

(2) *Automatic control.* For vehicles with automatic control systems running in automatic mode, set the temperature to 72 °F and the air flow control to the front window defrost mode for the whole test.

(3) *Multiple-zone systems.* For vehicles that have separate driver and passenger controls or separate front and rear controls, you must set all temperature and fan controls as described in paragraphs (c)(1) and (2) of this section, except that rear controls need not be set to defrost the front window.

(4) *Alternative test procedures.* We may approve the use of other settings under 40 CFR 86.1840 if a vehicle's climate control system is not compatible with the provisions of this section.

(d) Take the following steps to prepare and precondition vehicles for testing under this section:

(1) Prepare the vehicle as described in §1066.810(a).

(2) Fill the fuel tank to approximately 40% of the manufacturer's nominal fuel tank capacity with the appropriate test fuel for cold temperature testing as specified 40 CFR Part 1065, subpart H. The temperature of the dispensed test fuel must be at or below 15.5 °C. If the leftover fuel in the fuel tank before the refueling event does not meet these specifications, drain the fuel tank before refueling. You may operate the vehicle prior to the preconditioning drive to eliminate fuel effects on adaptive memory systems.

(3) You may start the preconditioning drive once the fuel in the fuel tank reaches (12.6 to –1.4) °C. Precondition the vehicle as follows:

(i) Push or drive the vehicle onto the dynamometer.

(ii) Operate the vehicle over one UDDS. You may perform additional vehicle preconditioning with repeated driving over the UDDS, subject to our advance approval.

(iii) Turn off the test vehicle and any cooling fans within 5 minutes after completing the preconditioning drive. Ambient temperature must be between (–12.0 and –1.0) °C in the 5 minutes following the preconditioning drive.

(iv) Do not manually purge or load the evaporative canister.

(e) Soak the vehicle for (12 to 36) hours to stabilize it at test tempera-

tures before starting the emission test as described in this paragraph (e). If you move a stabilized vehicle through a warm area when transporting it to the dynamometer for testing, you must restabilize the vehicle by holding it at an ambient temperature within the range specified in paragraph (b)(1) of this section for at least six times as long as the vehicle was exposed to warmer temperatures. Use one of the following methods to reach a stabilized condition:

(1) *Cold storage.* Measure and record ambient temperature in the test cell at least once every 60 seconds during the ambient cold soak period. These ambient temperatures may be above –4.0 °C or below –9.0 °C, but not for more than 3 minutes at a time. Use measured values to calculate an hourly average temperature. Each hourly average temperature must be (–7.0 °C ±2.8) °C.

(2) *Forced-cooling or warming.* Position fans to blow temperature-controlled air onto the vehicle to stabilize the vehicle at the specified temperatures for emission testing. Position fans to target the vehicle's drive train, engine block, and radiator rather than the oil pan. You may not place fans under the vehicle. You may consider the vehicle to be stabilized at the test temperature when the bulk oil temperature reaches (–8.7 to –5.3) °C; measure oil temperature at one or more points away from the side or bottom surfaces of the oil pan. Each oil temperature measurement must be within the specified range before stabilization is complete. Once the vehicle reaches this stabilized condition, cold soak the vehicle within the stabilized temperature range for at least one hour before starting the emission test. During this time, keep the ambient temperature within the range specified in paragraph (b)(1) of this section.

[79 FR 23823, Apr. 28, 2014, as amended at 80 FR 9122, Feb. 19, 2015]

Subpart I—Exhaust Emission Test Procedures for Motor Vehicles

§ 1066.801 Applicability and general provisions.

This subpart I specifies how to apply the test procedures of this part for light-duty vehicles, light-duty trucks, and heavy-duty vehicles at or below

14,000 pounds GVWR that are subject to chassis testing for exhaust emissions under 40 CFR Part 86, subpart S. For these vehicles, references in this part 1066 to the standard-setting part include this subpart I.

(a) Use the procedures detailed in this subpart to measure vehicle emissions over a specified drive schedule in conjunction with subpart E of this part. Where the procedures of subpart E of this part differ from this subpart I, the provisions in this subpart I take precedence.

(b) Collect samples of every pollutant for which an emission standard applies, unless specified otherwise.

(c) This subpart covers the following test procedures:

(1) The Federal Test Procedure (FTP), which includes the general driving cycle. This procedure is also used for measuring evaporative emissions. This may be called the conventional test since it was adopted with the earliest emission standards.

