



Terry Tamminen
Agency Secretary

Air Resources Board

Alan C. Lloyd, Ph.D.
Chairman

9480 Telstar Avenue, Suite 4
El Monte, California 91731 www.arb.ca.gov



Arnold Schwarzenegger
Governor

April 29, 2004

MANUFACTURERS ADVISORY CORRESPONDENCE (MAC) #04-04

TO: - All Manufacturers of Urban Buses and Urban Bus Engines
- All Manufacturers of Aftertreatment Systems for Diesel Particulate Matter
- All Manufacturers of Aftertreatment Systems for Oxides of Nitrogen
- All Other Interested Parties

SUBJECT: Optional Durability Demonstration and Certification Procedure for New 2002-2006 Model-Year Diesel, Diesel Dual-Fuel and Diesel Bi-Fuel Urban Bus Engines Produced On or After October 1, 2002 Meeting New 0.01 g/bhp-hr Particulate (PM) and/or 0.5 g/bhp-hr Oxides of Nitrogen (NOx) Standards Using a Verified Diesel PM or NOx Aftertreatment System

New 2002 and subsequent model-year (MY) diesel, diesel dual-fuel and diesel bi-fuel (hereinafter referred to as diesel) urban bus engines produced on or after October 1, 2002 are required to meet a 0.01 g/bhp-hr PM standard. New MY2004-2006 diesel urban bus engines are also required to meet a 0.5 g/bhp-hr NOx standard, except engines certified under Section 1956.1(a)(11) in Title 13, California Code of Regulations (13 CCR) and sold to transit fleets that are exempted under 13 CCR Sections 1956.2(c)(8) and (d)(7) by the Executive Officer.

The attached Manufacturers Advisory Correspondence (MAC) outlines an optional procedure for engine manufacturers to demonstrate the durability of aftertreatment systems installed on base 2002-2006 MY diesel urban bus engines to meet the certification standards in 13 CCR Section 1956.1(a)(10). This procedure allows an engine manufacturer to submit an engineering evaluation demonstrating: (1) the aftertreatment system has received a verification from the Air Resources Board pursuant to the provisions of the verification procedures applicable to in-use diesel engines (13 CCR Section 2700 et seq.), and (2) the aftertreatment system is durable and appropriate for the diesel urban bus engine application, in lieu of an actual durability demonstration.

If you have any questions regarding this MAC, please contact Mr. Satya Devesh, Air Resources Engineer, On-Road Certification/Audit Section, at (626) 575-6704 or by e-mail at sdevesh@arb.ca.gov. For any questions regarding the verification of PM or NOx aftertreatment systems, please contact Mr. Scott Rowland, Manager, Retrofit Assessment Section, at (626) 575-6972 or by e-mail at growland@arb.ca.gov.

Sincerely,

/s/

Allen Lyons, Chief
Mobile Source Operations Division

Attachment

The energy challenge facing California is real. Every Californian needs to take immediate action to reduce energy consumption. For a list of simple ways you can reduce demand and cut your energy costs, see our Website: <http://www.arb.ca.gov>.

California Environmental Protection Agency

MANUFACTURERS ADVISORY CORRESPONDENCE (MAC) #04-04

SUBJECT: Optional Durability Demonstration and Certification Procedure for New 2002-2006 Model-Year Diesel, Diesel Dual-Fuel and Diesel Bi-Fuel Urban Bus Engines Produced On or After October 1, 2002 Meeting New 0.01 g/bhp-hr Particulate (PM) and/or 0.5 g/bhp-hr Oxides of Nitrogen (NOx) Standards Using a Verified Diesel PM or NOx Aftertreatment System

NOMENCLATURE AND ABBREVIATIONS:

The following nomenclature and abbreviations are used in this MAC.

13 CCR abc=Title 13, California Code of Regulations, Section abc
AECD=auxiliary emission control device as defined in regulations, test procedures, and related policy documents (e.g., MACs, Mail-outs, USEPA Advisory Circulars or CCD letters)
ARB=Air Resources Board
DF=deterioration factor
ECS=emission control system
EURO=European III test procedure
FEL=family emission limit in an averaging, banking and trading plan
FTP=federal test procedure
MAC=Manufacturers Advisory Correspondence
MY=model-year
NTE=not-to-exceed
CO = carbon monoxide
HCHO=formaldehyde
NMHC=non-methane hydrocarbon
NOx=oxides of nitrogen
PM=particulate matter
g/bhp-hr=grams per brake horsepower-hour

