

**PART 8**

**FINAL REGULATION ORDER TEST PROCEDURES**

**Part I – E (Part 1065)**

**(2011 and Later Model Years)**

**Tier 4 Off-Road Compression-Ignition Engines**

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## FINAL REGULATION ORDER TEST PROCEDURES

NOTE: This appendix shows the entirety of regulatory amendments to the test procedures titled below, which were approved by the Air Resources Board on December 16, 2011, and refined via subsequent conforming modifications authorized under Resolution 11-41. Incorporated by reference into these test procedures are portions of 40 Code of Federal Regulations (CFR) Part 1065, Subparts A, B, C, D, E, F, G, H, I, J, and K, as amended June 28, 2011, and the subparts of 40 CFR Part 60, 40 CFR Part 85, 40 CFR Part 86, 40 CFR Part 89, 40 CFR Part 92, and 40 CFR Part 1033 that are internally referenced within 40 CFR Part 1065. Sections that have been included in their entirety are set forth with the section number and title. California provisions that replace specific federal language provisions are denoted by the words "DELETE" for the federal language and "REPLACE WITH" or "ADD" for the California language. The notation [ \* \* \* \* \* ] or [ ... ] means that the remainder of the CFR text for a specific section is not shown in these procedures but has been incorporated by reference, with only the printed text changed. CFR sections that are not listed are not part of the test procedures. If there is any conflict between the provisions of this document and the California Health and Safety Code, Division 26, or Title 13 of the California Code of Regulations (CCR), the Health and Safety Code and Title 13 apply.

This document is all newly adopted text.

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**State of California**  
**AIR RESOURCES BOARD**

**California Exhaust Emission Standards and Test Procedures for New 2011 and  
Later Tier 4 Off-Road Compression-Ignition Engines**

PART I-E

Adopted: October 25, 2012

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# CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR NEW 2011 AND LATER TIER 4 OFF-ROAD COMPRESSION-IGNITION ENGINES

The following provisions of Part 1065, Title 40, Code of Federal Regulations, as promulgated by the United States Environmental Protection Agency on the date listed, are adopted and incorporated herein by this reference for 2011 model year and later off-road compression-ignition engines as the California Exhaust Emission Standards and Test Procedures for New 2011 and Later Tier 4 Off-Road Compression-Ignition Engines, Part I-E, except as altered or replaced by the provisions set forth below.

## PART 1065 – ENGINE-TESTING PROCEDURES

SOURCE: 76 FR 37977.

### Subpart A – Applicability and General Provisions

§ 1065.1      Applicability.

(a)(1)          DELETE,

REPLACE WITH:

(a)(1) Reserved.

(a)(2)          DELETE,

REPLACE WITH:

(a)(2) Reserved.

(a)(3) DELETE,

REPLACE WITH:

(a)(3) Land-based off-road compression-ignition engines regulated under Title 13, CCR, Chapter 9, Article 4, and subject to the emission standards in § 2423(b)(1)(B) of that Article.

(a)(4) DELETE,

REPLACE WITH:

(a)(4) Reserved.

(a)(5) DELETE,

REPLACE WITH:

(a)(5) Reserved.

(a)(6) DELETE,

REPLACE WITH:

(a)(6) Reserved.

(a)(7) DELETE,

REPLACE WITH:

(a)(7) Reserved.

(a)(8) DELETE,

REPLACE WITH:

(a)(8) Reserved.

\* \* \* \* \*

(g) DELETE.

§ 1065.2 Submitting information to ARB under this part.

\* \* \* \* \*

§ 1065.5 Overview of this part 1065 and its relationship to the standard-setting part.

\* \* \* \* \*

§ 1065.10 Other procedures.

\* \* \* \* \*

§ 1065.12 Approval of alternate procedures.

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§ 1065.15 Overview of procedures for laboratory and field testing.

\* \* \* \* \*

§ 1065.20 Units of measure and overview of calculations.

\* \* \* \* \*

§ 1065.25 Recordkeeping.

\* \* \* \* \*

## Subpart B – Equipment Specifications

§ 1065.101 Overview.

\* \* \* \* \*

§ 1065.110 Work inputs and outputs, accessory work, and operator demand.

\* \* \* \* \*

§ 1065.120 Fuel properties and fuel temperature and pressure.

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§ 1065.122 Engine cooling and lubrication.

