

analytical system and process the samples according to § 86.140-94 obtaining a stabilized reading of the bag exhaust sample on all analyzers within 20 minutes of the end of the sample collection phase of the test.

(xiii) Immediately after the end of the sample period, turn off the cooling fan, close the engine compartment cover, disconnect the exhaust tube from the vehicle tailpipe(s), and drive the vehicle from dynamometer.

(xiv) The CVS or CFV may be turned off, if desired.

[71 FR 77920, Dec. 27, 2006, as amended at 74 FR 61548, Nov. 25, 2009]

**§ 86.160-00 Exhaust emission test procedure for SC03 emissions.**

(a) *Overview.* The dynamometer operation consists of a single, 600 second test on the SC03 driving schedule, as described in appendix I, paragraph (h), of this part. The vehicle is preconditioned, in accordance with § 86.132-00 of this subpart, to bring the vehicle to a warmed-up stabilized condition. This preconditioning is followed by a 10 minute vehicle soak (engine off) that proceeds directly into the SC03 driving schedule, during which continuous proportional samples of gaseous emissions are collected for analysis. The entire test, including the preconditioning driving, vehicle soak, and SC03 official test cycle, is either conducted in an environmental test facility or under test conditions that simulates testing in an environmental test cell (see § 86.162-00 (a) for a discussion of simulation procedure approvals). The environmental test facility must be capable of providing the following nominal ambient test conditions of: 95 °F air temperature, 100 grains of water/pound of dry air (approximately 40 percent relative humidity), a solar heat load intensity of 850 W/m<sup>2</sup>, and vehicle cooling air flow proportional to vehicle speed. Section 86.161-00 discusses the minimum facility requirements and corresponding control tolerances for air conditioning ambient test conditions. The vehicle's air conditioner is operated or appropriately simulated for the duration of the test procedure (except for the vehicle 10 minute soak), including the preconditioning. For gasoline-fueled Otto-cycle vehicles, the

composite samples collected in bags are analyzed for THC, CO, CO<sub>2</sub>, CH<sub>4</sub>, and NO<sub>x</sub>. For petroleum-fueled diesel-cycle vehicles, THC is sampled and analyzed continuously according to the provisions of § 86.110. Parallel bag samples of dilution air are analyzed for THC, CO, CO<sub>2</sub>, CH<sub>4</sub>, and NO<sub>x</sub>.

(b) *Dynamometer activities.* (1) All official air conditioning tests shall be run on a large single roll electric dynamometer or an equivalent dynamometer configuration that satisfies the requirements of § 86.108-00.

(2) Position (vehicle can be driven) the test vehicle on the dynamometer and restrain.

(3) Required SC03 schedule test dynamometer inertia weight class selections are determined by the test vehicles test weight basis and corresponding equivalent weight as listed in the tabular information of § 86.129-00(a) and discussed in § 86.129-00 (e) and (f).

(4) Set the dynamometer test inertia weight and roadload horsepower requirements for the test vehicle (see § 86.129-00 (e) and (f)). The dynamometer's horsepower adjustment settings shall be set such that the force imposed during dynamometer operation matches actual road load force at all speeds.

(5) The vehicle speed as measured from the dynamometer rolls shall be used. A speed vs. time recording, as evidence of dynamometer test validity, shall be supplied at request of the Administrator.

(6) The drive wheel tires may be inflated up to a gauge pressure of 45 psi (310 kPa), or the manufacturer's recommended pressure if higher than 45 psi, in order to prevent tire damage. The drive wheel tire pressure shall be reported with the test results.

(7) The driving distance, as measured by counting the number of dynamometer roll or shaft revolutions, shall be determined for the test.

(8) Four-wheel drive and all-wheel drive vehicles may be tested either in a four-wheel drive or a two-wheel drive mode of operation. In order to test in the two-wheel drive mode, four-wheel drive and all-wheel drive vehicles may have one set of drive wheels disengaged; four-wheel and all-wheel drive

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vehicles which can be shifted to a two-wheel mode by the driver may be tested in a two-wheel drive mode of operation.

(c) *Vehicle and test activities for testing in a full environmental cell.* The SFTP air conditioning test in an environmental test cell is composed of the following sequence of activities. Alternative procedures which appropriately simulate full environmental cell testing may be approved under the provisions of §§ 86.162-00(a) and 86.163-00.

(1) Drain and fill the vehicle's fuel tank to 40 percent capacity with test fuel. If a vehicle has gone through the drain and fuel sequence less than 72 hours previously and has remained under laboratory ambient temperature conditions, this drain and fill operation can be omitted (see § 86.132-00(c)(2)(ii)).

(2)(i) Position the variable speed cooling fan in front of the test vehicle with the vehicle's hood down. This air flow should provide representative cooling at the front of the test vehicle (air conditioning condenser and engine) during the SC03 driving schedule. See § 86.161-00(e) for a discussion of cooling fan specifications.

(ii) In the case of vehicles with rear engine compartments (or if this front location provides inadequate engine cooling), an additional cooling fan shall be placed in a position to provide sufficient air to maintain vehicle cooling. The fan capacity shall normally not exceed 5300 cfm (2.50 m<sup>3</sup>/s). If, however, it can be demonstrated that during road operation the vehicle receives additional cooling, and that such additional cooling is needed to provide a representative test, the fan capacity may be increased or additional fans used if approved in advance by the Administrator.

(3) Close all vehicle windows.

(4) Connect the emission test sampling system to the vehicle's exhaust tail pipe(s).

(5)(i) Set the environmental test cell ambient test conditions to the conditions defined in § 86.161-00.

