Appendix F - 7

Purpose and Rationale

Section 1962.5. Data Standardization Requirements for 2026 and Subsequent Model Year Light-Duty Zero Emission Vehicles

Subsection 1962.5(a) Applicability.

Purpose

The purpose of this subsection is to define that the requirements of this section shall apply to California-certified 2026 and subsequent model year light-duty zero emission vehicles (ZEV) and plug-in hybrid electric vehicles (PHEV).

Rationale

This subsection is necessary to define the vehicles to which these standardized data requirements will apply. As explained in ISOR section III.B, mobile sources continue to be the largest source of smog-forming pollutants and greenhouse gases. Transitioning to zero-emission technologies is necessary to meet mandated near- and long-term emission goals for both criteria pollutants and greenhouse gases. The current ZEV regulation cannot, and was never intended to, reach 100 percent ZEVs. Accordingly, CARB is proposing to significantly expand ZEV requirements, largely aligning them with longstanding requirements for internal combustion engine vehicles while simultaneously phasing out new sales of internal combustion engine vehicles. CARB has long designed its internal combustion engine vehicle regulations and certification systems to ensure that vehicles, including their emission controls, perform properly throughout their life. Due to their lack of direct emissions and to help grow the technology in its earlier years, ZEVs have been exempt from these measures, which include warranty, durability, and serviceability. However, to address outstanding consumer challenges for broader and more permanent ZEV adoption (including durability and serviceability, see ISOR section III.A.5) and to secure the emission benefits of this proposal, CARB is proposing that ZEVs must now also meet continuing assurance requirements throughout their lives, like their petroleum-fueled counterparts. In order to monitor and assess whether ZEVs are actually meeting these assurance measures, CARB, vehicle technicians, and vehicle owners necessarily need easy access to certain vehicle data, and that data must be in understandable and uniform formatting (i.e., standardized) so that it is readily comprehensible and comparable across all ZEVs. In other words, the standardized data and data communication requirements of this section are essential in this proposal, without which it would be impossible to ensure ZEVs are operating as intended and required to meet the proposal's emission reductions goals.

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Subsection 1962.5(a)(1)

Purpose

The purpose of this subsection is to provide a phase-in for ZEVs to meet the requirements over the 2026 and 2027 model years.

Rationale

This subsection is necessary to define the portion of a vehicle manufacturer's ZEVs to which these standardized data requirements will apply in the 2026 and 2027 model years. Many of these data parameters are already available on ZEVs and able to be reported to and viewed on vehicle manufacturer-specific service tools used by dealer repair shops; this section ensures they are readily available in a more accessible and standardized format to CARB (for monitoring and enforcement purposes), vehicle owners (for informed purchasing and ZEV market expansion), and servicers (for adequate maintenance and repair). Phasing in the standardized data requirements over two years is necessary and reasonable to allow manufacturers to spread the burden of bringing all of their new light-duty ZEVs into compliance with these requirements. Requiring only 40 percent compliance with the data standardization requirements in the 2026 model year is necessary and reasonable to give manufacturers the opportunity to work through any challenges they may encounter in bringing their vehicles into compliance before the majority of their new light-duty ZEVs must comply. Requiring 100 percent compliance in the 2027 model year is necessary to ensure that full implementation of the required data standardization is not inappropriately delayed.

Subsection 1962.5(a)(2)

Purpose

The purpose of this subsection is to provide a phase-in for PHEVs certified to earn vehicle values to meet the requirements over the 2026 and 2027 model years.

Rationale

This subsection is necessary to define both the portion of a vehicle manufacturer's PHEVs to which data requirements will apply in the 2026 and 2027 model years and the subset of the data requirements in this section that apply to PHEVs. All PHEVs already have the required standardized connector and report similar standardized data parameters as required by a separate onboard diagnostic regulation in place since the 1996 model year for vehicles with an internal combustion engine. Accordingly, PHEVs are only subject to adding four new data parameters in this proposed section and making those limited parameters viewable to consumers in vehicle without the use of any tools. Phasing in the standardized data requirements over two years is necessary and reasonable to allow manufacturers to spread the burden of bringing all of their new light-duty PHEVs into compliance with these requirements. Requiring only 40 percent compliance with the data standardization requirements in the 2026 model

year is necessary and reasonable to give manufacturers the opportunity to work through any challenges they may encounter in bringing their vehicles into compliance before the majority of their new light-duty PHEVs must comply. Requiring 100 percent compliance in the 2027 model year is necessary to ensure that full implementation of the required data standardization is not inappropriately delayed.

This subsection also provides manufacturers additional flexibility in that only PHEVs produced to comply with the minimum PHEV qualifications of the ZEV regulation are subjected to the data standardization requirements. Additional PHEVs, perhaps produced by the manufacturer solely to assist its compliance with other vehicle regulations such as the greenhouse gas standards in title 13, CCR, section 1961.3, would not be subject to these data requirements.

Subsection 1962.5(a)(3)

Purpose

The purpose of this subsection is to explicitly allow for a vehicle manufacturer to meet the phase-in percentages based on projected sales of light-duty ZEVs and PHEVs rather than actual sales. Further, it requires manufacturers to submit a phase-in plan that shows they will meet the phase-in requirements prior to certification of any 2026 model year vehicle.

Rationale

This subsection is necessary to allow manufacturers to plan for introduction of the data required by this section during development by using projected sales volumes to determine compliance with the phase-in. Manufacturers must expend resources and take specific actions to meet these requirements well in advance of production of the actual vehicles, and it would be extremely cost-inefficient to subsequently try to add these requirements at the last minute to additional vehicle models if actual sales volumes of the compliant products turned out to be less than expected. Lastly, this section is necessary to require manufacturers to submit a phase-in plan that will show, based on projected sales, how they will meet the required phase-ins so CARB staff can verify the manufacturer will comply.

Subsection 1962.5(a)(4)

Purpose

The purpose of this subsection is to explicitly allow for a vehicle manufacturer to use alternative phase-in percentages to those required in subsections (a)(1) and (a)(2) should its planned roll-out or sales projections differ from the required phase-in. The subsection lays out a mathematical formula and specific restrictions to be used to verify the alternative phase-in will achieve an equivalent number of vehicles phased-in by the end of the final year of the required phase-in.

Rationale
This subsection is necessary to allow manufacturers to cost-effectively implement new requirements at normally scheduled updates or introductions for vehicle models when the sales rates of those vehicle models do not quite match the required phase-ins. Manufacturers can still meet the intent and needed benefits of the required phase-in with alternatives that may phase-in extra vehicles in earlier model years to offset a slower phase-in rate in the final years or vice-versa. This flexibility allows manufacturers to better match implementation of the new requirements to their scheduled product plans and avoid unnecessary revisions to vehicle models midstream in their lifecycle. The restrictions and mathematical formula are necessary to ensure that any manufacturer's alternative phase-in is evaluated with an objective standard and to prevent any extreme proposals that would try to include products introduced much earlier or much later than the required phase-in. These are similar in construct to provisions used in other CARB regulations, which provides consistency in compliance and minimizes burdens.

Subsection 1962.5(a)(5)

Purpose
The purpose of this subsection is to allow for small volume vehicle manufacturers to fully comply by model year 2028 with no required phase-in during earlier model years to certify vehicles to the new requirements.

Rationale
This subsection is necessary to allow small volume manufacturers, which may only have one or a few distinct vehicle models, to better plan for introduction of the new requirements of this section. These manufacturers typically have far fewer resources available to implement new requirements and limited product offerings that are not amenable to a phase-in to spread out the workload like a large manufacturer. Recognizing this, this subsection lets these manufacturers wait an additional year (model year 2028) to provide maximum flexibility for them to plan for implementation during other scheduled updates.

Subsection 1962.5(b) Definitions.

Purpose
The purpose of this subsection is to provide definitions for specific technical terms that are used in this section 1962.5 in addition to those defined in the related ZEV regulation at CCR, title 13, section 1962.4 and its incorporated test procedures.

Rationale
This subsection is necessary to define terms additional to those defined in CCR, title 13, section 1962.4 and incorporated test procedures. These three additional terms are integral to this section, so it is important to define them for clarity and comprehension.

