

California Environmental Protection Agency
AIR RESOURCES BOARD

**CALIFORNIA EVALUATION PROCEDURE FOR NEW
AFTERMARKET DIESEL PARTICULATE FILTERS INTENDED AS
MODIFIED PARTS FOR 2007 THROUGH 2009 ON-ROAD HEAVY-DUTY
DIESEL ENGINES (DRAFT)**

NOTE: This is a new Evaluation Procedure. For clarity the proposed text is shown in normal type.

Adopted: [INSERT DATE]

Note: This document is incorporated by reference in section 2222(k), title 13, California Code of Regulations. It contains the criteria the Air Resources Board (ARB) will use to evaluate whether new aftermarket diesel particulate filters intended as modified parts for 2007-2009 on-road heavy-duty diesel engines qualify for exemptions from California Vehicle Code sections 27156 and 38391. An ARB exemption is required before any new aftermarket diesel particulate filter can be advertised, sold, offered for sale, or installed on a 2007-2009 on-road heavy-duty diesel engine operating in California.

Table of Contents

(a) APPLICABILITY	1
(b) DEFINITIONS	1
(c) APPLICATION PROCESS	5
(d) TESTING SPECIFICATIONS	21
(e) EMISSION TESTING REQUIREMENTS	24
(f) LABORATORY AGING PROTOCOL AND FIELD SERVICE ACCUMULATION REQUIREMENTS	31
(g) ADDITIONAL FIELD DEMONSTRATION REQUIREMENTS	37
(h) APPROVAL CRITERIA FOR TESTING	38
(i) OTHER REQUIREMENTS.....	39
(j) WARRANTY	49
(k) SAFETY	59
(l) COMPLIANCE	60
(m) PENALTIES	60
APPENDIX 1	62
APPENDIX 2	63
APPENDIX 3	65

(a) APPLICABILITY

These procedures apply to market-ready new aftermarket modified parts, which through the use of sound principles of science and engineering, are intended as direct substitutes for original equipment manufacturer (OEM) emission control components. These procedures are used to approve aftermarket diesel particulate filters (DPF) which take the place of 2007 through 2009 on-road heavy duty diesel engines' wall flow DPFs. These procedures are not applicable to DPFs approved by the *Verification Procedure, Warranty, and In-Use Compliance Requirements for In-Use Strategies to Control Emissions from Diesel Engines* (Title 13, California Code of Regulations (CCR), Sections 2700-2711), DPFs that comply with the definition of a replacement part per Title 13, CCR, Section 1900, or used DPFs. Additionally, these procedures are not applicable to OEM configurations that use a metal substrate for the DPF.

(b) DEFINITIONS

The definitions in Title 13, California Code of Regulations, Section 1900(b), are incorporated by reference herein. The following definitions shall govern the provisions of this Procedure:

“Advertise” means to provide any notice, announcement, information, publication, catalog, listing for sale or lease, or other statement concerning a product or service to the public for the purpose of furthering the sale or lease of the product or service.

“Alternative Diesel Fuel” means any fuel used in diesel engines that is not commonly or commercially known, sold or represented as diesel fuel No. 1-D or No. 2-D, pursuant to the specifications in ASTM Standard Specification for Diesel Fuel Oils D975-81, and does not require engine or fuel system modifications for the engine to operate, although minor modifications (e.g., recalibration of the engine fuel control) may enhance performance. Examples of alternative diesel fuels include, but are not limited to, biodiesel, Fischer Tropsch fuels, and emulsions of water in diesel fuel. Natural gas is not an alternative diesel fuel.

“Applicant” means the entity that has applied for or has been granted certification for the modified part under this Procedure.

“Auxiliary Emission Control Device” (AECD) means any element of design which senses temperature, vehicle speed, engine revolutions per minute (RPM), transmission gear, manifold vacuum, or any other parameter for the purpose of activating, modulating, delaying, or deactivating the operation of any part of the emission control system.

“Average” means the arithmetic mean.

“Backpressure Monitor” means a device that includes a sensor for measuring the engine backpressure upstream of a hardware-based modified part or component thereof installed in the exhaust system and an indicator to notify the operator when the backpressure exceeds specified high and in some cases low backpressure limits, as defined by the engine manufacturer or the applicant for certification of the modified part.

“Certification” means a determination by the Executive Officer that a modified part meets the requirements of this Procedure. This determination is based on both data submitted or otherwise known to the Executive Officer and engineering judgment.

“Cold Start” means an engine transient cycle emission test following either natural or forced cool-down periods described in Sections 1334 and 1335 of the Code of Federal Regulations (CFR), Title 40, Part 86.

“Days” when computing any period of time, means normal working days on which ARB is open for business unless otherwise noted.

“Denied Warranty Claim” means a request from an end user to the installer or applicant for an inspection, repair, replacement, adjustment, or modification of a specific part or component of the modified part, or a claim that vehicle, or engine, due to a problem with the modified part needs inspection, repair, adjustment, or modification within the warranty period which is not determined to be a warrantable condition.

“Device” means the product, including the DPF component, which is described in the application for modified part or the modified part once approved by this Procedure. Only one device is allowed per application.

“Diesel Emission Control System” or “Diesel Emission Control Strategy” means any verified device, system, or strategy employed with an in-use diesel vehicle or piece of equipment that is approved under the *Verification Procedure, Warranty, and In-Use Compliance Requirements for In-Use Strategies to Control Emissions from Diesel Engines*, Title 13, CCR, Sections 2700-2711. This is not a modified part or a replacement part as defined in Title 13, CCR, Section 1900(b).

“Diesel Engine” means an internal combustion engine with operating characteristics significantly similar to the theoretical diesel combustion cycle. The primary means of controlling power output in a diesel cycle engine is by limiting the amount of fuel that is

injected into the combustion chambers of the engine. A diesel cycle engine may be petroleum-fueled (i.e., diesel-fueled) or alternative-fueled.

“Durability” means the ability of the applicant’s modified part to maintain compliance with the certified emission level of an engine on which it is equipped without interfering with the engine’s normal operation, affecting or altering infrequent regeneration events or engine control unit (ECU) function or programming, triggering AECDs, or causing physical damage to the engine or other emission control components.

“Emission control group” means a group of like engines and applications from the perspective of how the modified part will interact with the engines and how the engines will interact with the device. The emission control group for any modified part may only consist of engines from a single engine manufacturer and one DPF part number.

“End user” means any individual or entity that owns or operates a vehicle or piece of equipment that has a certified modified part installed.

“Engine Manufacturer Diagnostic (EMD) System” are On-Board Diagnostic (OBD) systems approved on 2007-2010 OEM heavy-duty engines that comply with the requirements of Title 13, CCR, Section 1971.

“Executive Officer” means the Executive Officer of the Air Resources Board.

“Executive Order (EO)” is the document issued by ARB to exempt a modified part design from the prohibitions of California Vehicle Code sections 27156 and 38391 when ARB’s Executive Officer has determined that the modified part complies with the criteria specified in this Procedure.

“Fuel Additive” means any substance designed to be added to fuel or fuel systems or other engine-related systems such that it is present in-cylinder during combustion and has any of the following effects: decreased emissions, improved fuel economy, increased performance of the entire vehicle or one of its component parts, or any combination thereof; or assists emission control components in decreasing emissions, or improving fuel economy or increasing performance of a vehicle or component part, or any combination thereof.

“Hot Start” means an engine emission test after starting a warmed-up engine. The first hot start Federal Test Procedure test run should be initiated 20 minutes after the cold start for Federal Test Procedure testing following Section 86.1327-90 of the Code of Federal Regulations, Title 40, Part 86.

“Installer” or “Authorized Installer” means any individual or entity that equips or services any vehicle, engine or equipment with a modified part, and has the authorization of the party that holds the certification for the modified part pursuant to section (i)(2).

“Malfunction Indicator Lights (MIL)” are indicators that notify the vehicle operator of detected malfunctions and comply with the MIL requirements of Title 13, CCR, Section 1971.

“Market-ready” means ready for introduction into commerce. A market-ready modified part is not a prototype and requires no design modifications, part changes, or other changes prior to being sold to end users for commercial use. All components that are necessary for a market-ready modified part to function properly are also commercially available.

“On-Board Diagnostic (OBD) system” are systems that comply with the requirements of Title 13, CCR, Section 1971.1.

“Original Equipment Manufacturer (OEM)” is as defined in CFR, Title 40, Part 85, Section 85.502, which is the original manufacturer of the new vehicle/engine or relating to the vehicle/engine in its original certified configuration.

“Quarterly” refers to the following calendar periods: January 1 – March 31; April 1 – June 30; July 1 – September 30; October 1 – December 31.

“Recall” means an inspection, repair, replacement, adjustment, or modification program of a modified part required by the Executive Officer and initiated and conducted by the applicant, or its agent or representative for which direct notification of the end user is necessary.

“Regeneration” means the periodic or continuous combustion of collected particulate matter that is trapped in a particulate filter through an active or passive mechanism. Active regeneration requires a source of heat other than the exhaust itself to regenerate the particulate filter. Examples of active regeneration strategies include, but are not limited to, engine management and the use of fuel burners.

“Revoke” means to cancel the Executive Order of a modified part. Upon revocation, all sales or leases of the modified part must immediately cease.

“Used DPF” means any DPF intended as a modified part which has been sold or leased to an end user and installed on an engine/vehicle/application.

“Valid Warranty Claim” means a request from an end user within the warranty period to the installer or applicant for an inspection, repair, replacement, adjustment, or modification of a specific part or component of the modified part, vehicle, or engine for which the applicant is invoiced for compensation pursuant to the warranty provisions and compensation is actually provided, excluding warranty repairs made solely for customer satisfaction purposes (i.e., good faith repairs).

“Warrantable Condition” means any condition of the modified part, vehicle, or engine which triggers the responsibility of the installer or applicant to take corrective action pursuant to this regulation.

“Warranty Claim” means a request from an end user to the installer or applicant for an inspection, repair, replacement, adjustment, or modification of a specific part or component of the modified part, vehicle, or engine within the warranty period.

“Warranty Period” means the time frame, defined in years, or miles whichever is longer, in which a claim may be made to an installer or applicant for inspection, repair, replacement, adjustment, or modification of their product due to a defect in design, materials, workmanship, or operation.

(c) APPLICATION PROCESS

(1) Emission Control Group. An application must be restricted to an emission control group and must include details regarding engine design criteria or engine programming which may vary across the group as well as a clear explanation of how the modified part is appropriate for all engines and engine configurations within the emission control group. Duty cycle differences must also be addressed.

(A) The emission control group for any modified part may only consist of engines from a single engine manufacturer and one OEM DPF part number. A change in OEM part number is a new emission control group.

(B) An applicant must not have multiple modified part designs corresponding to a single emission control group.

(C) Documents and other information that show the OEM DPF part number is the same for each engine configuration in the emission control group should be provided as part of the preapplication.

(D) Engines or applications which are dissimilar or unrepresentative of other engines or applications within the proposed group, or that the part may be incompatible with an engine or duty cycle, cause atypical emissions (certification or secondary), pose a safety risk, impact engine durability, or be affected by the engine (e.g., durability of the part) may be excluded by the Executive Officer.

(2) Overview. A modified part does not cause the engine to be in noncompliance with its original certification, negatively impact overall engine durability and functionality, AECs, or infrequent regeneration events, trigger engine fault codes/MILs, change or alter ECU behavior, or otherwise alter or modify the engine's certified configuration. Before submitting a final application for a modified part and associated parts for use with a specified emission control group, the applicant must submit a preliminary application (pursuant to section (c)(3)) in the format shown in section (c)(7). Only one emission control group can be included in the application. The application must include a discussion of how (A) through (G) below are met:

(A) The modified part must not result in potentially harmful secondary emissions and must not pose a safety risk.

(B) The modified part must be of like material (e.g., mullite for mullite, cordierite for cordierite, silicon carbide for silicon carbide, aluminum titanate for aluminum titanate, etc.), physical dimensions (e.g., diameter, length, width), segmentation (e.g., segmented versus unsegmented), and shape (e.g., oval versus round) to the OEM part.

(C) Characteristics such as cells per square inch (CPSI), wall thickness, segmentation pattern, and porosity must be similar enough to the original part such that back pressure profiles, structural integrity, thermal tolerances and filtration efficiency are not negatively impacted.

(D) The modified part must not allow emissions to bypass or circumvent the DPF or OEM certified emission control strategy.

(E) An applicant or applicant's modified part may include an independent ECU (i.e., not OEM engine ECU) or datalogger, additional sensors, wiring and the ECU components provided they do not affect the OEM engine ECU function.

(F) Applicants must obtain an approved test plan prior to conducting any testing. See section (c)(3)(A) for more details on the test plan requirements.

(G) Applicants must submit all test results (pursuant to sections (d), (e), (f), and (g)), along with comments and other information (pursuant to sections (i) and (j)), in a final certification application to the Executive Officer, in the format shown in section (c)(7). Submitted data must include all files recorded in its raw format as well as compiled and analyzed in a manner specified by the Executive Officer. The applicant must provide all data for the emission testing, laboratory aging, field service accumulation and compatibility demonstrations. All data collected from initial development of the product to product certification shall be submitted upon request.

(H) If the Executive Officer grants certification of a modified part and associated parts, the Executive Officer will issue an Executive Order for the device and identify any terms and conditions that are necessary to support the certification.

(l) Manufacturers must not arbitrarily change part numbers for the same product or product components after certification. If a manufacturer wishes to change a part number, it must provide a part change request to ARB per section (c)(14).

(3) Preliminary Certification Application Requirements. Before formally submitting a final application for certification of a modified part, the applicant must submit a preliminary certification application. A fully-functional sample of the market-ready modified part may be required at the time of the preliminary application that is identical in all material respects to the product that will be sold upon receiving certification. Failure to provide a sample in 15 calendar days will terminate the application. No modifications to the device are permitted after submittal of the preliminary application. For modified parts that include multiple sizes (e.g., the diesel particulate filter), the Executive Officer will specify which size must be submitted. The Executive Officer shall return, at the applicant's expense, the market-ready modified part after the request for certification is either granted, denied, or withdrawn. The Executive Officer shall use the information in the preliminary certification application to help determine whether the modified part is approved to take the place of the original equipment manufacturer part and the need for additional analyses. The preliminary certification application must follow the format shown in section (c)(7) and include the information specified in (A) and (B) below.

(A) Test Plan Requirements.

1. The test plan must include test engines and testing conditions that are representative of the least favorable conditions within the requested emission control group for the modified part.
2. Detailed information supporting how the least favorable testing conditions are determined. The effects on the engine, other aftertreatment (including exhaust gas recirculation systems), and the modified part must be provided.
3. The effects of emission profiles, backpressure, control logic, sizing and displacement, duty cycle, regeneration strategies, auxiliary emissions control devices, infrequent regeneration events, and other pertinent factors must be provided.
4. Any data collected prior to the issuance of the test plan approval letter cannot be used in lieu of conducting the required testing.

(B) Tracking In-Use Parts. Method of tracking and reporting in-use parts for determining when the warranty rate exceeds the 4 percent trigger prior to the annual reporting requirement and how the applicant will ensure installers provide complete reporting information.

