) from incomplete or partial test runs, tests deemed invalid, and any other test run excluded from emission calculations, and the reason(s) for their exclusion.

(5) Emission Calculations.

Average mass-based (grams per mile) emission values are first calculated, as adjusted for net energy change (calculated pursuant to Section 7(c)(3)(E)), for each of the following:

- (A) Hybrid vehicle as driven over the high-speed route ( $A_{\text{HybridHS}}$ )
- (B) Base vehicle as driven over the high-speed route ( $A_{\text{BaseHS}}$ )
- (C) Hybrid vehicle as driven over the transient route ( $A_{\text{HybridTransient}}$ )
- (D) Base vehicle as driven over the transient route ( $A_{\text{BaseTransient}}$ )

Emissions for each of the above ((A), (B), (C), and (D)) are to be calculated as:

$$A = ((1/7)(M_{cs}/D_{cs}) + (6/7)(M_{hs}/D_{hs}))$$

Where:

A = grams per mile emissions

$M_{cs}$  = mass (in grams) of cold-start test emissions for all valid cold-start tests

$D_{cs}$  = distance (in miles) the vehicle drives during all valid cold-start tests

$M_{hs}$  = mass (in grams) of hot-start test emissions for all valid hot-start tests

$D_{hs}$  = distance (in miles) the vehicle drives during all valid hot-start tests

Average weighted emissions for each are then calculated as:

Average weighted hybrid emissions (A<sub>Hybrid</sub>) =

$$(A_{HybridHS} * 0.08) + (A_{HybridTransient} * 0.92)$$

Average weighted base vehicle emissions =

$$(A_{Base}) = (A_{BaseHS} * 0.08) + (A_{BaseTransient} * 0.92)$$

Greenhouse gas exhaust emissions for the purposes of compliance are to be calculated based upon emissions directly measured by the PEMS unit.

- (6) Criteria Pollutant Pass-Fail Determination. For NO<sub>x</sub>, CO and HC emissions, if  $A_{Hybrid} < (A_{Base} * 1.10)$ , where 1.10 reflects a 10 percent test allowance, then the hybrid vehicle is found to not increase emissions of that pollutant. If  $A_{Hybrid} \leq (A_{Base} * 1.10)$  for NO<sub>x</sub>, CO, or HC, then the hybrid vehicle has passed these procedures' emission criteria for the applicable pollutant. If  $A_{Hybrid} > (A_{Base} * 1.10)$  for NO<sub>x</sub>, CO, or HC, then the hybrid vehicle has failed these procedures' emission criteria for the applicable pollutant.
- (7) CO<sub>2</sub> Emission Pass-Fail Determination. The hybrid vehicle CO<sub>2</sub> emission reduction is calculated as  $((A_{Base} - A_{Hybrid})/A_{Base})$ . If the hybrid vehicle CO<sub>2</sub> emission reduction  $\geq 0.10$ , then the vehicle has passed these procedures' CO<sub>2</sub> emission reduction criteria. If the hybrid vehicle CO<sub>2</sub> emission reduction  $< 0.10$ , then the vehicle has failed these procedures' CO<sub>2</sub> emission reduction criteria. CO<sub>2</sub> emissions for a hybrid vehicle with AER may be adjusted for the purposes of this section pursuant to Section 7(d)(6) of these procedures.

(d) Chassis-Dynamometer Emission Testing.

Chassis-dynamometer emission testing conducted to demonstrate compliance with Sections 3(a)(1)(A) and (B) of these procedures must conform to requirements of Section 7(d) of these procedures.

- (1) Light- and Medium-Duty Vehicles. Hybrid conversion systems installed on a chassis-certified light- or medium-duty vehicle must demonstrate emission compliance pursuant to Sections 7(d)(1)(A) through (D) of these procedures.
  - (A) Criteria Pollutant Emission Testing. A converted hybrid light- or medium-duty vehicle must be emission tested for criteria pollutants pursuant to "California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," as amended on September 3, 2015, which is hereby incorporated by reference herein.
  - (B) Criteria Pollutant Pass-Fail Determination. The hybrid conversion system has passed the emission criteria of Section 3(a)(1)(B) of these procedures if the NO<sub>x</sub>, CO, HC and PM emission rates identified pursuant to Section 7(d)(1)(A) for the converted vehicle do not exceed the applicable criteria pollutant emission standards to which the pre-converted vehicle was certified. The hybrid conversion system has failed the emission criteria of Section 3(a)(1)(B) of these procedures if the NO<sub>x</sub>, CO, HC or PM emission rates identified pursuant to Section 7(d)(1)(A) for the converted vehicle do exceed the applicable criteria pollutant emission standards to which the pre-converted vehicle was certified.
  - (C) CO<sub>2</sub> Emission Testing. A manufacturer must measure CO<sub>2</sub> emissions from both the base vehicle and its hybrid configuration, with emissions collected over the Urban Dynamometer Driving Schedule (UDDS), pursuant to SAE International J1711, "Recommended Practice for Measuring the Exhaust Emissions and Fuel Economy of Hybrid Electric Vehicles, including Plug-in Hybrids" (SAE J1711), revised June 2010, which is hereby incorporated by reference herein.
  - (D) CO<sub>2</sub> Emission Pass-Fail Determination. CO<sub>2</sub> emission compliance shall be determined pursuant to Section 7(c)(7) of these procedures.