\* \* \* \* \*

§ 1065.125 Engine intake air.

\* \* \* \* \*

§ 1065.127 Exhaust gas recirculation.

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§ 1065.130 Engine exhaust.

\* \* \* \* \*

§ 1065.140 Dilution for gaseous and PM constituents.

\* \* \* \* \*

§ 1065.145 Gaseous and PM probes, transfer lines, and sampling system components.

\* \* \* \* \*

§ 1065.150 Continuous sampling.

\* \* \* \* \*

§ 1065.170 Batch sampling for gaseous and PM constituents.

\* \* \* \* \*

§ 1065.190 PM-stabilization and weighing environments for gravimetric analysis.

\* \* \* \* \*

§ 1065.195 PM-stabilization environment for in-situ analyzers.

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Subpart C – Measurement Instruments

§ 1065.201 Overview and general provisions.

\* \* \* \* \*

§ 1065.202 Data updating, recording, and control.

\* \* \* \* \*

§ 1065.205 Performance specifications for measurement instruments.

\* \* \* \* \*

Measurement of Engine Parameters and Ambient Conditions

§ 1065.210 Work input and output sensors.

\* \* \* \* \*

§ 1065.215 Pressure transducers, temperature sensors, and dewpoint sensors.

\* \* \* \* \*

Flow-Related Measurements

§ 1065.220 Fuel flow meter.

\* \* \* \* \*

§ 1065.225 Intake-air flow meter.

\* \* \* \* \*

§ 1065.230 Raw exhaust flow meter.

\* \* \* \* \*

§ 1065.240 Dilution air and diluted exhaust flow meters.

\* \* \* \* \*

§ 1065.245 Sample flow meter for batch sampling.

\* \* \* \* \*

§ 1065.248 Gas divider.

\* \* \* \* \*

### CO and CO<sub>2</sub> Measurements

§ 1065.250 Nondispersive infra-red analyzer.

\* \* \* \* \*

### Hydrocarbon Measurements

§ 1065.260 Flame-ionization detector.

\* \* \* \* \*

§ 1065.265 Nonmethane cutter.



\* \* \* \* \*

§ 1065.267 Gas chromatograph.

\* \* \* \* \*

### NO<sub>x</sub> and N<sub>2</sub>O Measurements

§ 1065.270 Chemiluminescent detector.

\* \* \* \* \*

§ 1065.272 Nondispersive ultraviolet analyzer.

\* \* \* \* \*

§ 1065.275 N<sub>2</sub>O measurement devices.

\* \* \* \* \*

### O<sub>2</sub> Measurements

§ 1065.280 Paramagnetic and magnetopneumatic O<sub>2</sub> detection analyzers.

\* \* \* \* \*

### Air-to-Fuel Ratio Measurements

§ 1065.284 Zirconia (ZrO<sub>2</sub>) analyzer.

\* \* \* \* \*

PM Measurements

§ 1065.290 PM gravimetric balance.

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§ 1065.295 PM inertial balance for field testing analysis.

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Subpart D – Calibrations and Verifications

§ 1065.301 Overview and general provisions.

\* \* \* \* \*

§ 1065.303 Summary of required calibration and verifications.

\* \* \* \* \*

§ 1065.305 Verifications for accuracy, repeatability, and noise.

\* \* \* \* \*

§ 1065.307 Linearity verification.

\* \* \* \* \*

§ 1065.308 Continuous gas analyzer system-response and updating-recording verification.

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§ 1065.309 Continuous gas analyzer system-response and updating-recording verification -- for gas analyzers continuously compensated for other gas species.

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### Measurement of Engine Parameters and Ambient Conditions

§ 1065.310 Torque calibration.

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§ 1065.315 Pressure, temperature, and dewpoint calibration.

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### Flow-Related Measurements

§ 1065.320 Fuel-flow calibration.

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§ 1065.325 Intake-flow calibration.

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§ 1065.330 Exhaust-flow calibration.

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§ 1065.340 Diluted exhaust flow (CVS) calibration.

\* \* \* \* \*

§ 1065.341 CVS and batch sampler verification (propane check).

\* \* \* \* \*

§ 1065.342 Sample dryer verification..

\* \* \* \* \*

§ 1065.345 Vacuum-side leak verification.