(C) Preliminary Application Approval.

1. The Executive Officer shall notify the applicant in writing within 45 days of receiving the preliminary application if, upon review, it is determined that the application has deficiencies or requires additional information which must be addressed in writing by the applicant.
 2. The Executive Officer shall ask for additional information based on the responses submitted by the applicant.
 3. Failure to address the deficiencies or requests for information within 45 days from the date of the letter will result in the application being terminated.
 4. The applicant can resubmit a new preliminary certification application no earlier than 60 days from the date of the suspension notification letter.
- (D) If the applicant has misrepresented the device or its interaction with the engine or that the device poses a safety risk, may increase emissions, or may result in secondary emissions not disclosed at the time of the initial application for certification, the Executive Officer can terminate the application process.

(4) Signed Statement of Compliance.

(A) The applicant must submit a signed statement that all testing was completed in accordance with the requirements of this Procedure, the test plan approval letter, and any applicable regulations incorporated therein. The statement must also affirm that all required data has been submitted and the applicable quality assurance and quality control has been verified to comply with the requirements of this Procedure, the test plan approval letter, and any applicable regulations incorporated therein. The statement must also attest to the fact that all testing, information, and data was obtained from a system matching the description in the application and test plan approval letter and that the description provided was comprehensive and did not omit or misrepresent any aspect of system design, function or emission control group information.

(B) The applicant must also provide a statement that the applicant acknowledges and agrees to:

1. Comply with the warranty requirements of section (j), including all recordkeeping and reporting requirements, including reporting if and when a 4% trigger is reached, and provide a statement on how they will comply with the reporting requirements. The warranty must be included in the final application package.
2. Comply with the quality control, audit, and recall provisions of section (i) including any recordkeeping requirements.
3. Keep records for 4 years from date of installation or no less than one year beyond the required warranty period, whichever is longer, that contains the information required per section (c)(11).

4. Provide all maintenance information for the modified part to the owner pursuant to section (i)(9)(B).

(5) All applications, correspondence, and reports, must be submitted in writing to:

CHIEF, IN-USE PROGRAMS BRANCH
AIR RESOURCES BOARD
9480 TELSTAR AVENUE, SUITE 4
EL MONTE, CA 91731

(6) Treatment of Confidential Information. Information submitted to the Executive Officer by an applicant may be claimed as confidential, and such information shall be handled in accordance with the procedures specified in Title 17, California Code of Regulations, Sections 91000-91022. The Executive Officer may consider such confidential information in reaching a decision on a certification application.

(7) Application Format. The preliminary and final certification applications must be submitted in writing to the address shown in subsection (5) above. Electronic mail, presentations, publications, applied or approved patents, and verbal submissions do not constitute acceptable application formats and will not be accepted. The preliminary and final certification applications for a modified part must follow the format shown below. Final certification applications must include all of the information provided in the preliminary certification application as described in section (c)(3), including any additional information, updates, or changes, and all additional information shown below. Any substantive changes or modifications between documents or revisions of a document must be clearly identified (e.g., highlighted) and the applicant must attest in writing to the fact that no other product change, emission control group, or testing changes were made.

1. *Introduction*

1.1 Identification of applicant, manufacturer of the market-ready modified part, and description of the modified part.

1.1.1 The applicant information must include the entity legally responsible for complying with all the requirements of the procedure as well as any designated representative. To prevent confusion and misinformation, an applicant may only designate one authorized representative at a time.

1.1.2 A valid business address, telephone number(s), email, and any other information which assists in the identification of the applicant and allows ARB to easily contact it.

- 1.1.3 List of all manufacturers of all components of the modified part as well as the combined system. If the applicant will allow subcontractors it must address this and ARB may request detailed information regarding these entities as well as quality control and quality assurance information on how the applicant controls this.
- 1.1.4 A description of the modified part.
- 1.2 Description of the OEM part.
 - 1.2.1 Complete description of the OEM part including but not limited to part number, size(s)/dimensions of the DPF core itself as well as the canned part, core type (e.g., cordierite, silicon carbide, etc.), porosity, maximum soot loading capacity, median pore size, pore size distribution, cell density, wall thickness, method of sealing or plugging cell ends (e.g., pinched versus plugged), method of canning including type of matting used, grade and specification of can material, catalyst coating/composition and/or washcoat information (e.g., composition and loadings) including how the OEM part is coated (e.g., zone), soot holding capacity, thermal expansion, and melting temperature.
 - 1.2.2 Identification by engine family name and engine model and/or calibration the engines on which the OEM part are found.
- 1.3 Description of emission control group selected including differences in engine configurations, sizes, regeneration strategies, exhaust components, identification of other exhaust components by part number which may vary over the emission control group, etc.
 - 1.3.1 Information on engine platforms where another part is necessary for successful operation (e.g., upstream DOC). Identify part numbers for these parts across the emission control group and explain if the part changes or is different for any engine configuration within the emission control group.
- 1.4 Description of intended applications (examples of in-use vehicles or equipment, typical duty cycles, fuel requirements, etc.) if the engines in the emission control group can go into diverse applications.
 - 1.4.1 Description of any changes or modifications to the engine regeneration events for different applications.

2. *Modified Part Information*

- 2.1 Description of the modified part.
 - 2.1.1 Complete description of the modified part. Factors pertinent in determining that the part is capable of successfully taking the place of the original OEM part, without negatively impacting the certified emissions levels of the engine, vehicle functionality, or durability,

including but not limited to part number, size(s)/dimensions of the DPF core itself as well as the canned part, core type (e.g., cordierite, silicon carbide etc.), porosity, median pore size, pore size distribution, maximum soot loading capacity, cell density, wall thickness, method of sealing or plugging cell ends (e.g., pinched versus plugged), method of canning including type of matting used, grade and specification of can material, catalyst coating/composition and/or washcoat information (e.g., composition and loadings), coating formulations (catalyst, washcoat etc.) including how the part is coated (e.g., zone), soot holding capacity, thermal expansion, and melting temperature.

- 2.1.1.1 Comparison of the modified part to the OEM part.
- 2.1.1.2 Detailed information including data or other engineering support addressing at a minimum how differences between the OEM part and modified part will not negatively impact engine or aftertreatment performance, emissions certification compliance of the engine, engine (or component part) durability, ECU performance or behavior, secondary emissions, AECDs, and infrequent regeneration events and will not trigger warning codes or MILs.
- 2.1.2 Detailed discussion of the modified part's principles of operation, the part's function within the engine's emissions control system and overall engine emission control operation highlighting any differences from OEM operation.
- 2.1.3 Schematics depicting the operation, installation, and location of the modified part and all associated parts (including diagrams of relative positioning for the modified part, associated parts and OEM components, air flow throughout the engine, exhaust flow through filter substrates, electrical diagrams, fuel flow diagrams, etc.).
- 2.1.4 A detailed part list for all parts of its product and a unique part number for all parts which are not from the same supplier. Each part must be identified by common name and all related part numbers associated with a common part name must be provided. If certain parts are only found in groupings with other parts this must be clearly indicated.
- 2.1.5 The addition of an ECU and associated hardware (e.g., sensors) for the purposes of, for example, protection in case of a warranty claim, may be proposed. A schematic detailing how the ECU and associated hardware will integrate with or add to the OEM components must be submitted with the application along with a

statement of the purpose of the ECU. The parts must be warranted and tested for durability and compatibility as part of the entire system and the applicant must provide a detailed description of potential factors which may cause adverse interactions between the ECU and OEM components.

- 2.1.6 Indication if the OEM configuration is designed for a unidirectional part (DPF). The modified part must be unidirectional if it is replacing a unidirectional OEM part. All modified parts must clearly identify the correct direction of exhaust flow via an arrow imprinted on or affixed to the modified part which is clearly visible, legible, and durable. Detailed information addressing potential unidirectionality issues, including how its system is designed to account for this, and provide a picture, diagram, or schematic of the arrow indicating direction.
- 2.2 Description of regeneration method.
 - 2.2.1 Modified part's effect on OEM engine regeneration on an emission control group basis.
 - 2.2.2 Description of the OEM engine's regeneration.
 - 2.2.2.1 Operating condition requirements for regeneration.
 - 2.2.2.2 A description of thresholds and control logic to activate regeneration.
 - 2.2.2.3 A description of sensors and monitors involved for an active regeneration.
 - 2.2.2.4 A description of typical regeneration intervals under certain duty cycles.
 - 2.2.2.5 A description of how often the engine is expected to rely on active regeneration as compared to passive regeneration.
 - 2.2.3 Complete description of the modified part's effect on OEM engine regeneration if applicable.
 - 2.2.3.1 Any difference in operating condition requirements for the OEM engine equipped with the modified part regarding regeneration.
 - 2.2.3.2 A detailed description of any thresholds and control logic changes to activate regeneration for the OEM engine equipped with the modified part.
 - 2.2.3.3 A detailed description of any regeneration interval change due to the modified part.
- 2.3 Favorable operating conditions for the modified part and associated parts.
- 2.4 Unfavorable operating conditions for the modified part and associated parts including associated reductions in performance.
- 2.5 Fuel and lubricating oil requirements and misfueling considerations.

- 2.6 Identification of modified part's failure modes and associated consequences.
 - 2.6.1 Discussion in context of potential safety issues, engine usability issues, emissions compliance issues and address what influence the failure of the modified part may have on the OEM engine including all exhaust emission control components.
 - 2.6.2 All installations of the modified part must conform to applicable industrial safety requirements including but not limited to Federal Motor Carrier Safety Administration, Subpart G, *Miscellaneous Parts and Accessories*, Section 393.83 *Exhaust Systems*.
- 2.7 Detailed analysis of the modified part's potential safety and catastrophic failure (e.g., uncontrolled regeneration, lack of proper maintenance, unfavorable operating conditions, use of inappropriate fuel, high exhaust temperatures, substrate failure, sensor failure, etc.), including a description of the mitigation strategies employed by the modified part and associated parts for each potential safety and catastrophic failure issue.
 - 2.7.1 OEM engine considerations if they address this concern.
- 2.8 Complete description of the modified part's and associated parts installation procedures.
 - 2.8.1 A detailed installation manual which fully addresses correct installation practices.
- 2.9 Pre-installation assessment procedures for the modified part.
 - 2.9.1 Guidelines for assessing the OEM engine to ensure the modified part is not installed on an inappropriate engine (e.g., non-complaint with the modified part's Executive Order), an engine which is in non-compliance with its certification (e.g. non-approved aftermarket modifications), or which is not in a proper state of maintenance (e.g., active MILs, error/fault codes, etc.).
- 2.10 Maintenance requirements.
 - 2.10.1 Detailed description of all normal maintenance requirements for the OEM part replaced by the modified part and associated parts.
 - 2.10.2 Detailed description of all normal maintenance requirements for the modified part and associated parts.
 - 2.10.2.1 There should not be any deviations between maintenance requirements of the modified part and the OEM part that would be less stringent than OEM (e.g., less frequent maintenance) but more proactive maintenance may be proposed for the modified part.
 - 2.10.2.2 Discussion of the potential ramifications of not following maintenance requirements for the modified part. This must address the potential ramifications for the modified part as

well as for the engine or other OEM engine components or follow the maintenance procedures for the original part.

- 2.10.3 Objective criteria for the modified part's ash removal (pressure drop across the filter, maximum clean filter weight, pre-installation filter weight comparison, etc.) for determination if the modified part is "clean".
 - 2.10.4 A copy of the language that will instruct the end user of proper handling of spent components and/or materials cleaned from the modified part, and identify any hazardous materials. Ensure that cleaning methods do not allow for the release of hazardous materials into the environment or allow for workplace exposure. Directions consistent with the OEM engine manufacturer's directions such that ECU and error codes are appropriately handled, if routine maintenance cleaning is allowed.
- 2.11 Description of noise level control compliance for the modified part.

3. *Modified Part and Emission Control Group Compatibility*

3.1 Compatibility with the engine.

- 3.1.1 Discussion of calibrations and design features that may vary from engine to engine.
- 3.1.2 Effect on overall engine performance.
- 3.1.3 Effect on engine backpressure.
- 3.1.4 Additional load on the engine.
- 3.1.5 Effect on fuel consumption.
- 3.1.6 Engine oil consumption considerations.
- 3.1.7 Effect on infrequent regeneration events.
- 3.1.8 Effect on other emission control components.
- 3.1.9 AECD interactions.
- 3.1.10 Identification of the worst case engine configuration within the emission control group from the perspective of the effects of the engine configuration on the modified part. Information, data, and engineering justifications for this determination shall be provided. It must include, but is not limited to, potential durability ramifications as well as the effect on emission compliance (certified and secondary).
- 3.1.11 Identification of worst case engine configuration within the emission control group from the perspective of the effects of the modified part on the engine/engine parts (including but not limited to other emission control components, ECU behavior, and active regeneration components). Information, data, and engineering justifications for this determination shall be provided. It must include, but is not limited to,

potential durability ramifications as well as the effect on emission compliance (certified and secondary).

3.2 Compatibility with the vehicle application.

- 3.2.1 Dependence of calibration and other design features on application characteristics.
- 3.2.2 Presentation of typical exhaust temperature profiles and other relevant field-collected data from representative applications within the emission control group.
- 3.2.3 Comparison of field-collected application data with operating conditions suitable for the modified part.
- 3.2.4 Identification of the worst case application within the emission control group from the perspective of the effects of the modified part on the engine/engine parts (including but not limited to other emission control components, ECU behavior, and active regeneration). Information, data, and engineering justifications supporting this determination. It must include, but is not limited to, potential durability ramifications as well as the effect on emission compliance (certified and secondary). It must address AECD and infrequent regeneration events.
- 3.2.5 Identification of the worst case application within the emission control group from the perspective of the effects of the engine configuration on the modified part. Information, data, and engineering justifications supporting this determination. It must include, but is not limited to, potential durability ramifications as well as the effect on emissions compliance (certified and secondary). It must address AECD and infrequent regeneration events.

4. *Testing Information*

4.1 Emission testing.

- 4.1.1 Test facility identification including capabilities and identification of all analytical instruments.
- 4.1.2 Detailed description of all vehicles and engines (engine serial number, engine family name, engine make, engine model, engine model year, engine code, engine configuration, horsepower, PM and NO_x certification levels, etc.) used to support the application for certification.
- 4.1.3 For the preapplication a statement indicating that the applicant understands that the test engine must be in a proper state of maintenance, meets its certification, and is in the OEM configuration.

For the final application, testing and data must be provided which demonstrates compliance with these requirements.