"Grid energy" is necessary because it delineates which on-vehicle measurements of energy must be designated as energy received from the electrical grid in the form of off-board energy provided to the vehicle during charging events. Details in the definition include clear direction on exclusion of electrical losses on vehicle during the charging event such as through inefficiencies of the onboard charger or use of electrical accessories while charging. All such energy into the vehicle is required to be cumulatively tracked and stored as a standardized data parameter in this section 1962.5.

"Propulsion-related part" is necessary because it defines which on-vehicle components and systems are subject to the requirements of this section. Specifically, manufacturers are required to support a standardized method of reading out fault codes, which provide repair technicians with crucial identification of the components or systems involved in a malfunction detected on the car, but only for propulsion-related faults. This is necessary to distinguish faults that compromise the ability of the vehicle to achieve its primary purpose of being driven from other faults that might affect the creature comforts or other capabilities of the vehicle such as infotainment systems or safety-related systems. By ensuring that faults related to the propulsion of the vehicle are accessible with standardized tooling, there is higher assurance that consumers will be able to find a repair facility that can effectively diagnose and repair faults necessary to restore the ability of the vehicle to be driven as originally designed even if other auxiliary functions of the vehicle are not working properly.

"Propulsion system active" is necessary because it defines a specific state that the vehicle and its control system are in when the vehicle is enabled by the driver and ready to be driven and is necessary to differentiate other states that the vehicle may be in including off, charging, or even partially enabled while parked to perform some form of self-checks or other non-driver-initiated events. Definition of this state is needed to limit the conditions under which the vehicle is required to comply with communication of the standardized data required under this section 1962.5.

Subsection 1962.5(c)(1) Standardization Requirements.

Purpose

The purpose of this subsection is to introduce the following subsections and identify the standards body, known as SAE International, under which relevant automotive standards for communication of data between a vehicle and an off-board tool have been developed and are incorporated by reference in this section 1962.5.

Rationale

This subsection is necessary to incorporate documents developed by the standards body that are specific to the automotive sector and provide very detailed information on how to carry out digital communication between a vehicle and an off-board tool

used by repair technicians to establish communication and transfer vehicle data in a standardized format that can be properly interpreted and displayed by all tools. Incorporating these documents ensures all vehicles will meet uniform specifications and that CARB, vehicle owners, and servicers will not have to grapple with varying forms of data or methods of data communication. That, in turn, supports expansion of the ZEV market and will ease ZEV displacement of ICEVs.

Subsection 1962.5(c)(1)(A)

Purpose

The purpose of this subsection is to incorporate the SAE J1962 physical and electrical specifications for an electrical connector on the vehicle to which off-board tools are plugged to access vehicle.

Rationale

This subsection is necessary to ensure all vehicles are built with a uniform connector in both physical dimensions and wiring assignments necessary to ensure universal compatibility among cars and off-board tools in connecting to a vehicle.

Subsection 1962.5(c)(1)(B)

Purpose

The purpose of this subsection is to incorporate the SAE J1979-3 physical, electrical, and software communication protocol specifications for vehicles to be used when connecting to an off-board tool to access standardized data on the vehicle.

Rationale

This subsection is necessary to define detailed software message and format specifications for ZEVs to properly respond to requests for individual data parameters from an off-board tool. This specification includes details of bit and byte assignments for individual electronic control units on the vehicle that contain the standardized data and will be required to package such data into discrete messages sent to the off-board tool upon request.

Subsection 1962.5(c)(1)(B)1.

Purpose

The purpose of this subsection is to incorporate the most recent version of the digital annex, or DA, of the SAE J1979 specifications which contains specific address, scaling, resolution, and usage notes for each unique standardized data parameter. The digital annex is separately updated by the SAE committee from the J1979 document itself as new standardized data parameters are frequently added.

Rationale

This subsection is necessary to define detailed software identifiers for each unique data parameter such that all vehicles will report the same parameter, with the same

resolution and scaling, to any off-board tool which can then properly convert that data into a displayable parameter for the tool user to see and understand. This SAE document provides vehicle manufacturers and tool manufacturers with the necessary information to be able to request, receive, and translate a string of bits and bytes into alphanumeric characters and real-time values of on-vehicle data such as vehicle speed or accelerator pedal position.

Subsection 1962.5(c)(1)(C)

Purpose

The purpose of this subsection is to incorporate the SAE J2012 specifications for formatting and assignment of standardized fault codes.

Rationale

This subsection is necessary to align the proposed requirements of this section 1962.5 for ZEVs with the existing requirements of CCR, title 13, section 1968.2 for internal combustion engine vehicles in California and the United States. For over 25 years, the automotive industry has been using the format and assignment of fault codes in accordance with SAE J2012 to communicate which emission control component or sub-system has been identified as malfunctioning by an onboard vehicle diagnostic system. J2012 also requires unique fault codes to be used for different failure modes of the same component and provides a list of several thousand pre-defined fault codes for the manufacturers to use. This proposal will ensure ZEVs also use a similar format and structure as non-ZEVs to facilitate understanding by tool manufacturers and repair technicians who are accustomed to the current structure. This provides consistency for manufacturers in regulatory requirements and lessens their burdens of complying with the requirements of this section.

Subsection 1962.5(c)(1)(C)1.

Purpose

The purpose of this subsection is to incorporate the newest version of the separately updated digital annex, or DA, of SAE J2012 which includes all of the individual fault code assignments for use by vehicle manufacturers.

Rationale

This subsection is necessary to align the proposed requirements of this section 1962.5 for ZEVs with the existing requirements of CCR, title 13, section 1968.2 for internal combustion engine vehicles in California and the United States, which provides consistency in regulatory requirements for manufacturers and lessens their compliance burdens. The digital annex format has been used by SAE to provide for a separate document that can be more readily updated by the SAE committee as requests from manufacturers for new code assignments come in. The digital annex also provides

details on slight changes in the fault code assignment and format that correspond with the change to the updated SAE J1979-2 UDS message format where a single fault code is now assigned to a component and then a separate portion of the message contains information about what type of failure of that component has been detected. This structure was utilized in UDS to conserve fault code assignments (one code per component instead of several) while still providing a high level of detail to the repair technician about the component and the specific failure mode that was identified (e.g., shorted to ground, open circuit, out of range high).

Subsection 1962.5(c)(1)(D)

Purpose

The purpose of this subsection is to incorporate the proposed test procedures for future model year ZEVs into section 1962.5.

Rationale

This subsection is necessary link some of the data requirements of this section to the terms and data required to carry out the official testing procedures to determine range and energy consumption of ZEVs. This linkage provides context to vehicle manufacturers when implementing the requirements to better understand the intended usage of the parameter and how it will meet the needs of data required to be collected during official testing.

Subsection 1962.5(c)(2)(A)

Purpose

The purpose of this subsection is to introduce the requirements that apply to the diagnostic connector that all vehicles must be equipped with and identify that it must comply with the SAE J1962 specifications.

Rationale

This subsection is necessary to provide direction to vehicle manufacturers on what type of connector must be installed in the vehicle including the physical dimensions and electrical assignments of different pins or wires within the connector. The reference to a SAE J1962 Type A connector gives manufacturers details as to which of the two connectors specified in J1962 the vehicle connector must meet. This connector requirement also aligns with what is currently required for all internal combustion engine vehicles in California and the United States, providing consistency in regulatory requirements and lessening manufacturers' compliance burdens.

Subsection 1962.5(c)(2)(B)

Purpose

The purpose of this subsection is to ensure vehicle manufacturers install the connector with a suitable mounting bracket to withstand the typical forces imparted on the connector when a technician plugs in or unplugs an off-board tool from the vehicle.

Rationale

This subsection is necessary to provide vehicle manufacturers with explicit, objective specifications to ensure the vehicle connector is suitably mounted in the vehicle to avoid damage or breakage when an off-board tool is connected to the vehicle. This requirement aligns with what is currently required for all internal combustion engine vehicles in California and the United States, providing consistency in regulatory requirements and lessening manufacturers' compliance burdens.

Subsection 1962.5(c)(2)(C)

Purpose

The purpose of this subsection is to prohibit vehicle manufacturers from covering the required connector or otherwise obscuring the location or access to the connector.

