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and liquefied petroleum gas-fueled diesel heavy-duty engines.

[59 FR 48521, Sept. 21, 1994]

§ 86.884-2 Definitions.

The definitions in § 86.084-2 apply to this subpart.

§ 86.884-3 Abbreviations.

The abbreviations in § 86.078-3 apply to this subpart.

§ 86.884-4 Section numbering.

The section numbering system set forth in § 86.084-4 applies to this subpart.

[48 FR 52203, Nov. 16, 1983, as amended at 59 FR 48521, Sept. 21, 1994]

§ 86.884-5 Test procedures.

The procedures described in this and subsequent sections will be the test program to determine the conformity of engines with the standards set forth in § 86.084-11(b).

(a) The test consists of a prescribed sequence of engine operating conditions on an engine dynamometer with continuous examination of the exhaust gases. The test is applicable equally to controlled engines equipped with means for preventing, controlling, or eliminating smoke emissions and to uncontrolled engines.

(b) The test is designed to determine the opacity of smoke in exhaust emissions during those engine operating conditions which tend to promote smoke from diesel vehicles.

(c) The test procedure begins with a preconditioned engine which is then run through preloading and preconditioning operations. After an idling period, the engine is operated through acceleration and lugging modes during which smoke emission measurements are made to compare with the standards. The engine is then returned to the idle condition and the acceleration and lugging modes are repeated. Three consecutive sequences of acceleration and lugging constitutes the full set of operating conditions for smoke emission measurement.

(d)(1) Except in cases of component malfunction or failure, all emission control systems installed on, or incorporated in, a new motor vehicle engine

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shall be functioning during all procedures in this subpart.

(2) Maintenance to correct component malfunction or failure shall be authorized in accordance with § 86.084-25.

[48 FR 52203, Nov. 16, 1983, as amended at 49 FR 48140, Dec. 10, 1984; 54 FR 14559, Apr. 11, 1989]

§ 86.884-6 Fuel specifications.

The requirements of this section are set forth in § 86.1313.

[54 FR 14559, Apr. 11, 1989]

§ 86.884-7 Dynamometer operation cycle for smoke emission tests.

(a) The following sequence of operations shall be performed during engine dynamometer testing of smoke emissions, starting with the dynamometer preloading determined and the engine preconditioned (§ 86.884-12(c)).

(1) *Idle Mode.* The engine is caused to idle for 5.0 to 5.5 minutes at the manufacturer's recommended curb idle speed. The dynamometer controls shall be set to provide the speed and load necessary to comply with the heavy-duty "curb idle" definition per § 86.084-2, in accordance with predominant engine application.

(2) *Acceleration mode.* (i) The engine speed shall be increased to 200 ± 50 rpm above the measured free idle speed measured at the point where the throttle begins to move from part-throttle to the full throttle position. The speed anywhere during this mode should not exceed this checkpoint speed by more than 50 rpm. The duration of this first acceleration shall be three seconds or less measured from the point where the speed first begins to increase above idle to the point where the throttle reaches full open position.

(ii) Immediately upon completion of the mode specified in paragraph (a)(2)(i) of this section, the throttle shall be moved rapidly to, and held in, the fully open position. The inertia of the engine and the dynamometer, or alternately a preselected dynamometer load, shall be used to control the acceleration of the engine so that the speed increases to 85 percent of the rated speed in 5 ± 1.5 seconds. This acceleration shall be linear within 100 rpm as specified in § 86.884-13(c).

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(iii) After the engine reaches the speed required in paragraph (a)(2)(ii) of this section the throttle shall be moved rapidly to, and held in, the fully closed position. Immediately after the throttle is closed, the preselected load required to perform the acceleration in paragraph (a)(2)(iv) of this section shall be applied. For electric motoring dynamometer operation in speed mode, the deceleration shall be performed in 2 ± 1.5 seconds.

(iv) When the engine decelerates to the intermediate speed (within 50 rpm), the throttle shall be moved rapidly to, and held in, the fully open position. The preselected dynamometer load which was applied during the preceding transition period shall be used to control the acceleration of the engine so that the speed increases to at least 95 percent of the rated speed in 10 ± 2 seconds.

(v) For electric dynamometer operation in speed mode, motoring assist may be used to offset excessive dynamometer inertia load when necessary. No negative flywheel torque shall occur during any of the three acceleration modes in paragraph (a)(2) of this section except for a maximum of 10ft-lbs. for the first 0.5 second of the mode.

(3) *Lugging mode.* (i) Immediately upon the completion of the preceding acceleration mode, the dynamometer controls shall be adjusted to permit the engine to develop maximum horsepower at rated speed. This transition period shall be 50 to 60 seconds in duration. During the last 10 seconds of this period, the average engine speed shall be maintained within 50 rpm of the rated speed, and the average observed power (corrected, if necessary, to rating conditions) shall be no less than 95 percent of the maximum horsepower developed during the preconditioning prior to the smoke cycle.

(ii) With the throttle remaining in the fully open position, the dynamometer controls shall be adjusted gradually so that the engine speed is reduced to the intermediate speed. This lugging operation shall be performed smoothly over a period of 35 ± 5 seconds. The rate of slowing of the engine shall be linear, within 100 rpm, as specified in § 86.884-13(c).

(4) *Engine unloading.* Within five seconds of completing the preceding lugging mode, the dynamometer and engine controls shall be returned to the idle position described in paragraph (a)(1) of this section. The engine must be at free idle condition within one minute after completion of the lugging mode.

(b) The procedures described in paragraphs (a)(1) through (a)(4) of this section shall be repeated until three consecutive valid cycles have been completed. If three valid cycles have not been completed after a total of six consecutive cycles have been run, the engine shall be preconditioned by operation at maximum horsepower at rated speed for 10 minutes before the test sequence is repeated.

[48 FR 52203, Nov. 16, 1983, as amended at 49 FR 48141, Dec. 10, 1984; 52 FR 47870, Dec. 16, 1987; 62 FR 47122, Sept. 5, 1997]

§ 86.884-8 Dynamometer and engine equipment.

The following equipment shall be used for smoke emission testing of engines on engine dynamometers:

(a) An engine dynamometer with adequate characteristics to perform the test cycle described in § 86.884-7.

(b) An engine cooling system having sufficient capacity to maintain the engine at normal operating temperatures during conduct of the prescribed engine tests.

(c) An exhaust system with an appropriate type of smoke meter placed 10 to 32 feet from the exhaust manifold(s), turbocharger outlet(s), exhaust aftertreatment device(s), or crossover junction (on Vee engines), whichever is farthest downstream. The smoke exhaust system can share the same hardware required in part 86, subpart N, § 86.1327-84(f)(2), insofar as that hardware also meets the following smoke test requirements. The smoke exhaust system shall present an exhaust backpressure within +0.2 inch Hg of the upper limit at maximum rated horsepower, as established by the engine manufacturer in his sales and service literature for vehicle application. The following options may also be used:

(1) For engines with multiple exhaust outlets, join the exhaust outlets together into a single exhaust system