(ii) Turn on the solar heating system.

(iii) All vehicle test phases of preconditioning, soak, and the official SC03 test cycle are to be performed in this set of ambient test conditions.

(6) Set the air conditioning system controls as follows:

(i) A/C mode setting at Maximum.

(ii) Airflow setting at Recirculate, if so equipped.

(iii) Fan setting at Highest setting.

(iv) A/C Temperature setting at full cool (for automatic systems set at 72 °F).

(v) Air conditioning controls should be placed in the "on" position prior to vehicle starting so that the air conditioning system is active whenever the engine is running.

(7) Start the vehicle (with air conditioning system on) and conduct a preconditioning cycle as discussed in § 86.132-00(o)(1).

(i) If engine stalling should occur during any air conditioning test cycle operation, follow the provisions of § 86.136-90 (Engine starting and restarting).

(ii) For manual transmission vehicles, the vehicle shall be shifted according to the provisions of § 86.128-00.

(8) Following the preconditioning cycle, the test vehicle (and consequently the air conditioning system) and cooling fan(s) are turned off and the vehicle is allowed to soak in the ambient conditions of paragraph (c)(5) of this section for 10 ±1 minutes.

(9) Start engine (with air conditioning system also running). Fifteen seconds after the engine starts, place vehicle in gear.

(10) Eighteen seconds after the engine starts, begin the initial vehicle acceleration of the driving schedule.

(11) Operate the vehicle according to the SC03 driving schedule, as described in appendix I, paragraph (h), of this part.

(12) Turn the engine off 2 seconds after the end of the last deceleration (i.e., engine off at 596 seconds).

(d) *Exhaust Emission Measurement Activities.* The following activities are performed, when applicable, in order to meet the timing of the vehicle test and environmental facility activities.

(1) Perform the test bench sampling calibration sequence outlined in § 86.140-94 prior to or in conjunction with each series of exhaust emission measurements.

(2) With the sample selector valves in the "standby" position, connect evacuated sample collection bags to the dilute exhaust and dilution air sample collection systems.

(3) Start the CVS (if not already on), the sample pumps, the temperature recorder, the vehicle cooling fan, and the heated THC analysis recorder (diesel-cycle only). The heat exchanger of the constant volume sampler, if used, petroleum-fueled diesel-cycle THC analyzer continuous sample line should be preheated to their respective operating temperatures before the test begins.

(4) Adjust the sample flow rates to the desired flow rate and set the gas flow measuring devices to zero.

(i) For gaseous bag samples (except THC samples), the minimum flow rate is 0.17 cfm (0.08 liters/sec).

(ii) For THC samples, the minimum FID (or HFID in the case of diesel-cycle vehicles) flow rate is 0.066 cfm (0.031 l/sec).

(iii) CFV sample flow rate is fixed by the venturi design.

(5) Attach the exhaust tube to the vehicle tailpipe(s).

(6) Start the gas flow measuring device, position the sample selector valves to direct the sample flow into the exhaust sample bag, the dilution air sample bag, turn on the petroleum-fueled diesel-cycle THC analyzer system integrator, mark the recorder chart, and record both gas meter or flow measurement instrument readings, if applicable.

(7) Start the engine (with air conditioning system also running). Fifteen seconds after the engine starts, place vehicle in gear.

(8) Twenty seconds after the engine starts, begin the initial vehicle acceleration of the driving schedule.

(9) Operate the vehicle according to the SC03 driving schedule.

(10) Turn the engine off 2 seconds after the end of the last deceleration (i.e., engine off at 596 seconds).

(11) Five seconds after the engine stops running, simultaneously turn off gas flow measuring device No. 1 (and the petroleum-fueled diesel hydrocarbon integrator No. 1 and mark the petroleum-fueled diesel hydrocarbon recorder chart if applicable) and position the sample selector valves to the

"standby" position. Record the measured roll or shaft revolutions and the No. 1 gas meter reading or flow measurement instrument).

(12) As soon as possible, transfer the exhaust and dilution air bag samples to the analytical system and process the samples according to §86.140 obtaining a stabilized reading of the bag exhaust sample on all analyzers within 20 minutes of the end of the sample collection phase of the test.

(13) Immediately after the end of the sample period, turn off the cooling fan, disconnect the exhaust tube from the vehicle tailpipe(s), and drive the vehicle from dynamometer.

(14) The CVS or CFV may be turned off, if desired.

(e) *NO<sub>x</sub> humidity correction.* Calculated NO<sub>x</sub> exhaust emissions from air conditioning tests conducted in an environmental test cell at a nominal 100 grains of water/pound of dry air are to be corrected for humidity to 100 grains of water/pound of dry air (see the relationship of §86.164-00(d)).

[61 FR 54895, Oct. 22, 1996, as amended at 70 FR 40434, July 13, 2005; 70 FR 72928, Dec. 8, 2005]

#### §86.161-00 Air conditioning environmental test facility ambient requirements.

The goal of an air conditioning test facility is to simulate the impact of an ambient heat load on the power requirements of the vehicle's air conditioning compressor while operating on a specific driving cycle. The environmental facility control elements that are discussed are ambient air temperature and humidity, minimum test cell size, solar heating, and vehicle frontal air flow.

(a) *Ambient air temperature.* (1) Ambient air temperature is controlled, within the test cell, during all phases of the air conditioning test sequence to 95 ±2 °F on average and 95 ±5 °F as an instantaneous measurement.

(2) Air temperature is recorded continuously at a minimum of 30 second intervals. Records of cell air temperatures and values of average test temperatures are maintained by the manufacturer for all certification related programs.