- (2) Medium-Duty Engines. A hybrid conversion system installed on an engine that was certified on an engine dynamometer for use in a medium-duty vehicle must be tested pursuant to SAE J1711, with emissions from the pre-converted engine and vehicle being evaluated relative to those from the converted engine and vehicle, as both are tested on a chassis dynamometer.
- (A) Emission Testing. The vehicle equipped with a medium-duty engine that was certified by ARB on an engine dynamometer and its converted hybrid counterpart must be emission tested on a chassis dynamometer over two duty cycles – the UDDS and either the US-06 or the LA-92. Each cycle must be repeated at least four times for the base and hybrid vehicles, and the UDDS cycle must include at least one cold-start test.
- (B) Emission Pass-Fail Determination. Emissions from each duty cycle are to be weighted equally in determining emissions from the hybrid vehicle (i.e.,  $A_{Hybrid}$ ) and base vehicle (i.e.,  $A_{Base}$ ). To determine compliance with Section 3(a)(1)(A) of these procedures, CO<sub>2</sub> emission results from the hybrid vehicle and base vehicle are to be evaluated pursuant to Section 7(c)(7) of these procedures. To determine compliance with Section 3(a)(1)(B) of these procedures, criteria pollutant emission results from the hybrid vehicle and base vehicle, with cold-start emissions weighted pursuant to SAE J1711, section 5.1.5, are to be evaluated pursuant to Section 7(c)(6) of these procedures.
- (3) Heavy-Duty Engines. Unless otherwise described in Sections 7(d)(3)(A) and (B), a hybrid conversion system installed on an engine that was originally certified on an engine dynamometer for use in a heavy-duty vehicle must conform to the requirements of Section D of the “California Interim Certification Procedures for 2004 and Subsequent Model Hybrid-Electric and Other Hybrid Vehicles, in the Urban Bus and Heavy-Duty Vehicle Classes.”
- (A) On-Road Duty-Cycles. A heavy-duty base vehicle and its hybrid configuration are to be tested over the following two duty cycles instead of those identified in the “California Interim Certification Procedures for 2004 and Subsequent Model Hybrid-Electric and Other Hybrid Vehicles, in the Urban Bus and Heavy-Duty Vehicle Classes”:
- (i.) the 55 mph Cruise Cycle, and

- (ii.) the Transient Portion of the Heavy Heavy-Duty Truck 5 Mode Cycle, or, for transit buses, the Orange County Bus Cycle. The Transient Portion of the Heavy Heavy-Duty Truck 5 Mode Cycle and the Orange County Bus Cycle are to represent the heavy-duty vehicle's anticipated transient-like operation.
  
- (B) Electric Power Take-Off Duty-Cycle. For a plug-in heavy-duty hybrid utility or refuse vehicle with ePTO, in addition to the two on-road duty-cycles identified in Section 7(d)(3)(A) of these procedures, CO<sub>2</sub>, NO<sub>x</sub>, HC, CO and PM emission testing is to be conducted on the hybrid and its associated base vehicle pursuant to the procedures in Title 40, Code of Federal Regulations, Part 1037, Section 1037.540, as amended on October 25, 2016, which is hereby incorporated by reference herein, over the PTO duty cycle identified in Title 40, Code of Federal Regulations, Part 1037, Appendix II, as amended on October 25, 2016, which is hereby incorporated by reference herein.
  
