



**Tier 5 Rulemaking Workshop**  
**Potential Amendments to the**  
**Off-Road Diesel New Engine Regulations**  
**October 8, 2024**

# Outline

- The draft proposed regulation order reflects the October 2023 workshop proposal\*
- Tier 5 elements and timeline
- Summary of the changes since the October 2023 proposal:
  - Hydrogen-fueled internal combustion engine (H2-ICE) pathway
  - Steady-state duty cycles
  - Limited Production Volume Allowance Under Averaging, Banking and Trading (ABT)
  - Zero-emission (ZE) credit generation limits
  - California Averaging, Banking, and Trading (CA-ABT)
  - Labeling clarifications
  - Corrective action procedure revisions

# October 2023 Tier 5 Proposal Elements\*

- Lower emission standards
  - Criteria pollutant standards
  - Greenhouse gas (GHG) pollutant standards
  - New off-road Low Load Cycle (LLC) for certification
  - Reduced idling provisions
- Improved certification
  - Use of accelerated aging for certification
  - California-specific credit provisions
- In-use reliability
  - Revised useful life, warranty, and defects reporting requirements
  - New and enhanced in-use screening and testing provisions
  - Selective catalytic reduction inducement provisions
  - Off-Road On-Board Diagnostics

# Tier 5 Timeline

- Release of draft test procedures: 4<sup>th</sup> Quarter 2024
- Release of Initial Statement of Reasons: August 2025
- 45-day public notice: August 2025
- Board hearing date: October 2025
- Status of the Southwest Research Institute demonstration project
  - Developed the new off-road LLC
  - Completed technology selection, calibration, and demonstration using certification cycles
  - Conducting off-cycle testing

# H2-ICE Pathway (1 of 3)

## Background

- On November 28, 2023, California Air Resources Board (CARB) staff convened a public workshop on on-road H2-ICEs and their use in California's trucks. Presentations showed the potential for H2-ICE to power heavy-duty trucks.
- H2-ICE, currently under development, typically uses port-injection spark-ignition.
- Under the current off-road regulation,\* for **any engine that is not a distinctly compression-ignition (CI) engine nor derived from such**, the Executive Officer shall determine whether the engine shall be subject to these regulations, taking into consideration the **relative similarity of the engine's torque-speed characteristics with those of CI engines**.
- Staff proposes to add clarity to the applicability of H2-ICE to Tier 5.

## H2-ICE Pathway (2 of 3)

- Proposal
  - Off-road H2-ICE with model year (MY) 2029 and later would be required to certify as CI engines if:
    - Engine employs boosted air induction, or
    - H2-ICE engine is designed to operate in equipment historically powered with an off-road CI engine
  - Exceptions
    - H2-ICE certified to the CI standards shall not be used in equipment historically powered with an off-road spark-ignition engine if the equipment category is subject to a phase-out requirement, such as those recently adopted for large spark-ignition (LSI) forklifts

## H2-ICE Pathway (3 of 3)

- Rationale:
  - Ensure that H2-ICEs which replace diesel engines would be certified to Tier 5 standards
  - Allow applications historically powered by naturally-aspirated LSI engines to certify to the LSI standard

## H2-ICE Credits

- October 2023 Proposal: No specific requirements for H2-ICE credits
- Change:
  - H2-ICEs would not qualify for generating carbon dioxide (CO<sub>2</sub>) credits under the CA-ABT provisions and ZE credits
  - H2-ICEs would qualify for CA-ABT credits for criteria pollutants
- Rationale
  - H2-ICEs do not meet the CARB's definition of ZE



# Steady-State Duty Cycles

- October 2023 Proposal
  - The proposal did not specify requirements for a Steady-State Duty Cycle used for GHG and criteria pollutant emission testing
- Change
  - The Steady-State Duty Cycle used for GHG emission testing shall be the same Steady-State Duty Cycle used by a manufacturer to demonstrate compliance with the applicable criteria pollutant exhaust emission standards
- Rationale
  - To prevent handpicking of test results between ramped modal and discrete mode Steady-State Duty Cycles

# Limited Production Volume Allowance Under ABT

## (1 of 2)

- Tier 5 Interim (Tier 5i) Compliance Options
  - **#1: Direct compliance with Tier 5i standards without ABT credits**
  - #2: 50% of engine sales within a power category at the Tier 5 final (Tier 5f) level and 50% at the Tier 4 final (Tier 4f) level
  - #3: Direct compliance with Tier 5i standards using CA-ABT credits
  - #4: Longer continuance of Tier 4f compliant engines in exchange for earlier introduction of Tier 5f compliant engines
- October 2023 proposal
  - The proposal is based on allowances for heavy-duty highway engines under 40 CFR 1036.150 (k) and would allow manufacturers to continue producing a limited number of **Tier 4f engines for five MYs** starting with the first MY in which Tier 5f compliance is required
  - The number of Tier 4f engines produced under this flexibility may not exceed **5%** of a manufacturer's annual total California production volume across all power categories

