

Compression- and Spark- Ignition Engine Certification

2012 EMA Certification Workshop
April 17, 2011

California Environmental Protection Agency

 **Air Resources Board**

2012 EMA Certification Workshop

- **2012+ General Certification Topics**
- **2013+ On-Road Diesel Certification Topics**
- **2012+ Off-Road Diesel Certification Topics**
- **2012+ Off-Road Spark-ignition Certification Topics**

General Certification Topics

- **Experimental Permits**
- **Alternative Fueled Engines/Vehicles**
- **Emission Control Label Visibility**
- **Compliance Reports**

Experimental Permits

Required Information

- Description of experimental device/modification
- Description of test program
- Explanation of modified/removed stock ECS
- Vehicle/engine information
- Disposition of vehicle/engine/device at end of test program

Experimental Permits

Permit Responsibilities

DO's:

- Ensure test vehicles/engines are covered by valid experimental permit
- Permit must accompany each engine/vehicle
 - Off-road engines must have emission ID label
- Recordkeeping of engines/vehicles and test programs
- Ensure engines/vehicles are removed from state or in certified configuration after permit expiration

Experimental Permits

Permit Responsibilities

DON'Ts:

- Experimental vehicles/engines/devices cannot be sold or leased
- Permit cannot be used to circumvent emission certification requirements
- Permit cannot be exclusively used for marketing evaluations

Alternative-Fueled Engines

- **New alternative-fueled engines—Not sold to ultimate purchaser**
 - **To convert new gasoline/diesel certified engine to new alt fuel engine, need separate EO**
 - **EO applies to new alt fuel engine for current MY only**
- **Existing alternative-fueled engines—Conversion after sold to ultimate purchaser**
 - **To convert existing gasoline/diesel engines/vehicles, follow aftermarket parts requirements**
 - **Data from new alt fuel engine may be applicable to aftermarket process**
 - **EO applies to engine family for all future conversions**

Emission Control Label

Visibility

- **Applicable to On-Road and Off-Road Engines:**
Emission Control Label Regulations Require the Label to be *Readily Visible After Installation*
- **If installation obscures the label on the engine, the vehicle/equipment manufacturer shall attach a supplemental label such that it is readily visible**
- **If vehicle/equipment was produced with labels not readily visible, manufacturers may perform a recall to add supplemental labels**

Compliance Reports

On-Road

- End-of-Year ABT
(90 days + 180 days to revise)
- Certification Fee (Mailout)
- Evap. End-of-Year (90 days)

Off-Road

Engine Mfr.

- Sales Report
- Production Line Reports
- End-of-Year ABT (90 days)
- Final ABT (270 days)
- Replacement Engine (conclusion of model year)

Equipment Mfr.

- Flex Sales Report (March 31)

General Diesel Certification Topics

- **2012 MY Diesel Engine Certification – Lessons Learned**
- **Certification Application Issues**
- **Emission Control Label Testing**

Compression-Ignition and Heavy-Duty Certification (CI-HD)

- CA-MDE (engine certified GVWR 8501~14000)
- CA-MDV (using above: exhaust and evaporative)
- On-Road HD Otto Cycle Engines (GVWR>14000)
- On-Road HD Diesel Cycle Engines (GVWR>14000)
- On-Road HD Evaporative Vehicles Certification
- On-Road HD Hybrid Vehicles (GVWR>14000)
- Off-Road Compression-Ignition Engines
- On-Road HD ZEV Approvals
- Fuel-Fired Heaters Approval (GVWR>14000)

Lessons Learned

From 2012 Diesel Engine Certification

- **Review of Sensors Table**
- **SCR Strategy Approval for 2012 MY**
- **Toxic Compound Emissions (TAC Emissions)**

Certification Application Issues

- **Engine Label Testing**
- **Delegated Assembly Process**
- **DF Program Options**

Engine Label Testing

- **Labels must not be reusable upon removal**
- **Durability**
 - **10 years or compliance period**
 - **Engine compartment environment**
 - **Normal solvent for de-greasing engine**
- **Provide at least TWO samples for ARB testing**

Delegated Assembly (DA)

- **ARB's On-Road HDDE regulations do not include DA, OFCI regulations are the same as EPA**
- **Staff accepts EPA's procedure**
- **Manufacturers must submit procedures/audit into DMS**
- **Manufactures must identify DA parts**

DF Program Options

- **2012+ On-HHDD, Tier4i and Tier4 OFCI Engines**
- **Discussion needed for new engines before testing begins**
- **Staff prefers 50% UL testing using in-use service cycle**
- **Most manufacturers have already chosen an option**
- **2013+ Discussions needed**

2013+ On-Road Certification Topics

2013+ Certification

On-Road Topics

- **OBD**
- **Alternative Fueled Engines**
- **HD Hybrids**
- **Future Board Items**

On-Board Diagnostics

- **MY2013: all engine families with OBD, except alternative fueled engines (EMD+)**
- **Submit OBD documents to MSCD directly**
- **Submit OBD approval letter from MSCD into DMS**