- (C) Emission Calculations and Pass-Fail Determination. Emission values from each duty cycle are to be weighted equally in determining emissions from the hybrid vehicle (i.e., A<sub>Hybrid</sub>) and base vehicle (i.e., A<sub>Base</sub>). Hybrid vehicle emissions and base vehicle emissions are to be calculated pursuant to Section 7(c)(5) of these procedures. NO<sub>x</sub>, CO, HC, and PM emission pass-fail determinations are to be conducted pursuant to Section 7(c)(6) of these procedures, and the CO<sub>2</sub> emission pass-fail determination is to be conducted pursuant to Section 7(c)(7) of these procedures. For a plug-in heavy-duty hybrid utility or refuse vehicle with ePTO, the emission impact of the hybrid vehicle PTO operation relative to that of the base vehicle shall be calculated and incorporated into the overall pass-fail determination as follows:
  - (i.) Convert each CO<sub>2</sub>, NO<sub>x</sub>, HC, CO, and PM time-based PTO emission rate determined pursuant to Section 7(d)(3)(B) of these procedures to a grams per mile emission rate pursuant to the methodology identified in Title 40, Code of Federal Regulations, Part 1037, Section 1037.540(d), (e)(1), and (e)(2). Grams per mile and grams per ton-mile emission rates are assumed to be equivalent;
  
  - (ii.) The conversion factor, identified in Title 40, Code of Federal Regulations, Part 1037, Section 1037.540(d)(4), is 0.0217 hours per mile;



- (iii.) Weight CO<sub>2</sub> and criteria pollutant emissions pursuant to Title 40, Code of Federal Regulations, Part 1037, Section 1037.540(f)(3); and
  - (iv.) Add the hybrid vehicle work cycle grams per mile emission rate to the average weighted hybrid grams per mile emission rate ( $A_{\text{Hybrid}}$ ) for each pollutant calculated pursuant to Section 7(c)(5) of these procedures, and add the base vehicle work cycle grams per mile emission rate to the average weighted base vehicle grams per mile emission rate ( $A_{\text{Base}}$ ) for each pollutant calculated pursuant to Section 7(c)(5) of these procedures, prior to conducting pass-fail determinations pursuant to Sections 7(c)(6) and (7) of these procedures.
- (4) Alternate Duty Cycles. A manufacturer may propose, as part of its Hybrid Technology Emission Test Plan, an alternate duty cycle in lieu of the duty cycles identified in this section. The Executive Officer may approve an alternate duty cycle if he or she determines, based upon his or her engineering judgement and data provided by the applicant, that the proposed alternate test cycle more accurately represents the hybrid vehicle's anticipated in-use activity by California fleets.
- (5) Charge-Depleting Hybrids. Notwithstanding the requirements of Sections 7(d)(1) and (2) of these procedures, a charge-depleting hybrid vehicle shall meet the requirements of Section 7(c)(3)(B) when tested on a chassis dynamometer to represent a "worst case" emission scenario.
- (6) Utility Factors. For a hybrid vehicle between 6,001 and 8,500 pounds GVWR with AER, a utility factor (UF) may, at the manufacturer's discretion, be applied to hybrid CO<sub>2</sub> emissions as follows when calculating CO<sub>2</sub> emissions pursuant to these procedures:

$$A_{\text{Hybrid}} = ((A_{\text{Hybrid}}) * (1 - \text{UF}(D)))$$

Where:

UF(D) is the utility factor for a vehicle that achieves at least D miles AER. For such a vehicle, UF(D) is to be determined according to SAE International J2841, "Utility Factor Definitions for Plug-In Hybrid Electric Vehicles Using Travel Survey Data" (SAE J2841), revised September 2010, which is hereby incorporated by reference herein, from the Fleet Utility Factors (FUF) Table in SAE J2841, Appendix B, or using a polynomial curve fit with "FUF Fit" coefficients from SAE J2841, Table 2: Utility Factor Equation Coefficients.

For vehicles above 8,500 pounds GVWR with AER, a manufacturer may propose, as part of its Hybrid Technology Emission Test Plan, a UF to be used when calculating CO<sub>2</sub> emissions pursuant to these procedures, where the FUF is calculated pursuant to SAE J2841, based upon electronic in-use daily mileage data for the proposed hybrid vehicle class and vocation. The Executive Officer may approve, deny, or adjust the proposed UF based upon his or her engineering judgement regarding whether the proposed in-use daily mileage data are representative of how the hybrid vehicle, given its size and intended vocation, is likely to be operated by California fleets.

- (e) AER Determination. Determination of AER must be performed in accordance with the provisions of this section.

A hybrid vehicle's AER is defined as the distance, after the battery has been fully charged, that the vehicle is capable of traveling with the engine off before the engine turns on for the first time. The vehicle is to be tested for AER in default mode, or in normal mode if the vehicle does not have a default mode.