(i) The FTP consists of one Urban Dynamometer Driving Schedule (UDDS) as specified in paragraph (a) of Appendix I of 40 CFR Part 86, followed by a 10-minute soak with the engine off and repeat driving through the first 505 seconds of the UDDS. Note that the UDDS represents about 7.5 miles of driving in an urban area. Engine start-up (with all accessories turned off), operation over the initial UDDS, and engine shutdown make a complete cold-start test. The hot-start test consists of the first 505 seconds of the UDDS following the 10-minute soak and a hot-running portion of the UDDS after the first 505 seconds. The first 505 seconds of the UDDS is considered the transient portion; the remainder of the UDDS is considered the stabilized (or hot-stabilized) portion. The hot-stabilized portion for the hot-start test is generally measured during the cold-start test; however, in certain cases, the hot-start test may involve a second full UDDS following the 10-minute soak, rather than repeating only the first 505 seconds. See §§1066.815 and 1066.820.

(ii) Evaporative emission testing includes a preconditioning drive with the UDDS and a full FTP cycle, including exhaust measurement, followed by

evaporative emission measurements. In the three-day diurnal test sequence, the exhaust test is followed by a running loss test consisting of a UDDS, then two New York City Cycles as specified in paragraph (e) of Appendix I of 40 CFR Part 86, followed by another UDDS; see 40 CFR 86.134. Note that the New York City Cycle represents about 1.18 miles of driving in a city center. The running loss test is followed by a high-temperature hot soak test as described in 40 CFR 86.138 and a three-day diurnal emission test as described in 40 CFR 86.133. In the two-day diurnal test sequence, the exhaust test is followed by a low-temperature hot soak test as described in 40 CFR 86.138–96(k) and a two-day diurnal emission test as described in 40 CFR 86.133–96(p).

(iii) Refueling emission tests for vehicles that rely on integrated control of diurnal and refueling emissions include vehicle operation over the full FTP test cycle corresponding to the three-day diurnal test sequence to precondition and purge the evaporative canister. For non-integrated systems, there is a preconditioning drive over the UDDS and a refueling event, followed by repeated UDDS driving to purge the evaporative canister. The refueling emission test procedures are described in 40 CFR 86.150 through 86.157.

(2) The Supplemental Federal Test Procedure (SFTP) measures the emission effects from aggressive driving and operation with the vehicle's air conditioner. The SFTP is based on a composite of three different test elements. In addition to the FTP, vehicles generally operate over the US06 and SC03 driving schedules as specified in paragraphs (g) and (h) of Appendix I of 40 CFR part 86, respectively. In the case of heavy-duty vehicles above 10,000 pounds GVWR and at or below 14,000 pounds GVWR, SFTP testing involves additional driving over the Hot LA-92 driving schedule as specified in paragraph (c) of 40 CFR part 86, Appendix I, instead of the US06 driving schedule. Note that the US06 driving schedule represents about 8.0 miles of relatively aggressive driving; the SC03 driving schedule represents about 3.6 miles of urban driving with the air conditioner operating; and the hot portion of the

§ 1066.801

40 CFR Ch. I (7-1-16 Edition)

LA-92 driving schedule represents about 9.8 miles of relatively aggressive driving for commercial trucks. See §§ 1066.815 and 1066.820.

(3) The Highway Fuel Economy Test (HFET) is specified in Appendix I of 40 CFR Part 600. Note that the HFET represents about 10.2 miles of rural and freeway driving with an average speed of 48.6 mph and a maximum speed of 60.0 mph. See § 1066.840.

(4) Cold temperature standards apply for CO and NMHC emissions when vehicles operate over the FTP at a nominal temperature of -7°C . See 40 CFR Part 86, subpart C, and subpart H of this part.

(5) Emission measurement to determine air conditioning credits for greenhouse gas standards. In this optional procedure, manufacturers operate vehicles over repeat runs of the AC17 test sequence to allow for calculating credits as part of demonstrating compliance with CO₂ emission standards. The AC17 test sequence consists of a UDSS preconditioning drive, followed by emission measurements over the SC03 and HFET driving schedules. See § 1066.845.

(d) The following provisions apply for all testing:

(1) Ambient temperatures encountered by the test vehicle must be (20 to 30) °C, unless otherwise specified. Where ambient temperature specifications apply before or between test measurements, the vehicle may be exposed to temperatures outside of the specified range for up to 10 minutes to account for vehicle transport or other actions to prepare for testing. The temperatures monitored during testing must be representative of those experienced by the test vehicle. For example, do not measure ambient temperatures near a heat source.

