

## § 1039.510

(1) Use the 5-mode duty cycle or the corresponding ramped-modal cycle described in Appendix II of this part for constant-speed engines. Note that these cycles do not apply to all engines used in constant-speed applications, as described in § 1039.801.

(2) Use the 6-mode duty cycle or the corresponding ramped-modal cycle described in Appendix III of this part for variable-speed engines below 19 kW. You may instead use the 8-mode duty cycle or the corresponding ramped-modal cycle described in Appendix IV of this part if some engines from your engine family will be used in applications that do not involve governing to maintain engine operation around rated speed.

(3) Use the 8-mode duty cycle or the corresponding ramped-modal cycle described in Appendix IV of this part for variable-speed engines at or above 19 kW.

(c) During idle mode, operate the engine with the following parameters:

(1) Hold the speed within your specifications.

(2) Set the engine to operate at its minimum fueling rate.

(3) Keep engine torque under 5 percent of maximum test torque.

(d) For full-load operating modes, operate the engine at its maximum fueling rate. However, for constant-speed engines whose design prevents full-load operation for extended periods, you may ask for approval under 40 CFR 1065.10(c) to replace full-load operation with the maximum load for which the engine is designed to operate for extended periods.

(e) See 40 CFR part 1065 for detailed specifications of tolerances and calculations.

(f) For those cases where transient testing is not necessary, perform the steady-state test according to this section after an appropriate warm-up period, consistent with 40 CFR part 1065, subpart F.

### § 1039.510 Which duty cycles do I use for transient testing?

(a) Measure emissions by testing the engine on a dynamometer with one of the following transient duty cycles to determine whether it meets the transient emission standards in § 1039.101(a):

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(1) For variable-speed engines, use the transient duty cycle described in Appendix VI of this part.

(2) [Reserved]

(b) The transient test sequence consists of an initial run through the transient duty cycle from a cold start, 20 minutes with no engine operation, then a final run through the same transient duty cycle. Start sampling emissions immediately after you start the engine. Calculate the official transient emission result from the following equation:

Official transient emission result =  $0.05 \times$  cold-start emission rate +  $0.95 \times$  hot-start emission rate.

[69 FR 39213, June 29, 2004, as amended at 70 FR 40463, July 13, 2005]

### § 1039.515 What are the test procedures related to not-to-exceed standards?

(a) *General provisions.* The provisions in 40 CFR 86.1370-2007 apply for determining whether an engine meets the not-to-exceed emission standards in § 1039.101(e). Interpret references to vehicles and vehicle operation to mean equipment and equipment operation.

(b) *Special PM zone.* For engines certified to a PM standard or FEL above 0.07 g/kW-hr, a modified NTE control area applies for PM emissions only. The speeds and loads to be excluded are determined based on speeds B and C, determined according to the provisions of 40 CFR 86.1360-2007(c). One of the following provisions applies:

(1) If the C speed is below 2400 rpm, exclude the speed and load points to the right of or below the line formed by connecting the following two points on a plot of speed-vs.-power:

(i) 30% of maximum power at the B speed; however, use the power value corresponding to the engine operation at 30% of maximum torque at the B speed if this is greater than 30% of maximum power at the B speed.

(ii) 70% of maximum power at 100% speed.

(2) If the C speed is at or above 2400 rpm, exclude the speed and load points to the right of the line formed by connecting the two points in paragraphs (b)(2)(i) and (ii) of this section (the 30% and 50% torque/power points) and

below the line formed by connecting the two points in paragraphs (b)(2)(ii) and (iii) of this section (the 50% and 70% torque/power points). The 30%, 50%, and 70% torque/power points are defined as follows:

- (i) 30% of maximum power at the B speed; however, use the power value corresponding to the engine operation at 30% of maximum torque at the B speed if this is greater than 30% of maximum power at the B speed.
- (ii) 50% of maximum power at 2400 rpm.
- (iii) 70% of maximum power at 100% speed.

**§ 1039.520 What testing must I perform to establish deterioration factors?**

Sections 1039.240 and 1039.245 describe the method for testing that must be performed to establish deterioration factors for an engine family.

**§ 1039.525 How do I adjust emission levels to account for infrequently regenerating aftertreatment devices?**

This section describes how to adjust emission results from engines using aftertreatment technology with infrequent regeneration events. For this section, "regeneration" means an intended event during which emission levels change while the system restores aftertreatment performance. For example, exhaust gas temperatures may increase temporarily to remove sulfur from adsorbers or to oxidize accumulated particulate matter in a trap. For this section, "infrequent" refers to regeneration events that are expected to occur on average less than once over the applicable transient duty cycle or ramped-modal cycle, or on average less than once per typical mode in a discrete-mode test.

(a) *Developing adjustment factors.* Develop an upward adjustment factor and a downward adjustment factor for each pollutant based on measured emission data and observed regeneration frequency. Adjustment factors should generally apply to an entire engine family, but you may develop separate adjustment factors for different engine configurations within an engine family. If you use adjustment factors for certification, you must identify the

frequency factor,  $F$ , from paragraph (b) of this section in your application for certification and use the adjustment factors in all testing for that engine family. You may use carryover or carry-across data to establish adjustment factors for an engine family, as described in §1039.235(d), consistent with good engineering judgment. All adjustment factors for regeneration are additive. Determine adjustment factors separately for different test segments. For example, determine separate adjustment factors for hot-start and cold-start test segments and for different modes of a discrete-mode steady-state test. You may use either of the following different approaches for engines that use aftertreatment with infrequent regeneration events:

(1) You may disregard this section if regeneration does not significantly affect emission levels for an engine family (or configuration) or if it is not practical to identify when regeneration occurs. If you do not use adjustment factors under this section, your engines must meet emission standards for all testing, without regard to regeneration.

(2) If your engines use aftertreatment technology with extremely infrequent regeneration and you are unable to apply the provisions of this section, you may ask us to approve an alternate methodology to account for regeneration events.

(b) *Calculating average adjustment factors.* Calculate the average adjustment factor ( $EF_A$ ) based on the following equation:

$$EF_A = (F)(EF_H) + (1-F)(EF_L)$$

Where:

$F$  = the frequency of the regeneration event in terms of the fraction of tests during which the regeneration occurs.

$EF_H$  = measured emissions from a test segment in which the regeneration occurs.

$EF_L$  = measured emissions from a test segment in which the regeneration does not occur.

(c) *Applying adjustment factors.* Apply adjustment factors based on whether regeneration occurs during the test run. You must be able to identify regeneration in a way that is readily apparent during all testing.

(1) If regeneration does not occur during a test segment, add an upward