APPLICABILITY:

MY2002-2006 diesel, diesel dual-fuel and diesel bi-fuel urban bus engines produced on or after October 1, 2002

REFERENCES:

1. 13 CCR 1956.1 "Exhaust Emission Standards and Test Procedures – 1985 and Subsequent Model Heavy Duty Urban Bus Engines and Vehicles," last amended November 15, 2003.
2. 13 CCR 1956.2 (c)(8) and (d)(7) "Fleet Rule for Transit Agencies," last amended November 15, 2003.
3. "California Exhaust Emission Standards and Test Procedures for 1985 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles," last amended November 22, 2000.
4. 13 CCR 2700-2710, "Verification Procedure, Warranty and In-Use Compliance Requirements for In-Use Strategies to Control Emissions from Diesel Engines," adopted June 11, 2003.

BACKGROUND AND DISCUSSION:

A. 13 CCR 1956.1(a)(7) requires new 2002 and subsequent model-year diesel, diesel dual-fuel and diesel bi-fuel (hereinafter “diesel”) urban bus engines produced on or after October 1, 2002 comply with a 0.01 PM standard. (All emissions and emission standards in this MAC are in g/bhp-hr.) This section also provides that manufacturers may elect to meet this standard with an aftertreatment system that reduces PM emissions to 0.01.

B. 13 CCR 1956.1(a)(11) requires that new MY2004-2006 diesel urban bus engines comply with 0.5 NO_x, 0.01 PM, 0.05 NMHC, 5.0 CO and 0.01 HCHO standards. Manufacturers may elect to meet the NO_x and PM standards with a base engine that has been certified to the standards specified in 13 CCR 1956.1(a)(10) and that is equipped with an aftertreatment system that reduces emissions to 0.5 NO_x and 0.01 PM standards. The NMHC, CO and HCHO standards remain applicable. The engine manufacturer is responsible for full certification, durability, testing, warranty and other requirements for the base diesel engine. For the aftertreatment system, the engine manufacturer is not subject to the certification durability requirements or in-use recall and enforcement provisions, but is subject to warranty provisions for functionality.

C. To certify an engine, an engine manufacturer generally establishes an engine’s durability by conducting durability testing on the engine with all ECS installed and operating, including any aftertreatment system(s). The durability tests are intended to demonstrate that the engine and its associated ECS are sufficiently durable to control emissions over the engine’s useful life. Data from the durability tests are used to calculate the DFs for the engine and its ECS combination. An emission data engine is then tested under specified test procedures (FTP and, as applicable, EURO and NTE). Test results from the emission data engine are adjusted by the DFs to determine the engine’s certification levels. The traditional certification procedure must be used when (1) the base diesel engine has not been certified to, or has any FEL higher than, the standards in 13 CCR 1956.1(a)(10), **or** (2) if the aftertreatment system has not been verified by the ARB, **or** (3) if the verified aftertreatment system has not been proven to reduce NO_x and/or PM emissions to 0.5 and 0.01, respectively.

D. The optional durability demonstration procedure described herein may be used when the base diesel engine has been certified to, or has all FELs below, the standards in 13 CCR 1956.1(a)(10) **and** the aftertreatment system has been verified by ARB **and** shown to reduce NO_x and/or PM emissions to 0.5 and 0.01, respectively.

Under the optional procedure, a manufacturer may submit an engineering evaluation demonstrating that use of the aftertreatment system that has received a verification from the ARB under the provisions in Reference 4. on the diesel urban bus engine application is appropriate, based on relevant characteristics of the diesel urban bus engine and the aftertreatment system in lieu of conducting an actual durability demonstration. The engineering evaluation should compare the specified permissible exhaust feedgas conditions (e.g., flow rate, temperature, exhaust back pressure and pressure drop, oxygen content, pollutant loading rates including that for sulfates) and vibration tolerance levels of the verified aftertreatment system to the corresponding design parameters and operating conditions of the diesel urban bus engine. Other data and information, (e.g., from the manufacturer’s own in-use testing, in-house or development testing) may also be submitted. The engineering evaluation must include a determination of the PM and/or NO_x DFs for the diesel urban bus engine application based on the durability data of the verified aftertreatment system. The engineering evaluation must also describe all AECDs required for the operation and control of the

diesel urban bus engine equipped with the aftertreatment system. Any change to the operation and control of any AECD compared to those previously approved for the base diesel engine or the verified aftertreatment system must be approved by the ARB. The ARB will disapprove an engineering evaluation if it does not provide a good basis (e.g., good support data, sound analysis based on accepted engineering practices, etc.) for the manufacturer's determination of durability of the verified aftertreatment system when used on the diesel urban bus engine application for the useful life of the engine (or until the first permitted replacement point of the aftertreatment system, whichever occurs first).