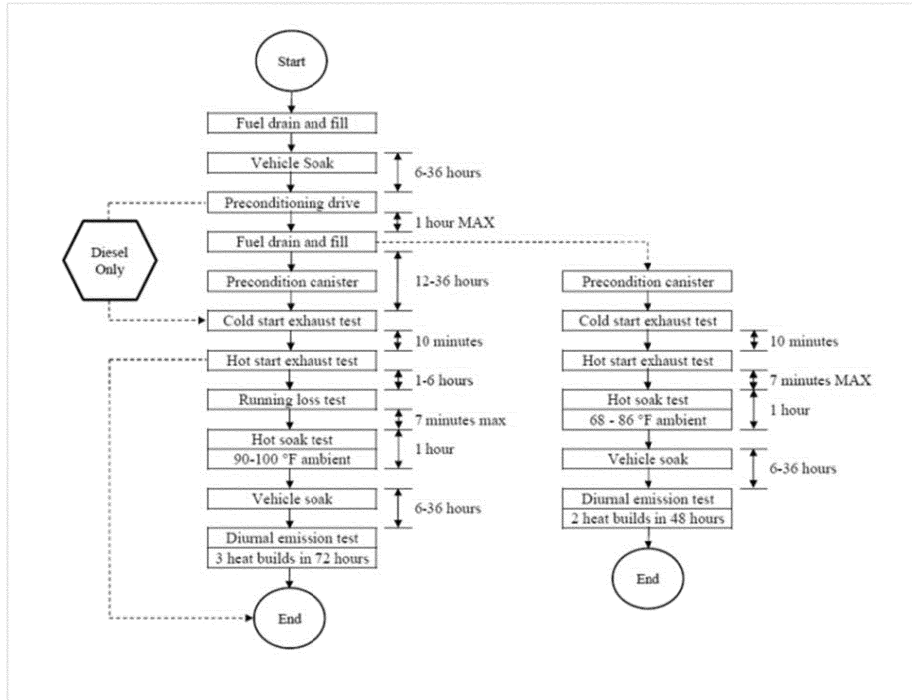
(2) Do not operate or store the vehicle at an incline if good engineering judgment indicates that it would affect emissions.

(3) If a test is void after collecting emission data from previous test segments, the test may be repeated to collect only those data points needed to complete emission measurements. You may combine emission measurements from different test runs to demonstrate compliance with emission standards.

(4) Prepare vehicles for testing as described in § 1066.810.

(e) The following figure illustrates the FTP test sequence for measuring exhaust and evaporative emissions:

Figure 1 of §1066.801 —FTP test sequence



[79 FR 23823, Apr. 28, 2014, as amended at 80 FR 9123, Feb. 19, 2015]

§ 1066.805 Road-load power, test weight, and inertia weight class determination.

(a) Simulate a vehicle's test weight on the dynamometer using the appropriate equivalent test weight shown in Table 1 of this section. Equivalent test weights are established according to each vehicle's test weight basis, as described in paragraph (b) of this section. Table 1 also specifies the inertia weight class corresponding to each equivalent test weight; the inertia weight class allows for grouping vehicles with a range of equivalent test weights. Table 1 follows:

TABLE 1 OF § 1066.805—EQUIVALENT TEST WEIGHTS (POUNDS)

Test weight	Equivalent test	Inertia weight
Up to 1062	1000	1000

TABLE 1 OF § 1066.805—EQUIVALENT TEST WEIGHTS (POUNDS)—Continued

Test weight	Equivalent test	Inertia weight
1063 to 1187	1125	1000
1188 to 1312	1250	1250
1313 to 1437	1375	1250
1438 to 1562	1500	1500
1563 to 1687	1625	1500
1688 to 1812	1750	1750
1813 to 1937	1875	1750
1938 to 2062	2000	2000
2063 to 2187	2125	2000
2188 to 2312	2250	2250
2313 to 2437	2375	2250
2438 to 2562	2500	2500
2563 to 2687	2625	2500
2688 to 2812	2750	2750
2813 to 2937	2875	2750
2938 to 3062	3000	3000
3063 to 3187	3125	3000
3188 to 3312	3250	3000
3313 to 3437	3375	3500
3438 to 3562	3500	3500
3563 to 3687	3625	3500
3688 to 3812	3750	3500
3813 to 3937	3875	4000
3938 to 4125	4000	4000
4126 to 4375	4250	4000
4376 to 4625	4500	4500

