

(16) Connect evacuated sample collection bags to the dilute exhaust and dilution air sample collection systems.

(17) Install fresh methanol and formaldehyde impingers (or capsules) in the exhaust and dilution air sample systems for methanol and formaldehyde.

(18) Start the CVS (if not already on) or connect the exhaust system to the CVS (if disconnected). Start the sample pumps (except the particulate sample pump(s), if applicable), the engine cooling fan(s) and the data collection system. The heat exchanger of the constant volume sampler (if used) and the heated components of any continuous sampling system(s) (if applicable) shall be preheated to their designated operating temperatures before the test begins. See §86.1340(e) for continuous sampling procedures.

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

(20) For diesel engines tested for particulate, carefully install a clean particulate filter in each of the filter holders and install assembled filter holders in the sample flow line (filter holders may be preassembled).

(21) Follow the manufacturer's choke and throttle instruction for hot starting. Simultaneously start the engine and begin exhaust and dilution air sampling. For diesel engines, turn on the hydrocarbon and NO<sub>x</sub> (and CO and CO<sub>2</sub>, if continuous) analyzer system integrator (if used), indicate the start of the test on the data collection medium, and turn on the particulate sample pump(s).

(22) As soon as it is determined that the engine is started, start a "free idle" timer.

(23) Allow the engine to idle freely with no-load for 24±1 seconds. The provisions and interpretations of paragraph (a)(9) of this section apply.

(24) Begin the transient-engine cycle such that the first non-idle record of the cycle occurs at 25±1 seconds. The free idle is included in the 25±1 seconds.

(25) On the last record of the cycle, allow sampling system response times to elapse and cease sampling. Turn off the particulate sample pump(s) (if appropriate), the gas flow measuring device(s) and any continuous analyzer system integrator and indicate the end

of the test on the data collection medium.

(26) As soon as possible, transfer the "hot start cycle" exhaust and dilution air bag samples to the analytical system and process the samples according to §86.1340. A stabilized reading of the exhaust sample on all analyzers shall be obtained within 20 minutes of the end of the sample collection phase of the test. Analyze the methanol and formaldehyde samples within 24 hours. (If it is not possible to perform analysis within 24 hours, the samples should be stored in a cold (approximately 0 °C) dark environment until analysis can be performed). For petroleum-fueled and methanol-fueled diesel engines, carefully remove the assembled filter holder from the sample flow lines and remove each particulate sample filter from its holder and invert the secondary filter and place it stain side to stain side on top of the primary filter. Place the filter pairs in a clean petri dish and cover as soon as possible. Within 1 hour after the end of the hot start phase of the test, transfer the particulate filters to the weighing chamber for post-test conditioning.

(27) The CVS and the engine may be turned off, if desired.

(b) The procedure in paragraph (a) of this section is designed for one sample bag for the cold start portion and one for the hot start portion. It is also permissible to use more than one sample bag per test portion.

(c) If a dynamometer test run is determined to be void, corrective action may be taken. The engine may then be allowed to cool (naturally or forced) and the dynamometer test rerun per paragraph (a) or (b) of this section.

[58 FR 16065, Mar. 24, 1993, as amended at 59 FR 48533, Sept. 21, 1994; 60 FR 34375, June 30, 1995; 62 FR 47133, Sept. 5, 1997]

#### § 86.1337-2007 Engine dynamometer test run.

(a) The following steps shall be taken for each test:

(1) Prepare for the cold-start test.

(i) For gasoline- and methanol-fueled engines only, evaporative emission canisters shall be prepared for use in this testing in accordance with the procedures specified in §86.1232-96 (h) or (j). The size of the canisters used for

testing shall correspond with the largest canister capacity expected in the range of vehicle applications for each engine. (The Administrator may, at his/her discretion, use a smaller canister capacity.) Attach the evaporative emission canister(s) to the engine, using the canister purge plumbing and controls employed in vehicle applications of the engine being tested. Plug the canister port that is normally connected to the fuel tank.

(ii) Prepare the engine, dynamometer, and sampling system.

(iii) Change filters, etc., and leak check as necessary.

(2) Connect evacuated sample collection bags to the dilute exhaust and dilution air sample collection systems if bag sampling is used.

(3) For methanol-fueled vehicles, install fresh methanol and formaldehyde impingers (or cartridges) in the exhaust and dilution air sample systems for methanol and formaldehyde. A single dilution air sample covering the total test period may be utilized for methanol and formaldehyde background. (Background measurements of methanol and formaldehyde may be omitted and concentrations assumed to be zero for calculations in § 86.1344.)

(4) Attach the CVS to the engine exhaust system any time prior to starting the CVS.