- 4.1.4 Analysis and description of test fuel (fuel analysis, where it was purchased, purchase volume, etc.).
 - 4.1.5 All engine codes, warnings, MILS, and other engine parameters monitored, measured, and recorded during testing.
 - 4.1.5.1 Device warnings or error codes if the device includes a control or monitoring system.
 - 4.1.6 Test procedure description (pre-conditioning period, test cycle, etc.).
 - 4.1.7 Test results and comments.
 - 4.1.8 Incomplete, failed, voided, and invalid test data and explanations.
 - 4.1.9 All testing provided in the format specified by the Executive Officer and include clearly identified (including units) raw data and summarized data.
- 4.2 Durability testing.
- 4.2.1 Detailed description of the aging and field testing performed to demonstrate the modified part's durability and compatibility with the emission control group.
 - 4.2.2 Laboratory durability and aging demonstration.
 - 4.2.2.1 Test facility identification including capabilities and identification of all analytical instruments.
 - 4.2.2.2 Detailed description of all vehicles and engines (engine serial number, engine family name, engine model, engine make, engine model year, engine configuration, engine code, horsepower, PM and NOx certification levels, etc.) used to support the application request.
 - 4.2.2.3 Information demonstrating the test engines and vehicles are in a proper state of maintenance, or if they have been rebuilt or modified from the OEM configuration.
 - 4.2.2.4 Description of test fuel (type of fuel, where it was purchased, purchase volume, etc.).
 - 4.2.2.5 Detailed analysis of durability and aging test fuel.
 - 4.2.2.6 Detailed description of the test procedures (bench, test cycle, etc.).
 - 4.2.2.7 Detailed description of the test procedure for demonstrating functionality of the monitoring, storage or notification system if an applicant chooses to include this.
 - 4.2.2.8 Description of allowable maintenance performed during the laboratory demonstration.

- 4.2.2.8.1 Allowable maintenance shall be prescribed in CFR, Title 40, Part 86, Subpart A, Section 004-25 - *Maintenance*.
- 4.2.2.8.2 All engine codes, warnings, MILs, and other engine parameters monitored, measured, and recorded during testing.
- 4.2.2.9 Test results and comments. Description of failed, voided, invalid, and incomplete tests.
- 4.2.2.10 All testing including units, raw data and summarized data.
- 4.2.3 Field durability demonstration.
 - 4.2.3.1 Identification of application owner (company name, company contact person, address, phone number, etc.).
 - 4.2.3.2 Description of test vehicle and engine (engine serial number, engine family name, engine make, engine model, engine model year, engine configuration, engine model, engine code, horsepower, PM and NOx certification levels, etc.).
 - 4.2.3.3 Pre-installation evaluation including engine/vehicle check, identification of OEM configuration and all exhaust system components (including part numbers).
 - 4.2.3.4 Description and analysis of fuel used during the field demonstration (specifically identify each different type of fuel i.e. ultra low sulfur, low sulfur, summer or winter blends, etc.).
 - 4.2.3.5 Analysis of a fuel sample drawn from the field demonstration vehicle during the durability test.
 - 4.2.3.6 Description of application usage during field demonstration (application operation, region of operation, route, etc.).
 - 4.2.3.7 Test results and comments.
 - 4.2.3.8 Summary of evaluative comments from third-party (e.g., driver or fleet operator).
 - 4.2.3.9 Description of failed, voided, invalid, and incomplete tests.
 - 4.2.3.10 All testing must be provided to ARB in the format specified by the Executive Officer.

5. *References*

6. *Appendices*

- A. Emissions test report information (for all tests, including incomplete, voided, invalid, and failed tests). All test data provided to ARB must be submitted in the format specified by the Executive Officer.

- A.1 Actual emissions test data. Raw, real-time data gathered by the laboratory's data acquisition system during emissions testing in electronic format on a compact disc. These are the raw data from which emissions test results are derived (e.g., analyzer voltage readings recorded at a frequency of 1 Hertz).
- A.2 All engine/ECU codes, warnings, MILs which occurred over the course of testing.
 - (1) Proof that the device did not alter normal ECU operation
- A.3 Plots of engine backpressure and exhaust temperature over time second-by-second.
- A.4 Quality assurance and quality control information.
- A.5 Testing equipment information and indications that testing equipment meets specifications and calibrations required by sections (d), (e), (f), and (g) as appropriate.
- B. Durability information. All testing data including units, raw data and summarized data.
 - B.1 Engine backpressure and exhaust temperature data (as described in sections (f) and (g)).
 - B.2 Original copies of third-party letters or questionnaires describing in-field performance.
 - B.3 All engine/ECU codes, warnings, and MILs which occurred over the course of testing.
 - (1) Proof that the device did not alter normal ECU operation.
- C. Copy of the Owner's Manual (as described in section (i)(6)).
- D. Copy of the Installation Manual (as described in section (i)(7)).
- E. Sample scale drawings of the modified part label (see section (i)(1)).
- F. Other supporting documentation

(8) Final Certification Application Review Process. A final application for certification is reviewed as follows:

- (A) The Executive Officer shall not review a final application unless the applicant has conducted testing according to the ARB approved test plan.
- (B) The Executive Officer shall conduct a review of the final application and will determine within 45 days whether the final application is complete and adequate to support certification. If the final application is not complete and adequate to support certification, the Executive Officer shall request additional information from the applicant. The applicant must respond within 60 days.
 - 1. If, after requesting missing information three times, the Executive Officer determines that the final application is still not complete or accurate, the application will be terminated.

(C) Certification. Within 60 days of determining that the final application is complete, the Executive Officer shall determine whether all information, data, testing, and supporting materials are consistent with the product described in the preapplication process and test plan approval, and shows the modified part successfully complied with all Procedure and test plan requirements and merits certification. The Executive Officer will specify any terms and conditions that are necessary to support the certification and notify the applicant (in writing) within 60 days of the decision.

(D) If the final application is terminated by the Executive Officer and the applicant wishes to attempt certification again, the applicant must wait at least 60 calendar days before submitting a revised final certification which addresses all outstanding issues or concerns raised by the Executive Officer.

(9) Application Termination. If at any point during the review process an application is terminated, the Executive Officer will cease review of all materials regarding the modified part and associated application. The applicant may submit a new, revised application per section (c)(8) after 60 days of the date of the termination notification. This time is intended to allow the applicant to correct any deficiencies in the application. If the preliminary application was terminated, a resubmitted preliminary application will be reviewed as a new application. The re-submission must address the concerns that caused the termination and must not be identical to the terminated application.

(10) Certification Transfers. If an applicant wishes to sell, lease, or supply another manufacturer's previously certified modified part, the applicant must do the following:

(A) Submit a letter of consent from the manufacturer that legally holds the original certification. The letter must give the applicant the right to hold a certification for the modified part and, if applicable, to use information that was previously submitted as support in the application for the original certification.

(B) Submit an application(s) per section (c)(7) of this Procedure. If previously submitted information is included, necessary additional information must be submitted that satisfies all applicable requirements of this Procedure (e.g., testing data, warranty statement, label, owner's manual, etc.).

(C) Submit a description of the modified part's principles of operation. The applicant must demonstrate understanding of how the product relies on sound principles of science and engineering and demonstrate comprehensive understanding of the modified part, engines and applications within the emission control group and the interaction between the modified part and said emission control group. All supporting materials must be updated and resubmitted (e.g.

owner's manuals). All warranty, recall, audit, and product support obligations must be fully addressed.

(11) Recordkeeping Requirements. Applicants and authorized modified part installers are responsible for keeping records for, at the minimum, no less than one year beyond the required warranty period or four years from date of installation, whichever is longer.

(A) Applicants that receive a certification must keep records that have valid end user contact information (name, address, phone number), a description of the vehicles or equipment the units are applied to (type of vehicle/equipment, make, model year, vehicle identification number, pre-installation assessment), a description of the engines the units are applied to (make, model, model year, engine serial number, engine family name, horsepower, engine configuration, hours/miles at time of installation), and information, including serial number, of the modified part installed and the reason for DPF replacement as well as date of installation and the installer.

(B) The applicant must keep these records for each modified part. Applicants that receive certification must submit these records upon request by the Executive Officer to an agent or employee of ARB. The applicant must provide these records within 30 days of the request by ARB.

(C) Authorized installers must keep all pre-installation assessment records as described in section (i) and must provide a copy of these to the end user and applicant at time of installation of the modified part. The installer must provide these records within 30 days of a request by ARB.

(D) Applicants and authorized installers are responsible for maintaining all records pursuant to the warranty requirements of section (j).

(E) Applicants are responsible for maintaining quality control documentation as described in section (i). These reports must be submitted within 15 days of written request by ARB.

(12) Applicants that receive a certification must demonstrate sales or the active pursuit of sales of their modified part in California or the Executive Officer may revoke the Executive Order.

(13) The Executive Officer may at any time with respect to any modified part sold, leased, offered for sale, intended for sale, or manufactured for sale in California, order the applicant or manufacturer to submit records pertaining to the modified part, at the applicant's expense, to a location specified by the Executive Officer.

(14) If a manufacturer wishes to change a part number, it must provide a part change request to ARB in the form of a written application. It must provide a detailed comparison of the originally approved part and the proposed new part delineating all differences between the parts. ARB will review the request. Major differences in a part may be grounds for ARB to determine the change is significant enough to require the part to hold a new Executive Order, requiring appropriate testing and support per this Procedure. Changes in physical characteristics of the part (e.g., DPF, size, porosity/CPSI, materials, catalyst or washcoat composition, coating type/method, etc.) will be considered as requiring a new Executive Order. Non-substantive parts changes will be approved on a case by case basis and ARB will determine if the parts must be reported discretely (e.g., each part type/number if a part is changed or altered over time) or as a combined part type (e.g., a company uses 3 intumescent matting suppliers having equivalent product) for warranty reporting purposes.

(15) The Executive Officer may revoke the certification status of a modified part, cease review of an application in progress, or suspend all review of pending certification applications if the Executive Officer determines that there are errors, omissions, inaccurate information, fraudulent submittals, or a deficiency of required submittals, in the application for certification, supporting information, warranty report, recall plan, or proof of pursuit of sales, or if the modified part fails audit testing, or if the applicant fails to satisfactorily demonstrate safety of the modified part, follow quality control and recordkeeping reporting requirements, or the provisions of the Executive Order.

(d) TESTING SPECIFICATIONS

(1) OEM Part. The OEM part used for testing must be a newly manufactured replacement part provided by the OEM as a direct replacement for the OEM DPF.

(2) Test Fuel and Lubricant Oil

(A) Emission Testing

1. The test fuel must meet the specifications in the California Code of Regulations (Sections 2280 through 2283 of Title 13).
2. The same fuel must be used throughout the entire set of testing including engine qualification testing, OEM part emission testing, and modified part emission testing.
3. The test fuel (or batch of fuel purchased) must be analyzed using American Society for Testing and Materials (ASTM) test methods listed in the following document: <http://www.arb.ca.gov/enf/fuels/dieselspecs.pdf>. At a minimum, sulfur content, aromatic content, polycyclic aromatic hydrocarbons, nitrogen

content, and cetane number must be reported. The Executive Officer may ask for additional properties to be reported if evidence suggests those properties may affect functioning of the modified part or influence potential secondary emissions and/or air toxics.

(B) Laboratory Aging

1. The test fuel must meet the specifications in the CCR (Sections 2280 through 2283 of Title 13) or U.S. EPA diesel fuel compliant with standards set forth in Title 40, CFR, Part 80.
2. The test fuel (or batch of fuel purchased) must be analyzed using the methods specified above in section (d)(2)(A)3.
3. The lubricant oil must meet OEM engine lubricant oil specifications.
4. The same lubricant oil must be used throughout the laboratory aging for both the OEM part and modified part.

(C) Field Service Accumulation and Additional Field Demonstrations

1. The test fuel must meet the specifications in the CCR (Sections 2280 through 2283 of Title 13) or U.S. EPA diesel fuel compliant with standards set forth in Title 40, CFR, Part 80.
2. The test fuel (or batch of fuel purchased) must be analyzed using the methods specified above in section (d)(2)(A)3.
3. The fuel used during the field service accumulation period should be equivalent to the test fuel, or a fuel with properties less favorable to the durability of the modified part. The field service accumulation period may, at the applicant's discretion and with the Executive Officer's approval, include intentional misfueling events so that data on the effects of misfueling may be obtained.

(3) Visual Inspection and Photographic Documentation. The applicant must conduct a visual inspection and submit digital photographs in electronic format.

(A) Laboratory Aging

1. Applicants must conduct a complete visual inspection of the OEM part and modified part after the 500 hours aging and report the results in the final report. The visual inspection includes, but is not limited to:
 - (i) Front and back face of the DPF and outlet DOC (if the configuration includes a DOC).
 - (ii) Photograph documents addressing any issues regarding leaks around the side/matting, exhaust leaks upstream of the DPF, and any indications of canning issues (leaks) or excessive heat (i.e., discoloration of the can) after completing the laboratory aging period.
2. The engine or piece of equipment before installation of the OEM part and modified part. Photographs must be taken and clearly show:

- (i) The entire engine or piece of equipment.
 - (ii) A close-up of the location in which the OEM part and modified part will be installed.
 - (iii) All available engine identification including the make, model, serial number, and engine label.
3. The engine or piece of equipment after installation of the OEM part and modified part. Photographs must be taken and clearly show:
- (i) The entire engine or piece of equipment showing the OEM part or modified part installed.
 - (ii) A close-up of the installed the OEM part or modified part.
 - (iii) All available OEM part or modified part identification including labels and logos.
 - (iv) Additional detailed photographs addressing the visual inspection points listed in section (d)(3)(A)1.
- (B) Field Service Accumulation
1. Applicants must conduct a complete visual inspection of the modified part and engine exhaust system after the 500 hour, and two, 200 hour field service accumulation periods and report the results in the final report. The visual inspection includes, but is not limited to:
- (i) Front and back face of DPFs, and outlet DOCs (if the configuration includes a DOC), cans, installations and locations.
 - (ii) Photograph documents addressing any issues regarding leaks around the side/matting, exhaust leaks upstream of the DPF, and any indications of canning issues (leaks) or excessive heat (i.e., discoloration of the can) after completing the field demonstration period.
2. The vehicle or piece of equipment before installation of the modified part. Photographs must show:
- (i) The entire vehicle or piece of equipment.
 - (ii) A close-up of the location in which the modified part will be installed.
 - (iii) All available vehicle or equipment identification including the make, model, license plate, and vehicle number.
 - (iv) All available engine identification including the make, model, serial number, and engine label.
3. The vehicle or piece of equipment after installation of the modified part. Photographs must show:
- (i) The entire vehicle or piece of equipment showing the modified part installed, if possible.
 - (ii) A close-up of the installed modified part.
 - (iii) All available modified part identification including labels and logos.

4. Applicants must submit the photographic documents specified in section (d)(3)(B)1.

(e) EMISSION TESTING REQUIREMENTS

(1) Testing on an Emission Control Group Basis.

(A) The applicant must test the modified part on an emission control group basis and clearly identify the emission control group as set forth in section (c)(1).

(B) The applicant must select a worst case test engine or engines based on the proposed emission control group, which will be reviewed by the Executive Officer for appropriateness.

(C) The applicant must clearly identify all test engine(s) by providing the engine family name, make, model, displacement, engine code, engine serial number, model year, horsepower, and CO, PM and NOx or NOx plus NMHC certification levels for all test engines.

(D) The applicant must also describe the applications for which the modified part is intended to be used by giving examples of in-use vehicles or equipment, characterizing typical duty cycles, indicating any fuel requirements, and/or providing other application-related information as specified by the Executive Officer.