# Limited Production Volume Allowance Under ABT

## (2 of 2)

- Potential concern
  - Manufacturers choosing Tier 5 Compliance Option #1 would no longer produce Tier 4f engines and would be forced to reintroduce Tier 4f engines to use the 5% provision under the current proposal
- Change
  - Staff proposes to extend the applicability of the 5% flexibility to both **Tier 4f and Tier 5i engines** as applicable to the selected Compliance Option
  - A manufacturer that elects to comply with Compliance Option #1 shall be required to carry-over Tier 5i engines instead of Tier 4f engines under this allowance and not reintroduce a less stringent technology
- Rationale
  - Prevents manufacturers who choose Compliance Option #1 from reverting back to less stringent Tier 4f engines
  - Provides flexibility to manufacturers producing cleaner Tier 5i engines

# Calculation of ZE Credits

- October 2023 proposal
  - To generate ZE credits, a manufacturer would replace its production of new equipment historically powered by an off-road CI engine with equipment powered by a ZE powertrain
- Change
  - Staff proposes to limit the generation of ZE credits to calendar years 2026 through 2028, and only  $\geq 130$  kilowatt (kW) would be eligible for credit generation
  - However, an engine manufacturer may still use ZE credits to certify engine families  $< 130$  kW
- Rationale:
  - In anticipation of nationally harmonized federal policy for off-road ZE equipment, ZE credit generation in California is limited to incentivizing early adoption of ZE equipment  $\geq 130$  kW in 2026-2028
  - Staff may explore expanding ZE credits under the proposed Phased Advanced Clean Equipment (PACE) Rulemaking

# California Averaging, Banking, and Trading (CA-ABT) Credits

- October 2023 proposal
  - Credits may be used within a single averaging set applicable to any engine family across all power ranges
  - The proposal did not have a limit on power categories for credit generation
- Change
  - Criteria pollutants (Oxides of Nitrogen (NO<sub>x</sub>) and Particulate Matter (PM))
    - Staff proposes to limit the generation of criteria pollutant credits to  $\geq 130$  kW only
    - It does not prevent manufacturers from using banked credits to certify engine families  $< 130$  kW
  - CO<sub>2</sub>
    - Staff proposes to limit the generation and use of CO<sub>2</sub> credits to  $130 \leq \text{kW} \leq 560$  only
- Rationale
  - To promote the transition from combustion engines to ZE equipment in the  $< 130$  kW power category
  - Staff considers CO<sub>2</sub> credits are not needed for meeting capping standards

# Newly Proposed Labeling Requirements

- For engines certified with CA-ABT credits under the California Transition Program for Equipment Manufacturers (CA-TPEM), the engine label shall state the family emission limits (FEL) to which the engine is certified regardless of the FEL being more or less stringent than the standard
- Staff proposes to require that the standard (tier) of the engine under the CA-TPEM be listed on the label
- Staff also proposes to make supplemental labels mandatory for rebuilt replacement engines
- Rationale
  - For enforcement purposes and to let owners know whether the engine's emissions are higher or lower than the emission standards

# Corrective Action Procedure Revisions

- Current requirements
  - A repair label must be affixed to an engine after a recall
  - A manufacturer must obtain new owner information via post cards
- Change:
  - Staff proposes to exempt manufacturers from repair label requirements if the recall involves **software changes only**, and the manufacturer keeps a record of the engine serial numbers of all pieces of equipment that were inspected and/or repaired and provides the information upon request from the Executive Officer
- Manufacturers may obtain new owner information electronically or use another format other than the postcard with postage paid
- Rationale
  - To reduce manufacturers' compliance burden of over-the-air recalls
  - To be consistent with on-road heavy-duty labeling requirements proposal

# Questions/Feedback

- Voluntary Blue Sky Series Engine Requirements.
  - Blue Sky standards were previously introduced to spur innovation toward cleaner combustion engines.
  - Staff is proposing the continuation of “Voluntary Blue Sky Series Engine Requirements” under Tier 5. The voluntary standards would be half of the Tier 5 Final NOx and PM standards and would be eligible to earn CA-ABT credits.
  - Staff requests feedback regarding whether Blue Sky standards would be beneficial especially given California’s goals toward ZE under Executive Order N-79-20. Would any manufacturer consider using them?
- Staff continues to work with the PACE rulemaking staff.
- Staff is requesting feedback on all proposed changes discussed in this workshop and on the draft proposed regulatory language.



