

Procedure for Approving Aftermarket Diesel Particulate Filters (DPF) Intended as Modified Parts For 2007 - 2009 On-Road Heavy-Duty Diesel Engines

Public Workshop



April 7, 2015

California Environmental Protection Agency

 **Air Resources Board**

Purpose

- Establish a procedure for evaluation and approval of DPFs as modified parts
- 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)
- Provide end users additional market place options when purchasing DPFs intended as substitutes for non-functional OEM parts
- Focus is on 2007-2009 engines certified with DPFs

Overview

- Background
- Projected Schedule
- Proposed Procedure
- Questions and Open Discussion

Background

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

- Modified parts

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

Projected Schedule

- Second public workshop
- Individual stakeholder meetings (in April)
- Comments/feedbacks for contributions to the board package (in April)
- 45-Day comment period – (October 2 through November 16, 2015)
- Board hearing (Sacramento) – November 19 and 20, 2015

Proposed Aftermarket Modified Part Procedure

Overview

Proposed Procedure

- Proposed procedure includes:
 - Applicability
 - Application process
 - Testing
 - Warranties
 - Other Requirements
 - Draft procedure available online

Applicability

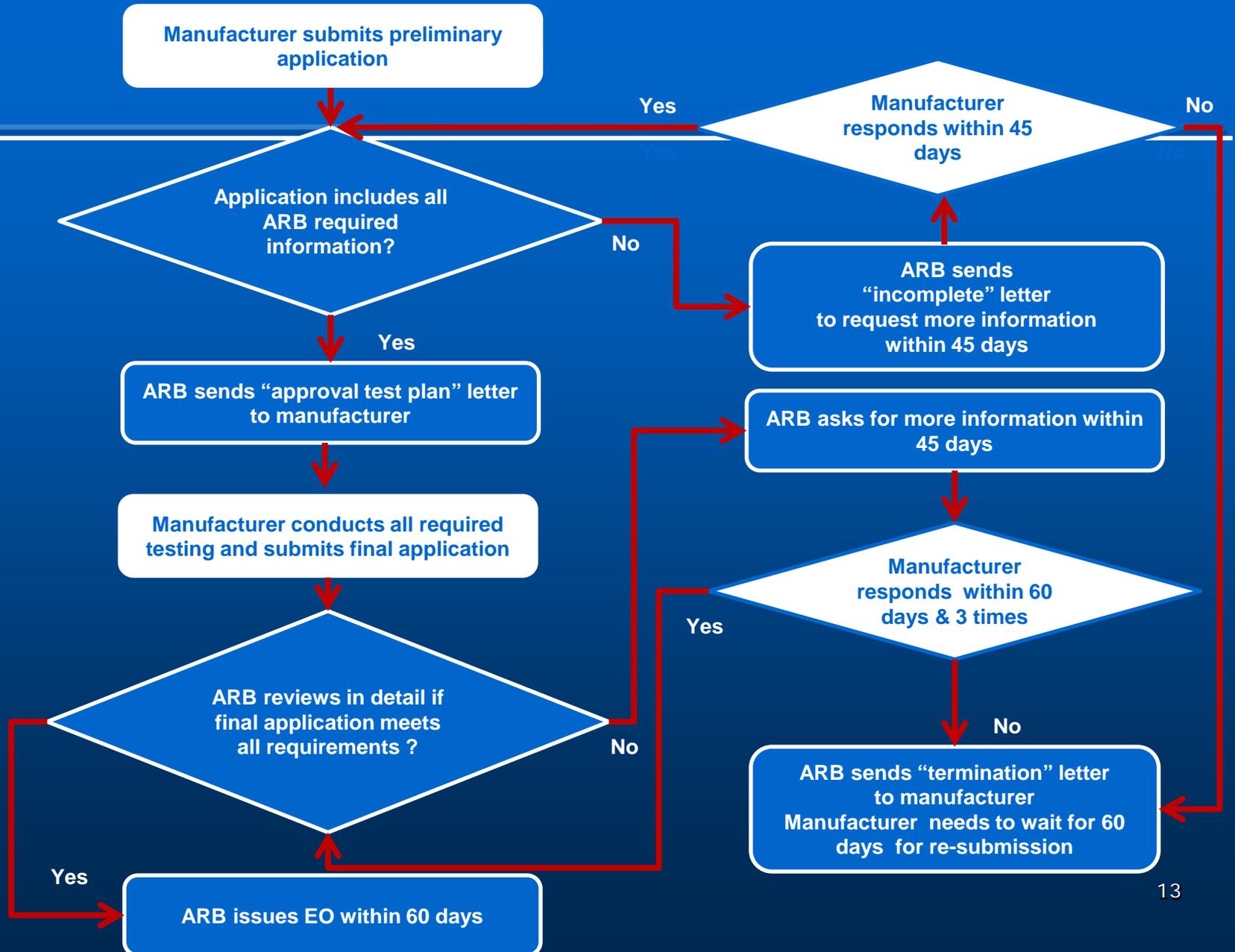
- Applicability
 - Market-ready new aftermarket DPFs intended as modified parts
 - 2007-2009 on-road heavy-duty diesel engines with DPFs
 - NOT for the following:
 - DPFs covered under verification provisions
 - DPFs intended as replacement parts
 - Used DPFs