(E) For a modified part that has the potential to generate secondary emissions, the applicant must identify this potential to the Executive Officer and propose an emissions test engine accordingly. The applicant must provide detailed and comprehensive information showing how the proposed emissions test engine is appropriate and represents a “worst case” engine within the emission control group. ARB requires additional secondary emissions testing for modified parts that potentially could result in the increase of toxic air contaminants, other harmful compounds, or a change in the nature or amount of the emitted particulate matter. Additional testing for secondary emissions is described in section (e)(10).

(2) Emission Testing Sequence.

(A) Applicants shall select an appropriate emission test engine within the emission control group which is in a proper state of maintenance, in its certified configuration, and meeting its original certified emission levels.

(B) Applicants shall conduct, at a minimum, 500 hours laboratory aging for both the new OEM part and the new modified part on an aging engine. The aging engine is defined in section (f)(1)(A) of this procedure.

(C) Applicants shall conduct emission testing for the laboratory aged OEM part and modified part.

(D) Applicants shall remove the laboratory aged modified part and install it on an appropriate field service accumulation vehicle for a minimum of 500 hours. Two, 200 hour field demonstrations must be conducted on different engines and applications within the emission control group, but do not require emissions testing.

(E) Applicants shall remove the field aged modified part, reinstall the part on the emission test engine, and conduct emission testing.

(3) Test Engine Requirements and Pre-conditioning.

(A) All testing should be performed with the test engine in a proper state of maintenance and meeting its original certified emissions level.

(B) All engines must be diesel cycle, using diesel fuel, and certified for NOx and PM by either ARB or United States Environmental Protection Agency (U.S. EPA).

(C) Engine must be in the original OEM configuration (i.e., not possess any components not part of the originally certified parts list or certified configuration).

(D) Engine must have accumulated a minimum of 5,000 miles or 125 hours prior to conducting the engine qualification testing.

(E) Engine must not have any EMD fault codes prior to conducting the engine qualification testing.

(F) The same emission test engine must be used for all emission testing steps (engine qualification testing, OEM part emission testing, modified part emission testing after laboratory aging, and after field durability). No substitutions are allowed once testing has commenced.

(4) Emission Test Engine Qualification.

(A) The emission test engine must meet its certified emission levels and be in its certified configuration.

(B) All engines must be diesel cycle, using diesel fuel, and certified for NOx and PM by either ARB or U.S. EPA.

(C) The emission test engine for qualification testing must be with a brand-new OEM replacement DPF.

(D) The required test cycles are specified in Table 1-1.

(E) Applicants must conduct emission tests in accordance with the provisions of the Code of Federal Regulations, Title 40, Part 86, Subpart N.

(F) Crankcase emissions must be added to the exhaust emission during the engine qualification testing. The details for the crankcase emission are specified by the California Code of Regulations, Title 13, Section 1956.8 a(5).

(G) Engine must not have any EMD fault codes during the engine qualification testing.

(5) First Stage Emission Testing of the OEM Part and Modified Part. After both parts have been similarly aged for a minimum of 500 hours per section (f) of this Procedure, they must be installed on an appropriate emission test engine.

(A) Installation and Preconditioning.

1. The OEM part and modified part must be appropriately sized for the emission test engine(s) based on the sizing information provided by the OEM parts list and the modified part sizing information provided in the preapplication.
2. The OEM part must be an appropriate part for the engine, engine model, and calibration based on certification information.
3. The OEM part and modified part must be installed in the test engine in accordance with the test engine manufacturer's instructions or OEM part manufacturer's instructions if applicable.
4. The same type of OEM part must be used for all testing. For example, if the OEM offers several different replacement parts for the same engine configuration, the applicant must choose one make/configuration. This type would be used for all testing. The applicant should provide an explanation why a particular make/configuration was chosen.
5. No EMD fault codes or warnings shall exist prior to or during the emission testing.
6. The OEM part and modified part must be, at a minimum, laboratory aged for 500 hours prior to this emission testing. The 500 hours laboratory aging for the OEM part and modified part is detailed in section (f) of this Procedure. The aging for the OEM part and modified part must be exactly the same.

(B) The emission testing of the OEM part and modified part shall be measured and evaluated as follows:

1. After equipping the emission test engine with a DPF, perform a forced and complete DPF regeneration for the OEM DPF (per the OEM engine manufacturer's instructions) and/or the modified DPF prior to any emission testing. The applicant must use the regeneration method specified in section (f)(1)(B) of this procedure if the selected emission testing engine has a DOC plus DPF configuration. Otherwise, the applicant must address how it will achieve regeneration (e.g., "parked" regeneration or manual regeneration, etc.) and provide details regarding the testing and equipment set up. The applicant must also address how it will determine and measure that the regeneration is complete. During regeneration event, the applicant must record the exhaust temperature and backpressure on a second by second (1 Hz) basis during the entire regeneration event. A complete regeneration must show the exhaust backpressure staying within plus or minus 5% of the average backpressure for the last 5 minutes of the regeneration event.

2. Perform a FTP heavy-duty transient cycle (1 cold start and 3 hot-starts). Exhaust temperature and backpressure must be measured and recorded on a second by second (1 Hz) basis. The exhaust temperature and backpressure must be measured upstream of the DPF.
3. Emissions testing must include emissions contributions during DPF regeneration events. Applicants must propose an appropriate test method to trigger DPF regeneration and account for emissions from these events.
4. DPF regeneration emission testing must be part of the approved test plan.
5. The testing should follow U.S. EPA guidance documents Cisd-06-17 (issued August 7, 2006) and Cisd-06-22 (issued November 6, 2006) and include factors relevant to the target emission control group including, but not limited to, test cycles, number of test cycles necessary to cover the entire DPF regeneration event, and methods to pre-load the filter, trigger DPF regeneration, measure and record exhaust temperature, exhaust backpressure, and engine speed, and sample and record exhaust flow and criteria pollutants. The DPFs must be appropriately loaded with soot at the time of the regeneration testing.
6. The applicant must also propose a calculation method for adjusting the emission level to account for frequent/infrequent regeneration adjustment factors as specified by the Code of Federal Regulations, Title 40, Part 86, Section 004-28(i).
7. The emission testing results must include total particulate matter (PM), non-methane hydrocarbons or total hydrocarbons, oxides of nitrogen, nitrogen dioxide, carbon monoxide, and carbon dioxide reported in grams/brake horsepower-hour (g/bhp-hr) and any secondary emissions or air toxics identified in the approved test plan. The instruments/devices for measuring the pollutants listed above must comply with the requirements in the Code of Federal Regulations, Title 40, Part 86, Subpart N.

(6) Second Stage Emission Testing of the Modified Part.

(A) Installation and Preconditioning.

1. After the minimum 500 hours field service accumulation period specified in section (f) of this procedure, the modified part must be removed from the field service engine/vehicle and installed on the approved test engine for emission testing.
2. The 500 hours field service accumulation modified part must be installed on the test engine in accordance with the OEM engine manufacturer's requirements for DPF installation.
3. During the field service accumulation and subsequent emission testing, all EMD fault codes must be recorded and checked.

(B) Emission testing for the field aged modified part shall be measured and evaluated as follows:

1. After equipping the emission test engine with a DPF, perform a forced and complete DPF regeneration per the test engine manufacturer's instructions prior or the requirements and specifications listed in section (e)(5)(B)1 prior to conducting any testing.
2. Perform FTP heavy-duty transient cycle (1 cold start and 3 hot-starts). Exhaust temperature and backpressure must be measured and recorded on a second by second (1 Hz) basis. The exhaust temperature and backpressure must be measured upstream of the DPF. For a DOC plus DPF configuration, this location must be between the DOC and DPF.
3. Emissions testing must include emissions contributions during DPF regeneration events. DPF regeneration testing requirements are specified in sections (e)(5)(B)3-6.
4. The emission testing results and the instruments/devices for pollutants are specified in section (e)(5)(B)7.

(7) Test Cycle.

(A) The engine, OEM part and modified part must be tested using the test cycles indicated and summarized in Table 1-1.

Table 1-1 Test Cycles for Emission Testing

Configuration	Tests
Engine Qualification Testing	1 FTP Heavy-duty Transient Cycle (1 cold-start and 3 hot-starts) 1 SET (3 hot starts)
Engine with OEM Replacement Part	1 FTP Heavy-duty Transient Cycle (1 cold-start and 3 hot-starts) for a 500 hour laboratory aged unit 1 Regeneration Emission Test*
Engine with Modified Part	1 FTP Heavy-duty Transient Cycle (1 cold-start and 3 hot-starts) for a 500 hours laboratory aged unit 1 FTP Heavy-duty Transient Cycle (1 cold-start and 3 hot-starts) for a 500 hours field service accumulation unit 1 Regeneration Emission Test*

FTP = Federal Test Procedure; SET = Supplemental Emissions Test

* Regeneration emission test is specified in sections (e)(5)(B) 3-6.

(B) Engine testing must consist of one cold-start and at least three hot-start tests using the Federal Test Procedure (FTP) Heavy-duty Transient Cycle for engines

used in on-road applications, in accordance with the provisions in the Code of Federal Regulations, Title 40, Part 86, Subpart N.

(C) Applicants must conduct three hot-start SET tests, in accordance with the provisions in the Code of Federal Regulations, Title 40, Part 86, Subpart N. The 2007 ramped modal cycle Supplemental Emissions Test (SET) is applicable to 2007-2009 heavy-duty engines.

(8) Test Run.

The number of tests indicated in Table 1-1 must be run for each emission control group or configuration.

(9) Results.

(A) For all valid emission tests used to support the application, the device manufacturer must report emissions of total PM, non-methane hydrocarbons (NMHC) or total hydrocarbons (whichever is used for the relevant engine or vehicle certification), oxides of nitrogen, nitrogen dioxide, carbon monoxide, and carbon dioxide and all secondary emissions required in the approved test plan.

(B) Evaluation criteria for comparison of the 500 hours laboratory aged OEM part to modified part based on the emission testing shall be:

1. Emission of CO, NMHC, NO_x or NO_x plus NMHC and PM for engine with OEM part or modified part must comply with the engine certification standards.
2. NO_x shall not exceed 10% of certification level.
3. Average exhaust backpressure and temperature for the modified part must be no greater than 10% above or below the average exhaust backpressure and temperature of the OEM part.
4. No EMD fault codes or warnings may occur during the emission testing.

(C) Evaluation criteria for comparison of the 500 hours field service accumulation modified part to previous emission testing of the 500 hours laboratory aged modified part shall be:

1. Emission of CO, NMHC, NO_x or NO_x plus NMHC and PM for the 500 hours field service accumulation modified part shall demonstrate compliance with the engine certification standards.
2. NO_x shall not exceed 10% of the certification level.
3. Average exhaust temperature for the 500 hours field service accumulation modified part must be within 10% of the average exhaust temperature from the previous emission testing of the 500 hours laboratory aged modified.
4. The average exhaust backpressure for the 500 hours field service accumulation modified part must be within 20% of the average exhaust

backpressure from the previous emission testing of the 500 hours laboratory aged modified part.

5. No EMD fault codes or warnings may occur during the emission testing.

(10) Additional Analyses.

The applicant shall perform additional analyses if it is determined that the use of a modified part may result in the increase of toxic air contaminants, other harmful compounds, or a change in the nature of the emitted particulate matter.

(A) In its determination, the Executive Officer considers all relevant data, including but not limited to the following:

1. The addition of any substance to the fuel, intake air, or exhaust stream,
2. Whether a catalytic reaction is known or reasonably suspected to increase toxic air contaminants or ozone precursors,
3. Results from scientific literature,
4. Field experience, and
5. Any additional data.

(B) These additional analyses may include, but are not limited to, measurement of the following:

Benzene

1,3-butadiene

Formaldehyde

Acetaldehyde

Polycyclic aromatic hydrocarbons (PAH)

Nitro-PAH

Dioxins

Furans

Vanadium (V) Oxide, Vanadium (III) Oxide, Manganese and Cerium

(C) Exhaust emissions of formaldehyde, acetaldehyde, benzene, toluene, ethyl benzene, xylenes, butadiene, polycyclic aromatic hydrocarbons, nitro-PAH, dioxins/furans, and certain metals are to be sampled and analyzed as specified in Table 1-2 for a minimum of three test samples collected from separate emission test repetitions.

Table 1-2 Toxics sampling and analysis

Toxics	Method
Formaldehyde and acetaldehyde	ARB SOP 104
Benzene toluene, ethyl benzene, xylenes, and 1,3-butadiene	ARB SOP 102/103 ARB SOP 148
Polycyclic aromatic hydrocarbons	40 CFR Part 1065 Subpart L - Methods for Unregulated and Special Pollutants
Nitro-PAH	40 CFR Part 1065 Subpart L - Methods for Unregulated and Special Pollutants
Dioxins/Furans	40 CFR Part 1065 Subpart L - Methods for Unregulated and Special Pollutants
Metal	40 CFR Part 1065 Subpart B ICP-MS

(D) The Executive Officer will make the final determination of appropriate testing.

(f) LABORATORY AGING PROTOCOL AND FIELD SERVICE ACCUMULATION REQUIREMENTS

Laboratory aging of the OEM part and modified part and field service accumulation of the modified part shall be implemented in accordance with this section for each emission control group.

(1) OEM and Modified Part New Units Laboratory Aging Protocol

(A) Selection of Engine

1. Subject to the approval of the Executive Officer, the test engine selected for the OEM part and modified part laboratory aging must be either a 2007-2009 engine certified with an OEM DPF from within the proposed emission control group or an engine appropriate for DPF aging purposes (e.g., a “mule” engine).
2. Non-diesel engines, engines using alternative fuels, or engines that are uncertified for PM or NOx by either ARB or the U.S. EPA are strictly prohibited.
3. If a mule or surrogate engine is used for aging, an engineering justification for why the engine is appropriate for aging purposes must be provided. The mule engine must have the DOC plus DPF configuration if the OEM engines in the emission control group include a DOC.

4. Test engine description must list the engine family name, make, model, model year, horsepower, displacement, OEM configuration with all exhaust components identified by OEM part number, engine serial number, and PM and NOx certification levels.
 5. Engine must be in the original OEM configuration and in a proper state of maintenance.
 6. Accumulated a minimum of 5,000 miles or 125 hours, whichever occurs first.
 7. Be in the same configuration for aging both the OEM part and modified part. No changes to the OEM aftertreatment are permitted.
- (B) DPF Regeneration Testing for DOC plus DPF engines
1. For 2007-2009 DOC plus DPF engines, DPF regeneration shall be as follows: engine shall operate at a steady-state speed and load condition specified in Table 2-1 which provides sufficient exhaust temperature for DOC activity and sufficient flow for DPF regeneration.
 2. Using a supplemental fuel injection system, DPF inlet temperature must be ramped to the target temperature within a certain time as specified in Table 2-1.
 3. The DOC must be in a proper state of maintenance and perform functionally as a chemical burner to act as a supplemental fuel injection system.
 4. The “mule” engine testing must meet the aforementioned active regeneration requirements specified in Table 2-1.
 5. The DOC must be the same as a new DOC made by the same OEM engine manufacturer for an engine within the emission control group.
 6. Detailed information on the DOC including part number and the engine within the emission control group for which it is a part of the certified engine configuration must be provided.
- (C) Active regeneration test protocol must satisfy the temperature and time duration requirements specified in Table 2-1 for all configurations other than DOC plus DPF.
- (D) The OEM and modified part new units must undergo a minimum of 500 hours aging each.
1. The two parts must be aged for the same duration (i.e., both are aged for the same period of time under the same conditions).
 2. Applicants shall use the ARB-modified aging cycle described in Table 2-1 of this Procedure for both OEM and modified part new units.