\* \* \* \* \*

#### CO and CO<sub>2</sub> Measurements

§ 1065.350 H<sub>2</sub>O interference verification for CO<sub>2</sub> NDIR analyzers.

\* \* \* \* \*

§ 1065.355 H<sub>2</sub>O and CO<sub>2</sub> interference verification for CO NDIR analyzers.

\* \* \* \* \*

#### Hydrocarbon Measurements

§ 1065.360 FID optimization and verification.

\* \* \* \* \*

§ 1065.362 Non-stoichiometric raw exhaust FID O<sub>2</sub> interference verification.

\* \* \* \* \*

§ 1065.365 Nonmethane cutter penetration fractions.

\* \* \* \* \*

### NO<sub>x</sub> and N<sub>2</sub>O Measurements

§ 1065.370 CLD CO<sub>2</sub> and H<sub>2</sub>O quench verification.

\* \* \* \* \*

§ 1065.372 NDUV analyzer HC and H<sub>2</sub>O interference verification.

\* \* \* \* \*

§ 1065.375 Interference verification for N<sub>2</sub>O analyzers.

\* \* \* \* \*

§ 1065.376 Chiller NO<sub>2</sub> penetration.

\* \* \* \* \*

§ 1065.378 NO<sub>2</sub>-to-NO converter conversion verification.

\* \* \* \* \*

### PM Measurements

§ 1065.390 PM balance verifications and weighing process verification.

\* \* \* \* \*

§ 1065.395 Inertial PM balance verifications.

\* \* \* \* \*

### Subpart E – Engine Selection, Preparation, and Maintenance

§ 1065.401 Test engine selection.

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§ 1065.405 Test engine preparation and maintenance.

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§ 1065.410 Maintenance limits for stabilized test engines.

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§ 1065.415 Durability demonstration.

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### Subpart F – Performing an Emission Test Over Specified Duty Cycles

§ 1065.501 Overview.

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§ 1065.510 Engine mapping.

\* \* \* \* \*

§ 1065.512 Duty cycle generation.

\* \* \* \* \*

§ 1065.514 Cycle-validation criteria for operation over specified duty cycles.

\* \* \* \* \*

§ 1065.520 Pre-test verification procedures and pre-test data collection.

\* \* \* \* \*

§ 1065.525 Engine starting, restarting, and shutdown.

\* \* \* \* \*

§ 1065.526 Repeating of void modes or test intervals.

\* \* \* \* \*

§ 1065.530 Emission test sequence.

\* \* \* \* \*

§ 1065.545 Validation of proportional flow control for batch sampling.

\* \* \* \* \*

§ 1065.546 Validation of minimum dilution ratio for PM batch sampling.

\* \* \* \* \*

§ 1065.550 Gas analyzer range validation, drift validation, and drift correction.

\* \* \* \* \*

§ 1065.590 PM sample media (e.g., filters) preconditioning and tare weighing.

\* \* \* \* \*

§ 1065.595 PM sample post-conditioning and total weighing.

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### Subpart G – Calculations and Data Requirements

§ 1065.601 Overview.

\* \* \* \* \*

§ 1065.602 Statistics.

\* \* \* \* \*



§ 1065.610 Duty cycle generation.

\* \* \* \* \*

§ 1065.630 1980 international gravity formula.

\* \* \* \* \*

§ 1065.640 Flow meter calibration calculations.

\* \* \* \* \*

§ 1065.642 SSV, CFV, and PDP molar flow rate calculations.

\* \* \* \* \*

§ 1065.644 Vacuum-decay leak rate.

\* \* \* \* \*

§ 1065.645 Amount of water in an ideal gas.

\* \* \* \* \*

§ 1065.650 Emission calculations.

\* \* \* \* \*

§ 1065.655 Chemical balances of fuel, intake air, and exhaust.

\* \* \* \* \*

§ 1065.659 Removed water correction.

\* \* \* \* \*

§ 1065.660 THC, NMHC, and CH<sub>4</sub> determination.

\* \* \* \* \*

§ 1065.665 THCE and NMHCE determination.

\* \* \* \* \*

§ 1065.667 Dilution air background emission correction.

\* \* \* \* \*

§ 1065.670 NO<sub>x</sub> intake-air humidity and temperature corrections.

\* \* \* \* \*

§ 1065.672 Drift correction.