Rationale

This subsection is necessary to avoid vehicle manufacturers locating the connector behind the dashboard or interior panels or access covers that would make the connector difficult to locate by a repair technician or increase the likelihood of damage to the vehicle interior by a technician when attempting to locate such a connector by prying or pulling on various vehicle trim pieces. This requirement aligns with what is currently required for all internal combustion engine vehicles in California and the United States, providing consistency in regulatory requirements and lessening manufacturers' compliance burdens. This also ensures that the necessary connector for the standardized data will be easily locatable and the data readily accessible.

Subsection 1962.5(c)(2)(D)

Purpose

The purpose of this subsection is to ensure any electrical connectors, or pins, in the vehicle connector that provide electrical power to the off-board tool are designed with sufficient electrical safety precautions to avoid excessive power being applied to the circuit or off-board tool.

Rationale

This subsection is necessary to eliminate the potential for an electrical fault that causes damage to the off-board tool or vehicle from an excessive power draw or an abnormally high voltage condition through the vehicle connector. This requirement

aligns with what is currently required for all internal combustion engine vehicles in California and the United States, providing consistency in regulatory requirements and lessening manufacturers' compliance burdens.

Subsection 1962.5(c)(2)(E)

Purpose

The purpose of this subsection is to prohibit vehicle manufacturers from locating additional vehicle connectors, of an identical shape and size, in close proximity to the location of the required vehicle connector.

Rationale

This subsection is necessary to avoid confusion among service and repair technicians who are intending to utilize the required vehicle connector to access standardized vehicle data but mistakenly plug in to an additional connector the vehicle manufacturer has installed in the same proximate location on the vehicle but for other proprietary purposes. This requirement aligns with what is currently required for all internal combustion engine vehicles in California and the United States providing consistency in regulatory requirements and lessening manufacturers' compliance burdens. This also ensures the necessary connecter for standardized data will be clearly identifiable and the data readily accessible.

Subsection 1962.5(c)(3)

Purpose

The purpose of this subsection is to identify which communication protocols are allowed to be used between the vehicle and the off-board tool for all standardized data required by this section 1962.5.

Rationale

This subsection is necessary to provide clear direction to vehicle manufacturers as to which SAE specifications they must adhere to for the communication of all messages necessary to transmit the standardized data between the vehicle and an off-board tool. Uniform communication specifications are critical for CARB and vehicle servicers to easily access the vehicle's standardized data, which is necessary for monitoring and enforcement of ZEV requirements and proper service and maintenance of ZEVs. This supports achieving the necessary emissions reductions of these proposed amendments.

Subsection 1962.5(c)(3)(A)

Purpose

The purpose of this subsection is to identify a specific protocol within SAE J1979-3 known as unified diagnostic services on a controller area network (UDSonCAN) that is allowed to be used by manufacturers for this section.

Rationale

This subsection is necessary to align with the communication protocol for all internal combustion engine vehicles by the 2027 model year in accordance with CCR, title 13, section 1968.2, which provides consistency across regulatory requirements and minimizes compliance burdens. Most ZEV manufacturers also produce internal combustion engine vehicles that will be required to support this protocol and allowing ZEV models to also use the same protocol is necessary to enable vehicle manufacturers to have a common solution across ZEV and non-ZEV vehicles and use consistent tooling at their dealer workshops to access and service the vehicles.

Subsection 1962.5(c)(3)(B)

Purpose

The purpose of this subsection is to identify an alternative communication protocol within SAE J1979-3 known as unified diagnostic services on an internet protocol network (UDSonIP) to be used by manufacturers for this section.

Rationale

This subsection is necessary to accommodate manufacturers that do not have a legacy of traditional internal combustion engine vehicles that have relied on a controller area network (CAN) for the past decade. It is also necessary to ensure future technological progression in vehicle data communication is not impeded. As technology on vehicles has advanced, many ZEV-only manufacturers, and some conventional manufacturers, have implemented more and more capable electronic control units that are interconnected by an ethernet or internet protocol rather than a traditional automotive CAN set-up. To facilitate compliance for these manufacturers, and with an eye to the future as to where even many traditional manufacturers may be headed, this option takes advantage of the developed unified diagnostic services (UDS) message structure but utilized on a higher speed ethernet network. To a repair technician, the data and format displayed on a scan tool will be identical. However, because an ethernet network is becoming more commonly used to interconnect multiple discrete networks on a vehicle, there is also potential for this protocol option to become more ubiquitous than just for propulsion-related components as this section 1962.5 requires. Movement in that direction would likely benefit the repair community and thus, vehicle owners, by providing a more common framework to access information from virtually every electronic controller on the vehicle.

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Subsection 1962.5(c)(4)

Purpose

The purpose of this subsection is to introduce the required standardized functions that vehicles will be required to support in accordance with SAE specifications. This subsection also requires that access to the required standardized information must be open to all users and not require any special access codes, subscriptions, authorization, or other mechanisms to restrict access to only certain users or tools.

Rationale

This subsection is necessary to introduce the types of standardized data and functions that are required by this section and the applicable SAE specifications defining such standardization. This subsection is also necessary, in an environment of heightened security around accessing data in a vehicle, to ensure that the subset of non-intrusive data required by this subsection is available unrestricted to users analogous to how it is available on all internal combustion engine vehicles. With a scan tool designed to comply with these standardized protocols, the data is available to any user, with any brand of tool, on any vehicle manufacturer's car, without the use of any special access codes, subscriptions, authorization, or any other special recognition. This is necessary not only for CARB to access the information needed for testing or verification of compliance but also so that repair technicians and even do-it-yourselfers can get to this information unimpeded by the vehicle manufacturer. This supports consumer confidence in ZEVs and achieving the necessary emissions reductions of these proposed amendments.

Subsection 1962.5(c)(4)(A)

Purpose

The purpose of this subsection is to identify the required standardized data stream parameters that vehicles will be required to support in accordance with SAE specifications. This subsection also requires that such parameters always be reported with the actual value for the parameter rather than any default or substitute values the control system might resort to upon realization that the actual value is invalid.

Rationale

This subsection is necessary to introduce the lists of standardized individual data stream parameters required by this subsection and the applicable SAE specifications defining such standardization. The referenced SAE digital annex provides critical details regarding identification of the specific parameter and scaling and resolution of the data to ensure it can be consistently and accurately displayed to a technician. The requirement to always provide the actual signal is needed to assist repair technicians

in troubleshooting actual malfunctions rather than confusing the diagnosis by reporting values the control system has already substituted in place of the actual value. Uniform, clear data stream parameters are necessary and critical for both CARB and vehicle servicers to easily interpret and understand the vehicle's data, which is necessary for monitoring and enforcement of ZEV requirements and proper service and maintenance of ZEVs. This supports achieving the necessary emissions reductions of these proposed amendments.

Subsection 1962.5(c)(4)(A)1.a.

Purpose

The purpose of this subsection is to identify a set of data required to be reported in a standardized format for all ZEVs to facilitate vehicle testing and diagnosis of detected malfunctions.

Rationale

This subsection is necessary to list the specific data parameters related to driving the vehicle during official testing and information about how recently attempts to repair a fault may have occurred. In conducting official testing on a chassis dynamometer, the first level of verification involves looking at how closely the actual vehicle speed correlated to the required speed specified by the driving cycle of the test being conducted including the driver's actions reflected in the accelerator pedal position movement during the test. This subsection also provides necessary details on the estimated odometer and vehicle activity that has occurred since the fault memory was last cleared to give repair technicians helpful information for troubleshooting intermittent malfunctions or difficult to repair malfunctions that have already had attempted repairs made by the owner or other repair technicians. Thus, these data stream parameters are necessary for maintenance of ZEVs, and ensuring this information is readily and understandably available to servicers is critical to ensure adequate and proper maintenance and support broader and more permanent consumer confidence in ZEVs.

Subsection 1962.5(c)(4)(A)1.b.

Purpose

The purpose of this subsection is to identify a set of data related to the high voltage battery pack required to be reported in a standardized format for all ZEVs to facilitate vehicle testing and diagnosis of detected malfunctions.