Table 2-1 ARB Modified Aging Cycles

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

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.

3. DPF Aging Protocol Multi-point Temperature Measurement Requirements. Applicants must perform the multi-point temperature measurement as specified in Appendix 1 during the entire aging period.

4. Effective active regeneration aging time. Throughout the active regeneration aging process, the effective aging time of each second of aging is calculated by comparing the actual aging temperature to the desired aging temperature by using the Arrhenius equation. When the cumulative effective active regeneration aging time equals the target aging time (minimum 166 hours), the aging process is complete, regardless of the actual aging time. The detailed effective active regeneration aging time is described in Appendix 2.

5. Lubricant oil exposure requirement. The test plan must include the oil exposure process during the 500 hours aging period. At a minimum, the oil exposure test plan shall include:

- (i) Using observed on-road heavy-duty diesel engine field average oil consumption (0.06% of fuel rate) to estimate oil exposure target for 150,000 miles (modified parts warranty period).
- (ii) Based on 5(i) above, provide an estimate of the aging engine oil consumption.
- (iii) Using oil consumption acceleration options show how the target oil consumption is achieved.
- (iv) Specify a method to track the actual oil consumption during the aging process. This method must follow Appendix 3.

(E) Test Run.

1. Engine backpressure, exhaust temperature, and engine speed must be measured and recorded on a second-by-second basis (1 Hertz) for 500 hours or over the entire aging period.
2. The exhaust temperature and backpressure must be measured upstream of the device in the same location for both the OEM and modified part configurations. For a DOC plus DPF configuration, this location must be between the DOC and DPF.
3. The data must include an accurate date and time stamp that corresponds with periods of actual engine operation.
4. Data must be submitted electronically in columns as a spreadsheet or text file in a format approved by the Executive Officer.
5. All EMD error or fault codes, the MILs, etc., must be monitored and recorded over the aging period.

(2) Modified Part Field Service Accumulation Requirements

(A) Engine Selection and Sizing.

1. The test engine selected for a modified part must be a 2007 through 2009 model year engine certified with an OEM DPF. Test engine and vehicle must be identified by the engine family name, make, model, model year, engine serial number, horsepower, PM and NOx certification levels, and vehicle identification number.
2. The selected engine must be in the same emission control group of the engine used for emission testing.
3. The engine must represent a “worst case” configuration or duty cycle.
4. The selected engine must have the same displacement and DOC as the engine used for emission testing.

(B) Service Accumulation.

1. The modified part undergoes a minimum of 500 hours actual field service accumulation.

2. Service accumulation begins after the first emission test (performed after the 500 hours laboratory aging period).
 3. It concludes before the final emission test (at least 500 hours on an appropriate in-field vehicle).
- (C) Parameters to be Monitored/Recorded Over 500 Hours or Entire Field Service Accumulation
1. Temperature and Backpressure Measurement Requirements.
 - (i) Engine backpressure.
 - (ii) Exhaust temperature.
 - (iii) Engine speed.
 - (iv) Exhaust temperature and backpressure must be measured upstream of the DPF. For a DOC plus DPF configuration, this location must be between the DOC and DPF.
 - (v) Measure and record values once every 10 seconds, with recording of averages, minima, and maxima.
 - (vi) Data must include accurate date and time stamps corresponding with periods of actual engine operation.
 - (vii) Data must be submitted electronically in columns as a spreadsheet or text file in the format approved by the Executive Officer.
 2. All EMD error or fault codes, MILs, etc., must be monitored and recorded over the aging period.
 3. Regeneration Interval Requirements.
 - (i) Regeneration intervals must be reported.
 - (ii) Regeneration intervals from an OEM engine must be provided for each selected emission control group with similar field operation duty-cycles.
 - (iii) Information from applicable published literature or similar field demonstrations for OEM engines within the emission control group may be used.
 - (iv) The regeneration intervals from the modified part shall approximate that of the OEM part.
 4. Electronic System Codes. Error codes, fault codes, and high backpressure codes that are generated by an engine electronic control system and/or operational monitoring system during the durability demonstration must be submitted with the date and time each code occurs.
- (D) Third-Party Statement for Field Service Accumulation.
1. For each field service accumulation part, including those used for compatibility, the applicant must provide a written statement from an Executive Officer approved third party, such as the owner or operator of the vehicle or equipment used, at the end of the field service accumulation period.

2. Prepackaged “fill in the blank” letters are not appropriate. Comments must be specific to the actual vehicle.

3. The statement must include:

(i) Name and contact information of the third party.

(ii) Device serial number.

(iii) Clearly identified field service accumulation engine and vehicle.

a. Unique identifier (e.g., vehicle identification number, engine serial number).

b. Engine family name.

(iv) Description of overall performance, maintenance required, problems encountered, and any other relevant comments.

4. At the end of the field service accumulation period, a visual inspection of the DPF must be conducted and documented by an independent (from the applicant) third party. The description should include:

a. Comments on whether the modified part is physically intact, securely mounted, or leaking any fluids.

b. Any other evaluative observations.

(E) The applicant must provide information per section (d)(3).

(F) Emissions Testing Post Field Service Accumulation. Testing requirements are summarized in the aforementioned Table 1-1. The applicant must perform engine dynamometer-based testing after completion of the service accumulation.

1. A minimum of one cold-start and three hot-start tests and 1 regeneration emission test are required for engine testing.

2. Engine speed, engine backpressure and exhaust temperature must be measured and recorded on a second-by-second basis (1 Hertz) during the test run.

(G) Maintenance during Field Service Accumulation. Maintenance during the field service period is strictly prohibited. If an engine failure or problem occurs during the field service period, the applicant must immediately notify ARB within 24 hours upon learning of the issue.

(H) Compatibility. At a minimum, a modified part must demonstrate the following to be considered compatible with the chosen engine and application during the field service accumulation period or the additional field demonstrations as defined in section (g) of this Procedure:

1. Must not cause damage to the engine or cause engine malfunction.

2. Must not cause backpressure or temperature to exceed the engine manufacturer's specified limits or result in any damage to the engine.

3. Does not hinder or detract from the vehicle or equipment's ability to perform its normal functions.

4. Is physically intact and well mounted with no signs of exhaust leakage or other visibly detectable problems.
 5. Complies with all emission performance requirements of this Procedure.
 6. Shows appropriate regeneration patterns.
 7. Does not directly or indirectly cause any EMD fault codes after the installation.
 8. Vehicle does not experience failure of any other emission related component during the field service accumulation period including, but not limited to, turbocharger components, injectors, heating elements, sensors, DOCs, etc.
 9. ECU programming or behavior is not altered.
- (l) Performance Requirements. At a minimum, the modified part must meet the following requirements after completion of the field service accumulation:
1. Emissions test results show compliance with section (e)(9)(C).
 2. Must maintain its physical integrity. Its physical structure and all of its components not specified for regular replacement during the field service accumulation period must remain intact and fully functional.
 3. Does not cause any damage to the engine, vehicle, or equipment.
 4. Backpressure caused by the modified part should not exceed the engine manufacturer's specified limits or result in any damage to the engine.
 5. Does not cause any EMD fault codes during the field service accumulation period.
 6. Vehicle does not experience failure of any other emission related component during the compatibility period including, but not limited to, turbocharger components, injectors, heating elements, sensors, DOCs, etc.
 7. ECU programming or behavior is not altered.

(g) ADDITIONAL FIELD DEMONSTRATION REQUIREMENTS

- (1) Demonstrate compatibility of the modified part in the field with at least two different engines (other than the 500 hours field service accumulation engine) within the requested emission control group.
- (2) Vehicle must be operated with the modified part installed for a minimum period of 200 hours or 10,000 miles, whichever occurs first.
- (3) The requirements for this additional field demonstration are the same as in the 500 hours field service accumulation specified in section (f)(2) of this Procedure excluding the duration and emission testing requirements.
- (4) The data (exhaust temperature and backpressure, RPM, ECU codes, and regeneration interval, etc.), visual inspection photos and records, field demonstration reports, and third-party statements as specified in sections (d)(3) and (f)(2) of this Procedure must be submitted.

(5) The additional field demonstration units must satisfy the performance (excluding emission testing results) and compatibility requirements specified in section (f)(2)(H) and (I) of this Procedure.

(h) APPROVAL CRITERIA FOR TESTING

(1) The modified part testing must meet all evaluation criteria specified in sections (e), (f), and (g).

(2) The modified part must pass the visual inspections specified in section (d). Any signs of soot on the outlet DPF, broken cells, cell plugs, cracks, erosion, leaks around the side/matting, exhaust leaks upstream of the DPF, and any indications of canning issues (leaks), burn through cells, or excessive heat (i.e., discoloration of the can) are considered as failure of the DPF.

(3) All incomplete, voided, invalid, and failed tests must be identified and explained. All raw data from these tests must be submitted which clearly identifies the data and/or data columns.

(4) Any incomplete, inconsistent or incorrect data submitted for emission testing, durability and compatibility demonstrations (through laboratory aging and field service accumulations) will result in ARB determining the testing cannot be accepted to support the modified part application and the application will be terminated.

(5) All EMD fault codes must be clearly identified and reported for all runs, including voided, failed, incomplete, and invalid runs.

(6) EMD fault codes, alteration of the EMD/ECU from its certified configuration, or any other change in engine operation inconsistent with its certification shall be grounds for deeming the modified part to be incompatible with the engine and emission control group.

(7) An engine failure that compromises or destroys the modified part (e.g., turbocharger failure resulting in a fouled emission control system) at any point in testing will be treated as a failed testing demonstration. The application will be suspended and/or terminated barring the existence of a backup unit included and approved in the test plan.

(8) Failure during the field service accumulation or additional field demonstrations.

(A) Engine problem. A detailed analysis of the engine issue and data sufficient to prove the modified part was not involved in the engine problem must be provided. Failure to provide robust data and information in support of the modified part will result in the Executive Officer determining the device was incompatible with the engine and application and terminating the application process.

(B) If the modified part fails, requires repair or maintenance, or suffers any type of component failure, Executive Officer will determine the demonstration was

unable to show compatibility with the engine and application and terminate the application process.

(i) OTHER REQUIREMENTS

(1) Labeling

(A) The applicant must ensure that identical, legible, visible, and durable labels are affixed on both the modified part and the engine on which the modified part is installed.

(B) All labels must be constructed and affixed so that they resist tampering and remain legible, visible, and durable for the entire time the modified part is on the vehicle.

(C) One label shall be welded, riveted, or otherwise permanently attached to the modified part and the other affixed to the engine in such a manner that it cannot be easily removed (e.g., bolted).

(D) The applicant and/or installer must ensure that the label is visible after installation.

(E) The required labels must identify:

1. EO number issued by ARB
2. Name, address, and phone number of the applicant
3. Product part number
4. Unique serial number
5. Month and year of manufacture
6. Directional flow arrow
 - (i) The directional flow arrow shall indicate the direction exhaust is designed to flow through the modified part when properly installed.
 - (ii) The purpose and meaning of the arrow shall be explained in the Installer’s Manual (section (i)(7)).
7. Other information such as “birth weight” to help the end user clean their filter.

(F) The label information must be in the following format:

D-XXX-XX (EO number issued by ARB)

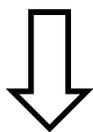
Name, Address, and Phone Number of Manufacturer

YYYYYY (Product Part Number)

Unique Product Serial Number

ZZ-ZZ (Month and Year of manufacture, e.g., 06-15)

Other Information



(Directional Flow Arrow)

(2) Pre-Installation Assessment

(A) Installers of modified parts shall adhere to the following requirements for proper installation. Failure to adhere to these requirements will invalidate the Executive Order.

(B) The applicant shall specify these installation requirements to installers of its products in the Installer's Manual (section (i)(7)).

(C) The installer must be able to demonstrate, to the satisfaction of the Executive Officer, that an engine being considered for installation of the modified part is appropriate for that part by adhering to the requirements of this section.

(D) Installers may not install a modified part on a candidate engine unless all of the following conditions are met:

1. The installer is approved by the applicant as an authorized installer.
2. The engine, engine configuration, etc. is specifically listed in the Executive Order for the modified part.
3. The OEM engine emission warranty period has expired.
4. The engine has a legitimate need for replacement of the existing diesel particulate filter that has been established and documented by the installer on the repair invoice. If the OEM diesel particulate filter is present, the installer must make a determination that it is not functioning properly before acting to replace it.
5. The engine is in its original certified configuration.
6. No engine error codes are present that indicate engine problems.
7. The engine and other emission control components that do not include the diesel particulate filter that is being replaced are in a proper state of maintenance and the engine is operating within manufacturer's specifications.
 - (i) The applicant must select and define specific assessment criteria (e.g., oil consumption limits, fuel inspection requirements, and visual inspections) which must be used by the installer to determine a proper state of maintenance of the engine and other components (especially for DOC).
 - (ii) Addition of a datalogger may be proposed to generate data to support assessment of a proper state of maintenance and/or duty cycle behavior.
8. The modified part must be installed in the same location and orientation as the OEM diesel particulate filter it is designed to replace. The installation may not alter the location, position, or orientation of any OEM sensors upstream and downstream of the diesel particulate filter.
9. The modified part is installed correctly in accordance with applicant's instructions.
10. The modified part is installed on a one-for-one diesel particulate filter basis (i.e., a single OEM DPF is replaced with only one modified part).

11. The modified part is installed with all other required emission control components (no consolidation of emission control components, nor addition of extra emission control components).
 12. An installation warranty must be offered according to section (j)(2).
 13. A warranty card has been filled out according to section (j)(1).
- (E) The party performing the installation of the modified part must maintain a record of all documentation used to determine suitability of the engine for the modified part as described in section (c)(11).

(3) Quality Control Procedures. The modified part applicant shall implement, utilize, and document quality control (QC) procedures to ensure that production modified parts conform to the specifications of the approved modified parts within acceptable production tolerances.

(A) Requirements for Quality Control Process

1. The QC procedures shall, at a minimum, provide for the monitoring of:
 - (i) Average per piece precious metal content of coated substrates for each precious metal constituent that is applied.
 - (ii) Average relative per piece total base metal content that is applied to each substrate.
 - (iii) Average per piece total washcoat loading applied to each substrate.
 - (iv) Proper coating of substrates
 - (v) Proper placement of matting materials around the substrate.
 - (vi) Leaks after the canning process.
2. No less than one percent of production parts within a production lot shall be evaluated.
3. Parts selected for evaluation shall be randomly distributed over the production lot.
4. The applicant shall submit its quality control procedures for ARB approval, and shall obtain written approval from the ARB prior to implementation of the procedures.
 - (i) The procedures shall include a production flow chart covering the entire manufacturing process from receipt of raw materials to shipment of the final product. The production flow chart shall identify each quality control check that is performed and at what point in the process it is performed.
 - (ii) The submitted procedures shall also contain a detailed description of the methods used to measure the properties listed in section (i)(3)(A)(1.), along with all other quality control checks that are performed.
 - (iii) With concurrence from the applicant, relevant portions of the documentation required in this section may be sent directly to ARB by the

applicant's catalyst substrate supplier(s) and any other suppliers involved in the manufacturing process.

