Procedures for Approving Aftermarket Diesel Particulate Filters (DPF) For 2007 - 2009 Model Year HDE

Public Workshop

August 10, 2015

California Environmental Protection Agency

Air Resources Board

Purpose

- Establish a procedure for evaluation and approval of non-OEM aftermarket DPF (AMP)
- Procedure ensures:
  - DPF is functional with real and durable emission reductions
  - DPF is compatible and fully integrated with the engine (i.e., does not impact engine durability or functionality)
- Procedure solely for 2007-2009 MY engines certified with DPFs

Overview

- Background
- Regulation Adoption Status
- Proposed Regulation Language
- Proposed Evaluation Procedure
- Questions and Open Discussion

Existing Programs
Replacement Parts

- Definition - 13 CCR 1900 (b)(23) "…is functionally identical to the original equipment part in all respects which in any way affect emissions (including durability)…"
- Testing and specifications equivalent to OEM certification
- Must be able to provide sufficient information to show that product meets these requirements (13 CCR 2221 and 2224)

Modified Parts -DPFs
Proposed Regulation

- Not identical in all respects to certified emissions control component
- Existing procedures deemed inadequate for evaluating certain emission critical parts like DOCs, DPFs, etc.
- Separate evaluation procedure and approval path needed for aftermarket DPFs

Regulation Adoption Status

- Public workshops – Dec 4th, April 7th, and August 10th
- Board date delayed late 2015 to early 2016
  - Significant comments received on April 7th Proposed Test Procedure (TP)
  - Significant comments received on June 9th mail-out (relaxation to the April 7th TP)
- Currently meeting with individual stakeholders
  - Requesting data on concerns raised
  - Researching bond requirements

Comments Received

- Proposal too costly and overly burdensome
  - June 9th mail-out provided concepts for reducing testing and administrative requirements
- June 9th revisions
  - TP not robust and will result in incompatibilities between the OEM engine and AMP DPF
  - DPF technical specifications are different across OEM 2007-2009 engine platforms
  - Staff requesting data from stakeholders

Comments Received (continued)

- Procedure may be applied to 2010 and newer engines
  - Procedure cannot be applied to SCRs, DOCs, and DPFs for 2010 and newer MY engines
  - Different testing procedure would required for 2010+
- Does not account for running changes within an engine family
  - Requesting data and other information
- Concern that some companies may abandon products or be financially unable to support products if issues
  - Bond proposal

Summary of Revisions

#	Items	Draft Procedure (April 7, 2015)	Mail-out Revisions (June 9, 2015)	New Revisions (August 10, 2015)
1	Emission Control Groups	~40	6	7
2	Laboratory aging hours	500	300	300
3	OEM part laboratory aging	Required	Not required	Not required but degreening is required
4	OEM part emission testing	Required	Not required	Required after degreening
5	NO2 Emission or soot accumulation	Not required	Not required	Required
6	Product warranty	5 years /150,000 miles	2 years /unlimited miles	2 years /unlimited miles
7	Installation warranty	5 years /150,000 miles	2 years /unlimited miles	2 years /unlimited miles
8	Authorized installer	Required	Not required	Not required
9	Reporting for the installer	Required	Not required	Not required
10	Swapping	Not allowed	Allowed	Allowed
11	Bond	Not required	Required	Required
	Approx. testing cost per ECG	$210,000	$123,000	$127,000-137,000
	Cost per ECG reduction %		41.8%	34.8%-39.5%
	Approx. testing cost (total)	$8,432,000	$693,500	896,000
	Total cost reduction %		91.7%	89.3%

Proposed Regulation Language

13 CCR 2222(k)

- Proposed regulation language includes:
  - Exempt aftermarket DPF the prohibitions of California Vehicle Code sections 27156 and 38391 through ARB's evaluation procedure
  - Prohibitions of any used, remanufactured, refurbished, recycled, or salvaged DPF in California
  - Definitions of a new aftermarket DPF, OEM DPF, and used DPF