- (1) PEMS Tested Vehicles. The AER of a vehicle that it tested with a PEMS pursuant to Section 7(c) of these procedures must be demonstrated over the transient test route on which the vehicle is PEMS tested. The location at which the engine first turns on must be captured by the GPS system and recorded, and the distance traveled must be identified by the vehicle odometer or other mechanism approved by the Executive Officer as part of the Hybrid Technology Emission Test Plan. The altitude at the start of the test and at the point the engine first turns on must be recorded. The altitude of the location at which the engine first turns on may not be more than 100 feet lower than the altitude of the starting location. The starting point of such a test route should be no more than 100 feet higher in elevation than the lowest point of the route, to avoid the possibility of invalid AER determinations.
  - (2) Other Vehicles. A vehicle that is demonstrated to meet the emissions criteria of these test procedures on a chassis dynamometer must demonstrate its AER on the chassis dynamometer over one of the duty-cycles, as selected by the manufacturer, that is utilized to demonstrate criteria pollutant or CO<sub>2</sub> emission compliance pursuant to Section 7(d) of these procedures.
- (f) A heavy-duty hybrid engine being emission tested for the purposes of California Code of Regulations, title 13, section 2208.1 (13 CCR 2208.1), subdivision (c)(1)(C) shall also be governed by the following criteria:
    - (1) Vehicle Selection and Preparation. When selecting vehicles for testing pursuant to Section 7(c) or (d) of these procedures, the baseline and

hybrid vehicle must be of the same vehicle class and intended vocation, and be identical or as closely matched as possible in MY, engine power and displacement, number of axles and real axle ratios, electrical and mechanical accessories (such as power steering and brakes), body style and external surface contours, aerodynamic configuration, wheel circumference, rear differential, transmission type (e.g., automatic, automated manual, etc.), and accessories. To be comparable, the baseline and hybrid vehicle must be able to accomplish the same function, with similar performance, utility, and durability attributes. Vehicles must be tested with all body equipment and appendages intact (e.g., mirrors, bumpers, etc.), and with the same mechanical and electrical accessories in operation, such that the power demand on the vehicles during testing is representative of the expected power demand on the vehicles while in use. The power and displacement of the engines used in the base and hybrid vehicles may differ if this difference is directly related to the more-efficient functioning of the hybrid system, such as use of a smaller engine in the hybrid configuration. A baseline engine or vehicle may be from a different MY relative to the hybrid vehicle if the engine, aftertreatment, and on-board diagnostics system is functionally unchanged between the two MYs and if all other vehicle characteristics are substantially similar, with the exception of the hybrid system.

- (2) Fuel Specifications. When conducting emission testing pursuant to Section 7(c) or 7(d) of these procedures, both base and hybrid vehicles must use an identical gaseous or liquid fuel, unless a different fuel is approved in advance by the Executive Officer. If an appropriate base vehicle that utilizes the same fuel type as the hybrid vehicle is unavailable, the Executive Officer may approve use of an alternate base vehicle fuel type that best represents the typical fuel used by a newly manufactured vehicle in the intended vehicle class and vocation. For example, a gasoline-fueled Class 8 hybrid truck may warrant use of a diesel-fueled Class 8 base truck for the purposes of emission testing, because Class 8 vehicles are typically diesel fueled.
- (3) Post-Transmission Powertrain Vehicle Simulation. In lieu of conducting emission testing pursuant to Section 7(c) or (d) of these procedures, a hybrid engine certifying to meet “Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium- and Heavy-Duty Vehicles – Phase 1” pursuant to Title 40, Code of Federal Regulations, Part 1037, Section 1037.550, as amended on June 17, 2013, which is hereby incorporated by reference herein, may use the post-transmission powertrain vehicle simulation emissions data derived pursuant to said certification testing to demonstrate CO<sub>2</sub> emission compliance with the requirements of 13 CCR 2208.1(c)(1)(a). Such a test — that concurrently measures NO<sub>x</sub>, CO, and HC emissions in the identical fashion as done for CO<sub>2</sub> emissions pursuant to Title 40, Code of Federal Regulations,

Part 1037, Section 1037.550 — may use the NO<sub>x</sub>, CO, and HC emissions data derived pursuant to said certification testing to also demonstrate NO<sub>x</sub>, CO, and HC emission compliance for the purposes of 13 CCR 2208.1(c)(1)(a). In such case, the percent CO<sub>2</sub> reduction is calculated as follows:

$$\text{Percent CO}_2 \text{ reduction} = \text{IF} * 100$$

Where

IF = the CO<sub>2</sub> Improvement Factor calculated pursuant to Title 40, Code of Federal Regulations, Part 1037, Section 1037.615, as amended on June 17, 2013, which is hereby incorporated by reference herein.