Application Process

Application Format and Process

- Two types of application
 - Preliminary application (PA)
 - Final application (FA)
- Application process (see flow chart on next slide)

Application Process



Pre-application

- Defined emission control group (ECG). Limit 1 per application.
- Contact persons/phones/emails/addresses
- Complete information on the OEM and modified part
- Detailed test plan (all required tests, test facilities, fleet/vehicles/engines, equipment/instruments, etc.)
- Warranty 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
- Sample scale drawings of labels
- Other supporting information

Emission Control Group

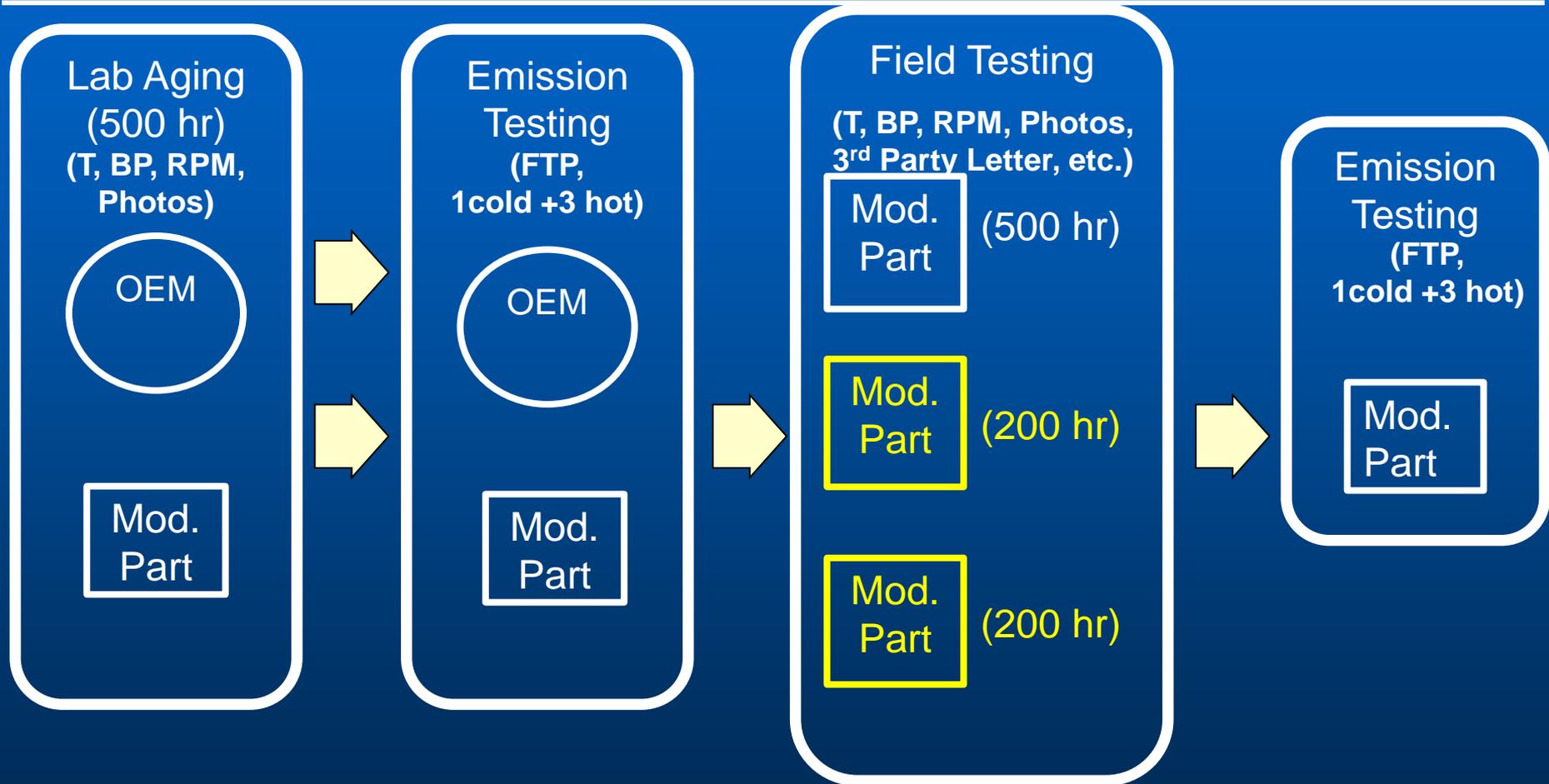
- Proposed definition:
 - Single OEM
 - OEM DPF part number within a single OEM
 - An ECG must only include a single modified part
- Based upon:
 - Robust review of OEM data
 - Consultation with stakeholders
 - Differences between OEMs
 - Effects on the engine must be considered

Testing

Testing Goals

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

Testing Sequence



Laboratory Aging Protocol

Table 1 ARB Modified Aging Cycles

¹Temperature ramping period during the aging cycle is not considered as part of the 500 hours aging time.