(B) Evaluation Criteria

1. Parts must be free from physical defects which may affect performance or compatibility with the OEM engine including, but not limited to, plugged channels which should be open, open channels which should be plugged, and cracks.
2. Catalyst composition, loading, and coating design (e.g., zone versus straight coating), and formulation must match the approved configuration.
3. Canning must ensure that the core is well-seated and will neither loosen nor allow leaks between the can and the core nor allow holes in the can itself (e.g., due to metal fatigue or poor welding/seals).

(C) Corrective Action

1. If any sample fails to pass all elements of the quality control test, all parts produced from the time the last sample that passed quality control was produced shall be quarantined by the applicant.
2. Only quarantined parts that individually pass the applicant's quality control test may be released for sale.
3. All other parts must be reprocessed to fall within the evaluation criteria prior to being released for sale.
4. The Executive Officer may require a recall, pursuant to section (i)(5), of any affected parts or lots that have already been released for sale.

(D) Documentation Requirements

1. Within 15 days of written request by ARB, applicants shall report for each modified part design the following information for each production lot produced within the quarter:
 - (i) The average per piece precious metal content of the coated substrates, reported in absolute grams per cubic foot, for each precious metal constituent contained on the catalyst (e.g. platinum, palladium), along with the minimum acceptable loading specification.
 - (ii) The average per piece total base metal content of the coated substrate, reported in relative grams per cubic foot, along with the minimum acceptable base metal loading specification.
 - (iii) The average per piece total washcoat loading of the coated substrates reported on either a weight basis (e.g., grams per part or grams per unit volume) or a total surface area basis (e.g., square meters per part, square meters per unit volume, or square meters per unit weight of coated part) along with the minimum acceptable loading specification.

- (iv) Results of the applicant's QC inspection findings for the substrate, applied mattings, and the integrity of the can and welding, including minimum acceptable specifications for each inspection.
- 2. Reports shall be sent to the Chief, In-Use Programs Branch, ECARS Division, 9480 Telstar Avenue, Suite 4, El Monte, CA 91731.
- 3. With concurrence from the applicant, relevant portions of the documentation required in this section may be sent directly to ARB by the applicant's catalyst substrate supplier(s) and any other suppliers involved in the manufacturing process.

(4) Audit Testing

(A) The Executive Officer may, with respect to any modified part sold, leased, offered for sale, intended for sale, or manufactured for sale in California, order the applicant to make available for testing and/or inspection each year up to five modified parts including but not limited to modified parts selected by ARB staff that are in the possession of authorized dealers but not yet installed on applicable engines, or in-field units that may be used or new (applicants must provide a replacement unit at no cost to the affected fleet).

(B) Delivered at the applicant's expense to the state board at the Haagen-Smit Laboratory, 9528 Telstar Avenue, El Monte, California or where specified by the Executive Officer.

(C) The Executive Officer may also, with respect to any modified part being sold, leased, offered for sale, intended for sale, or manufactured for sale in California, have an applicant test and/or inspect under the supervision of the Executive Officer up to five units at the applicant's facility or at any test laboratory accepted by the Executive Officer.

(D) If one or more of the tested parts meets any of the failure criteria listed below, the Executive Officer may revoke the Executive Order, request further analysis and data from the applicant, or require, at the applicant's expense, additional parts (from the same modified part model as the failed parts) to be procured and sent for testing at an ARB-designated test facility. Such additional testing shall be limited to no more than five modified parts from the same Executive Order as the failed part.

- 1. Fails to meet the applicable certification emission standards in an applicable test engine.
- 2. Fails to conform to its original aftermarket certification.
- 3. Negatively impacts engine durability and functionality.
- 4. Causes damage to the engine or chassis.
- 5. Is not compatible with the OEM system (e.g., triggers engine fault codes/MIL, alters ECU behavior)

- 6. Poses a safety risk.
- 7. Causes secondary emissions.

(E) Any testing and inspection done by ARB cannot be used as a substitute for emissions test data or other support required in an application for certification. All such testing and inspection is confirmatory in nature.

(5) Recall

(A) Recall Provisions. If the Executive Officer determines after a review of an applicant's warranty report (pursuant to section (j)), an enforcement case, audit testing, quality control, or any other information that a modified part: has the potential to experience catastrophic failure or other safety related failure, has valid warranty claims in excess of four percent as defined in section (j)), or has caused engine issues or other parts to fail on the engine, or a substantial number of units experience a failure of an operational feature, parts have failed QC, or the applicant has not resolved warranty claims within the 30 day timeframe, the Executive Officer may require a recall.

(B) In the event of a recall the Executive Officer shall provide notification to the applicant that includes a description of the nature of the failure or warrantable condition, the factual basis for the determination, and shall designate a date at least 30 days (or sooner if a safety-related issue) from the date of receipt of such notification by which the applicant shall submit a recall plan for review and approval to address the failures or warrantable condition.

(C) Each recall plan must be approved by the Executive Officer in writing.

(D) No further sales of the modified part shall take place after the applicant receives the recall notification from the Executive Officer.

(E) Recall Plan. At a minimum, an applicant's recall plan shall contain the following information unless otherwise specified in the notification:

1. A description of each modified part subject to the recall including the number of units to be recalled, the emission control group(s) affected, and any information required to identify the recalled units.
2. A description of the type and nature of the failure, issue, or warrantable condition and the specific modifications, design changes, alterations, repairs, adjustments, or other changes to be made to correct the failures or warrantable condition with a description of the technical studies, data, or other information which support the applicant's decision regarding specific corrections to be made.
3. A description of the method by which the applicant will determine the most current names and addresses of the end users and the applicant's methods and schedule for notifying the end users and service facilities.

4. A description of the procedure to be followed by the end users to correct the failures or warrantable condition. This shall include the date on or after which the end user can have the failures or warrantable condition remedied, the time necessary to perform the remedy, and the designation of facilities at which the remedy can be performed, as well as how the applicant will ensure the remedy addressed the issue or problem.
 5. The plan may specify the maximum incentives, if any, the applicant will offer to induce vehicle or equipment owners to present their modified parts for repair, as evidence that the applicant has made a good faith effort to repair or replace all the modified parts in the plan. The plan shall include a schedule for implementing actions to be taken including identified increments of progress towards implementation and deadlines for completing each such increment.
 6. A copy of the letter of notification to be sent to the end users.
 7. A description of the system by which the applicant will assure that an adequate supply of parts will be available to perform any repairs under the recall plan, including the date by which an adequate supply of parts will be available to initiate the repair or replacement campaign, and the method to be used to assure that the supply remains both adequate and responsive to end user demand.
 8. A copy of all necessary instructions to be sent to those persons who perform the replacement or repair.
 9. A description of the impact the proposed replacement or repairs will have on the vehicle, equipment, or engine including: exhaust backpressure, exhaust temperature, durability, regeneration, maintenance, fuel economy, drivability, performance, safety, warranty, and a summary of the data and technical studies used to support such determinations.
- (F) Reporting Requirements. Unless otherwise specified by the Executive Officer, the applicant shall report on the progress of a recall campaign by submitting subsequent reports on a monthly basis, at a minimum, until the recall process is complete. Such reports shall be submitted no later than 25 days after the close of each month to: Chief, In-Use Programs Branch, ECARS Division, 9480 Telstar Avenue, Suite 4, El Monte, CA 91731.
- (G) The Executive Officer may revoke the Executive Order of a modified part if the applicant fails to adhere to the requirements of this section.

(6) Owner's Manual. The applicant must provide a copy of the modified part owner's manual to the Executive Officer and, upon delivery of the modified part, to the end user, which must clearly specify at least the following information:

- (A) A Table of Contents located at the beginning of the owner's manual identifying the location of subsections (B) through (M) identified below.
- (B) A statement alerting the end user of their responsibility for maintaining the candidate engine such that it continues to meet the pre-installation assessment conditions identified in section (i)(2)) and the OEM engine maintenance requirements.
- (C) Warranty statement including the warranty period.
- (D) Installation procedure and maintenance requirements for the modified part.
- (E) The Executive Order for a modified part is only valid if the modified part is properly installed and maintained
- (F) An objective criteria for ash removal (pressure drop across the filter, maximum clean filter weight, pre-installation filter weight comparison, etc.) for determination if a filter is "cleaned" pursuant to section (i)(9)(B).
- (G) Fuel requirements, including sulfur limits, if any.
- (H) Requirements for lubrication oil quality and maximum lubrication oil consumption rate.
- (I) The following statements must be included verbatim in the owner's manual:

YOUR RIGHT TO MAINTENANCE INFORMATION

The Air Resources Board requires that (Applicant's name) provide detailed maintenance information for the modified part upon delivery to the end user pursuant to the Title 13, California Code of Regulations, Section 2222(k), at no additional cost to the owner. If you do not already have this information, contact (Applicant's chosen contact) at 1-800-xxx-xxxx.

THE IMPORTANCE OF ENGINE MAINTENANCE

Proper engine maintenance is critical for the proper functioning of your modified part. Failure to document proper engine maintenance, including oil consumption records, may be grounds for denial of a warranty claim for a failed modified part.

THE IMPORTANCE OF PROPERLY MAINTAINING A MODIFIED PART

Proper maintenance is critical for the modified part to function as intended. Failure to document proper modified part maintenance, including cleaning and/or ash removal of the system, replacement of consumables, and replacement of broken/failed parts, may be grounds for denial of a warranty claim for a failed modified part.

- (J) Contact information for replacement components and cleaning agents.
- (K) Contact information to assist an end user to determine proper ways to dispose of waste generated by the modified part (e.g., ash accumulated in filter-

based systems). At a minimum, the owner's manual should indicate that disposal must be in accordance with all applicable Federal, State and local laws governing waste disposal.

(L) Parts list. An identification of the modified part and all associated parts by description, quantity and part number.

(M) Notification of potential safety concerns associated with the operation of the modified part.

(7) Installation Manual. The applicant must provide a copy of the modified part installation manual that the applicant intends to provide to authorized installers. The installation manual must include sufficient detail to enable the installer to properly install the modified part such that the installation is free from defects in workmanship, materials, or operation which could cause any of the components of the modified part to fail and allow the installer to warrant the installation pursuant to section (j)(2).

(A) The installation manual must include the criteria that will be used by the applicant to authorize a person or company to install their modified part.

(B) The installation manual must also include the criteria that will be used by the applicant to revoke a person or company's authorization to install their modified part.

(C) The installation manual must explain the purpose and meaning of the directional arrow from section (i)(1), if applicable.

(8) Technical service bulletins, installation criteria, other service-related information, or any other documentation that affects the proper operation and maintenance of the modified part provided to end users or authorized installers must be submitted concurrently to ARB. Technical service bulletins shall not contradict any information supplied or approved as part of certification.

(9) Maintenance Requirements. The applicant must provide information on maintenance of the modified part as follows:

(A) The applicant must identify all normal maintenance requirements for the modified part.

1. The applicant must specify the recommended intervals for cleaning and/or replacing components.

2. Any components to be replaced within the warranty period must be included within the original modified part package or provided free of charge to the customer at the appropriate maintenance intervals.

3. In addition, the applicant must specify procedures for proper handling of spent components and/or materials cleaned from the modified part. If any

such materials are hazardous, the applicant must identify them as such in the owner's manual.

(B) The applicant must provide detailed maintenance information for the modified part to the owner upon delivery of the modified part. This information must not conflict with or contradict OEM engine manufacturer's instructions for proper engine maintenance. If the applicant allows the owner to perform the maintenance procedures, the information provided must be sufficient to enable the owner to properly conduct the routine maintenance on the modified part. The required information includes, but is not limited to:

1. Specific routine maintenance and cleaning procedures and timeframes.
2. All performance criteria used to determine a proper state of maintenance, such as the pressure drop across a fully-cleaned diesel particulate filter. The information provided must be detailed and specific enough to allow determination of whether a filter has been properly cleaned, and should not recommend, and must exclude practices which may result in damage to the part.
3. Any prohibitions or specific maintenance practices which may result in damage to the modified part.
4. Directions consistent with OEM engine manufacturer's directions for proper handling of ECU, error codes, and engine maintenance.

(10) Training Requirements. The applicant is responsible for developing training to ensure end users can safely operate and maintain their modified part. This training must include, at a minimum: a review of the installation assessment results, the effects of engine maintenance on the part's performance, identification of all warning and/or fault alarms and appropriate end-user responses, and cleaning and maintenance information for the modified part. If the applicant allows the end user to perform routine maintenance of the modified part, this training information must include the maintenance procedures described in section (i)(9). The applicant or their authorized installer is responsible for ensuring that this training is presented to the end user before the vehicle, equipment, or engine is put back into service following the installation of the modified part and must be available to the end user on an on-going basis (e.g., online training materials).

(11) Noise Level Control. Any modified part that replaces an OEM diesel particulate filter must continue to provide at a minimum the same level of exhaust noise attenuation as the diesel particulate filter with which the vehicle was originally equipped by the vehicle or engine manufacturer. Applicants must ensure that the modified part complies with all applicable noise limits contained in Part 205, Title 40, Code of Federal Regulations and California Vehicle Code, Sections 27150, 27151

and 27200 through 27207, for the gross vehicle weight rating and year of manufacture of the vehicle for which the modified part is intended. All modified parts must be in compliance with applicable local government requirements for noise control.

(12) Fuel Additives and Alternative Diesel Fuels. A modified part must not include the use of fuel additives or alternative diesel fuels as part of its emissions control strategy. The use of fuel additives or alternative diesel fuels with a modified part is strictly forbidden.

(13) Fuel and Oil Requirements. The applicant must specify the fuel and lubricating oil requirements necessary for proper functioning of the modified part. The applicant must also specify any consequences that will be caused by failure to comply with these requirements, as well as methods for reversing any negative consequences.

(14) Component Swapping and Re-designation. A modified part must remain on the vehicle it was initially installed on and may not be transferred to or installed on another vehicle.

(15) Sales and Installation. No person or entity shall advertise, sell, lease, supply, offer for sale, represent, or install any device, apparatus, or mechanism as a modified part for or on any engine, vehicle, or equipment that does not meet the terms and conditions of the modified part's Executive Order.

(16) Certification of a modified part by the Air Resources Board does not release the applicant from complying with all other applicable legal requirements. Modified parts certified under the Executive Order shall conform to all applicable regulations. The terms and conditions of the Executive Order must be satisfied regardless of where the modified part is sold in order for the system to be considered certified. Modified parts sold as certified, or which carry the ARB-approved label, must satisfy all the terms and conditions of the Executive Order. The Executive Order does not release the applicant from complying with all other applicable regulations.