For each required pollutant, if  $(\text{Emission Rate A} * 1.10) \geq \text{Emission Rate B}$ , where Emission Rates A and B have the meanings described in Title 40, Code of Federal Regulations, Part 1037, Section 1037.615(b)(2)(iii), then the hybrid vehicle is found to not increase emissions of that pollutant.

## **8. REQUEST FOR CERTIFICATION**

- (a) Overview. To obtain ARB Tier 1, Tier 2, or Tier 3 certification of the hybrid conversion system, the applicant must submit an application to the Executive Officer pursuant to Section 8 of these procedures. The Executive Officer will use the information provided during the application process to help determine whether the hybrid conversion system relies upon sound principles of science and engineering to meet required eligibility criteria, the need for additional analyses, and the appropriateness of allowing for alternatives to the prescribed requirements. The applicant must submit one application for each discrete conversion system as it applies to each potential base vehicle test group or engine family. Supporting data in electronic format may be accepted as part of an application at the discretion of the Executive Officer. An application must be submitted in the format approved by the Executive Officer.
- (b) Application Information. The request for certification must, at a minimum, include the following information:
- (1) Identification as to whether the applicant is requesting Tier 1, Tier 2, or Tier 3 certification;
  - (2) Name, business affiliation, business title, business e-mail address and business telephone number for: the person submitting the application; persons authorized to sign documents for submittal to ARB, and a single

point of contact authorized to communicate with ARB staff on behalf of the applicant during the application review process;

- (3) The applicant's product website address, if applicable;
- (4) Identification of the proposed hybrid conversion system make and models, including: detailed schematics, wiring diagrams, and parts list; identifying part numbers for all major individual components of the hybrid conversion system, including battery pack, traction motor, controller, inverter, and on-board charger (if applicable); and a list of all warranted parts;
- (5) A detailed description of the energy storage system, including (as applicable), battery manufacturer, battery chemistry, connection type (e.g., series, parallel, or other), whether the system is charge-depleting or charge-sustaining, weight, power capacity, maximum voltage, and voltage at fifty percent state of charge;
- (6) An explanation of how the hybrid conversion system interacts with, or integrates into, the base vehicle;
- (7) A description of any modifications made to the base engine's or vehicle's original engine hardware or aftertreatment device(s), and any modifications made to the base engine's original software calibrations;
- (8) An engineering evaluation of potential negative emission impacts that could result from installation of the hybrid conversion system on base vehicles or engines including, but not limited to, the potential for an increased number of cold starts or low temperature operation leading to increased criteria pollutant emissions, the potential for increased evaporative or exhaust HC emissions, and how the hybrid conversion system could potentially change the engine's regeneration cycles or events for emission control devices;
- (9) A demonstration that the hybrid conversion system meets the general requirements of Section 3 of these procedures and the applicable Tier 1, Tier 2, or Tier 3 certification requirements of Sections 4, 5, or 6 of these procedures, respectively;
- (10) Names and business addresses of the fabrication, assembly line, and test facilities where the hybrid conversion system and its major components are manufactured and tested;
- (11) A description of the criteria the manufacturer uses to authorize a person to install its hybrid conversion system;

- (12) Procedures for installing and maintaining the hybrid conversion system, including tune-up specifications, and discussion of any special tools or techniques required for its proper installation, maintenance, or operation;
- (13) Business names, physical business addresses, business e-mail addresses and business phone numbers of authorized conversion system installers, and a copy of all contract(s) and other written agreements between the hybrid conversion system manufacturer and authorized installer(s);
- (14) A description of the chassis and engine combination(s) on which the proposed hybrid conversion system is intended to be installed, including base vehicle test group and/or base engine family, base vehicle or engine weight class, and the applicable engine emission standards for non-methane organic gases, non-methane hydrocarbons (NMHC), NO<sub>x</sub> or NMHC + NO<sub>x</sub>, CO, formaldehyde, and PM;
- (15) A description of any modifications or updates to information provided in any previous application for ARB certification of the applicable hybrid conversion system;
- (16) A proposed Hybrid Technology Emission Test Plan that meets the minimum requirements of Section 7(b) of these procedures (Tier 2 or 3 certification application only);
- (17) A copy of the following: emission control label(s) required pursuant to Section 3(b) of these procedures; owner's manual required pursuant to Section 3(e) of these procedures; warranty statements required pursuant to Section 10(c) and Section 10(e) of these procedures; and warranty notification required pursuant to Section 10(d) of these procedures;
- (18) Full documentation and description, in writing, of all modifications that may affect OBD compliance, including added, modified, or removed base vehicle hardware (e.g., components, wiring), and software changes (e.g., programming and calibration), and if such modifications are made to comply with the Tier 1, 2, or 3 OBD requirements of these procedures; and
- (19) Compliance Statements. The application must be signed and dated by the applicant and include the following statement above the signature and date:

"I affirm that to the best of my knowledge, the information submitted is true, accurate, and complete.