TABLE 1 OF § 1066.805—EQUIVALENT TEST WEIGHTS (POUNDS)—Continued

Test weight	Equivalent test	Inertia weight
4626 to 4875	4750	4500
4876 to 5125	5000	5000
5126 to 5375	5250	5000
5376 to 5750	5500	5500
5751 to 6250	6000	6000
6251 to 6750	6500	6500
6751 to 7250	7000	7000
7251 to 7750	7500	7500
7751 to 8250	8000	8000
8251 to 8750	8500	8500
8751 to 9250	9000	9000
9251 to 9750	9500	9500
9751 to 10250	10000	10000
10251 to 10750	10500	10500
10751 to 11250	11000	11000
11251 to 11750	11500	11500
11751 to 12250	12000	12000
12251 to 12750	12500	12500
12751 to 13250	13000	13000
13251 to 13750	13500	13500
13751 to 14000	14000	14000

(b) The test weight basis for non-MDPV heavy-duty vehicles is “adjusted loaded vehicle weight”. For all other vehicles, the test weight basis for establishing equivalent test weight is “loaded vehicle weight”. These load terms are defined in 40 CFR 86.1803.

(c) For FTP, SFTP, New York City Cycle, HFET, and LA-92 testing, determine road-load forces for each test vehicle at speeds between 9.3 and 71.5 miles per hour. The road-load force must represent vehicle operation on a smooth, level road with no wind or calm winds, no precipitation, an ambient temperature of approximately 20 °C, and atmospheric pressure of 98.21 kPa. You may extrapolate road-load force for speeds below 9.3 mph.

§ 1066.810 Vehicle preparation.

(a) Include additional fittings and adapters as required to accommodate a fuel drain at the lowest point possible in the tank(s) as installed on the vehicle.

(b) For preconditioning that involves loading an evaporative emission canister with butane, provide valving or other means to allow for purging and loading the canister.

(c) For vehicles to be tested for running loss emissions (40 CFR 86.134), prepare the fuel tank for measuring temperature and pressure as specified in 40 CFR 86.107-98(e) and (f) and 40 CFR 86.134. Vapor temperature measure-

ment is optional during the running loss test.

(d) For vehicles to be tested for running loss emissions, prepare the exhaust system by sealing or plugging all detectable sources of exhaust gas leaks. Inspect or test the exhaust system to ensure that there are no leaks that would cause exhaust hydrocarbon emissions to be detected as running losses.

(e) The following provisions apply for preconditioning steps to reduce nonfuel emissions to normal vehicle background levels for vehicles subject to Tier 3 evaporative emission standards under 40 CFR 86.1813:

(1) You must notify us in advance if you plan to perform such preconditioning. This notice must include a detailed description of the intended procedures and any measurements or thresholds for determining when stabilization is complete. You need not repeat this notification for additional vehicle testing in the same or later model years as long as your preconditioning practice conforms to these procedures.

(2) You may precondition a vehicle as described in paragraph (e)(1) of this section only within 12 months after the vehicle’s original date of manufacture, except that you may ask us to approve further preconditioning steps for any testing to address identifiable sources of nonfuel emissions beyond what would generally occur with an appropriately aged in-use vehicle. For example, you may clean up fluid leaks and you may perform further off-vehicle preconditioning for tires or other replacement parts that are less than 12 months old. You may also replace the spare tire with an aged spare tire, and you may replace the windshield washer fluid with water.

§ 1066.815 Exhaust emission test procedures for FTP testing.

(a) *General.* The FTP exhaust emission test sequence consists of a cold-start test and a hot-start test as described in § 1066.801.

(b) *PM sampling options.* Collect PM using any of the procedures specified in paragraphs (b)(1) through (5) of this section and use the corresponding equation in § 1066.820 to calculate FTP composite emissions. Testing must

meet the requirements related to filter face velocity as described in 40 CFR 1065.170(c)(1)(vi), except as specified in paragraphs (b)(4) and (5) of this section. For procedures involving flow weighting, set the filter face velocity to a weighting target of 1.0 to meet the requirements of 40 CFR 1065.170(c)(1)(vi). Allow filter face velocity to decrease as a percentage of the weighting factor if the weighting factor is less than 1.0. Use the appropriate equations in §1066.610 to show that you meet the dilution factor requirements of §1066.110(b)(2)(iii)(B).

(1) You may collect a separate PM sample for transient and stabilized portions of the cold-start UDDS and the hot-start UDDS. This may either be done by sampling with three bags or four bags. You may omit the stabilized portion of the hot-start test (bag 4) and use the stabilized portion of the cold-start test (bag 2) in its place.

(2) You may collect PM on one filter over the cold-start UDDS and on a separate filter over the hot-start UDDS.