Proposed Aftermarket DPF Test Procedure

Procedure's Major Elements

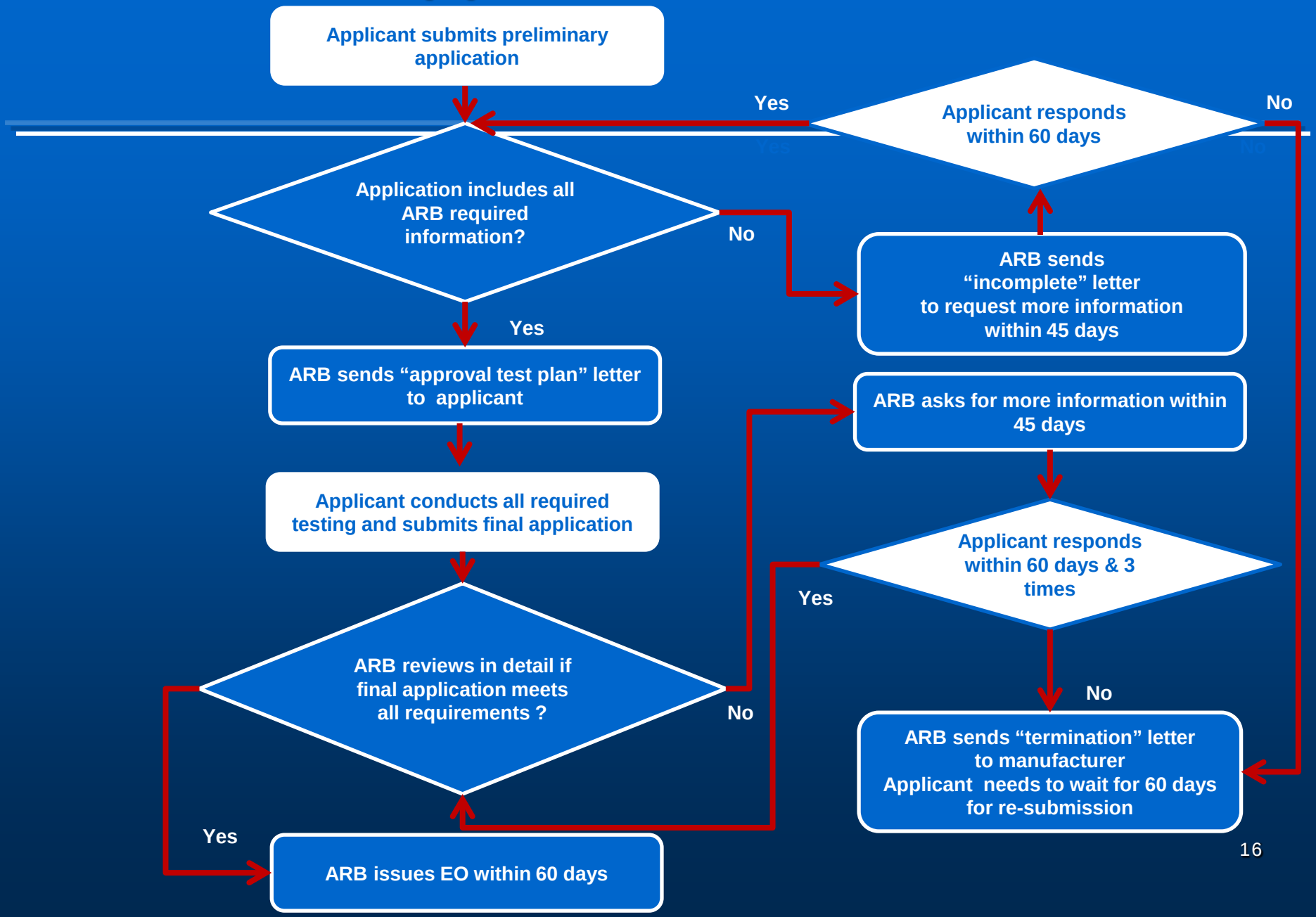
- Applicability
- Application process
- Testing
  - Emissions
  - Field demonstrations
- Warranties
- Other requirements

Applicability

- Market-ready new aftermarket DPFs intended as modified parts
- 2007-2009 MY on-road heavy-duty diesel engines certified with DPFs
- NOT for the following:
  - DPFs covered under verification provisions
  - OEM replacement DPFs
  - Used DPFs
  - 2010+ DPFs; DOCs or SCRs
  - Metal DPFs

Application Process

Application Process



Preliminary Application

- Defined emission control group (ECG). Limit 1 per application.
- Contact persons/phones/emails/addresses
- Complete information on the OEM DPF and aftermarket DPF
- Detailed test plan (all required tests, test facilities, fleet/vehicles/engines, equipment/instruments, etc.)
- Bond information
- Statement of compliance
- Detailed application format - see draft procedure

Final Application

- Testing reports and results
- Testing data and QA/QC data
- Third-party statements and letters
- Signed statement of compliance letter
- Owner’s manual /installation manual
- Warranty Information
- Sample scale drawings of labels
- Proof of bond and maintaining bond
- Other supporting information