(5) Start the CVS (if not already on), the sample pumps (except for the particulate sample pump(s), if applicable), the engine cooling fan(s), and the data collection system. The heat exchanger of the constant volume sampler (if used), and the heated components of any continuous sampling system(s) (if applicable) shall be preheated to their designated operating temperatures before the test begins. (See § 86.1340(e) for continuous sampling procedures.)

(6) Adjust the sample flow rates to the desired flow rates and set the CVS gas flow measuring devices to zero. CFV-CVS sample flow rate is fixed by the venturi design.

(7) For engines tested for particulate emissions, carefully install a clean, loaded particulate sample filter cartridge into the filter holder assembly. It is recommended that this be done within the filter stabilization environment, with both ends of the filter hold-

er assembly plugged during transport to the emissions test facility. Install the assembled filter holder into the sample flow line.

(8) Follow the manufacturer's instructions for cold starting. Simultaneously start the engine and begin exhaust and dilution air sampling. For petroleum-fueled diesel engines (and natural gas-fueled, liquified petroleum gas-fueled or methanol-fueled diesels, if used) Turn on the hydrocarbon and NO<sub>x</sub> (and CO and CO<sub>2</sub>, if continuous) analyzer system integrators (if used), and turn on the particulate sample pumps and indicate the start of the test on the data collection medium.

(9) Allow the engine to idle freely with no-load for 24±1 seconds. This idle period for automatic transmission engines may be interpreted as an idle speed in neutral or park. All other idle conditions shall be interpreted as an idle speed in gear. It is permissible to lug the engine down to curb idle speed during the last 8 seconds of the free idle period for the purpose of engaging dynamometer control loops.

(10) Begin the transient engine cycles such that the first non-idle record of the cycle occurs at 25±1 seconds. The free idle time is included in the 25±1 seconds.

(i) During particulate sampling it must be demonstrated that the ratio of main tunnel flow to particulate sample flow does not change by more than ±5.0 percent of its set point value (except for the first 10 seconds of sampling). For double dilution operation, sample flow is the net difference between the flow rate through the sample filters and the secondary dilution air flow rate.

(ii) Record flow. If the set flow rate cannot be maintained because of high particulate loading on the filter, the test shall be terminated. The test shall be rerun using a lower sample flow rate or greater dilution.

(11) Begin the transient engine cycles such that the first non-idle record of the cycle occurs at 25±1 seconds. The free idle time is included in the 25±1 seconds.

(12) On the last record of the cycle, cease sampling. Immediately turn the engine off and start a hot-soak timer. Also turn off the particulate sample

pumps, the gas flow measuring device(s) and any continuous analyzer system integrator and indicate the end of the test on the data collection medium. Sampling systems should continue to sample after the end of the test cycle until system response times have elapsed.

(13) Immediately after the engine is turned off, turn off the engine cooling fan(s) if used. As soon as possible, transfer the "cold start cycle" exhaust and dilution air bag samples to the analytical system and process the samples according to §86.1340. A stabilized reading of the exhaust sample on all analyzers shall be obtained within 20 minutes of the end of the sample collection phase of the test. Analysis of the methanol and formaldehyde samples shall be obtained within 24 hours of the end of the sample collection period. For particulate measurements, carefully remove the filter holder from the sample flow apparatus

(14) Allow the engine to soak for 20±1 minutes.

(15) Prepare the engine and dynamometer for the hot start test.

(16) Connect evacuated sample collection bags to the dilute exhaust and dilution air sample collection systems.

(17) Install fresh methanol and formaldehyde impingers (or capsules) in the exhaust and dilution air sample systems for methanol and formaldehyde.

(18) Start the sample pumps (except the particulate sample pump(s), if applicable), the engine cooling fan(s) and the data collection system. The heat exchanger of the constant volume sampler (if used) and the heated components of any continuous sampling system(s) (if applicable) shall be preheated to their designated operating temperatures before the test begins. See §86.1340(e) for continuous sampling procedures.

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

(20) For diesel engines tested for particulate, carefully install a clean, loaded particulate sample filter cartridge in the filter holder assembly and install the filter holder assembly in the sample flow line.

(21) Follow the manufacturer's choke and throttle instruction for hot start-

ing. Simultaneously start the engine and begin exhaust and dilution air sampling. For diesel engines, turn on the hydrocarbon and NO<sub>x</sub> (and CO and CO<sub>2</sub>, if continuous) analyzer system integrator (if used), indicate the start of the test on the data collection medium, and turn on the particulate sample pump(s).

(22) [Reserved]

(23) Allow the engine to idle freely with no-load for 24±1 seconds. The provisions and interpretations of paragraph (a)(9) of this section apply.