Rationale

This subsection is necessary to list the specific data parameters related to measurement of battery voltage, current, and energy usage during official testing. In conducting official testing on a chassis dynamometer, measurements of battery

voltage, current, and thus energy usage during the test are critical to determine the overall energy consumption of the vehicle and its estimate driving range. These measurements have traditionally been made with off-board equipment directly connected to the vehicle wiring system but the high voltage of vehicle battery packs combined with difficult access to make such connections greatly increases the costs and safety risks of doing such testing. Requiring such data to be available through the data connector provides an opportunity to greatly simplify the data collection and make it notably safer. The data also provides for minimum and maximum cell voltage to assist repair technicians and battery rebuilders in identifying degradation or malfunctions where a particular cell or string of cells is performing at a level substantially different from the rest of the cells.

Subsection 1962.5(c)(4)(A)2.a.

Purpose

The purpose of this subsection is to introduce and identify a separate set of data related to the high voltage battery pack required to be reported in a standardized format for all ZEVs and PHEVs with off-board charging capability to communicate the current health of the battery and the distance traveled since the health was last updated.

Rationale

This subsection is necessary to require vehicle manufacturers to report a normalized state of health of the battery pack to quantify its state of degradation relative to when it was new. State of health is a new metric proposed for model years 2026 and subsequent ZEVs and PHEVs and plays an important role in proposed ZEV durability and warranty requirements (see ISOR section III.D.1-3). Such information is also critical for vehicle owners, or prospective buyers, to be able to properly assess the state of degradation of the battery pack, the eligibility for a warranty repair, and the overall valuation of the car given the current health of the battery. This data is also necessary for CARB to assess the degradation at any point in time of the vehicle's life and in verifying compliance to the durability requirements for ZEVs in title 13, CCR, section 1962.2.

Subsection 1962.5(c)(4)(A)2.b.

Purpose

The purpose of this subsection is to identify data related to charging rates of the high voltage battery pack required to be reported in a standardized format for all ZEVs and PHEVs. These vehicles must communicate, while charging, the actual rate of charge occurring and the maximum rate the vehicle is capable of accepting.

Rationale

This subsection is necessary to address an issue occurring in-use with charging. Namely, while charging, vehicle owners have no way of knowing whether the infrastructure (the charger) or the vehicle is the limiting factor in the rate of charging. Vehicle manufacturers have complex algorithms designed to protect the battery from damage during charging and use many different criteria including things like battery temperature and state of charge to determine how fast it can be recharged. This information is communicated automatically between the car and the off-board charger such that the charger will deliver no more than what the car is willing to accept. However, the charger itself also has limitations in what it can deliver based on various factors like where it is connected to the electricity grid, how many other charge events are happening at the same location, and the capability of the charger itself. These behind-the-scenes factors and the arbitration between vehicle and charger to determine the ultimate charging rate are not readily apparent to the driver on today's ZEVs and can leave the driver with uncertainty if the charge event is not proceeding as it should and whether the infrastructure or the car is the limiting factor.

With this subsection, the charge rate that is actually being delivered as well as the maximum rate the car is capable of accepting at that moment would be required to be available in a standardized format. These two pieces of data can provide critical decision-making information to a consumer that has initiated a charge and can either confirm the expected rate of charge (and thus charge time) is occurring, or the expected rate of charge is not occurring and definitively identify if the charger or the car is causing the actual rate of charge to be lower than expected. Today, when faced with this latter situation, consumers are left wondering whether to stay where they are, to unplug and plug into a different charger at the same facility, or to unplug and go to a different facility in hopes of achieving the expected higher rate of charge. When provided with the information required by this subsection, consumers would be better informed to make that decision by knowing if the car is the limiting factor (and thus moving to a different charger or facility will not help) or if the charger is the limiting factor and how much higher the car is willing to accept (to determine the potential value of moving to a different charger). This subsection is therefore necessary to provide consumers more real-time charging information about their vehicles and address some of the current challenges with broader and more permanent consumer acceptance (e.g., see ISOR section III.A.5).

Subsection 1962.5(c)(4)(A)3.

Purpose

The purpose of this subsection is to introduce and identify additional data parameters specific to a fuel cell powertrain that are required only on ZEVs that are fuel cell electric vehicles rather than battery electric vehicles. These parameters include data

on the consumption of hydrogen fuel and the electrical power generated by the fuel cell that are measured during official testing of the vehicles to determine energy consumption and driving range of the vehicle.

Rationale
This subsection is necessary to facilitate official testing by making necessary parameters available in standardized format accessible by a scan tool rather than expensive custom laboratory measurement equipment currently used. For example, the required data includes the cumulative quantity of hydrogen consumed which could avoid the need for laboratory test cells to have an off-board hydrogen tank that is temporarily connected to the vehicle in lieu of the on-board tank and is equipped with external devices to measure the quantity of hydrogen consumed during testing. Likewise, the data provides information on the electrical output of the fuel cell including voltage and current, integrated over time, that is measured during official testing. Thus, having this data reported directly from the vehicle through the standardized connector is necessary to greatly simplify the ability to test the vehicle (compared to the laboratory alternative using off-board current and voltage measurement equipment that must be directly connected by laboratory personnel to the high voltage wiring of the vehicle) while preserving the accuracy of the retrieved data and removing notable safety risks.

Subsection 1962.5(c)(4)(A)4.a.

Purpose
The purpose of this subsection is to introduce and identify minimum accuracy specifications for the data parameters required to be reported. This subsection establishes that manufacturers must use the most accurate value that is available within the onboard computers on the vehicle responsible for reporting the data.

Rationale
This subsection is necessary to ensure that vehicle manufacturers do not undermine the value of the data by purposely reporting less accurate values than the onboard computers have calculated or are using for vehicle control algorithms. Accurate values are critical to ensure vehicle owners, servicers, and CARB have representative information about a given vehicle, which informs purchasing, operational, servicing, and enforcement decisions. This method, as opposed to establishing standalone accuracy specifications for each and every data parameter, provides more flexibility to the vehicle manufacturer to make its own determination as to the accuracy needed for vehicle functionality (e.g., control algorithms) and then simply provide that same level of accuracy in reporting the data in a standardized manner to a scan tool.

Subsection 1962.5(c)(4)(A)4.b.

Purpose

The purpose of this subsection is to identify details regarding sampling frequency and data parameter update rates for key pieces of information used during official testing. Namely, the measurements of voltage and current from the high voltage battery and/or fuel cell stack are required to be sampled with a minimum frequency of 20 hertz, integrated over a one second period, and used to update reported values of cumulative current and energy every second.

Rationale

This subsection is necessary to align the frequency and structure of the reported data to closely mimic the method used by off-board voltage and current measurement tools during official testing to quantify energy consumption. This alignment increases the likelihood that the standardized electronic data could ultimately be used in place of the off-board measurements thereby making official testing easier and safer to conduct. In other words, this subsection is necessary to acquire battery and fuel cell system current and energy data at the requisite level of detail captured in official testing to lay the foundation for testing in the future that will hopefully be easier and safer while still providing the requisite level of detail and accuracy needed.

Subsection 1962.5(c)(4)(A)4.c.

Purpose

The purpose of this subsection is to delineate additional accuracy and standardized format details regarding only the battery state of health (SOH) data parameter. This subsection requires the data parameter to be reported as a value from 0 to 100 percent, correlating to the current percentage of usable battery energy relative to the usable battery energy when the vehicle was new. The subsection defines the quantification of usable battery energy as per the method used in official testing and identified in the ZEV test procedures incorporated by reference in this section. A minimum accuracy requirement is also included that specifies the reported SOH must correlate to a usable battery energy that is no more than 5 percent higher than the actual measured usable battery energy.

Rationale

This subsection is necessary to ensure the reported SOH value is sufficiently accurate to be relied on by consumers, repair technicians, and CARB and is consistently implemented across industry by all vehicle manufacturers in a manner that could be readily understood to a typical vehicle owner. Such information is critical for vehicle owners, or prospective buyers, to be able to properly assess the state of degradation of the battery pack, the eligibility for a warranty repair in title 13, CCR, section 1962.8, and the overall valuation of the car given the current health of the battery. This data is

also a critical parameter for CARB to assess the degradation at any point in time of the vehicle's life and in targeting vehicle test groups that may be at risk of not meeting the durability requirements for title 13, CCR 1962.4. For consistency in assessing the accuracy of this parameter across all manufacturers, it is necessary to follow the method used for determining usable battery energy provided in the ZEV test procedures. Given the far-reaching implications of this data parameter, it is necessary to go beyond the general accuracy requirements of subsection (c)(4)(A)4.a. and require manufacturers to implement robust and highly accurate calculations of SOH within a prescribed 5 percent accuracy level. The SOH accuracy requirement was determined to be 5 percent based on discussions with the regulated industry to determine a reasonable specification given the variation of in-use vehicle operation.