Emission Control Group

- Proposed definition:
  - Single OEM or emission control configuration
  - An ECG must only include a single aftermarket DPF
- Based upon:
  - Review of OEM certifications
  - Consultation with stakeholders
  - Differences between OEM design principles
  - Effects on the engine must be considered

New ECG Concept

ECG #	Representative OEM Manufacturer or Emission Control Configuration	Testing Requirements
1	Cummins	Full testing required[2]
2	Detroit Diesel Corporation	Full testing required[2]
3	International/Navistar	Full testing required[2]
4	Volvo/Mack	Full testing required[2]
5	Caterpillar	Full testing required[2]
6	Uncatalyzed DPF + Burner	Full testing required[3]
7	General Motors/Isuzu/Mitsubishi	See note[4]

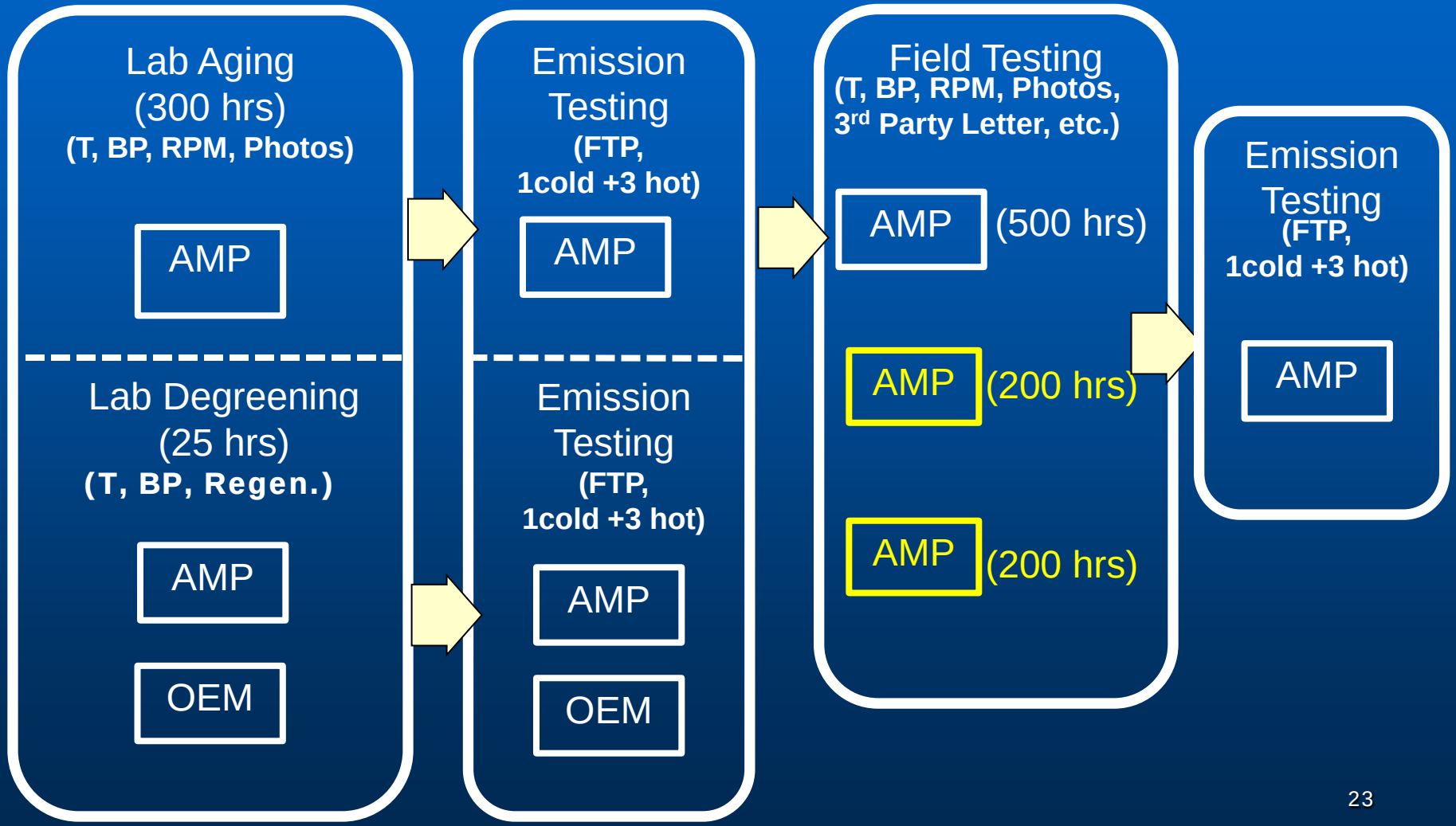
See draft procedure for footnote explanations