I affirm that to the best of my knowledge this hybrid conversion system does not cause the emission into the ambient air of any

noxious or toxic matter that is not emitted in the operation of such motor vehicle without such device.

I understand that Air Resources Board (ARB) approval of this hybrid conversion system, if granted, does not constitute a certification, accreditation, approval, or other endorsement by ARB of claims concerning alleged in-use emission benefits of a hybrid conversion system, and that ARB makes no assertion or warranty regarding potential CO2 emission impacts experienced by individual users in-use or over the life of the hybrid conversion system. No claims of any kind concerning potential emission benefits may be made for an approved hybrid conversion system, with the exception of a claim concerning any potential CO2 emission benefit specified in the device's applicable ARB Executive Order."

- (c) The Executive Officer may require a manufacturer to provide a market-ready hybrid conversion system or converted hybrid vehicle for inspection and/or testing as part of its application for ARB certification. Such market-ready hybrid conversion systems or converted vehicles must be identical in all material respects to the product that will be sold upon receiving ARB certification of the applicable hybrid conversion system. If such a request is made by the Executive Officer, the applicant must submit the market-ready hybrid conversion system or converted base vehicle within 30 days or another mutually agreed upon date, or the application may be disapproved. The Executive Officer shall return, at the applicant's expense, the market-ready hybrid conversion system or converted vehicle after the hybrid conversion system application has been approved, denied, or withdrawn.

## **9. HYBRID CONVERSION SYSTEM APPROVAL**

- (a) Issuance of Executive Orders. If, after reviewing the test data and other information submitted by the applicant, the Executive Officer determines that the hybrid conversion system meets the requirements of these procedures, he or she shall issue an Executive Order certifying the hybrid conversion system for sale and installation on the vehicle test groups and/or engine families specified in the certification application.
  - (1) A manufacturer of a Tier 2- or Tier 3-certified hybrid conversion system that has been demonstrated to achieve at least a 20 percent CO2 emission reduction pursuant to these procedures and has been demonstrated to comply with all other applicable requirements of these procedures will receive an Executive Order identifying the hybrid conversion system as providing said CO2 emission benefit.

- (A) An Executive Order issued for a hybrid conversion system that has been demonstrated to achieve a 20 percent or greater potential CO<sub>2</sub> emission reduction will stipulate that said potential reductions are based upon emission testing over a given duty cycle or test route, and that ARB makes no assertion or warranty regarding potential CO<sub>2</sub> emission impacts experienced by individual users in-use or over the life of the hybrid conversion system.
  - (2) Any potential CO<sub>2</sub> emission benefit identified on, or inferred from, a hybrid conversion system Executive Order may not be used to demonstrate compliance with any rule, regulation, or other air quality mandate, nor may it be credited as part of any emission averaging, banking or trading program.
- (b) Carryover and Carry-Across.
- (1) Carryover or carry-across of emission test data from the previous model year to the following model year, and from one test group, engine family, evaporative emissions family, or OBD group, to similar test groups or engine families, may be allowed if the Executive Officer determines that the carryover or carry-across data adequately represent the emission and OBD monitor performance of the hybrid conversion system to be certified.
  - (2) Requests for use of carryover and carry-across data must be accompanied by an engineering analysis that includes test data and other relevant information demonstrating that the emissions performance of the hybrid conversion system and the test group, engine family, evaporative emissions family, or OBD group for which the certification is sought is adequately represented by the emission and OBD monitor performance of the hybrid conversion system and test group or engine family, and other relevant information.
  - (3) Updated Parts or Calibrations. Changes made to the design or operating conditions of a hybrid conversion system must be fully described in writing and submitted for Executive Officer approval. Any changes to the design or operating conditions of the hybrid conversion system not approved in advance and in writing by the Executive Officer will invalidate the hybrid conversion system certification at the Executive Officer's sole discretion.

## **10. MINIMUM WARRANTY REQUIREMENTS**

- (a) Product Warranty.
  - (1) Each conversion system manufacturer must warrant to the person having the vehicle or engine converted and to each subsequent purchaser of the



converted vehicle or engine that the hybrid conversion system will not cause damage to any part on the converted vehicle or engine, and is free from defects in materials and workmanship that can cause the conversion system to fail to conform with the applicable requirements of these procedures. This warranty must cover customer service and the full repair or replacement costs, including the costs of diagnosis, labor, and parts, and any part on the converted vehicle or engine that is damaged by the hybrid conversion system. This warranty requirement will be effective for the applicable duration identified in Table 1.