(j) WARRANTY

(1) Product Warranty

(A) The manufacturer of the modified part must warrant to all owners, for ownership within the warranty period and lessees, for lease contracts within the warranty period, that its modified part is free from defects in design, materials, workmanship or operation which cause the modified part to fail to conform with

the requirements of this Procedure and the governing Executive Order, which cause the engine on which it is installed to fail to conform to the engine's certified configuration, which poses a safety risk, which allows for secondary emissions, is found to be incompatible with the engine and application or which is the proximate cause of damage to the engine. This warranty shall cover customer service, and shall cover the full repair and replacement costs including the costs of diagnosis, labor, and parts (including any part on the modified engine that is damaged due to a defect in the modified part) for the length of the warranty periods listed in this Procedure.

(B) The manufacturer must warrant that any new modified part is free from any manufacturing defects, including defects in design, materials, workmanship, or operation that would cause the part to fail to perform as tested. The part must be warranted for a period of 5 years or 150,000 miles from the date of installation, whichever is shorter. The warranty must cover customer service and the full repair and replacement cost, including diagnosis, parts, and labor and any damage to the engine caused by the modified part.

(C) The warranty must also cover the full repair or replacement cost of returning the engine to the condition the engine was in prior to the failure, including parts and labor, for damage caused by the modified part. Repair or replacement of any warranted part, including the engine, must be performed at no charge to the vehicle or equipment owner. This includes only those relevant diagnostic expenses in the case in which a warranty claim is valid. The applicant may, at its option, instead pay the fair market value of the engine (whichever is relevant) prior to the time the failure occurred.

(D) The manufacturer must resolve all claims within 30 days of notification (as notified through either the manufacturer directly or authorized installer) of an issue with a modified part or modified system. The manufacturer must be able to provide an appropriate replacement part for a malfunctioning or failed component of the modified part/modified system within 5 business days of determining the part is malfunctioning or failed. Failure of the vehicle or engine owner to ensure scheduled maintenance or to keep maintenance records for the vehicle, equipment, engine, or modified part may, but shall not per se, be grounds for disallowing a warranty claim.

(E) Warranty Card

The manufacturer shall provide a warranty card with each modified part intended for sale or use. The warranty card shall include:

1. The general terms and conditions of the modified part warranty;
2. A statement that the modified part has been designed and manufactured to meet the warranty requirements;

3. A place for the customer's signature in acknowledgement of the modified part warranty;
4. The modified part's part number;
5. The modified part's unique serial number
6. The vehicle year, make, model, VIN, and odometer reading on which the modified part was installed;
7. The date of installation;
8. The name of the installation shop or facility; and
9. Acknowledgement that the installer followed the modified part manufacturer's requirements for assessing the vehicle for compatibility prior to installation of the part.

The warranty card shall be supplied and filled out in triplicate; the original for the customer, one copy for the installer to keep, and one copy to be sent back to the manufacturer. The copy to be returned to the manufacturer shall have pre-paid postage and be of sufficient size to allow for mailing without the use of a separate envelope.

(F) The device manufacturer must ensure each modified part sold to the ultimate purchaser includes a copy of the governing Executive Order, parts list, and owner's manual.

(G) Within 15 days of denying a claim (which may be in addition to the 30 day warranty resolution period), the device manufacturer must provide a "Grounds for Denial" in the form of a dated letter or document to the owner of any modified part for which a claim was denied. This document must identify the reason(s) for the denied claim, the date of the claim, the unique serial number of the unit, the part number, the nature of any damage to the engine, and the contact information of the modified part owner. This authority may be delegated to an authorized installer provided a copy of the Grounds for Denial is provided to the modified part manufacturer. This copy should be sent to the modified part manufacturer at the same time as it is sent to the owner of the modified part.

Grounds for Denial must be provided to ARB within 15 days of written request.

(H) Warranty Reporting. Annual Warranty Report for the modified part.

1. The applicant must submit a complete and accurate warranty report to the Executive Officer annually by April 1 of each calendar year for each modified part with a unique Executive Order.
2. Products covered by several Executive Orders must not be combined into a single report.
3. Parts with different part numbers determined by the Executive Officer as constituting one part category or grouping during the certification process must be reported as such.

4. The warranty report must include all warranty claims, even those that were denied, and must delineate claims that resulted in warranty service (i.e., valid claims) from those that were denied. Any issue brought by an owner of a modified part to an authorized installer or to the modified part manufacturer within the warranty period must be reported as a claim. Prescreening must not occur. Invalid claims may be identified as denied claims in the warranty report and an appropriate reason for the denial must be included (e.g., outside the warranty period, no problem with device, etc.).
5. Manufacturers are also required to monitor warranty claims on an ongoing basis and provide a written report to ARB within 15 days when the cumulative valid claims exceed 4 percent per part or part category each calendar year. The manufacturer shall include in the report a description of the probable cause of the failures, the impact of the failures on vehicle emissions, the impact of the failure on the OEM aftertreatment system and engine, and any potential safety concerns.
6. The warranty report (annual and those triggered by exceedances of the 4 percent trigger) must, at a minimum, include the following information and shall be submitted in the format specified by the Executive Officer:
 - (i) The manufacturer's corporate name, sales for the given calendar year and cumulative sales, and leases for the given calendar year and cumulative leases of a modified part.
 - (ii) Annual summary of warranty claims for the given calendar year. The summary must include:
 - a. A description of the nature of the claims (including denied warranty claims) and of the warranty replacements or repairs. The applicant must categorize warranty claims for each modified part holding a discrete Executive Order by the part(s), part group(s) or component(s) replaced or repaired. All information must be correlated to a valid and unique modified part/system serial number.
 - b. Each part number, part description (common name of the part) or part grouping (in cases identified by the EO due to a parts change request) for which there was a valid claim. Denied claims which were for parts or part grouping under warranty must be reported.
 - c. The total number of claims (absolute and as a percentage of cumulative sales) for a part or part grouping.
 - d. Valid claims involving engine components not part of the modified part (by OEM part number and common name description).
 - e. Denied claims for engine parts not part of the modified part which suffered damage related to thermal events related to the modified part.
 - f. The reason for the failure, repair, or replacement.

- g. The engine family, engine model, and horsepower associated with each claim.
 - h. The vehicle application associated with each claim.
 - i. The fleet contact information corresponding to each claim.
 - j. The installer for each claim.
 - k. Date of claim(s).
 - l. Mileage at time of claim(s) and mileage at time of installation.
 - m. The time from report of issue to resolution of the claim (in days).
 - n. If a claim was deemed valid, "good faith", or denied.
 - o. If a claim was denied the applicant must clearly state the reason(s).
7. A current list of authorized installers for the modified part.
 8. A modified part warranty report that does not contain all required information, or contains inaccurate information, will not be considered complete.
 9. The Executive Officer may suspend the review of all other applications sent by an applicant if that applicant fails to submit warranty reports.

(l) Product Warranty Statement.

The manufacturer must include the warranty statement in the owner's manual of each modified part sold. A copy of the owner's manual, installation manual, warranty card and governing Executive Order must be provided to each owner at the time of installation of the modified part. The manufacturer may include in the owner's manual circumstances that could result in the denial of a warranty claim, however, that shall not limit the warranty terms in any way.

YOUR WARRANTY RIGHTS AND OBLIGATIONS

(Manufacturer's name) of the modified part must warrant that its modified part is free from defects in design, materials, workmanship or operation which cause the modified part to fail to conform to all the requirements of Title 13, California Code of Regulations, Section 2222(k), provided there has been no abuse, neglect, or improper maintenance of the modified part or engine, as specified in the modified part owner's manual and engine maintenance and/or owner's manual. Where a warrantable condition exists, this warranty covers engine damage directly caused by the modified part subject to the same exclusions for abuse, neglect or improper maintenance. Please review your owner's manual for other warranty information. Your modified part may include a core part (e.g. particulate filter in an appropriate housing), as well as flanges, brackets, gaskets, additional sensors and other system related assemblies. Where a warrantable condition exists, (Manufacturer's name) will repair or replace your part at no cost to you including diagnosis, parts, and labor.

WARRANTY COVERAGE:

For a (engine size) engine used in a(n) (type of application) application, the warranty period will be 5 years or 150,000 miles of operation. If any part of your modified part is defective in design, materials, workmanship, or operation of the modified part thus causing the modified part or engine, or other engine component, to fail to conform to the emission certification level it was approved for, or to found to be in non-compliance with the Executive Order, pose a safety risk, allow for secondary emissions, or be found to be incompatible with the engine and application, (Applicant's name) will repair or replace the modified part, including diagnosis, parts, and labor.

In addition, (applicant's name) will replace or repair the engine components to the condition they were in prior to the failure, including parts and labor, for damage to the engine proximately caused by the modified part. This also includes those relevant diagnostic expenses in the case in which a warranty claim is valid. (Applicant's name) may, at its option, instead pay the fair market value of the engine depending on the nature of the damage prior to the time the failure occurs.

OWNER'S WARRANTY RESPONSIBILITY

As the (vehicle, engine, equipment) owner, you are responsible for performing the required maintenance described in your owner's manual. (Manufacturer's name) recommends that you retain all maintenance records and receipts for maintenance expenses for your engine, and modified part. If you do not keep your receipts or fail to perform all scheduled maintenance, (Manufacturer's name) may have grounds to deny warranty coverage. You are responsible for making your engine and modified part available to (Manufacturer's name) as soon as a problem is detected. You must ensure you make the engine available for review and assessment by the modified part manufacturer or its authorized representative so it can process the warranty claim. The warranty repair should be completed in a reasonable amount of time, not to exceed 30 days. If a warranty claim is denied, (Manufacturer's name) must provide a written reason why the claim was denied. The owner of the modified part should retain this written statement for their records should a warranty dispute arise. Failure of the owner to retain the written statement may, but shall not per se, be grounds for disallowing a warranty claim.

If you have questions regarding your warranty rights and responsibilities, you should contact (Insert chosen manufacturer's contact) at 1-800-xxx-xxxx or the

California Air Resources Board at 9528 Telstar Avenue, El Monte, California 91731, or (800) 363-7664, or electronic mail: helpline@arb.ca.gov.

(2) Installation and Service Warranty

(A) An installer who installs a modified part must ensure that all the conditions and requirements of the governing Executive Order are met prior to installation. This must include a determination of the state of maintenance of the vehicle, equipment, or engine. An installer who installs or services a modified part on a vehicle, equipment, or an engine that does not adhere to the requirements of the governing Executive Order, must cover customer service and the full repair and replacement cost of the modified part, and any damage to the engine caused by the device, including diagnosis, parts, and labor. Failure to ensure the modified part is installed on an engine and application consistent with its governing Executive Order shall also be in violation of Vehicle Code, Section 27156.

(B) An installer must warrant that the installation and service is free from defects in design, workmanship, operation, or materials which cause the modified part to fail to conform to the applicable requirements in this Procedure, cause it or the engine it is installed upon to fail to conform to the engine's governing emission certification, cause it to be incompatible with the engine or application, pose a safety risk, cause it be in non-compliance with its governing Executive Order, or cause damage to the engine.

(C) The installation warranty for the modified part must be for a period of 5 years or 150,000 miles from the date of installation, whichever is shorter.

(D) The installation warranty coverage provided by installers must meet the same requirements as the warranty coverage provided by the applicant as established in section (j)(1) and the same exclusions must apply.

(E) The installer must resolve all installation-related claims within 30 days of notification.

(F) The installer must ensure it has the ability to maintain appropriate information on each installation and activity, including correct warranty times and be able to provide this information to the modified part manufacturer and ARB within 15 days of written request or in support of annual warranty obligations, or if a warranty trigger is generated prior to the yearly reporting requirement.

(G) The installer must ensure modified parts are properly tracked (e.g., address the variable warranty periods) and reported, including how they will ensure notification compliance with systems which exceed the warranty rate (4 percent triggers) prior to the annual reporting requirement.

(H) The installer must provide information on each installation and service event to the modified part manufacturer per its requirements. This includes, but is not limited to, information about each installation required for tracking and warranty

purposes and compliance with any timelines for providing this information to the modified part manufacturer.

(I) An installer must ensure that the engine ECU(s) is not directly or indirectly altered or changed from its certified configuration by the installation of the modified part.

(J) The installer must be able to provide appropriate technical support in the event of an installation related warranty claim. This shall include being familiar with the operation and deployment of the modified part and having the technical skills, abilities and instruments to assess issues with the part and OEM engine such that it can accurately determine the nature of the problem and provide appropriate direction to the modified part owner or correct the problem.

(K) The installer must be familiar with and comply with all pre-installation assessment requirements.

(L) The installer must ensure the purchaser of the modified part is provided a copy of the governing Executive Order, parts list, warranty card, owner's manual, and installation manual at the time the owner is in receipt of the modified part.

(M) The installer must notify ARB in writing within 15 days of being terminated as an authorized installer by the modified part manufacturer. The installer must address how it will comply with its outstanding reporting and warranty obligations.

(N) The installer must explain the warranty process to the owner of the modified part and identify appropriate contact information and numbers.

(O) The installer must be able to answer questions relating to proper maintenance of the part, compatibility with the engine and application, and consequences if the engine or modified part is not appropriately maintained.

(P) The installer must reference parts and part numbers consistent with the modified part manufacturer's direction.

(Q) Within 15 days of denying a claim (which may be in addition to the 30 day warranty resolution period), the installer must provide a "Grounds for Denial" in the form of a dated letter or document to the owner of any modified part for which an installation claim was denied. This document must identify the reason(s) for the denied claim, the date of the claim, the serial number of the unit, the part number affected (if appropriate) or engine damage incurred, and the contact information of the modified part owner.

(R) The installer is responsible for providing a copy of the Grounds for Denial to the modified part manufacturer. This copy should be sent to the modified part manufacturer at the same time as it is sent to the owner of the modified part. Grounds for Denial must be provided to ARB within 15 days of written request.

(S) Installation Report for the Modified Part.

1. The installer must submit a warranty report both to the Executive Officer of ARB and to the modified part manufacturer annually by March 1 of each calendar year for each modified part with a unique Executive Order.
2. These submitted warranty reports must be identical to each other.
3. Products covered by several Executive Orders, or from different manufacturers must not be combined in a single report.
4. The warranty report must include all warranty claims, even those that were denied, and must delineate claims that resulted in warranty service (i.e., valid claims) from those that did not result in warranty service as well as good faith fixes. Any issue brought by an owner of a modified part to an installer within the warranty period must be reported as a claim. Prescreening must not occur.
5. Installers are also required to monitor warranty claims on an ongoing basis and report to ARB and the modified part manufacturer within 30 days when the rate of installation related claims exceed 4 percent of the total installations of the modified part by the installer, or the total number of claims exceed 4 percent of total installations done within the same warranty reporting period.
6. The installer must comply with all reporting obligations required by the device manufacturer to ensure compliance with this Procedure, which may include submitting more frequent warranty report updates.
7. The warranty report must include the following information and shall be submitted in the format specified by the Executive Officer:
 - (i) A description of the nature of the claims (including denied warranty claims) and of the warranty replacements or repairs. The installer must categorize warranty claims for each modified part holding a discrete Executive Order by the part(s), part group(s) or component(s) replaced or repaired. All information must be correlated to a valid and unique modified part/system serial number.
 - (ii) For installation claims involving a problem with a modified system part(s), the individual part number, part description (common name of the part) or part grouping for which there was a valid claim. Denied claims which were for parts or part grouping under warranty must be reported.
 - (iii) Valid claims involving engine components not part of the modified part (by OEM part number and common name description).
 - (iv) Denied claims for engine parts not part of the modified part which suffered damage related to thermal events related to the modified part.
 - (v) The total number of claims (installation related claims exceeding 4 percent of the total installations of the modified part by the installer, or the total number of claims exceed 4 percent of total installations done within the same warranty reporting period).

