

§ 86.1363–2007

40 CFR Ch. I (7–1–08 Edition)

§ 86.1363–2007 **Steady-state testing with a discrete-mode cycle.**

This section describes an alternate procedure for steady-state testing that

manufacturers may use through the 2009 model year.

(a) Use the following 13-mode cycle in dynamometer operation on the test engine:

Mode number	Engine speed <sup>1</sup>	Percent load <sup>2</sup>	Weighting factors	Mode length (minutes) <sup>3</sup>
1	Idle	.....	0.15	4
2	A	100	0.08	2
3	B	50	0.10	2
4	B	75	0.10	2
5	A	50	0.05	2
6	A	75	0.05	2
7	A	25	0.05	2
8	B	100	0.09	2
9	B	25	0.10	2
10	C	100	0.08	2
11	C	25	0.05	2
12	C	75	0.05	2
13	C	50	0.05	2

<sup>1</sup>Speed terms are defined in 40 CFR part 1065.

<sup>2</sup>The percent torque is relative to the maximum torque at the commanded test speed.

<sup>3</sup>The percent torque is relative to maximum torque at the commanded engine speed.

(b) Prior to beginning the test sequence, the engine must be warmed-up according to the procedures in § 86.1332–90(d)(3)(i) through (iv).

(c) The test must be performed in the order of the mode numbers in paragraph (a) of this section. Where applicable, the EPA-selected test points identified under § 86.1360–2007(b)(2) must be performed immediately upon completion of mode 13. The engine must be operated for the prescribed time in each mode, completing engine speed and load changes in the first 20 seconds of each mode. The specified speed must be held to within ±50 rpm and the specified torque must be held to within plus or minus two percent of the maximum torque at the test speed.

(d) One filter shall be used for sampling PM over the 13-mode test procedure. The modal weighting factors specified in paragraph (a) of this section shall be taken into account by taking a sample proportional to the exhaust mass flow during each individual mode of the cycle. This can be achieved by adjusting sample flow rate, sampling time, and/or dilution ratio, accordingly, so that the criterion for the effective weighting factors is met. The sampling time per mode must be at least 4 seconds per 0.01 weighting factor. Sampling must be conducted as late as possible within each mode. Particulate sampling shall be completed

no earlier than 5 seconds before the end of each mode.

(e) The test must be conducted with all emission-related engine control variables in the highest brake-specific NO<sub>x</sub> emissions state which could be encountered for a 30 second or longer averaging period at the given test point and for the conditions under which the engine is being tested.

(f) Manufacturers must follow the exhaust emissions sample analysis procedures under § 86.1340, and the calculation formulas and procedures under § 86.1342, for the 13-mode cycle and the 3 EPA-selected test points as applicable for steady-state testing, including the NO<sub>x</sub> correction factor for humidity.

(g) Calculate the weighted average emissions as follows:

(1) For each regulated gaseous pollutant, calculate the weighted average emissions using the following equation:

$$A_{WA} = 1 - \frac{\sum_{i=1}^N [A_{Mi} \cdot WF_i]}{\sum_{i=2}^N [A_{Pi} - WF_i]}$$

Where:

A<sub>WA</sub> = Weighted average emissions for each regulated gaseous pollutant, in grams per brake horse-power hour.

**Environmental Protection Agency**

**§ 86.1370-2007**

A<sub>M</sub> = Modal average mass emissions level, in grams per hour. Mass emissions must be calculated as described in §86.1342.

A<sub>P</sub> = Modal average power, in brake horsepower. Any power measured during the idle mode (mode 1) is not included in this calculation.

WF = Weighting factor corresponding to each mode of the steady-state test cycle, as defined in paragraph (a) of this section.

i = The modes of the steady-state test cycle defined in paragraph (a) of this section.

n = 13, corresponding to the 13 modes of the steady-state test cycle defined in paragraph (a) of this section.

(2) For PM measurements, a single filter must be used to measure PM over the 13 modes. The brake-specific PM emission level for the test must be calculated as described for a transient hot start test in §86.1343. Only the power measured during the sampling period shall be used in the calculation.

(h) The test fuel used for supplemental steady-state testing under this

section must meet the requirements of §86.1313.

(i) Ambient conditions, charge cooling specifications, and intake and exhaust restrictions for supplemental steady-state testing and maximum allowable emission limit testing under this section must meet the requirements of §86.1330.

[70 FR 40440, July 13, 2005]

EFFECTIVE DATE NOTE: At 73 FR 37193, June 30, 2008, §86.1363-2007 was amended by revising paragraph (a) and the equation in paragraph (g)(1), effective July 7, 2008. For the convenience of the user, the revised text is set forth as follows:

**§86.1363-2007 Steady-state testing with a discrete-mode cycle.**

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(a) Use the following 13-mode cycle in dynamometer operation on the test engine:

Mode No.	Engine speed <sup>1</sup>	Percent load <sup>2</sup>	Weighting factors	Mode length (minutes) <sup>3</sup>
1	Warm Idle		0.15	4
2	A	100	0.08	2
3	B	50	0.10	2
4	B	75	0.10	2
5	A	50	0.05	2
6	A	75	0.05	2
7	A	25	0.05	2
8	B	100	0.09	2
9	B	25	0.10	2
10	C	100	0.08	2
11	C	25	0.05	2
12	C	75	0.05	2
13	C	50	0.05	2

<sup>1</sup> Speed terms are defined in 40 CFR part 1065.

<sup>2</sup> The percent torque is relative to the maximum torque at the commanded test speed.

<sup>3</sup> Upon Administrator approval, the manufacturer may use other mode lengths.

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(g) \* \* \*

(1) \* \* \*

$$A_{WA} = \frac{\sum_{i=1}^N [A_{Mi} \cdot WF_i]}{\sum_{i=2}^N [A_{Pi} \cdot WF_i]}$$

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**§86.1370-2007 Not-To-Exceed test procedures.**

(a) *General.* The purpose of this test procedure is to measure in-use emis-

sions of heavy-duty diesel engines while operating within a broad range of speed and load points (the Not-To-Exceed Control Area) and under conditions which can reasonably be expected to be encountered in normal vehicle operation and use. Emission results from this test procedure are to be compared to the Not-To-Exceed Limits specified in §86.007-11(a)(4), or to later Not-To-Exceed Limits. The Not-To-Exceed Limits do not apply for engine-starting conditions. Tests conducted using the procedures specified in §86.1301 are considered valid Not-To-Exceed tests (NOTE: duty cycles and limits on ambient conditions do not apply for Not-To-Exceed tests).