- (2) The repair or replacement of any part otherwise eligible for warranty coverage may be excluded from such warranty coverage if the hybrid conversion system or the vehicle or engine in which it is installed has been abused, neglected, or improperly maintained and such abuse, neglect, or improper maintenance was the direct cause of the need for the repair or replacement of the part. Manufacturers must maintain supporting documentation for a decision not to repair or replace an otherwise warranted part, and provide such documentation to the Executive Officer upon request. Failure of the converted vehicle or engine owner to ensure scheduled maintenance as recommended by the hybrid conversion system owner’s manual, or to keep maintenance records for the vehicle, engine, or hybrid conversion system, may, but will not per se, be grounds for disallowing a warranty claim.

Table 1: Minimum Manufacturer Warranty Periods	
Conversion System Approval Level	Hybrid conversion system minimum warranty period
Tier 1	3 years or 50,000 miles, whichever comes first <sup>1</sup>
Tier 2	5 years or 60,000 miles, whichever comes first <sup>1</sup>
Tier 3	7 years or 70,000 miles, whichever comes first <sup>2</sup>
1 – Hybrid conversion systems with ePTO may include a 3,000 hour warranty period in lieu of a minimum mileage.	
2 – Hybrid conversion systems with ePTO may include a 4,200 hour warranty period in lieu of a minimum mileage.	

(b) Installation Warranty.

Each authorized installer of a hybrid conversion system must warrant to the person having the vehicle or engine converted, and to each subsequent purchaser of the vehicle or engine that the hybrid conversion system will not fail to conform with the requirements of these procedures due to incorrect installation, and that no part on the converted vehicle or engine will be damaged due to improper installation. Authorized installers of hybrid conversion systems must install only conversion systems of a certified configuration, and must agree to indemnify the person having the vehicle or engine converted, and each subsequent purchaser of the vehicle or engine for the cost of repair of any

noncertified vehicle or engine configuration upon which the hybrid conversion system was installed. In addition, the authorized installer must agree to indemnify the person having the vehicle or engine converted, and each subsequent purchaser of the vehicle or engine, for any fines that may be imposed as a result of improper installation of the hybrid conversion system. The warranties and agreements to indemnify must be effective for 3 years or 50,000 miles, whichever occurs first, and must cover the full repair or replacement costs, including the costs of diagnosis, labor, and parts during the installation warranty period, as well as any part on the converted vehicle or engine that is damaged due to incorrect installation of the hybrid conversion system.

(c) Product Warranty Statement.

The applicant must include the following statement in the owner's manual, a copy of which must be provided to each owner upon delivery of the hybrid conversion system. The applicant may include descriptions of circumstances that may result in a denial of warranty coverage, but these descriptions must not limit warranty coverage in any way.

**“YOUR WARRANTY RIGHTS AND OBLIGATIONS**

<Applicant's name> warrants that the hybrid conversion system is free from defects in design, materials, workmanship, or operation that can cause significant degradation in emissions or fuel economy performance during the system warranty period, provided there has been no abuse, neglect, improper maintenance, or improper operation of your hybrid conversion system or vehicle, as specified in the owner's manual. Where a warrantable condition exists, <applicant's name> will repair or replace your hybrid conversion system at no cost to you, including diagnosis, parts, and labor. The warranty period for this hybrid conversion system is <years or miles of operation>, whichever occurs first. As the vehicle owner or operator, you are responsible for performing the required maintenance described in your owner's manual. <Applicant's name> recommends that you retain all maintenance records and receipts for maintenance expenses for your vehicle, engine, or hybrid conversion system. You are responsible for presenting your vehicle, engine, and hybrid conversion system to a <applicant's name> dealer or representative as soon as a problem is detected. The warranty repair or replacement should be completed in a reasonable amount of time, not to exceed 30 days. If you have questions regarding your warranty rights and responsibilities, you should contact <Manufacturer contact> at 1-800-xxx-xxxx, or the California Air Resources Board at 9528 Telstar Avenue, El Monte, CA 91731, by electronic mail at [helpline@arb.ca.gov](mailto:helpline@arb.ca.gov).”

(d) Warranty Notification.

For all hybrid conversion systems, the manufacturer must notify the hybrid conversion system purchaser or lessee in writing prior to purchase or lease that installation of the hybrid conversion system may affect the base vehicle or engine manufacturer's warranty. Acknowledgement of receipt of this notification must be signed by the purchaser or lessee prior to sale or lease of the hybrid conversion system, must be maintained by the applicant for the duration of the warranty period, and must be supplied by the manufacturer upon request of the Executive Officer, within ten days of such request.