Testing

Testing Goals

- Device-equipped engine is compliant with the original certification
  - Account for infrequent regeneration adjustment factors (IRAFs)
  - AECDs
- Ensure the device is durable
- Compatibility with the engine
  - No fault, EMD, ECU impacts, etc.
  - No effect on engine function or normal operations

Testing Sequence



Laboratory Degreening Protocol

- Use emission test engine
- Use hot start FTP or SET test cycles
- 25 hours for OEM and AMP each
- Record T (DPF inlet and DPF bed), BP, RPM, Torque, and regeneration events
- Multi-point temperature measurement requirement

Laboratory Aging Protocol

Mode #	Description	Parameters	Specification
1	2007 ramped-modal cycle	Engine Speed & Torque Time Duration	Code of Federal Regulations, Title 40, part 86, Subpart N 40 minutes
2	2007 ramped-modal cycle	Engine Speed & Torque Time Duration	Code of Federal Regulations, Title 40, part 86, Subpart N 40 minutes
3	Ramped temperature[1]	Target Temperature (DPF Inlet) Engine Speed & Torque Time Duration	620ºC ±20 ºC 2007 ramped-modal cycle Mode A100 2 minutes
4	Active Regeneration	Target Temperature (DPF Bed) Engine Speed & Torque Time Duration	700ºC ±50 ºC 2007 ramped-modal cycle Mode A100 40 minutes
5	Cooling down[2]	Target Temperature Operation Engine Speed & Torque	Back to 2007 ramped-modal cycle Mode A100 exhaust temperature Shut off supplemental fuel supply 2007 ramped-modal cycle Mode A100

Laboratory Aging Protocol
Continued

- Multipoint temperature measurement requirement

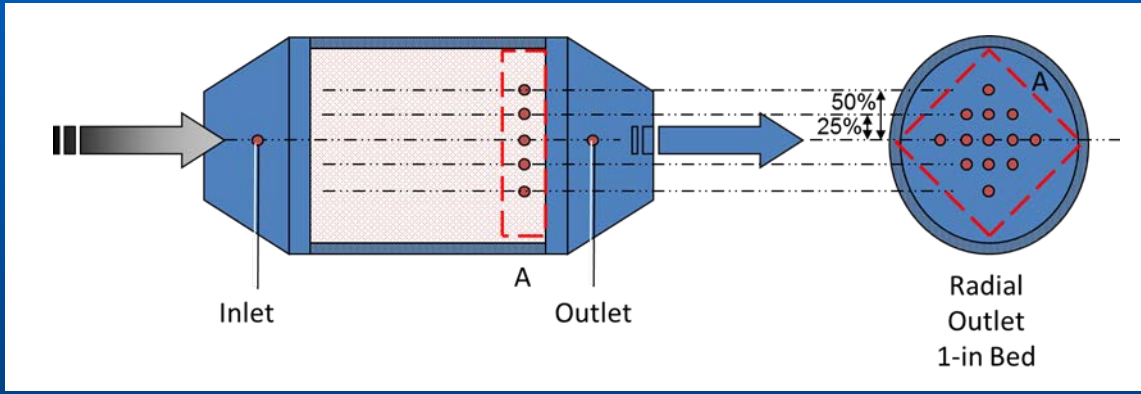


Figure 1 Temperature sensor locations for DPF aging

- Effective aging time concept
  - The temperature difference between DPF inlet and inside of DPF
  - Aging time is a function of aging temperature as defined by the Arrhenius equation
  - Use multipoint temperature data to achieve targeted effective aging time

Laboratory Aging Protocol
Chemical Aging

- Lubricant oil exposure requirement
  - Use observed field average oil consumption to estimate oil exposure target for 100,000 miles
  - Use 300 hours aging period to estimate the aging oil consumption
  - Oil satisfies OEM specifications (e.g., CJ-4).
  - Oil consumption acceleration options to achieve target oil consumption
  - Method (e.g. “drain and weigh” every 24 hours or use AVL 406 Oil Consumption Meter) to track actual oil consumption during aging process

Emission Testing Requirements

- Engine must be representative of the emission control group
- FTP heavy-duty transient cycle
- 1 cold start plus 3 hot starts
- Emissions testing during regeneration of a soot loaded filter
- Other testing as necessary (e.g., CFR 1065, Subpart L for semi-volatile organic compounds, dioxins)
- Detailed requirements in draft procedure