(3) You may collect PM on one filter over the cold-start UDDS (bag 1 and bag 2) and on a separate filter over the 867 seconds of the stabilized portion of the cold-start UDDS and the first 505 seconds of the hot-start UDDS (bag 2 and bag 3). Note that this option involves duplicate measurements during the stabilized portion of the cold-start UDDS.

(4) You may collect PM on a single filter over the cold-start UDDS and the first 505 seconds of the hot-start UDDS. If you use this method, adjust your sampling system flow rate to weight the filter face velocity over the three intervals of the FTP based on weighting targets of 0.43 for bag 1, 1.0 for bag 2, and 0.57 for bag 3.

(5) You may collect PM on a single filter over the cold-start UDDS and the full hot-start UDDS. If you use this method, adjust your sampling system flow rate to weight the filter face velocity based on weighting targets of 0.75 for the cold-start UDDS and 1.0 for the hot-start UDDS.

(c) *Gaseous sampling options.* Collect gaseous samples using any of the following procedures:

(1) You may collect a single sample for a full UDDS (cold-start or hot-start).

(2) You may sample emissions separately for transient and stabilized portions of any UDDS.

(3) You may omit the stabilized portion of the hot-start test (bag 4) and use the stabilized portion of the cold-start test (bag 2) in its place.

(d) *Test sequence.* Follow the exhaust emission measurement procedures specified in §§1066.410 through 1066.425, subject to the following exceptions and additional provisions:

(1) Take the following steps for the cold-start test:

(i) Precondition the vehicle as described in §1066.816. Initiate the cold-start test following the 12 to 36 hour soak period.

(ii) Start sampling and recording simultaneously with starting the vehicle. Place the vehicle in gear 15 seconds after engine starting, which is 5 seconds before the first acceleration.

(iii) At the end of the deceleration scheduled to occur 505 seconds into the cold-start UDDS, simultaneously switch all the sample flows from the cold-start transient interval to the stabilized interval, stopping all cold-start transient interval sampling and recording, including background sampling. Reset integrating devices for the stabilized interval and indicate the end of the cold-start interval in the recorded data. Operate the vehicle over the remainder of the UDDS. Turn the engine off 2 seconds after the end of the last deceleration in the stabilized interval (1,369 seconds after the start of the driving schedule).

(iv) Five seconds after the engine stops running, stop all stabilized interval sampling and recording, including background sampling. Stop any integrating devices for the stabilized interval and indicate the end of the stabilized interval in the recorded data. Note that the 5 second delay is intended to account for sampling system transport.

(2) Take the following steps for the hot-start test:

(i) Initiate the hot-start test (9 to 11) minutes after the end of the sample period for the cold-start UDDS.

§ 1066.816

40 CFR Ch. I (7-1-16 Edition)

(ii) Repeat the steps in paragraph (d)(1)(ii) of this section. Operate the vehicle over the first 505 seconds of the UDDS. For tests that do not include bag 4 operation, turn off the engine and simultaneously stop all hot-start sampling and recording, including background sampling, and any integrating devices at the end of the deceleration scheduled to occur 505 seconds into the hot-start UDDS.

(iii) To include bag 4 measurement, operate the vehicles over the remainder of the UDDS and conclude the testing as described in paragraphs (d)(1)(iii) and (iv) of this section.

(3) This completes the procedure for measuring FTP exhaust emissions. See § 1066.801 and subpart J of this part for

continuing the test sequence to measure evaporative or refueling emissions. [79 FR 23823, Apr. 28, 2014, as amended at 80 FR 9124, Feb. 19, 2015]

§ 1066.816 Vehicle preconditioning for FTP testing.

Precondition the test vehicle before the FTP exhaust measurement as described in 40 CFR 86.132.

§ 1066.820 Composite calculations for FTP exhaust emissions.

(a) Determine the mass of exhaust emissions of each pollutant for each FTP test interval as described in § 1066.605.

(b) Calculate the final composite gaseous test results as a mass-weighted value, $e_{[\text{emission}]-\text{FTPcomp}}$, in grams per mile using the following equation:

$$e_{[\text{emission}]-\text{FTPcomp}} = 0.43 \cdot \left(\frac{m_c}{D_{ct} + D_{cs}} \right) + 0.57 \cdot \left(\frac{m_h}{D_{ht} + D_{hs}} \right)$$

Eq. 1066.820-1

Where:

m_c = the combined mass emissions determined from the cold-start UDDS test interval (generally known as bag 1 and bag 2), in grams.