- (vi) The reason for the failure, repair, or replacement.
- (vii) The engine family, engine model, and horsepower associated with each claim.
- (viii) The vehicle application associated with each claim.
- (ix) The fleet contact information corresponding to for each claim.
- (x) The device manufacturer and Executive Order number associated with the modified part involved with each claim.
- (xi) Date of claim(s).
- (xii) Mileage at time of claim(s) and mileage at time of installation.
- (xiii) The time from report of issue to resolution of the claim (in days).
- (xiv) If a claim was deemed valid, "good faith", or denied.
- (xv) If a claim was denied the applicant must clearly state the reason(s).

8. It is the installer's responsibility to ensure that the installer provides complete and accurate information to the modified part applicant and ARB to ensure compliance with these warranty requirements.

9. A modified part installation warranty report that does not contain all required information, or contains inaccurate information, will not be considered complete.

(T) Installation Warranty Statement. The installer must furnish the owner with a copy of the following statement.

YOUR WARRANTY RIGHTS AND OBLIGATIONS

(Installer's name) of the modified part must warrant to all owners, for ownership within the warranty period and lessees, for lease contracts within the warranty period, that the installation of the modified part complies with the terms of its governing Executive Order, the engine and vehicle is deemed appropriate at time of installation, and the installation is free from defects in design, materials, workmanship or operation which cause the modified part to fail to conform with the requirements Title 13, California Code of Regulations, Section 2222(k) , which cause the engine on which it is installed to fail to conform to the engine's certified configuration, pose a safety risk, allow for secondary emissions, or which is the cause of damage to any other part on the engine. This warranty shall cover customer service, and shall cover the full repair and replacement costs including the costs of diagnosis, labor, and parts (including any part on the modified engine that is damaged due to a defect in the modified part) for the length of the minimum warranty periods listed in this Procedure.

OWNER'S WARRANTY RESPONSIBILITY

As the vehicle, engine, or equipment owner, you are responsible for presenting your engine and modified part to (installer's name) as soon as a problem with the installation is detected.

If you have questions regarding your warranty rights and responsibilities, you should contact (Insert chosen installer's contact) at 1-800-xxx-xxxx or the California Air Resources Board at 9528 Telstar Avenue, El Monte, California 91731, or (800) 363-7664, or electronic mail: helpline@arb.ca.gov.

(k) SAFETY

(1) Installation and Operation.

(A) The applicant must ensure that installation and operation of the engine with the OEM part and modified part for testing purposes conforms to all applicable industrial safety regulations (CCR, Title 8, Division 1, Chapter 4).

(B) The applicant must ensure that all installations of the modified part conform to applicable industrial safety requirements including but not limited to Federal Motor Carrier Safety Administration, Subpart G, *Miscellaneous Parts and Accessories*, Section 393.83 *Exhaust Systems*.

(2) Design of Modified Part. The applicant must give consideration to safety and catastrophic failure in the design of the modified part.

(A) The applicant must provide an analysis of all potential safety and catastrophic failure issues associated with the use of the modified part including an analysis of all potential failure modes. This analysis must include, but is not limited to, the effects of: uncontrolled regeneration, improper maintenance, unfavorable operating conditions, use of inappropriate fuel, high exhaust temperatures, substrate failure, and sensor failures. For any potential safety or catastrophic failure issues identified, the applicant must provide a detailed description of the safety risk mitigation strategies that it employs.

(B) The Executive Officer may require additional safety testing and design modifications to the modified part both before and after certification of the modified part which may include destructive testing. In making these determinations, the Executive Officer may consider all relevant information including, but not limited to, the safety and catastrophic failure analysis provided by the applicant, system design, properties of the materials used by the modified part, field experience, and warranty report data. The Executive Officer will require that safety testing be conducted by an independent test facility that has appropriate safety testing experience.

(C) If the Executive Officer determines that an applicant has not made a satisfactory demonstration of the safety of its modified part, the Executive Officer

will deny the applicant's request for certification or revoke an existing certification.

(l) COMPLIANCE

(1) Any ARB certified modified part shall be properly installed and maintained. The Executive Order for a modified part is only valid if it is properly installed and maintained.

(2) No person shall sell, offer to sell, or introduce into commerce an ARB certified modified part unless all of the conditions of the governing Executive Order and this Procedure are met.

(3) The Executive Officer may modify, revoke or suspend an existing certification or pending certification applications for any violation of the governing Executive Order or this Procedure, including but not limited to:

(A) Any changes deployed to the certified modified part not approved by ARB.

(B) Failure to submit warranty reports or any other requested information (e.g., recall plan, proof of pursuit of sales, quality control) or a deficiency of required submittals.

(C) The certified modified part does not comply with the requirements or provisions of the Executive Order or this Procedure (e.g., fails audit testing, applicant fails to satisfactorily demonstrate safety of the modified part).

(D) Errors, omissions, inaccurate information, or fraudulent submittals.

(E) Failure to follow the recordkeeping requirements.

(F) Failure to resolve warranty claims within the 30 day timeframe.

(G) Failure to provide complete and accurate testing data.

(H) Failure to demonstrate sales or the active pursuit of sales of the applicant's modified part in California upon receiving certification.

(4) No person shall represent a device as being an ARB certified modified part unless it has received certification pursuant to this Procedure.

(5) No person shall alter, physically disable, disconnect, bypass, or tamper with an installer ARB certified modified part.

(6) No party shall install, advertise, sell, lease, or offer for sale or lease, a used DPF.

(7) ARB has the right on entry to any facility or locations for purposes of enforcing these requirements.

(m) PENALTIES

The Executive Officer may assess penalties to the extent permissible under Part 5, Division 26 of the Health and Safety Code for violations of this Procedure.

NOTE: Authority cited: Sections 39600, 39601, 43000, 43000.5, 43011 and 43107, Health and Safety Code; and Sections 27156, 38391 and 38395, Vehicle Code.
Reference: Sections 39002, 39003, 39500, 43000, 43000.5, 43009.5, 43011, 43107, 43204, 43205, 43205.5 and 43644, Health and Safety Code; and Sections 27156, 38391 and 38395, Vehicle Code.

APPENDIX 1

DPF Aging Protocol Multi-point Temperature Measurement Requirements

1. Exhaust temperatures must be recorded at suitable multiple locations in a DPF to reflect the thermal exposure.

2. ARB suggests applicants use the method as follows:

2.1 13 point temperature measurement

Figure 1 describes the temperature sensor locations in a DPF. Applicants shall use 13 temperature sensors to measure multi-point temperature.

2.2 Temperature sensors requirements

2.2.1 Temperature sensors specifications

Applicants shall use 0.032" K-type thermocouples as temperature sensors.

2.2.1 Depth of thermocouples inside of a DPF

Applicants shall insert thermocouples one inch deep from DPF outlet face.

2.3 Data recording and reporting frequency

The temperatures shall be measured, recorded and reported at a minimum rate of once every second (1 Hz) during the whole DPF aging period.

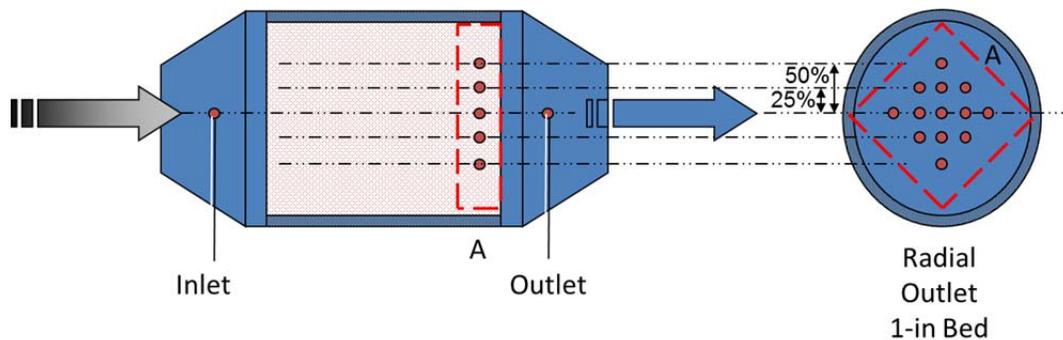


Figure 1 Temperature sensors location for DPF aging

3. Applicants may determine the number and locations (which is more than ARB suggested method) of the temperature measurements based on best engineering judgement. Such applicant's proposed test method must be approved by ARB.

Reference:

1. Eakle, S.T. and G.J. Bartley. The DAAAC Protocol™ for Diesel Aftertreatment System Accelerated Aging. Proceedings of the Emissions 2014 Conference, 2014. (<http://emissions2014.org/wp-content/uploads/2014/05/Edited-Eakle-Paper.pdf>)

APPENDIX 2

Method to Determine Effective Active Regeneration Aging Time

The temperature difference between DPF inlet and inside of the DPF may cause a difference in thermal aging process with a fixed aging time.

It is necessary to develop a method for calculating the equivalent aging time corresponding to a reference temperature.

Applicants must calculate the effective aging time according to the principles described here.

1. Recording multiple temperature points inside of a DPF

Applicants shall follow the instructions in APPENDIX 1 to measure and record temperature inside of the DPF on a second-by-second basis.

2. Reference temperature and actual temperature

The reference temperature is the measured DPF inlet temperature. The actual temperature is the highest temperature among the 13 locations specified in APPENDIX 1.

3. Equation

Aging time is a function of aging temperature as defined by the Arrhenius equation.

3.1 Applicants shall apply the following equation to calculate the equivalent aging time corresponding to a reference temperature.

$$\frac{t_1}{t_2} = \exp \left[-\frac{E_a}{R} \left(\frac{1}{T_2} - \frac{1}{T_1} \right) \right]$$

Where

R is the universal gas constant (8.315 Jmol⁻¹K⁻¹)

E_a is the activation energy; use the value of 150 KJmol⁻¹ for traditional PGM catalyst. For other types of catalyst, applicants must contact ARB.

T₂ = reference temperature (DPF inlet temperature, set default value as 943), in K.

T₁ = the highest temperature among the 13 locations specified in APPENDIX 1), in

t₂ = the time, set default value as 1 second, corresponding to the reference temperature

t₁ = the equivalent aging time, in seconds, needed to produce, by exposing the DPF at the temperature T₁, the same amount of aging as if the DPF was exposed at the temperature T₂ during the time t₂.

3.2 The total equivalent aging time shall be calculated in accordance with the following equation:

$$AT = \sum_{i=1}^n t_1^i / 3600$$

Where

AT = total equivalent aging time, in hours,

t_1^i = the equivalent aging time, in seconds, during each second of the active regeneration period.

i = bin number, where 1 is number for the bin with the earliest time and n the value for the bin with the last time (in seconds) for active regeneration.

4. Minimum 166 hours effective active regeneration aging time.

Applicants must perform the minimum 166 hours effective active regeneration aging time.

Reference:

1. US EPA Bench Aging Time (BAT) Calculator
(<http://www.epa.gov/oms/regs/ld-hwy/durability/bench-aging-calculator-spreadsheet-03-24-10.xls>)
2. Bartley, G.J. Improved Aging Precision Using RT-BAT™ and MTM™.
Proceedings of the Emissions 2014 Conference, 2014.
(<http://emissions2014.org/wp-content/uploads/2014/05/Edited-Bartley-Paper.pdf>)

APPENDIX 3

“Drain and Weigh” Method for Engine Oil Consumption during Laboratory Aging

1. Applicant shall develop an accurate method for determining engine oil consumption during the laboratory aging period. The method must be based on sound principles of science and engineering, and includes but is not limited to gravimetric methods¹ (i.e. “drain and weigh”, market-ready oil measurement systems²⁻³), volumetric methods¹, or methods with radioactive/non-radioactive tracers¹.

2. ARB suggests applicants use the “drain and weigh” method as follows:

2.1 Principle

The “drain and weigh” is a conventional gravimetric method, which involves weighing the oil both before and after a certain engine operating interval (hours to days) to quantify the oil consumed.

2.2 Equipment and Instruments

A constant volume oil sump system (conforms to ASTM standard D7156-13)⁴

An external reservoir and pump (maintains the oil level in engine)

A balance (accuracy within 1 gram)

Oil drain pan

Necessary supplies during the oil drain (e.g. rags)

2.3 Procedure

Step 1: Fill the engine with new oil by the oil pump. Check the oil level and make sure both the engine and external sump are full.

Step 2: Start the engine and operate the engine over desired laboratory aging cycles for minimum 1 hour.

Step 3: Once cycle is complete, allow oil temperature to stabilize at a steady-state engine condition before shutting the engine down.

Step 4: Weigh a clean and empty oil pan, and any clean supplies for the oil drain process.

Step 5: Drain oil by the external oil pump for 10 minutes, then an additional 10 minutes after shutting the pump off.

Step 6: Weigh and record the drained oil (in oil pan and any supplies). The difference between clean oil pan and drained oil pan plus the difference between clean supplies and dirty supplies is the total oil removed from the engine.

Step 7: Carefully return the oil to the engine.

Step 8: Weigh the empty oil pan and any supplies used for oil drain/return process. The difference between clean oil pan/supplies and dirty oil pan/supplies is the residual oil that was not returned to the engine.

Step 9: Subtract the amount of residual oil on the dirty oil pan and supplies from the amount of total oil removed from engine. The difference is the oil returned to engine.

Step 10: Operate the engine under the desired laboratory aging cycles for a certain interval (e.g., 24 hours).

Step 11: Repeat Step 3-6.

Step 12: Subtract the amount of oil removed from the engine in Step 11 from the amount of oil returned to the engine in Step 9. The difference is the total oil consumption during such certain engine operation interval. Divide the total oil consumption (in grams) by the time (in hours) accumulated in Step 10, the result is the oil consumption rate (in grams/hour).

3. Applicants may use AVL 406 Oil Consumption Meter² or Cummins Smart Oil Consumption Measuring System³ to track the oil consumption.

Reference:

1. Froelund, K., and Jääskeläinen, H. Measurement of Lubricating Oil Consumption. Dieselnet, 2009.
(https://www.dieselnet.com/tech/lube_cons_measure.php)
2. AVL 406 Oil Consumption Meter. (<https://www.avl.com/-/avl-oil-consumption-meter>)
3. Weng, W. and Richardson, D. Cummins Smart Oil Consumption Measuring System. SAE Technical Paper 2000-01-0927, 2000.
4. ASTM D7156-13: Standard Test Method for Evaluation of Diesel Engine Oils in the T-11 Exhaust Gas Recirculation Diesel Engine.