(24) Begin the transient-engine cycle such that the first non-idle record of the cycle occurs at 25±1 seconds. The free idle is included in the 25±1 seconds.

(25) On the last record of the cycle, allow sampling system response times to elapse and cease sampling. Turn off the particulate sample pump(s) (if appropriate), the gas flow measuring device(s) and any continuous analyzer system integrator and indicate the end of the test on the data collection medium.

(26) As soon as possible, transfer the "hot start cycle" exhaust and dilution air bag samples to the analytical system and process the samples according to §86.1340. A stabilized reading of the exhaust sample on all analyzers shall be obtained within 20 minutes of the end of the sample collection phase of the test. Analyze the methanol and formaldehyde samples within 24 hours. (If it is not possible to perform analysis within 24 hours, the samples should be stored in a cold (approximately 0 deg.C) dark environment until analysis can be performed). For particulate measurements, carefully remove the filter holder assembly. It is recommended that the filter cartridge be transferred to and from the filter stabilization environment within the filter holder assembly with both ends plugged, and that the cartridge be removed from the filter holder assembly within the stabilization environment. Transfer the particulate filter to the stabilization environment for post-test stabilization. Filters may be stabilized in the petri dishes while still within the filter cartridges, or the cartridge tops may be removed for stabilization, or the filters may be entirely removed

from the filter cartridges and stabilized in the petri dishes alone. Removal of the filters from the filter cartridges shall only take place within the stabilization environment.

(27) The CVS and the engine may be turned off, if desired.

(b) The procedure in paragraph (a) of this section is designed for one sample bag for the cold start portion and one for the hot start portion.

(c) If a dynamometer test run is determined to be void, corrective action may be taken. The engine may then be allowed to cool (naturally or forced) and the dynamometer test rerun.

[66 FR 5186, Jan. 18, 2001]

**§ 86.1338-84 Emission measurement accuracy.**

(a) *Measurement accuracy—Bag sampling.* (1) Good engineering practice dictates that exhaust emission sample analyzer readings below 15 percent of full scale chart deflection should generally not be used.

(2) Some high resolution read-out systems such as computers, data loggers, etc., can provide sufficient accuracy and resolution below 15 percent of full scale. Such systems may be used provided that additional calibrations of at least 4 non-zero nominally equally spaced points, using good engineering judgement, below 15 percent of full scale are made to ensure the accuracy of the calibration curves.

(3) The following procedure shall be followed:

(i) Span the analyzer using a calibration gas that meets the accuracy requirements of § 86.1314-84(f)(2), is within the operating range of the analyzer and at least 90% of full scale.

(ii) Generate calibration data over the full concentration range at a minimum of 6, approximately equally spaced, points (e.g. 15, 30, 45, 60, 75 and 90 percent of the range of concentrations provided by the gas divider). If a gas divider or blender is being used to calibrate the analyzer and the requirements of paragraph (a)(2) of this section are met, verify that a second calibration gas with a concentration between 10 and 20 percent of full scale can be named within 2 percent of its certified concentration. If more calibration points are needed to meet the re-

quirements of paragraph (a)(2) of this section, continue with paragraph (a)(3)(iii) of this section.

(iii) If a gas divider or blender is being used to calibrate the analyzer, input the value of a second calibration gas (a span gas may be used for calibrating a CO<sub>2</sub> analyzer) having a named concentration between 10 and 20 percent of full scale. This gas shall be included on the calibration curve. Continue adding calibration points by dividing this gas until the requirements of paragraph (a)(2) of this section are met.

(iv) Fit a calibration curve per §§ 86.1321 through 86.1324 for the full scale range of the analyzer using the calibration data obtained with both calibration gases.

(b) *Measurement accuracy—Continuous sampling.* (1) Analyzers used for continuous analysis must be operated such that the measured concentration falls between 15 and 100 percent of full scale chart deflection. Exceptions to these limits are:

(i) Analyzer response less than 15 percent or more than 100 percent of full scale may be used if automatic range change circuitry is used and the limits for range changes are between 15 and 100 percent of full scale chart deflection;

(ii) Analyzer response less than 15 percent of full scale may be used if one of the following is true:

(A) Alternative (a)(2) of this section is used to ensure that the accuracy of the calibration curve is maintained below 15 percent; or

(B) The full scale value of the range is 155 ppm (C) or less.

(iii) Analyzer response over 100% of full scale may be used if it can be shown that readings in this range are accurate.

(iv) The HC and CO readings are allowed to “spike” above full scale of the analyzer’s maximum operating range for a maximum accumulation of 5 seconds. These analyzer readings shall default to the maximum readable value during this time.

(c) If a gas divider is used, the gas divider shall conform to the accuracy requirements specified in § 86.1314-84(g),