# Backup Slides

# Partially Complete Engines

- Align with the federal definition of an “engine” in 1068.30 to include both complete and partially complete engines
- Add text to the replacement engine provisions in 1068.240 of the CA Test Procedures allowing partially complete engines to be prebuilt in limited quantities - 0.5%
  - Ensures that replacement engines are available during emergency situations for a wide variety of applications to minimize downtime

# Tier 5 Implementation Schedule

REQUIREMENTS		FINAL				
		< 19 kW	19 ≤ kW < 56	56 ≤ kW < 130	130 ≤ kW ≤ 560	> 560 kW
<b>Criteria Pollutant Standards*</b> (NO <sub>x</sub> , PM, NMHC, and CO) <b>DAAAC Aging*</b> <b>SCR Inducements*, **</b> <b>Longer Useful Life and Warranty*</b> <b>Enhanced Defects Reporting*</b>		2034+, or 2033+ (Op 4)			2033+, or 2031+ (Op 4)	2034+, or 2032+ (Op 4)
<b>GHG Standards</b> (CO <sub>2</sub> , N <sub>2</sub> O, and CH <sub>4</sub> )	Capping	n/a	2034+, or 2033+ (Op 4)	n/a		2034+, or 2032+ (Op 4)
	Reducing	n/a		2034+, or 2033+ (Op 4)	2033+, or 2031+ (Op 4)	n/a
<b>LLC Certification** , ***</b>		n/a		2034+, or 2033+ (Op 4)	2033+, or 2031+ (Op 4)	n/a
<b>Idle Reduction Provisions***</b>		n/a	2034+, or 2033+ (Op 4)		2033+, or 2031+ (Op 4)	2034+, or 2032+ (Op 4)
<b>In-Use Testing Program* , **</b>	Pilot	n/a				
	Enforceable	n/a		2033+	2031+	n/a

"Op 4" refers to the earlier Tier 5f start date in Option #4

\* Does not apply to Tier 4 final phase-out engines in Option #2  
 \*\* Only applies to engines certified with SCR or similar NO<sub>x</sub> aftertreatment  
 \*\*\* Does not apply to steady-state engine families

# Tier 5 Implementation Schedule

REQUIREMENTS		INTERIM				
		< 19 kW	19 ≤ kW < 56	56 ≤ kW < 130	130 ≤ kW ≤ 560	> 560 kW
<b>Criteria Pollutant Standards*</b> (NO <sub>x</sub> , PM, NMHC <sup>1</sup> , and CO) <b>DAAAC Aging*</b> <b>SCR Inducements*, **</b> <b>Longer Useful Life and Warranty*</b> <b>Enhanced Defects Reporting*</b>		2031-2033			2029-2032	2030-2033
<b>GHG Standards</b> (CO <sub>2</sub> , N <sub>2</sub> O, and CH <sub>4</sub> )	Capping	n/a				
	Reducing	n/a				
<b>LLC Certification** , ***</b>		n/a				
<b>Idle Reduction Provisions***</b>		n/a				
<b>In-Use Testing Program* , **</b>	Pilot	n/a	2031-2032	2029-2030	n/a	
	Enforceable	n/a				

DAAAC = Diesel Aftertreatment Accelerated Aging Cycle  
 NMHC = nonmethane hydrocarbon CO = carbon monoxide

\* Does not apply to Tier 4 final phase-out engines in Option #2  
 \*\* Only applies to engines certified with SCR or similar NOx aftertreatment  
 \*\*\* Does not apply to steady-state engine families  
<sup>1</sup> NMHC Interim standards are the same as Tier 4 final NMHC standards

# Tier 5 Standards Phase-In by Model Year

Options	Power Category	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Option 1~3	< 130 kW	Tier 4 Final		Tier 5 Interim			★ Tier 5 Final				
	130 ≤ kW ≤ 560	Tier 5 Interim				★ Tier 5 Final					
	> 560 kW	Tier 4	Tier 5 Interim				★ Tier 5 Final				
Option 4	< 130 kW	Tier 4 Final				★ Tier 5 Final					
	130 ≤ kW ≤ 560	Tier 4 Final		★ Tier 5 Final							
	> 560 kW	Tier 4 Final			★ Tier 5 Final						

★ : Small Volume Manufacturer Delay