

Environmental Protection Agency

§ 89.118

(4) Method of exhaust aftertreatment (for example, catalytic converter or particulate trap);

(5) Combustion chamber design;

(6) Bore;

(7) Stroke;

(8) Number of cylinders, (engines with aftertreatment devices only); and

(9) Cylinder arrangement (engines with aftertreatment devices only).

(c) Upon a showing by the manufacturer that the useful life period emission characteristics are expected to be similar, engines differing in one or more of the characteristics in paragraph (b) of this section may be grouped in the same engine family.

(d) Upon a showing by the manufacturer that the expected useful life period emission characteristics will be different, engines identical in all the characteristics of paragraph (b) of this section may be divided into separate engine families.

(e)(1) This paragraph (e) applies only to the placement of Tier 1 engines with power ratings under 37 kW into engine families. The provisions of paragraphs (a) through (d) of this section also apply to these engines. The power categories referred to in this paragraph (e) are those for which separate standards or implementation dates are described in § 89.112.

(2) A manufacturer may place engines with power ratings in one power category into an engine family comprised of engines with power ratings in another power category, and consider all engines in the engine family as being in the latter power category for the purpose of determining compliance with the standards and other requirements of this part, subject to approval in advance by the Administrator and the following restrictions:

(i) The engines that have power ratings outside the engine family's power category must constitute less than half of the engine family's sales in each model year for which the engine family grouping is made; and

(ii) The engines that have power ratings outside the engine family's power category must have power ratings that are within ten percent of either of the two power levels that define the engine family's power category.

(3) The restrictions described in paragraphs (e)(2)(i) and (e)(2)(ii) of this section do not apply if the emissions standards and other requirements of this part are at least as stringent for the engine family's power category as those of the other power categories containing engines in the engine family.

[59 FR 31335, June 17, 1994. Redesignated and amended at 63 FR 56995, 57003, Oct. 23, 1998]

§ 89.117 Test fleet selection.

(a) The manufacturer must select for testing, from each engine family, the engine with the most fuel injected per stroke of an injector, primarily at the speed of maximum torque and secondarily at rated speed.

(b) Each engine in the test fleet must be constructed to be representative of production engines.

(c) After review of the manufacturer's test fleet, the Administrator may select from the available fleet one additional test engine from each engine family.

(d) For establishing deterioration factors, the manufacturer shall select the engines, subsystems, or components to be used to determine exhaust emission deterioration factors for each engine-family control system combination. Engines, subsystems, or components shall be selected so that their emission deterioration characteristics are expected to represent those of in-use engines, based on good engineering judgment.

[59 FR 31335, June 17, 1994. Redesignated and amended at 63 FR 56995, 57003, Oct. 23, 1998]

§ 89.118 Deterioration factors and service accumulation.

This section applies to service accumulation used to determine deterioration factors and service accumulation used to condition test engines. Paragraphs (a) and (b) of this section apply only for service accumulation used to condition test engines. Paragraph (e) of this section applies only for service accumulation used to determine deterioration factors. Paragraphs (c) and (d) of this section apply for all service accumulation required by this part.

(a)(1) Each test engine in the test fleet must be operated with all emission control systems operating properly for a period sufficient to stabilize emissions.

(2) A manufacturer may elect to consider as stabilized emission levels from engines with no more than 125 hours of service.

(b) No maintenance, other than recommended lubrication and filter changes, may be performed during service accumulation without the Administrator's approval.

(c) Service accumulation should be performed in a manner using good engineering judgment to ensure that emissions are representative of in-use engines.

(d) The manufacturer must maintain, and provide to the Administrator if requested, records stating the rationale for selecting the service accumulation period and records describing the method used to accumulate service hours on the test engine(s).

(e) This paragraph (e) describes service accumulation and alternative requirements for the purpose of developing deterioration factor.

(1) *Service accumulation on engines, subsystems, or components selected by the manufacturer under § 89.117(d).* The manufacturer shall describe the form and extent of this service accumulation in the application for certification.

(2) *Determination of exhaust emission deterioration factors.* The manufacturer shall determine the deterioration factors in accordance with the applicable provisions of this part based on service accumulation and related testing, according to the manufacturer's procedures, except as provided in paragraph (e)(3) of this section.

(3) *Alternatives to service accumulation and testing for the determination of a deterioration factor.* A written explanation of the appropriateness of using an alternative must be included in the application for certification.

(i) *Carryover and carryacross of durability emission data.* In lieu of testing an emission data or durability data engine selected under § 89.117(d), a manufacturer may, with Administrator approval, use exhaust emission deterioration data on a similar engine for which certification to the same standard has

previously been obtained or for which all applicable data required under § 89.124 has previously been submitted. This data must be submitted in the application for certification.