(e) Installation Warranty Statement. The authorized installer must furnish the owner with a copy of the following statement:

“YOUR WARRANTY RIGHTS AND OBLIGATIONS

<Authorized installer's name> warrants that the installation of a hybrid conversion system will not prevent the hybrid conversion system from operating as it was designed during the installation warranty period, provided there has been no abuse, neglect, improper maintenance, or improper operation of your hybrid conversion system or vehicle, as specified in the owner's manual. The minimum installation warranty period is three (3) years or 50,000 miles, whichever comes first. The warranty period and mileage of the coverage provided by <Authorized installer's name> must be the same as that provided by the product manufacturer, and the same exclusions apply.”

(f) Hybrid Conversion System Warranty Report.

The applicant must submit a warranty report to the Executive Officer within 30 calendar days if, at any time, the cumulative number of valid warranty claims for the same part or component of an ARB-certified hybrid conversion system exceeds one percent of such system's cumulative sales or leases, or ten claims, whichever is greater. Where the cumulative number of valid warranty claims for the same part or component of an ARB-certified hybrid conversion system exceeds one percent of such system's cumulative sales or leases, or ten claims, whichever is greater, the Executive Officer may deny certification of the hybrid conversion system, or modify, revoke or suspend the existing ARB certification of affected systems. Where the cumulative number of valid warranty claims for the same part or component of an ARB-certified hybrid conversion system exceeds four percent of such system's cumulative sales or leases, or 25 claims, whichever is greater, the Executive Officer may order a recall per the requirements of Section 11 of these procedures, at the Executive Officer's discretion.

The warranty report must include the following information, and must be submitted in a format approved by the Executive Officer:

- (1) The manufacturer's business name, number of California sales for the given calendar year, number of cumulative California sales, number of California leases for the given calendar year, and the number of cumulative California leases of the applicable hybrid conversion system;
- (2) The California production volume for the current and prior calendar year, and the cumulative production volume of the applicable hybrid conversion system (across all calendar years);
- (3) A summary of California warranty claims for the applicable hybrid conversion system in the current and prior calendar year. The summary must include:
  - (A) The ARB Executive Order number for the hybrid conversion system;
  - (B) A description of the nature of the claims and of the warranty replacements or repairs provided. The applicant must categorize warranty claims for each hybrid conversion system by the part(s) and component(s) replaced or repaired;
  - (C) The number and percentage of hybrid conversion systems for which a need for a warranty replacement or repair was identified;
  - (D) A short description of the hybrid conversion system part and/or component that was replaced or repaired under warranty and the most likely cause for its failure;
  - (E) For each part and/or component replaced or repaired under warranty, the number of annual and cumulative replacements or repairs of each part or component;
  - (F) Name, physical business address, business e-mail address and business phone number of the end-user that filed the warranty claim and, if applicable, the company name. If personal, not business, information is given, the applicant must identify it as such;
  - (G) The date each warranty claim was filed, and the base engine family or base vehicle test group associated with each claim;
  - (H) A list of denied warranty claims and justification for each claim; and

- (l) A current list of authorized installers for the hybrid conversion system and their business contact information.
- (4) An applicant that fails to submit a complete hybrid conversion system warranty report within 30 calendar days for valid warranty claims in excess of 4 percent, or 25 claims, whichever is greater, for the same part or component, may be subject to civil penalties as specified in state law and regulations; and
- (5) A hybrid conversion system warranty report that does not contain all required information will not be considered complete. A hybrid conversion system warranty report will be considered to be complete as of the date that all required information is submitted.

## **11. RECALL PROVISIONS**

If the Executive Officer determines, after a review of an applicant's warranty report or any other information, that a hybrid conversion system has the potential to experience catastrophic or other safety-related failure due to the same part or component, that the cumulative number of valid warranty claims for the same part or component of an ARB-certified hybrid conversion system exceeds four percent of such system's cumulative sales or leases, or 25 claims, whichever is greater, or that a substantial number of units experience a failure of an operational feature, the Executive Officer may require the manufacturer to submit a recall plan and to conduct a recall.

In the event of a recall, the Executive Officer shall provide notification to the applicant that includes the factual basis for the determination, and will designate a date, at least 60 days from the date of receipt of such notification, by which the applicant must submit a recall plan to ARB for review and approval to address the failures or warrantable condition. Each recall plan must be approved by the Executive Officer in writing. A manufacturer of a hybrid conversion system subject to a recall must comply with provisions applicable to an influenced recall pursuant to California Code of Regulations, title 13, sections 2112 through 2121.