Testing of the emission data engine and the determination of the certification levels are the same as described in paragraph C. above.

13 CCR 1956.1(a)(11) states that the engine manufacturer is subject to the warranty provisions for the functionality for the aftertreatment system (i.e., it must provide warranty coverage consistent with ARB warranty requirements in 13 CCR 2035 et seq. for the aftertreatment system used on its certified diesel urban bus engines).

In its certification application, an engine manufacturer must provide the following information in addition to the information typically submitted in a certification application: reference to the ARB's verification of the aftertreatment system used on the diesel urban bus engine, reference to ARB's certification of the base diesel engine to the standards in 13 CCR 1956.1(a)(10), the manufacturer's statement attesting to the durability of the verified aftertreatment system for use on the diesel urban bus engine for the useful life of the engine (or up to the first permitted replacement point of the aftertreatment system, whichever occurs first), the manufacturer's warranty statement covering the emission control systems including the aftertreatment system of the certified diesel urban bus engine, and the manufacturer's requirements for scheduled maintenance of the certified diesel urban bus engine and its emission control systems including the aftertreatment system.

POLICY:

The optional durability demonstration procedure described below is available for MY2002-2006 diesel urban bus engines produced on or after October 1, 2002.

1. Eligibility

The optional durability demonstration procedure may only be used if both of the conditions are satisfied.

- a. The base diesel engine has been certified to, or has all FELs below, the standards specified in 13 CCR 1956.1(a)(10).
- b. The aftertreatment system has been verified by ARB and shown to reduce NOx and/or PM emissions to 0.5 and 0.01, respectively.

2. Durability Demonstration

An engineering evaluation as described in paragraph D. of the Background and Discussion section of this MAC may be used to satisfy the durability requirements for certifying diesel urban bus engines equipped with a verified aftertreatment system.

The ARB may disapprove any engineering evaluation that is not based on sound data or good engineering judgment and practice.

3. Emission Data Engine Testing

- a.** Prior to certification testing, an emission data engine equipped with the verified aftertreatment system and selected according to the test procedure must have accumulated 125 hours of service. An emission data engine with shorter service accumulation may be used if approved in advance by the Executive Officer.
- b.** The emission data engine shall be subject to FTP and, as applicable, EURO and NTE tests according to the test procedure. For MY2005-2006, the optional procedure in MAC 2003-02 "Guidance to Certification and Compliance with California's Supplemental Test Procedure, Including, and Specific to, Not-To-Exceed (NTE) Emission Testing Caps for 2005 and 2006 Model-Year (MY) Heavy-Duty and Medium-Duty Diesel Engines (HDDEs and MDDEs)" may be used to satisfy the EURO and NTE test and compliance requirements.

(MAC 2003-02 may be viewed at the following ARB website:
<http://www.arb.ca.gov/msprog/mac/mac0302/mac0302.pdf>.)

4. Warranty Coverage

The aftertreatment system of certified diesel urban bus engines must be warranted by the engine manufacturer as specified in 13 CCR 1956.1(a)(11) and 2035 et seq.

5. Application for Certification

In addition to other certification information and data typically submitted to ARB, manufacturers of diesel urban bus engines equipped with a verified aftertreatment system must include the following in the application for certification:

- a.** The reference to ARB's verification of the aftertreatment system and to ARB's certification of the base diesel engine meeting the eligibility described in Policy 1.
- b.** The manufacturer's durability demonstration, including the determination of the DFs, and a statement attesting to the manufacturer's determination of durability of the verified aftertreatment system for use on the diesel urban bus engine for the useful life of the engine (or up to the first permitted replacement point of the aftertreatment system, whichever occurs first).
- c.** Description of the AECDs for the operation and control of the diesel urban bus engine equipped with the verified aftertreatment system. Any change to the operation and control of any AECD compared to those previously approved for the base diesel engine or the verified aftertreatment system must be approved by the ARB.
- d.** Test results of the emission data engine and the calculated certification levels.
- e.** The manufacturer's statement of warranty coverage for the emission control systems, including the aftertreatment system.
- f.** The manufacturer's requirements for scheduled maintenance of the diesel urban bus engine and its emission control systems including the aftertreatment system.