(ii) *Use of on-highway deterioration data.* In the case where a manufacturer produces a certified on-highway engine that is similar to the nonroad engine to be certified, deterioration data from the on-highway engine may be applied to the nonroad engine. This application of deterioration data from an on-highway engine to a nonroad engine is subject to Administrator approval, and the determination of whether the engines are similar must be based on good engineering judgment.

(iii) *Engineering analysis for established technologies.* (A) In the case where an engine family uses established technology, an analysis based on good engineering practices may be used in lieu of testing to determine a deterioration factor for that engine family, subject to Administrator approval.

(B) Engines for which the certification levels are not at or below the Tier 3 NMHC+NO_x standards described in § 89.112 are considered established technology, except as provided in paragraph (e)(3)(iii)(D) of this section.

(C) Manufacturers may petition the Administrator to consider an engine with a certification level below the Tier 3 +NO_x standards as established technology. This petition must be based on proof that the technology used is not significantly different than that used on engines that have certification levels that are not below the Tier 3 NMHC+NO_x levels.

(D) Engines using exhaust gas recirculation or aftertreatment are excluded from the provision set forth in paragraphs (e)(3)(iii)(A) through (e)(3)(iii)(C) of this section.

(E) The manufacturer shall provide a written statement to the Administrator that all data, analyses, test procedures, evaluations, and other documents, on which the deterioration factor is based, are available to the Administrator upon request.

(iv) *Interim provision for engines rated under 37 kW.* For model year 1999 and 2000 engines rated under 37 kW, manufacturers may determine deterioration factors based on good engineering

Environmental Protection Agency

§ 89.120

judgement and reasonably available information. The manufacturer must maintain and provide to the Administrator, if requested, all information used to determine deterioration factors for these engines.

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§ 89.119 Emission tests.

(a) *Manufacturer testing.* (1) Upon completion of service accumulation, the manufacturer must test each test engine using the specified test procedures, except as provided in § 89.114. The procedures to be used are set forth in:

(i) Subpart E of this part;

(ii) The California Regulations for New 1996 and Later Heavy-Duty Off-Road Diesel Cycle Engines. This procedure has been incorporated by reference. See § 89.6; and

(iii) Part 86, subpart I of this chapter.

(2) Each test engine must be configured to be representative of actual in-use operation. The Administrator may specify the adjustment of any adjustable parameter. All test results must be reported to the Administrator.

(b) *Confirmatory testing.* The Administrator may conduct confirmatory testing or other testing on any test engine. The manufacturer must deliver test engines as directed by the Administrator. When the Administrator conducts confirmatory testing or other testing, those test results are used to determine compliance with emission standards.

(c) *Use of carryover test data.* In lieu of testing to certify an engine family for a given model year, the manufacturer may submit, with the Administrator's approval, emission test data used to certify that engine family in previous years. This "carryover" data is only allowable if the submitted test data show that the test engine would comply with the emission standard(s) for the model year for which certification is being sought.

(d) The provisions of this paragraph (d) apply only to Tier 1 nonroad engines without exhaust aftertreatment rated at or above 37 kW.

(1) Particulate emission measurements from Tier 1 nonroad engines without exhaust aftertreatment rated

at or above 37 kW may be adjusted to a sulfur content of 0.05 weight percent.

(2) Adjustments to the particulate measurement shall be made using the following equation:

$$PM_{adj} = PM - [BSFC \times 0.0917 \times (FSF - 0.0005)]$$

Where:

PM_{adj} = adjusted measured PM level [g/Kw-hr].

PM = measured weighted PM level [g/Kw-hr].

$BSFC$ = measured brake specific fuel consumption [G/Kw-hr].

FSF = fuel sulfur weight fraction.

(3) Where a manufacturer certifies using test fuel with a sulfur content less than or equal to 0.050 weight percent, EPA shall not use emission data collected using test fuel with a sulfur content greater than 0.050 weight percent to determine compliance with the Tier 1 PM standards.

(4) Where a manufacturer certifies using test fuel with a sulfur content greater than 0.050 weight percent, EPA shall not use emission data collected using test fuel with a sulfur content greater than 0.050 weight percent to determine compliance with the Tier 1 PM standards, unless EPA adjusts the PM measurement using the equation specified in paragraph (d)(2) of this section.

[59 FR 31335, June 17, 1994. Redesignated and amended at 63 FR 56995, 57004, Oct. 23, 1998]

§ 89.120 Compliance with emission standards.

(a) If all test engines representing an engine family have emissions less than or equal to each emission standard, that family complies with the emission standards.

(b) If any test engine representing an engine family has emissions greater than each emission standard, that family will be deemed not in compliance with the emission standard(s).

(c) For each nonroad engine family, except Tier 1 engine families with rated power at or above 37 kW that do not employ aftertreatment, a deterioration factor must be determined and applied.

(1) The applicable exhaust emission standards (or family emission limits, as appropriate) for nonroad compression-ignition engines apply to the