\* \* \* \* \*

§ 1065.675 CLD quench verification calculations.

\* \* \* \* \*

§ 1065.690 Buoyancy correction for PM sample media.

\* \* \* \* \*

§ 1065.695 Data requirements.

\* \* \* \* \*

Subpart H – Engine Fluids, Test Fuels, Analytical Gases and Other Calibration Standards

§ 1065.701 General requirements for test fuels.

\* \* \* \* \*

(b) DELETE,

REPLACE WITH:

With Executive Officer approval, the certifying entity may use other test fuels so long as they do not affect the demonstration of compliance.

\* \* \* \* \*

§ 1065.703 Distillate diesel fuel.

\* \* \* \* \*

ADD:

(d) The Executive Officer may allow other fuel specifications, such as California diesel fuel, so long as they do not affect the demonstration of compliance.

§ 1065.705 Residual and intermediate residual fuel.

\* \* \* \* \*

§ 1065.710 Gasoline.

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§ 1065.715 Natural gas.

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§ 1065.720 Liquefied petroleum gas.

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§ 1065.740 Lubricants.

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§ 1065.745 Coolants.

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§ 1065.750 Analytical gases.

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§ 1065.790 Mass standards.

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## Subpart I – Testing with Oxygenated Fuels

§ 1065.801 Applicability.

\* \* \* \* \*

§ 1065.805 Sampling system.

\* \* \* \* \*

§ 1065.845 Response factor determination.

\* \* \* \* \*

§ 1065.850 Calculations.

\* \* \* \* \*

## Subpart J – Field Testing and Portable Emission Measurement Systems

§ 1065.901 Applicability.

\* \* \* \* \*

§ 1065.905 General provisions.

\* \* \* \* \*

§ 1065.910 PEMS auxiliary equipment for field testing.

\* \* \* \* \*

§ 1065.915 PEMS instruments.

\* \* \* \* \*

§ 1065.920 PEMS Calibrations and verifications.

\* \* \* \* \*

§ 1065.925 PEMS preparation for field testing.

\* \* \* \* \*

§ 1065.930 Engine starting, restarting, and shutdown.

\* \* \* \* \*

§ 1065.935 Emission test sequence for field testing.

\* \* \* \* \*

§ 1065.940 Emission calculations.

\* \* \* \* \*

Subpart K – Definitions and Other Reference Information

§ 1065.1001 Definitions.

ADD:

40 CFR part 1039 or Part 1039 means Part 1039 and applicable subparts of the California Exhaust Emission Standards and Test Procedures for New 2011 and Later Tier 4 Off-Road Compression-Ignition Engines, PART I-D, when referenced in unrevised (i.e., “ \* \* \* \* \* ” ) sections. When referenced in revised sections, the term 40 CFR part 1039 refers to the federal regulations of the same title, last amended on June 28, 2011.

ADD:

40 CFR part 1065 or Part 1065 means Part 1065 and applicable subparts of the California Exhaust Emission Standards and Test Procedures for New 2011 and Later Tier 4 Off-Road Compression-Ignition Engines, PART I-E, when referenced in unrevised (i.e., “ \* \* \* \* \* ” ) sections. When referenced in revised sections, the term 40 CFR part 1065 refers to the federal regulations of the same title, last amended on June 28, 2011.

ADD:

40 CFR part 1068 or Part 1068 means Part 1068 and applicable subparts of the California Exhaust Emission Standards and Test Procedures for New 2011 and Later Tier 4 Off-Road Compression-Ignition Engines, PART I-F, when referenced in unrevised (i.e., “ \* \* \* \* \* ” ) sections. When referenced in revised sections, the term 40 CFR part 1068 refers to the federal regulations of the same title, last amended on June 28, 2011.

\* \* \* \* \*

Designated Compliance Officer DELETE.

REPLACE WITH:

Designated Compliance Officer means the Executive Officer of the Air Resources Board, or a designee of the Executive Officer.

\* \* \* \* \*

ADD:

ADDENDUM: The definitions in §1039.801 of the California Exhaust Emission Standards and Test Procedures for New 2011 and Later Tier 4 Off-Road Compression-Ignition Engines, PART I-D, apply.

§ 1065.1005 Symbols, abbreviations, acronyms, and units of measure.

\* \* \* \* \*

§ 1065.1010 Reference materials.

\* \* \* \* \*