Subsection 1962.5(c)(4)(A)4.d.

Purpose

The purpose of this subsection is to provide an additional standardization requirement regarding the battery SOH data parameter in specific cases where the vehicle has been designed to hold some battery capacity 'in reserve' when the vehicle is new and gradually open up that reserve to counteract degradation in the battery. For such designs, this subsection requires the SOH parameter correlate to the total usable battery energy including what may currently be in reserve and unavailable to the driver. Based on the uniqueness of this situation, this subsection also requires manufacturers employing such a strategy to make available to CARB special tools or software to allow CARB to properly verify the accuracy of the SOH parameter over the full battery including the reserve.

Rationale

This subsection is necessary to avoid undermining of the intent and value of the SOH parameter. Some vehicle manufacturers have identified initially holding back some reserve as a potential strategy they may employ to counteract customer-facing degradation of the battery by gradually opening up access to this reserve as the battery degrades. In this manner, the loss of capacity due to degradation could be offset by opening up an equivalent amount of reserve and have no perceived degradation by the vehicle owner. However, the battery is still degrading in such a case and it would be misleading to a consumer to falsely represent the SOH is still 100 percent. As an example, take two identical vehicles that both report an SOH of 100 percent yet one of them has not used up any of the reserve while the other has used up virtually all of reserve. To a used car shopper evaluating the two vehicles and looking only at the reported parameter, the SOH would indicate both are of equal value, yet the battery is actually far less degraded in the first car and the second car, which has so far been able to mask its degradation, will start showing signs of reduced battery capacity as the reserve has been depleted. By requiring the SOH parameter to

account for reserve capacity, the first vehicle could validly report 100 percent SOH while the second car would reporting something less than 100 to reflect that amount of degradation that has been masked by using up the reserve. This would allow the vehicle owner or used car shopper to appropriately discern between the two different vehicles and value the vehicle appropriately, and thus is a necessary and important piece to bolster consumer confidence in ZEVs.

The last part of this subsection is necessary to ensure that vehicle manufacturers will provide to CARB, when requested, special software or other functionality that would allow CARB to temporarily open up the full reserve (if it hasn't yet been fully used up on a subject vehicle) to conduct official testing to verify the SOH parameter accurately correlates to the usable battery energy. Without such a requirement, CARB would be unable to verify accuracy of the SOH parameter until vehicles were known to have fully used up all of the reserve, greatly reducing the ability to effectively enforce this requirement.

Subsection 1962.5(c)(4)(A)4.e.

Purpose

The purpose of this subsection is to explicitly allow manufacturers to design the SOH parameter to only be updated when certain operating or charging conditions have been satisfied if such action is necessary to maintain the accuracy within the specifications of subsection (c)(4)(A)4.c. However, this subsection allows such restrictions only if they are technically necessary, designed to be met under conditions reasonably expected to occur in normal use of the vehicle, and, on average, will provide for an updated SOH at least once every 4,000 miles.

Rationale

This subsection is necessary to provide manufacturers the ability to wait for driving and charging events to occur that are conducive to an accurate calculation of the battery SOH such that they can maintain the required accuracy of the parameter. In general, the calculation of SOH is more accurate when a larger portion of the battery energy has been used before the vehicle is fully recharged. Exercising the battery more fully allows repeated measurements over a large portion of the battery's state of charge which then allows for less extrapolation to estimate the capacity of the remaining portion of the battery. However, this data parameter must still get updated with sufficient frequency to be of value to consumers so this subsection imposes some limitations on the types of restrictions manufacturers can utilize. Specifically, it only allows the use of restrictions that are technically necessary to keep the accuracy of the parameter within 5 percent to avoid manufacturers employing systems designed primarily to update infrequently in hopes of undermining the confidence in the parameter or delaying communication of degradation to the consumer. Secondly, it

only allows manufacturers to utilize conditions that are reasonably expected to be encountered during typical usage of the vehicle to avoid manufacturers imposing unrealistic conditions that might only occur under extremely rare conditions such as during official testing procedures where the vehicle battery is depleted in a single drive event from fully charged to fully depleted such that car can no longer be driven. Lastly, this subsection sets a target for the overall frequency of updates on vehicles, on average, to be no less than once every 4,000 miles to ensure that manufacturers are fully considering typical expected usage of the vehicle over that amount of mileage when designing any restrictions on conditions necessary to update the parameter. Given degradation of the battery is a fairly slow process, a parameter that updates even just three to four times a year would be more than adequate to track such degradation. This length of time also fits in with research done by UC Davis for CARB that found vehicles in the program were still seeing 2 to 3 percent of weekday and weekend days (7 to 11 days per year) where the vehicle was operated more than 150 miles[1] which would represent a fairly significant discharge event even for 300-mile range ZEVs.

Subsection 1962.5(c)(4)(B)1.

Purpose

The purpose of this subsection is to introduce and define the requirement for manufacturers to provide standardized access to read propulsion-related fault codes in a format specified by SAE J1979-3, J2012, and J2012-DA.

Rationale

This subsection is necessary to ensure that repair technicians will have access to read fault codes detected and stored by the vehicle itself when a malfunction of a propulsion-related part occurs. This information is vital to assist a repair technician in efficiently diagnosing and repairing vehicles, which will translate to more affordable repairs especially on older used cars. This format also aligns with what is already required for internal combustion engine vehicles to provide familiarity to repair technicians in how the fault information is presented and understood.

Subsection 1962.5(c)(4)(B)2.

Purpose

The purpose of this subsection is to define the requirement for manufacturers to provide standardized access to clear (erase) propulsion-related fault codes.

[1] Figure 51 "Share of Daily VMT by Distance Bin: Weekdays vs Weekends," Advanced Plug-in Electric Vehicle Travel and Charging Behavior Final Report (CARB Contract 12-319 – Funding from CARB and CEC), April 10, 2020, https://csiflabs.cs.ucdavis.edu/~cjnitta/pubs/2020_03.pdf

Rationale
This subsection is necessary to ensure that, after repair, technicians will have the ability to clear the fault codes for any applicable vehicle via a standardized request before returning the vehicle to the customer. This is necessary for consumer satisfaction in knowing the vehicle was repaired correctly by having the vehicle returned to the customer with the fault and any associated warning lights, messages, or default actions reset to a normal state. This function is also useful to repair technicians during diagnosis to clear the fault and confirm the fault is redetected or explore the type of conditions that cause the fault to be redetected in order to better pinpoint the root cause.

Subsection 1962.5(c)(4)(C)1.

Purpose
The purpose of this subsection is to introduce requirements for vehicle identification information that must be reported in a standardized format and to define the requirement for manufacturers to provide a standardized parameter reporting the test group in which the vehicle was certified. This subsection also requires that no more than one onboard computer can report the test group.

Rationale
This subsection is necessary to associate any electronic data collected or reported from individual vehicles to the test group that they were certified in. The test group is the key designation used by CARB in identifying groups of vehicles that have been certified and can be linked back to the certification information for that test group for enforcement or other compliance testing. The limitation for no more than one onboard computer to report the test group mimics what has been done with the vehicle identification number for internal combustion engine vehicles, eliminates the possibility for a mismatch in reported values from different onboard computers, and reduces the burden on vehicle manufacturers to ensure any software updates to a single onboard computer are coordinated with all other computers reporting the test group.

Subsection 1962.5(c)(4)(C)2.

Purpose
The purpose of this subsection is to define the requirement for manufacturers to provide a standardized parameter to report the version of software calibration in each of the propulsion-related onboard computers. Manufacturers are to revise the calibration identification number if any single bit is different in a subsequent or revised calibration.

Rationale
This subsection is necessary to provide a means of identifying the particular software calibration being used in any vehicle. This is particularly helpful when vehicle noncompliances are discovered that are limited within a test group to only particular software versions or to track that the correct calibration was installed following a recall or other corrective action. Repair technicians can also use this information to identify if updated software is available when trying to resolve certain malfunctions that have been addressed by the manufacturer via a software fix. This requirement aligns with what is already required for emission-related onboard computers on internal combustion engine vehicles, which provides consistency across regulatory requirements and minimizes burdens.