Proposed Acceptance Criteria
Lab degreened OEM vs. Lab degreened AMP

- OEM NMHC, NOx (or NMHC + NOx), CO
  - Must be at or below certification EO emission levels
  - NOx shall not exceed 10% of certification level
- AMP NMHC, NOx (or NMHC + NOx), CO, PM
  - Must meet certification emission standards
  - AMP NO2 shall be within 15% of OEM
- AMP average backpressure and temperature
  - Within 10% of OEM
- No EMD fault or warning codes

Proposed Acceptance Criteria
Lab degreened AMP vs. Lab Aged AMP

- AMP NMHC, NOx (or NMHC + NOx), CO, PM
  - Must meet certification emission standards
  - NOx shall not exceed 10% of certification level
- Aged AMP
  - NO2 shall be within 15% of degreened AMP
  - Average backpressure and temperature within 10% of degreened AMP
- No EMD fault or warning codes

Proposed Acceptance Criteria
Lab aged AMP vs. Field Aged AMP

- AMP NMHC, NOx (or NMHC + NOx), CO, PM
  - Must meet certification emission standards
  - NOx shall not exceed 10% of certification level
- Field aged AMP
  - NO2 shall be within 20% of lab aged AMP
  - Average temperature within 10% of lab aged AMP
  - Average BP within 20% of lab aged AMP
- No EMD fault or warning codes

Compatibility
Field Trials

- Independent datalogger requirements (≤10 sec intervals)
  - Timestamp
  - Engine RPM
  - Temperature
  - Backpressure
- All ECU codes
- Third party letters
- Photographs of the device

Field Trial Requirements

- During the field trial the device must not:
  - Cause EMD error/fault codes or ECU interference
  - Require maintenance or cleaning
  - Damage engine or cause it to exceed manufacturer limits
  - Interfere with the vehicle's normal functions
  - Have emissions exceeding certified standards
  - Have component failures or lose physical integrity
  - Show inappropriate regeneration patterns
- Vehicle must not experience failure of other emission control components

Other Requirements

Bond Requirement

- Why Does AMP Manufacturer Need A Bond
  - Ensure adequate protection for the end user
  - Accountability for product recall or other issues
- What Are Required?
  - Proof of having a bond prior to awarding certification
  - No exemptions – everybody treated equally
  - Standard required base amount of $500,000
    - Increased annually based on total sales
  - Bond shall satisfy any administrative settlement agreement, administrative final order, or judicial judgment against the applicant/manufacturer

Warranty

- Product Warranty
  - 2 years, unlimited mileage
- Installation Warranty
  - 2 years, unlimited mileage
- Consistent with other aftermarket part warranties

Recordkeeping

- Manufacturers/applicants maintain information on:
  - Valid end user contact information
  - Description of vehicles and engines on which the units are installed
  - Date of purchase/installation
  - Hours/miles on engine at time of installation
  - Reason DPF was replaced
  - Vehicle assessment prior to installation
  - Device serial number
- Must maintain records for 4 years from date of installation, or no less than one year beyond the warranty period, which ever is longer

Vehicle Pre-Installation Assessment

- Manufacturers/applicants must ensure the following are met:
  - Appropriate vehicle/engine
  - Engine and DOC are in proper state of maintenance
  - No engine error codes, etc.
  - Vehicle is in original OEM exhaust aftertreatment configuration
  - Aftermarket part is installed in same location and orientation as OEM part with no change to other OEM components
  - Original DPF is out of warranty
  - Enough training for installer

Labeling

- Legible, visible, durable
- EO number issued by ARB
- Unique serial number
- Name, address, phone number of manufacturer
- Part number
- Date (month/year) of manufacture
- Directional flow arrow
- Other information such as filter “birth weight” to help the end user clean their filter

Swapping Policy

- Temporary - for DPF cleaning only
- Within common ownership fleet
- ARB approval of swapping policy with conditions
- Applicant must be preapproved
- Same size/model, and same flange type/muffler as original AMP DPF
- Other information such as installation instruction, warranty issue and recordkeeping

Additional Requirements

- Prohibit resale of used DPF
- Recall process if:
  - Catastrophic failures / safety issues
  - Enforcement action
  - Parts fail QC
  - Part causes engine issues or other parts to fail on the engine
  - High warranty claims, and/or operation failure issues
- Audit testing
  - Testing or inspection of new or in-use units
  - ARB can require a manufacture to provide a device for inspection and testing

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Draft regulation language - CCR 2222 (k) and draft evaluation procedure:
http://www.arb.ca.gov/diesel/mod-part/mod-part.htm

Questions/Comments