Alternative-Fueled Engines

- **Additional items needed in the application**
 - **List of authorized converting facilities**
 - **Durability information for additional parts**
 - **Base engine information**
- **Starting with the 2013 Model Year, all Alternative-Fueled engines require EMD+**

HD Hybrids—Under Development

- **HD Hybrids expected as significant bridging technology to future zero-emission technology**
- **Planning amendments to test procedure for vehicle certification**
- **Considering requirements for full hybrid-vehicle certification, building on current on-board diagnostic requirements**

HD Hybrids—Current Process

Alternative 1	Manufacturer certifies engine and hybridization system to emission standards	Manufacturer is certified at lower emission level using chassis testing
Alternative 2	No additional certification granted	Vehicle meets original engine manufacturer's emission level
		No modifications to engine hardware, software, or after-treatment devices
		Hybridization does not change the engine's certified regeneration cycles/events
		No modification to engine's emission control sensors or signals to or from the engine control module
		Have at least one CA service provider for hybrid vehicle

2012+ MY OFCI Certification Topics

2012+ MY OFCI

Certification Topics

- **Tier-3 ~ Tier-4i / Tier-4 → Transition Topics**
- **SCR → Implementation Concerns**
- **Sensors Table → All 2012+ MY OFCI Engines**
- **Flex Engines**

2012+ MY OFCI

Tier-3 to Tier-4 Transition Topics

- **Carryover of DFs from Tier-3 to Tier-4i, where applicable**
- **Two DFs needed for Tier-4 → NRTC and SS**
- **Carry-across of on-road DFs to off-road engines, where applicable**

2012+ MY OFCI

Selective Catalytic Reduction (SCR)

- **Similar concerns addressed by On-Road SCR**
- **Application specific approval may be possible**
- **Recommend early SCR discussion with agency**
- **Cu and V based SCR catalyst → TAC emissions needs to be quantified**
- **July 2010 workshop slides as guidance**
- **More discussion with Manufacturers needed**

2012+ MY OFCI - AECD Sensors Table

- Speeds up review for 2012+ applications
- Identifies in-appropriate shut-off of critical emissions control systems
- Identifies and possibly reduces system tamper

Item	Sensor Name / Abbreviation	Sensed Parameter Range / Low (Units)	Sensor - Actual Value (unit)	Sensor / Actual Value (unit)	Sensor still working? (yes / no)	Failure Detection	Failure Indication	Default Mode / threshold value	Failure Consquence	Impacts on Emissions	AECD Type	AECD Justification	ARB staff comment

<http://www.arb.ca.gov/msprog/cihd/cihd.htm>

2012+ MY OFCI – Flex Engines

- **Flex Engine EOs being issued by ARB**
- **Flex Engine MAC will be issued Summer 2012**
- **Additional guidance for equipment manufacturers forthcoming**
 - **Submittals**
 - **DO NOT email to Annette**
 - **Reports**

Small Spark-Ignition Engines (SORE)

Exhaust Requirements

Running Change Requests

- ARB cannot process running change requests submitted into DMS after the end of the model year (MY)
- Examples:
 - FEL changes after the end of the MY
 - Model additions after the end of the MY
 - Label revisions after the end of the MY

Production Line Testing

(Individual Failed Engine)

- Example: A PLT engine fails to meet one or more emission standard(s)
- Must report failed engine results in quarterly PLT report
- Executive Order (EO) for the failed engine is automatically suspended
- Diagnose failed engine, fix, and retest to show compliance before EO is reinstated for that engine

Production Line Testing (Non-Compliant Engine Family)

- Must report to ARB within 10 working days
- Must remedy non-compliance
 - Raise Family Emissions Limit (not allowed after end of production)
 - Use Certification Credits
 - Design fix for Engine Family and Recall

Small Spark-Ignition Engines (SORE)

Evaporative Requirements

≥ 225 cc
(SORE Equipment)

Model Year	Performance Requirements Section 2754(a)	Design Requirements Section 2754(b)		
	Diurnal Standard Grams HC/day	Fuel Hose Permeation Grams ROG/m²/day	Fuel Tank Permeation Grams ROG/m²/day	Carbon Canister or Equivalent Butane Working Capacity Grams HC
2012	1.20 + 0.056*tank vol. (liters)	15	2.5	Specified in TP-902
2013+	1.20 + 0.056*tank vol. (liters)	15	1.5	Specified in TP-902

Large Spark-Ignition Engines (LSI)

LSI > 1 Liter

(2013+ MY Exhaust Requirements)

- Small Volume Manufacturers must comply with more stringent standards beginning with 2013 MY (<2000 sales annually in U.S.)
- Exhaust Emission Standards
 - HC+NOx: 0.8 g/kW-hr
 - CO: 20.6 g/kW-hr

LSI Durability Demonstration

(2013+ MY)

- Small Volume Mfr. Durability Demonstration:
 - Should be representative of real-world use
 - Accumulation cycle - mixture of Transient and Steady-State operation
 - Minimum of 50% useful life
- Small Volume Manufacturers have begun submitting 2013 MY durability testing results