Subsection 1962.5(c)(4)(C)3.

Purpose
The purpose of this subsection is to define the requirement for manufacturers to provide a standardized parameter to report the vehicle identification number (VIN) of the individual vehicle. This subsection also requires that no more than one onboard computer can report the VIN.

Rationale
This subsection is necessary to facilitate large electronic data collections and be able to associate any electronic data collected or reported to the individual vehicle that was the source of the data, and thus is necessary for enforcement purposes. The VIN is a unique identifier for each and every vehicle that has been produced and can be used by CARB and the vehicle manufacturer in identifying specific build configurations or options. VIN is also often used by repair technicians when ordering replacement parts to ensure the ordered parts will be compatible with the particular vehicle. The limitation for no more than one onboard computer to report the VIN mimics what has been done for internal combustion engine vehicles and eliminates the possibility for a mismatch in reported values from different onboard computers. This also reduces the burden on vehicle manufacturers to ensure any software updates to a single onboard computer are coordinated with all other computers reporting the VIN.

Subsection 1962.5(c)(4)(C)4.

Purpose
The purpose of this subsection is to define the requirement for manufacturers to provide a standardized parameter to report the name of the individual onboard computer that is reporting the data parameters to a scan tool.

Rationale
This subsection is necessary to allow a repair technician to associate any reported data

with the actual onboard computer that is doing the reporting. The required SAE format provides a text character name such as "motor control module" or "battery management system" which can provide critical context to a repair technician in understanding reported fault codes based on which individual onboard computer is reporting the information. This information can also be important to CARB in enforcement contexts. Having a standardized format provides consistency and minimizes burdens.

Subsection 1962.5(c)(4)(D)1.a. through r.

Purpose

The purpose of this subsection is to introduce and define the requirements for manufacturers to track a number of parameters related to the operation of the vehicle in a standardized format such that they can be read with an automotive scan tool. The subsection identifies the SAE standards that specify the standardized format and lists out each required parameter. Data required to be tracked and stored on the vehicle include information about the activity of the car (e.g., distance traveled, number of trips, cumulative vehicle operational time, total energy produced) as well as data specific to the ZEV powertrain technology being used (e.g., quantity of hydrogen fuel consumed, cumulative amount of electricity used during charging, average battery temperature).

Rationale

This subsection is necessary to ensure vehicles directly track information that can subsequently be accessed and used by CARB, the manufacturer, or repair technicians to verify in-use performance of the vehicle is consistent with how the vehicle was certified. These required data parameters and capturing them via an automotive scan tool are critical to allow for cost-effective sampling of data from a larger number of vehicles (by simply plugging in and downloading the information) compared to programs that bring individual vehicles into a laboratory for days or weeks of testing or data logging programs where specialized equipment is installed on the vehicle to capture data. By effectively requiring the vehicle itself to keep track of cumulative values of these key parameters, a one-time plug-in event later in the life of a vehicle can yield meaningful data values representing average values over a lengthy period of time at very low cost. This data is necessary to validate that the vehicles are performing similarly in terms of energy usage and efficiency as to what the official testing at the time of certification found. This data can also be used to verify that the conditions used for testing in certification are adequately representative of in-use operation so that any consumer-facing information such as range or expected electricity usage is meaningful and representative of what a typical customer may encounter. Lastly, this data is also necessary to identify vehicles that have been subjected to conditions which may adversely impact the durability of the car and

would not readily be observable to a vehicle owner or purchaser such as the amount of energy that has been drawn out of the battery and used to power off board devices or put back into the grid. In sum, these vehicle operation tracking requirements are critically necessary for durability, warranty, and enforcement purposes.

Subsection 1962.5(c)(4)(D)2.

Purpose

The purpose of this subsection is to define detailed requirements for the format of the individual data parameters required in subsection (c)(4)(D)1. by referencing the required data formats in a specific SAE automotive document. This subsection also requires manufacturers to divide all the stored data values by two if any one of the values reaches the maximum value per SAE specifications.

Rationale

This subsection is necessary to ensure manufacturers implement the data in a standardized format across all of industry and consistent with the format of similar data already required in title 13, CCR, section 1968.2 for internal combustion engine vehicles. In order to preserve as much data as possible, it is also necessary to require manufacturers to implement a specific software strategy to divide all counters in half should any individual value hit the maximum value. The SAE specifications have assigned large maximum values that will unlikely be reached in a typical vehicle lifetime but by design, the software needs to protect for the unusual event to ensure predictable behavior rather than erratic results where some values reset to zero or some freeze at the maximum or other outcomes that render the data no longer usable.

Subsection 1962.5(c)(4)(D)3.a. through 3.b.

Purpose

The purpose of this subsection is to impose restrictions on CARB's collection and storage of data collected from vehicles owned by private individuals. Specifically, it requires CARB to verify any data it or its contractor directly collects from vehicles is only collected with the vehicle owner's voluntary and informed consent and that such data is stored by CARB consistent with CARB's data records policies that protect unauthorized access or disclosure of vehicle owner information.

Rationale

This subsection is necessary to ensure any data collected by CARB is done so voluntarily and with informed consent and maintained by CARB in a manner that prevents accidental disclosure or unauthorized access. CARB has recordkeeping policies in place that govern the manner in which sensitive data is maintained. This subsection is needed to provide assurances to vehicle manufacturers and owners that

any data CARB collects from vehicles owned by private individuals will be protected consistent with those policies.

Subsection 1962.5(c)(5)(A)

Purpose

The purpose of this subsection is to introduce and define special data collection requirements applicable to vehicles that are reprogrammed 'over-the-air' (remotely through a cellular or Wi-Fi data connection). This subsection requires vehicles to either be designed to retain the values of the data tracked per subsection (c)(4) in the vehicle during such a reprogramming event or, if such values will be erased during reprogramming, to collect the values for reporting to CARB before reprogramming.

Rationale

This subsection is necessary to ensure the tracked data of subsection (c)(4) is not undermined by frequent reprogramming that resets the information to zero. Prior to over-the-air reprogramming, vehicles needed to be taken into a repair station and physically connected to specialized tooling and, accordingly, reprogramming events were limited to those absolutely necessary and only if the vehicle owner actually brought the vehicle in. With remote programming, manufacturers have taken to more frequent reprogramming, even to address minor issues or to add features, and a high percentage of vehicles will accept the reprogramming event much like consumers agree to let their computer or cell phone do an update. Because the tracked data is intended to represent cumulative values over a long period of vehicle operation, frequent resetting of the data would greatly reduce the ability to locate vehicles with a sufficient quantity of collected data to meet the intended purpose of the data. This subsection is also necessary to align with what is already required for similar tracked data on all internal combustion engine vehicles per CCR, title 13, section 1968.2, which ensures consistency across vehicle regulations and minimizes burdens.

Subsection 1962.5(c)(5)(B)

Purpose

The purpose of this subsection is to define a reporting method and format for manufacturers to submit to CARB the data collected prior to an over-the-air reprogramming event per subsection (c)(5)(A) and to establish a deadline for reporting the data.

Rationale

This subsection is necessary to specify an electronic format for the collected data and a mechanism to submit that data electronically to CARB that is identical to the method used to report similar data for internal combustion engine vehicles per title 13, CCR, section 1968.2. This provides consistency across regulatory requirements and

minimizes burdens. Submittal of the data is required to allow CARB to achieve the original intent of the tracked data and collect values accumulated over a significant length of operation of the vehicle in understanding the typical operation of the vehicle and confirming it is consistent with the testing of the vehicle at the time of certification even if it requires piecing together multiple reported values between subsequent reprogramming events of the same vehicles.

Subsection 1962.5(c)(6)(A) and (B)

Purpose

The purpose of this subsection is to introduce requirements to be able to display a limited number of the data parameters required per subsection (c)(4) directly to a consumer in vehicle without the use of an automotive scan tool (e.g., by displaying the data on the instrument cluster or dashboard display). This subsection requires the battery state of health data required in subsection (c)(4)(A)2.a. to be displayable to the driver as well as information about the speed of recharging per subsection (c)(4)(A)2.b. while the vehicle is actively being charged.