²Cooling down period during the aging cycle is not considered as part of the 500 hours aging time.

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	670°C ±20 °C 2007 ramped-modal cycle Mode A100 2 minutes
4	Active Regeneration	Target Temperature (DPF Inlet) Engine Speed & Torque Time Duration	670°C ±20 °C 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

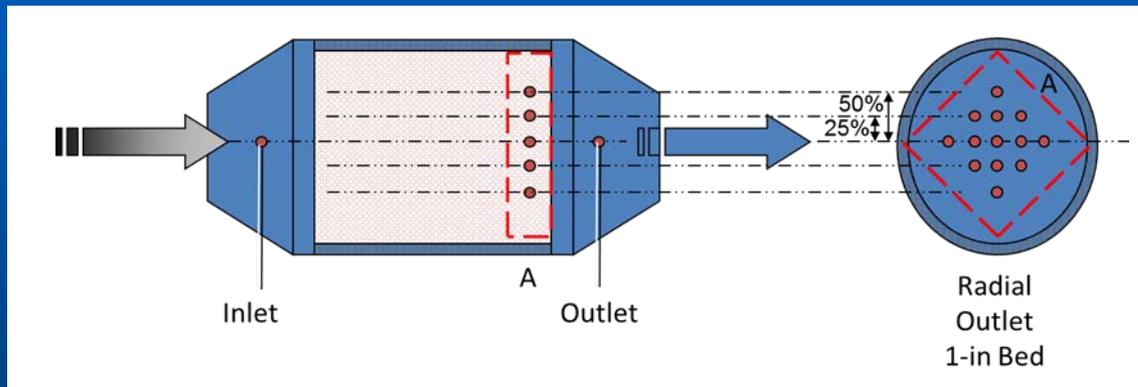


Figure 1 Temperature sensor locations for DPF aging

- 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 aging time

Laboratory Aging Protocol

Chemical Aging

- Lubricant oil exposure requirement
 - Use observed field average oil consumption to estimate oil exposure target for the modified part warranty period.
 - Use 500 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 Aged OEM vs. Lab Aged AMP

- NMHC, NO_x (or NMHC + NO_x), CO, PM must meet certification emission standards
- NO_x shall not exceed 10% of certification level
- Average backpressure and temperature no greater than 10% above or below OEM
- 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/OBD 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

Proposed Acceptance Criteria

Lab Aged AMP vs. Field Aged AMP

- NMHC, NO_x (or NMHC + NO_x), CO, PM must meet certification emission standards
- NO_x shall not exceed 10% of certification level
- Average exhaust temperature within 10%
- Average exhaust backpressure within 20%
- No EMD fault or warning codes

Other Requirements

Warranty

- Product Warranty
 - 5 years or 150,000 miles from date of installation whichever is shorter
- Installation Warranty
 - 5 years or 150,000 miles from date of installation, whichever is shorter
- Consistent with other aftermarket part warranties

Other Aftermarket Program Warranties

- Catalytic converter
 - 5 years/50,000 miles
 - Some OEMs offer lifetime warranty for replacement exhaust systems
- Highway motorcycle
 - If ≤ 4 year from purchase date, full warranty as certification (i.e., 5 year/12-30k km, depending on Class I, II, III)
 - If > 4 year from purchase date, 3 year or half applicable mileage of certification, whichever occurs first
 - Installation warranty: 2 year/12,000 km

Recordkeeping

- Manufacturers & installers 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
- Records maintained for 4 years from date of installation, or no less than one year beyond the warranty period, whichever is longer.

Vehicle Pre-Installation Assessment

- Manufacturers 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
 - Authorized 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.

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

Need Help From You!

- ARB developed a survey including 15 questions
- Who should answer questions?
 - Industry associations
 - Individual aftermarket DPF manufacturers
 - Installers and/or service providers
- Survey will provide costs and economic impact estimates for this board item

Contact Info

Dr. Jennifer Lin
(916) 445-0383
jennifer.lin@arb.ca.gov

Dr. Yong Yu, P.E.
(626) 450-6109
yong.yu@arb.ca.gov

Draft evaluation procedure:
<http://www.arb.ca.gov/diesel/mod-part/mod-part.htm>

Questions/Comments