D_{ct} = the measured driving distance from the transient portion of the cold-start test (bag 1), in miles.

D_{cs} = the measured driving distance from the stabilized portion of the cold-start test (bag 2), in miles.

m_h = the combined mass emissions determined from the hot-start UDDS test interval in grams. This is the hot-stabilized portion from either the first or second UDDS (bag 2, unless you measure

bag 4), in addition to the hot transient portion (bag 3).

D_{ht} = the measured driving distance from the transient portion of the hot-start test (bag 3), in miles.

D_{hs} = the measured driving distance from the stabilized portion of the hot-start test (bag 4), in miles. Set $D_{hs} = D_{cs}$ for testing where the hot-stabilized portion of the UDDS is not run.

(c) Calculate the final composite PM test results as a mass-weighted value, $e_{\text{PM-FTPcomp}}$, in grams per mile as follows:

(1) Use the following equation for PM measured as described in § 1066.815(b)(1), (2), or (3):

$$e_{\text{PM-FTPcomp}} = 0.43 \cdot \left(\frac{m_{\text{PM-cUDDS}}}{D_{ct} + D_{cs}} \right) + 0.57 \cdot \left(\frac{m_{\text{PM-hUDDS}}}{D_{ht} + D_{hs}} \right)$$

Eq. 1066.820-2

Environmental Protection Agency

§ 1066.831

Where:

$m_{\text{PM-cUDDS}}$ = the combined PM mass emissions determined from the cold-start UDDS test interval (bag 1 and bag 2), in grams, as calculated using Eq. 1066.605-2.

$m_{\text{PM-hUDDS}}$ = the combined PM mass emissions determined from the hot-start UDDS test interval (bag 3 and bag 4), in grams, as

calculated using Eq. 1066.605-2. This is the hot-stabilized portion from either the first or second UDDS (bag 2, unless you measure bag 4), in addition to the hot transient portion (bag 3).

(2) Use the following equation for PM measured as described in §1066.815(b)(4):

$$e_{\text{PM-FTPcomp}} = \frac{m_{\text{PM}}}{(0.43 \cdot D_{\text{ct}}) + D_{\text{cs}} + (0.57 \cdot D_{\text{ht}})}$$

Eq. 1066.820-3

Where:

m_{PM} = the combined PM mass emissions determined from the cold-start UDDS test interval and the first 505 seconds of the hot-start UDDS test interval (bag 1, bag

2, and bag 3), in grams, as calculated using Eq. 1066.605-3.

(3) Use the following equation for PM measured as described in §1066.815(b)(5):

$$e_{\text{PM-FTPcomp}} = \frac{m_{\text{PM}}}{0.43 \cdot (D_{\text{ct}} + D_{\text{cs}}) + 0.57 \cdot (D_{\text{ht}} + D_{\text{hs}})}$$

Eq. 1066.820-4

Where:

m_{PM} = the combined PM mass emissions determined from the cold-start UDDS test interval and the hot-start UDDS test interval (bag 1, bag 2, bag 3, and bag 4), in grams, as calculated using Eq. 1066.605-4.

element (§1066.835), and the FTP test element (§1066.820) are analyzed according to the calculation methodology and compared to the applicable SFTP emission standards as described in 40 CFR part 86, subpart S.

(b) The test elements of the SFTP may be run in any sequence that includes the specified preconditioning steps.

§ 1066.830 Supplemental Federal Test Procedures; overview.

Sections 1066.831 and 1066.835 describe the detailed procedures for the Supplemental Federal Test Procedure (SFTP). This testing applies for all vehicles subject to the SFTP standards in 40 CFR part 86, subpart S. The SFTP test procedure consists of FTP testing and two additional test elements—a sequence of vehicle operation with more aggressive driving and a sequence of vehicle operation that accounts for the impact of the vehicle’s air conditioner.

(a) The SFTP standard applies as a composite representing the three test elements. The emission results from the aggressive driving test element (§1066.831), the air conditioning test

§ 1066.831 Exhaust emission test procedures for aggressive driving.

(a) This section describes how to test using the US06 or LA-92 driving schedule. The US06 driving schedule can be divided into two test intervals—the US06 City cycle comprises the combined portions of the cycle from 1 to 130 seconds and from 495 to 596 seconds, and the US06 Highway cycle comprises the portion of the cycle between 130 and 495 seconds. See §1066.801 for further information on the driving schedules.

(b) Take the following steps to precondition vehicles for testing under this section:

(1) Drain and refill the vehicle's fuel tank(s) in any of the following cases:

(i) For aggressive-driving tests that do not follow FTP or HFET testing.