Rationale

This subsection is necessary to provide vehicle owners with the ability to access information on the health of the vehicle's battery without reliance on the use of specialized automotive tools or taking the vehicle to a dealer or other repair facility. Degradation of the battery will necessarily happen on ZEVs and as described earlier, this state of health data is critical to understand the health of the battery to determine warranty eligibility and to assess the relative value of the vehicle, especially for used car shoppers comparing multiple vehicles with differing levels of battery degradation. This subsection is therefore necessary to provide consumers direct access to a vehicle battery's SOH and address some of the current challenges with broader and more permanent consumer acceptance (e.g., see ISOR section III.A.5).

This subsection is also necessary to fill a gap in vehicle owner knowledge during charging events. Specifically, while charging, this data would report the speed at which charging is occurring as well as the maximum speed of charging that the vehicle could accept at this moment. This knowledge can empower the vehicle owner to be able to calculate how long it will likely take to achieve the desired charge amount and, if charging is happening at a slower rate than expected, to discern between a slower charge rate caused by the off-board charger's capability to deliver the charge or caused by restrictions in the vehicle that are limiting the rate at which it can accept the charge. Vehicle manufacturers have complex algorithms designed to protect the battery from damage during charging and use many different criteria including things like battery temperature and state of charge to determine how fast it can be recharged. This information is communicated automatically between the car and the

off-board charger such that the charger will deliver no more than what the car is willing to accept. However, the charger itself also has limitations in what it can deliver based on various factors like where it is connected to the electricity grid, how many other charge events are happening at the same location, and the capability of the charger itself. These behind-the-scenes factors and the arbitration between vehicle and charger to determine the ultimate charging rate are not readily apparent to the driver on today's ZEVs and can leave the driver with uncertainty if the charge event is happening as it should and if not, what action can be taken. For instance, a slower than expected charge rate caused by the charger itself could be addressed by the vehicle owner plugging into a different charger at the same station or going to a different station altogether. However, a slow charge limited by the vehicle itself cannot be addressed by the consumer changing charge locations and would unnecessarily waste the vehicle owner's time by seeking out alternate locations. This subsection is therefore necessary to provide consumers direct real-time charging information about their vehicles and address some of the current challenges with broader and more permanent consumer acceptance (e.g., see ISOR section III.A.5).

Subsection 1962.5(c)(6)(C)1. through (C)4.

Purpose

The purpose of this subsection is to define the format for manufacturers to use when displaying the required SOH and charging data in vehicle such as on a dashboard display by specifying limitations on how many screens or submenus selected to display the data and requiring the data to be displayed in standard user-friendly units.

Rationale

This subsection is necessary to ensure manufacturers do not make the data overly burdensome for a vehicle owner to find and display and, once displayed, to make sure the data is in commonly understood units (alphanumeric, SOH as a percentage, standard engineering units) instead of unscaled or difficult to understand units, which would undermine the intent of providing direct information to the consumer/owner.

Subsection 1962.5(d)

Purpose

The purpose of this subsection is to direct manufacturers to title 13, CCR, section 1962.4(i) to identify the documentation required at the time of certification demonstrate compliance with the requirements of this section 1962.5. This is separate from the submittal of testing documentation required on production vehicles after certification under subsection (e) below.

Rationale

This subsection is necessary to ensure manufacturers are aware of the requirements to

submit documentation at the time of certification that demonstrate compliance with this section 1962.5 and to point manufacturers to title 13, CCR, section 1962.4(i) where the entirety of documentation required at the time of certification is identified including the specific documentation to be submitted and details on how and when to submit it. Submittal of this information is necessary to allow CARB staff to confirm the manufacturer has implemented the required parameters, communication protocol, and vehicle connector at the time of certification and to retain such certification records for use during future enforcement investigations.

Subsection 1962.5(e)(1)

Purpose

The purpose of this subsection is to introduce and define a requirement for the manufacturer, after being certified per CCR, title 13, section 1962.4, to perform testing on production vehicles to demonstrate compliance with the requirements of subsections (c)(3) and (c)(4).

Rationale

This subsection is necessary to ensure actual production vehicles are designed and built in compliance with the standardization requirements for the communication of the data from the car to an offboard scan tool. Verifying compliance with the data parameters and communication is critical, as this data serves as the basis for assessing compliance and enforcement for several other proposed ZEV requirements. As explained earlier, having this data standardized and readily accessible is necessary to address outstanding consumer challenges for broader and more permanent ZEV adoption (particularly durability and serviceability) as well as CARB's monitoring and enforcement of those requirements, and therefore a key piece of meeting this proposal's emissions reductions goals. And, as explained more in the next subsection, it is necessary for manufacturers to perform this testing early in production to ensure the purpose of this section is not undermined. This testing requirement mimics that required for every internal combustion engine vehicle per title 13, CCR, section 1968.2, providing consistency across regulatory requirements and minimizing burdens.

Subsection 1962.5(e)(2)

Purpose

The purpose of this subsection is to define how many and which vehicles a manufacturer must perform the testing on to verify compliance. This subsection requires manufacturers to conduct such testing every model year no later than 60 days after the start of production and to carry out such testing on one vehicle from each vehicle model that utilizes different software or calibrations. It also allows manufacturers to request approval to group multiple vehicle models together that

have some differences in software or calibration as long as such differences do not affect the communication of the required standardized data.

Rationale

This subsection is necessary to ensure this required testing can identify noncompliant implementations early after production begins (i.e., within 60 days), thereby limiting the number of vehicles that are produced in a noncompliant configuration which would otherwise result in problems for tool manufacturers, repair technicians, and CARB in accessing the required information. Relying on testing after widespread distribution defeats the purpose of this section, as any noncompliance likely would pervade the entire vehicle model population, meaning the entire population would be unable to provide the requisite data (or otherwise provide it in a format difficult to comprehend) and assessment of whether these vehicles meet ZEV assurance measures would then be jeopardized. Allowing manufacturers to request Executive Officer approval to group multiple calibrations together in one testing is needed to strike a balance between the comprehensiveness of testing enough vehicles to be representative of every vehicle the manufacturer builds and imposing a manageable test burden. There may be multiple calibrations that may differ in ways that have no bearing on the data reporting and communication requirements or performance; where that is the case, and the software designed to comply with the standardization requirements of subsection (c) is identical across calibrations, the Executive Officer will approve the request, as in that instance the vehicle tested should be representative of the larger group for purposes of this section. It is necessary for the Executive Officer to notify the requesting manufacturer of an approval or denial within 30 days of receiving the request to ensure a timely response to the manufacturer so that they may still conduct the testing within the required timeframe.

Subsection 1962.5(e)(3)

Purpose

The purpose of this subsection is to define the type of off-board equipment a manufacturer is required to use to carry out the testing of subsection (e). This subsection details a process for manufacturers to submit a request identifying details of the equipment to be used to the Executive Officer and a process for the requested equipment to be approved for use prior to the start of testing.

Rationale

This subsection is necessary to ensure that CARB has oversight over the equipment being used by the manufacturer to ensure it has been designed to verify compliance in accordance with the SAE specifications and the requirements of this section 1962.5. This subsection is necessary to reduce the chance that an individual manufacturer can utilize equipment that has been specifically designed to ignore its vehicle's

noncompliances or otherwise falsely report that the standardized data is compliant when it is not, which would undermine the goals of this section and jeopardize compliance and enforcement of several other ZEV requirements. To that end, it is necessary for manufacturers to submit data, specifications, or engineering analysis that demonstrate the requested off-board device will verify a vehicle's ability to properly communicate the required data parameters. The Executive Officer will approve the use of the requested device upon determining the manufacturer has provided such demonstrating data, specifications, or engineering analysis. It is necessary for the manufacturer to submit its request at least 30 days prior to conducting testing, and for the Executive Officer to notify a manufacturer of their approval or denial within 30 days of receiving the request so that the manufacturer can still meet the testing deadline of no later than 60 days after the start of normal production. This request process is identical to the process used for internal combustion engine vehicles subjected to similar testing for standardized data per title 13, CCR, section 1968.1, which ensures consistency in regulatory requirements and minimizes burdens.

Subsection 1962.5(e)(4)(A)

Purpose

The purpose of this subsection is to introduce and define the individual requirements of section 1962.5 that must be verified during the testing required by subsection (e), beginning with verification that all of the vehicle's propulsion-related onboard computers can properly communicate with an off-board automotive scan tool as per the required SAE communication protocols.

