

# 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](mailto:matthew.diener@arb.ca.gov)

# California's Climate & Air Quality Challenges and Policy Objectives

- California needs significant additional NO<sub>x</sub> and GHG reductions beyond what can be achieved by existing technologies
- Broad deployment of zero- and near zero-emission 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

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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*	<ul style="list-style-type: none"> <li>&lt;51 per year</li> </ul>	<ul style="list-style-type: none"> <li>51-250 per year</li> </ul>	<ul style="list-style-type: none"> <li>&gt;250 per year</li> </ul>
Testing	<ul style="list-style-type: none"> <li>None, information only</li> </ul>	<ul style="list-style-type: none"> <li>Battery pack usable energy / capacity</li> </ul>	<ul style="list-style-type: none"> <li>Battery pack durability (cycle life)</li> </ul>
Warranty	<ul style="list-style-type: none"> <li>Manufacturer defined</li> <li>CARB clear language provision</li> </ul>	<ul style="list-style-type: none"> <li>Disclose warrantable battery energy / capacity</li> </ul>	<ul style="list-style-type: none"> <li>Minimum Battery and Powertrain Warranty</li> </ul>
Other	<ul style="list-style-type: none"> <li>Disclose repair/service location information within California</li> <li>Warranty reporting</li> </ul>	<ul style="list-style-type: none"> <li>Battery State of Health Information Available</li> <li>Required Heavy-Duty Electric Vehicle Symbols for Controls, Indicators, and Telltales</li> </ul>	<ul style="list-style-type: none"> <li>Service information System</li> <li>Monitoring/Diagnostics</li> <li>Standardized Communication Protocol</li> <li>Required Connector</li> </ul>

\* 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 battery pack level.
  - 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.

# Discussion

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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

- Key Concern Service and Repair of Heavy-Duty Zero-Emission Vehicles
- 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)

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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**

# ZEP Cert Rulemaking Contacts

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