Zero-Emission Powertrain Certification (ZEP Cert)

2nd Public Workshop El Monte, CA February 13, 2018

Meeting materials available at:

https://ww2.arb.ca.gov/our-work/programs/zero-emission-powertrain-certification



Agenda

- California's Climate/Air Quality Challenges, and Policy Objectives
- ZEP Cert Framework
 - Applicability
 - Vehicle-Based Certification
 - Tiered Approach
 - Battery Pack Testing

- Certification Families
- System Monitoring and Reporting Requirements
- Warranty and Repairability

Next Steps



Written Questions and Comments

Please send written questions & comments to: matthew.diener@arb.ca.gov



California's Climate & Air Quality Challenges and Policy Objectives

- California needs significant additional NOx and GHG reductions beyond what can be achieved by existing technologies
- Broad deployment of zero- and near zeroemission technologies needed
- ZEP Cert is intended to help accelerate the transition to zero-emission technologies
 - Empower Fleet Decision Making
 - Support Effective Funding Program Implementation



Zero-Emission Powertrain Certification

Conceptual ZEP Cert Framework for On-Road Vehicles



Applicability

- On-Road: MY2023+ battery-electric and fuel-cell electric vehicles
 - Not certified under the existing light-duty ZEV program
 - Heavy-Duty Vehicles >14,000 lbs GVWR
 - Medium-Duty Vehicles 8,501 lbs 14,000 lbs GVWR
- Optional process for zero-emission off-road equipment
- Battery-electric and fuel-cell electric vehicle conversions



Vehicle-Based Certification

- Initial concept certification process for ZEPs,
 - Provides direct pathway to market for ZEP manufacturers
- Update vehicle-based certifications
 - Vehicle manufacturers will likely be involved in the conversion process regardless of whether certification is ZEP- or vehicle-based.
 - Aligns with the HD Phase 1 and 2 programs.
 - Facilitates funding program processes.
- Staff is continuing to evaluate the potential barriers for ZEP manufacturers becoming the vehicle manufacturer of record



Written Questions and Comments

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ZEP Cert Tiered Approach (Draft-Deliberative)

Certification Level	Level 1 Includes Off-Road Equipment and Fuel Cells	Level 2 Builds on Level 1 requirements	Level 3 Builds on Level 2 requirements
US Sales Volume*	• <51 per year	• 51-250 per year	>250 per year
Testing	 None, information only 	 Battery pack usable energy / capacity 	 Battery pack durability (cycle life)
Warranty	Manufacturer definedCARB clear language provision	 Disclose warrantable battery energy / capacity 	 Minimum Battery and Powertrain Warranty
Other	 Disclose repair/service location information within California Warranty reporting 	 Battery State of Health Information Available Required Heavy-Duty Electric Vehicle Symbols for Controls, Indicators, and Telltales 	 Service information System Monitoring/Diagnostics Standardized Communication Protocol Required Connector

^{*} Based on the combined national total of all engine and vehicle sales.



Battery Pack Testing

- Level 1 No Testing
- Level 2 Usable Battery Energy / Capacity
 - Battery modules used must conform to the packaging requirements of SAE J1797.
 - Constant current discharge test at a rate of C/3 at 25 degrees Celsius per SAE J1798 at the battery pack level to determine the usable battery capacity and usable battery energy.



Battery Pack Testing (continued)

- Level 3 Life Cycle Testing
 - Perform SAE J2288 at the <u>battery pack level</u>.
 - Testing will be performed until the end-of-life conditions identified in SAE J2288 are reached.
 - The BMS and thermal management system shall be used during the test and scaled to the pack level.
 - Baseline durability test to estimate the number of cycles until battery end-of life is reached.



Battery Pack Testing (continued)

- Level 3 Alternative Life Cycle Testing
 - A manufacturer may request to perform an alternate battery pack life cycle test
 - Must justify and demonstrate that the alternative is equivalent to or exceeds the SAE J2288 requirements
 - The alternative test plan must be approved prior to testing.



Zero-Emission Powertrain Certification

ZEP Certification Families



ZEP Certification Families

- Based on battery pack characteristics, such as cell chemistry, cell construction, thermal management, usable energy, BMS, etc.
- Allows battery pack scaling.
- Would not limit the number of vehicle types or applications.



Discussion

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Zero-Emission Powertrain Certification

System Monitoring and Reporting Requirements



System Monitoring and Reporting Requirements

- OBD-like monitoring
 - Malfunctions
 - System health
 - Diagnostic information
 - Catastrophic component failure
- State of health/charge displayed on dash
- Indicators to clearly communicate
 - Electric powertrain operation
 - Malfunctions that could potentially impact operability or longevity of the powertrain/vehicle



Monitored System Parameters

- Align with OBD II system requirements for LD hybrids
- Energy Storage System (ESS)
 - State of Health; State of Charge; Cell balancing
 - Thermal Management System performance
- Inverter Thermal Management System Performance
- Regenerative braking
- Drive motor operation
- Charger operation
- Other components



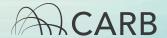
Required Connector

- Goal Standardize the diagnostic connector
- Proposal Align with Title 13 CCR 1971.1(H)(2)
 On-Board Diagnostic System Requirements- 2010 and Subsequent Model-Year Heavy-Duty
 Engines.



Required Communications to a Scan Tool

- Goal Standardize the controller area network
- Proposal Align with Title 13 CCR 1971.1(H)(3)
 On-Board Diagnostic System Requirements- 2010 and Subsequent Model-Year Heavy-Duty
 Engines.



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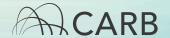
Zero-Emission Powertrain Certification

Warranty and Repairability



Warranty Requirements

- Zero-Emission Powertrain Definition: Any system of components capable of providing vehicle tractive effort for a given application without producing emissions.
- Energy Storage System
 - Battery modules and internal/external components of pack
 - Battery management system
 - Thermal management system
- Electric Drive Components
 - Traction motor/generator and inverter
 - Transmission
 - Axles



Warranty Requirements

- Level 1 Manufacturer defined (minimum)
 - CARB clear language provision
- Level 2
- If battery warranty offered, must be a percentage of the tested/certified usable battery pack energy / capacity
- Level 3
- Energy Storage System: min 6 yrs or 200,000 KWh of energy throughput per pack to 80% of original usable energy.
- Electric Drive Components: min 2 yrs or 100,000 mile warranty.



Repairability

- <u>Key Concern</u> Service and Repair of Heavy-Duty
 <u>Zero-Emission Vehicles</u>
- Proposal Require manufacturers to include service and repair network information within California through the warranty period
 - Physical locations
 - Dealers
 - Other fleet service networks
 - Remote diagnostics
 - Mobile service options
- Service information requirement (Level 3)



Discussion

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Zero-Emission Powertrain Certification

Next Steps



Next Steps

- Ongoing stakeholder meetings
- Third public workshop mid March 2018
- Proposed regulation released for 45-Day public comments May 2018
- Board consideration July 2018



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