Rationale

This subsection is necessary to define the scope of what the equipment must be designed to validate during testing of production vehicles and ensure that it verifies the vehicle is reporting the data consistent with the communication protocol specifications governing the transmittal of information between a vehicle and an off-board tool. This subsection is consistent with an identical requirement for all internal combustion engine vehicles per title 13, CCR, section 1968.2, which ensures consistency in regulatory requirements and minimizes burdens.

Subsection 1962.5(e)(4)(B)1. through 4.

Purpose

The purpose of this subsection is to identify the individual standardized data parameters and functions that must be verified as compliant during the testing required by subsection (e) including all data parameters required by subsection (c)(4) and the ability to read propulsion-related fault codes required by subsection (c)(4)(B)1.

Rationale

This subsection is necessary to ensure that the testing of subsection (e) verifies each individual data parameter is properly transmitted in the standardized format from a car to a tool such that it can be correctly displayed in valid units as required. Verification of each parameter greatly reduces the chance for a significant number of vehicles to be introduced into commerce with data that cannot be read properly by repair technicians or CARB, which is critical for performance evaluation and enforcement. This subsection is also necessary to verify that the vehicle can properly report fault codes and reduces the possibility of repair technicians, consumers, and tool manufacturers having problems with fault codes that cannot be read through normal means. This subsection is consistent with an identical requirement for all internal combustion engine vehicles per title 13, CCR, section 1968.2, which ensures consistency in regulatory requirements and minimizes burdens.

Subsection 1962.5(e)(4)(C)

Purpose

The purpose of this subsection is to require manufacturers to verify vehicles will properly erase fault codes upon request by an off-board scan tool as required in subsection (c)(4)(B)2.

Rationale

This subsection is necessary to ensure that the vehicle can properly respond to a request to clear fault codes and reduce the possibility of repair technicians, consumers, and tool manufacturers having problems with fault codes that cannot be erased through normal means even if repairs are properly conducted. This subsection is consistent with an identical requirement for all internal combustion engine vehicles per title 13, CCR, section 1968.2, which ensures consistency in regulatory requirements and minimizes burdens.

Subsection 1962.5(e)(4)(D)1.

Purpose

The purpose of this subsection is to introduce and specify reporting requirements for the manufacturers to submit the results of testing required by subsection (e) to CARB for vehicles that are found to have one or more noncompliances. Such reports are required to be submitted within 30 days of identifying a noncompliance, to provide details of the problem, and to propose corrective actions to remedy the noncompliance for Executive Officer approval. This subsection provides the factors for the Executive Officer's consideration in approving or denying the proposed corrective action.

Rationale

This subsection is necessary to ensure that manufacturers report noncompliances in a

timely fashion and describe the problems identified for CARB to understand. This requirement is also necessary to provide a process for the manufacturer to submit a proposal to remedy any issues discovered and an implementation timeline for the Executive Officer to evaluate. In evaluating the proposed corrective action, it is necessary for the Executive Officer to take into account the severity of the problem, the ability of servicers and CARB to access the required data, the impact on equipment and tool manufacturers, and the amount of time before implementation would begin because these are the factors most relevant to evaluating how well and how timely a proposed corrective action will address the identified noncompliance. This is similar to the process already used for all internal combustion engine vehicles per title 13, CCR, section 1968.2, which ensures consistency in regulatory requirements and minimizes burdens.

Subsection 1962.5(e)(4)(D)2.

Purpose

The purpose of this subsection is to specify separate reporting requirements for the manufacturers to submit the results of testing required by subsection (e) to CARB for vehicles that are found to be compliant with all of the tested requirements. Such reports are required to be submitted within 90 days of testing.

Rationale

This subsection is necessary to provide a separate submittal process for manufacturers to use in cases where the vehicle passes all requirements in the test. As this only applies in cases where the vehicle passed all tests, this subsection provides a longer timeline to give manufacturers additional flexibility to submit the report to CARB. This is similar to the process already used for all internal combustion engine vehicles per title 13, CCR, section 1968.2, which ensures consistency in regulatory requirements and minimizes burdens.

Subsection 1962.5(f) Electronic submittal.

Purpose

The purpose of this subsection is to define the mechanism by which manufacturers must submit documents, reports, information, and requests (hereinafter, “documents”) under the proposed regulations. The subsection provides that manufacturers must submit documents electronically using CARB’s Document Management System, an electronic system that allows manufacturers to send documents to CARB via the internet.

Rationale

This subsection is necessary to provide manufacturers with a designated mechanism to submit required or optional documents under the proposed regulations. It is necessary for CARB to require manufacturers to submit documents under this section through

CARB's Document Management System, which manufacturers already must use to submit certification documents to CARB, because it supports efficient transmittal and review, provides manufacturers with a consistent submittal mechanism across regulations, and reduces the bulk of paper. It is necessary to provide the website address https://ww2.arb.ca.gov/certification-document-management-system, which provides a detailed explanation of the system, instructions, support information, and a prominent link to the current location of the system at https://ssl.arb.ca.gov/edms, rather than the address of the current system location, which is only a log-in page lacking these features.

Subsection 1962.5(g) Deficient Requirements

Purpose

The purpose of this subsection is to provide vehicle manufacturers with a process to certify vehicles even though they fall short of one or more of the standardized data requirements of this section 1962.5. This subsection establishes a progressively increasing criteria to be used for 2026 through 2029 model year vehicles to determine if the vehicle is eligible to be certified based on the percentage of standardized data requirements that are met. This subsection also provides that any deficient requirements do not need to be included in any written report required under subsection (e)(4)(D)1.

Rationale

This subsection is necessary to provide additional flexibility to manufacturers that make good faith efforts to implement the requirements of this section 1962.5 in full but fall short of complete implementation in the first four years of the program. Specifically, this section provides defined percentages that a manufacturer and CARB can use to determine if a sufficient portion of the requirements were met, with 50 percent of the individual data requirements needing to be met for the first two years and 70 and 90 percent, respectively, for the 2028 and 2029 model years. As explained earlier, having this data standardized and readily accessible is necessary to address outstanding consumer challenges for broader and more permanent ZEV adoption (particularly durability and serviceability) as well as CARB's monitoring and enforcement of those requirements, and therefore a key piece of meeting this proposal's emissions reductions goals. It is therefore also important to ensure a successful introduction of the standardized data requirements, and this subsection is necessary and reasonable to ensure that success by providing this increasing compliance phase-in over the first four model years. This flexibility avoids manufacturers having to take more drastic and costly actions, such as delaying productions altogether, if they had to implement designs, software, and calibrations to meet all the requirements at once. It is also necessary to specify that each separately numbered subsection will count as an individual data requirement if applicable to the

vehicle to delineate how to tally total applicable requirements in order to determine the numerical threshold for certification. This deficiency provision is similar to a deficiency provision used for all internal combustion engine vehicles per title 13, CCR, section 1968.2, providing manufacturers similar flexibilities for meeting data requirements for ZEVs as for ICEVs.

It is also necessary to note that deficient requirements under this subsection do not need to be included in any written report per to subsection (e)(4)(D)1., provided that the manufacturer has included a list of the deficient requirements in its certification application. Since certain of these data requirements are permitted to be phased in, and CARB will already have notice of the deficient requirements, manufacturers do not need to then submit a written report for these deficiencies.

Subsection 1962.5(h) Enforcement.

Purpose

The purpose of this subsection is to identify the applicable regulation that defines the enforcement procedures CARB will follow to determine if noncompliances with this section 1962.5 exist and, if so, to determine appropriate corrective actions.

Rationale

This subsection is necessary to specify the regulation and process (proposed CCR, title 13, section 1962.7) under which CARB will determine the presence of a noncompliance with the requirements of this section and any enforcement actions needed. This ensures manufacturers are aware of the enforcement procedures they may be subject to.

Subsection 1962.5(i) Severability.

Purpose

The purpose of this subsection is to define that each provision of this section is severable and if any provision of this section is held to be invalid or unenforceable, the remainder of the article remains in full force and effect.

Rationale

This subsection is necessary to preserve the overall intent of what the proposed regulation is set to achieve, even if unforeseen issues arise with enforcing any individual term of the proposed regulation.