(ii) For a test element that starts more than 72 hours after the most recent FTP or HFET measurement (with or without evaporative emission measurements).

(iii) For testing in which the test vehicle has not remained in an area where ambient temperatures were within the range specified for testing since the previous FTP or HFET.

(2) Keep ambient temperatures within the ranges specified for test measurements throughout the preconditioning sequence.

(3) Warm up the vehicle to a stabilized condition as follows:

(i) Push or drive the vehicle onto the dynamometer.

(ii) Operate the vehicle one time over one of the driving schedules specified in this paragraph (b)(3)(ii). You may ask us to use a particular preconditioning driving schedule if that is related to fuel effects on adaptive memory systems. For our testing, we will generally operate the vehicle over the same preconditioning cycle that will be used for testing in this section. You may exercise your sampling equipment, but you may not determine emissions results during preconditioning. Choose from the following driving schedules:

(A) The first 505 seconds of the UDDS (bag 1).

(B) The last 867 seconds of the UDDS (bag 2).

(C) The HFET driving schedule.

(D) US06 driving schedule or, for heavy-duty vehicles at or below 10,000 pounds GVWR with a power-to-weight ratio at or below 0.024 hp/lbm, just the highway portion of the US06 driving schedule.

(E) The SC03 driving schedule.

(F) The LA-92 driving schedule.

(G) The Hot LA-92 driving schedule.

(4) Allow the vehicle to idle for (1 to 2) minutes. This leads directly into the test measurements described in paragraph (c) of this section.

(c) For testing involving the full US06 driving schedule, you may collect emissions from separate city and highway test intervals (see 40 CFR part 600), or you may collect emissions over the full US06 driving schedule as a single test interval. Take the following steps to measure emissions over separate city and highway test intervals:

(1) At 130 seconds, simultaneously stop all US06 City, and start all US06 Highway sampling, recording, and integrating (including background sampling). At 136 seconds (before the acceleration), record the measured dynamometer roll revolutions.

(2) At 495 seconds, simultaneously stop all US06 Highway, and start all US06 City sampling, recording, and integrating (including background sampling). At 500 seconds (before the acceleration), record the measured dynamometer roll revolutions.

(3) Except as specified in paragraph (c)(4) of this section, treat the emissions from the first and second portions of the US06 City test interval as a single sample.

(4) If you collect gaseous emissions over separate city and highway test intervals, you may still collect PM over the full US06 driving schedule as a single test interval. If you do this, calculate a composite dilution factor based on city and highway emissions using Eq. 1066.610-4 to show that you meet the dilution factor requirements of § 1066.110(b)(2)(iii)(B).

(d) For diesel-fueled vehicles, measure THC emissions on a continuous basis as described in 40 CFR part 1065. For separate measurement of the city and highway test intervals as described in paragraph (c) of this section, perform separate calculations for each portion of the test cycle.

(e) Follow the exhaust emission measurement procedures specified in §§ 1066.410 through 1066.425, subject to the following exceptions and additional provisions:

(1) Following the preconditioning specified in paragraph (b) of this section, place the vehicle in gear and simultaneously start sampling and recording. Begin the first acceleration 5 seconds after placing the vehicle in gear.

(2) Operate the vehicle over the full US06 driving schedule, except as follows:

(i) For heavy-duty vehicles above 10,000 pounds GVWR, operate the vehicle over the Hot LA-92 driving schedule.

(ii) Heavy-duty vehicles at or below 10,000 pounds GVWR with a power-to-weight ratio at or below 0.024 hp/lbm may be certified using only the highway portion of the US06 driving schedule as described in 40 CFR 86.1816.

(iii) Non-MDPV heavy-duty vehicles shall be tested at their adjusted loaded vehicle weight as described in 40 CFR 86.1816.

(3) Turn the engine off 2 seconds after the end of the last deceleration. Five seconds after the engine stops running, stop all sampling and recording, including background sampling. Stop any integrating devices and indicate the end of the test cycle in the recorded data. Note that the 5 second delay is intended to account for sampling system transport.

(4) Correct calculated NO_x emissions as described in § 1066.615(a)(1).

[79 FR 23823, Apr. 28, 2014, as amended at 80 FR 9124, Feb. 19, 2015]

§ 1066.835 Exhaust emission test procedure for SC03 emissions.

This section describes how to test using the SC03 driving schedule (see § 1066.801). This procedure is designed to determine gaseous exhaust emissions while simulating an urban trip on a hot summer day. The provisions of 40 CFR part 86 and 40 CFR part 600 waive SC03 testing for some vehicles; in those cases, calculate SFTP composite emissions by adjusting the weighting calculation as specified in 40 CFR part 86, subpart S.

(a) Drain and refill the vehicle's fuel tank(s) if testing starts more than 72 hours after the last drain and fill operation.

(b) Keep the vehicle in an environment meeting the conditions described in paragraph (f) of this section throughout the preconditioning sequence.

(c) Warm up the vehicle to a stabilized condition as follows:

(1) Push or drive the test vehicle onto the dynamometer.

(2) Close the vehicle's windows before testing.

(3) The test cell and equipment must meet the specifications in paragraph (e) of this section. Measure and control ambient conditions as specified in paragraph (f) of this section.

(4) Set the vehicle's air conditioning controls by selecting A/C mode and "maximum", setting airflow to "recirculate" (if so equipped), selecting the highest fan setting, and turning the A/C temperature to full cold (or 72 °F for automatic systems). Turn the control to the "on" position before testing so the air conditioning system is active whenever the engine is running.

(5) Perform a preconditioning drive by operating the test vehicle one time over the first 505 seconds of the UDDS (bag 1), the last 867 seconds of the UDDS (bag 2), or the SC03 driving schedule. If the air conditioning test sequence starts more than 2 hours after a different exhaust emission test, you may instead operate the vehicle one time over the full UDDS.

(6) Following the preconditioning drive, turn off the test vehicle and the vehicle cooling fan(s) and allow the vehicle to soak for (9 to 11) minutes.

(d) Follow the exhaust emission measurement procedures specified in §§ 1066.410 through 1066.425, subject to the following exceptions and additional provisions:

(1) Place the vehicle in gear 15 seconds after engine starting, which is 3 seconds before the first acceleration. Follow the SC03 driving schedule.

(2) Turn the engine off 2 seconds after the end of the last deceleration. Five seconds after the engine stops running, stop all sampling and recording, including background sampling. Stop any integrating devices any indicate the end of the test cycle in the recorded data. Note that the 5 second delay is intended to account for sampling system transport.

(3) Correct calculated NO_x emissions as described in § 1066.615(a)(2).

(e) The following requirements apply for the test cell and cooling fan configuration:

(1) *Minimum test cell size.* The test cell must be at least 20 feet wide, 40 feet long, and 10 feet high, unless we approve the use of a smaller test cell. We

§ 1066.840

40 CFR Ch. I (7–1–16 Edition)

will approve this only if you demonstrate that the smaller test cell is capable of meeting all the requirements of this section.

(2) *Vehicle frontal air flow.* Verify that the fan configuration meets the requirements of §1066.105(c)(5).

(f) Maintain ambient conditions as follows:

(1) *Ambient temperature and humidity.* Measure and record ambient temperature and humidity in the test cell at least once every 30 seconds during the sampling period. Alternatively, if you collect data of at least once every 12 seconds, you may use a moving average of up to 30 second intervals to measure and record ambient temperature and humidity. Control ambient temperature throughout the test sequence to 35.0 ± 3.0 °C. Control ambient temperature during emission sampling to (33.6 to 36.4) °C on average. Control ambient humidity during emission sampling as described in §1066.420(d).

(2) *Conditions before and after testing.* Use good engineering judgment to demonstrate that you meet the specified instantaneous temperature and humidity tolerances in paragraphs (f)(1) of this section at all times before and between emission measurements.

(3) *Solar heat load.* Simulate solar heating as follows:

(i) You may use a metal halide lamp, a sodium lamp, or a quartz halogen lamp with dichroic mirrors as a radiant energy emitter. We may also approve the use of a different type of radiant energy emitter if you demonstrate that it meets the requirements of this section.

(ii) We recommend achieving radiant heating with spectral distribution characteristics as described in the following table:

TABLE 1 OF § 1066.835—RECOMMENDED SPECTRAL DISTRIBUTION

Band width (nm)	Percent of total spectrum	
	Lower limit (%)	Upper limit (%)
<320 ^a	0	0
320–400	0	7
400–780	45	55
>780	35	53

^aNote that you may need to filter the UV region between 280 and 320 nm.

(iii) Determine radiant energy intensity experienced by the vehicle as the average value between two measurements along the vehicle’s centerline, one at the base of the windshield and the other at the bottom of the rear window (or equivalent location for vehicles without a rear window). This value must be 850 ± 45 W/m². Instruments for measuring radiant energy intensity must meet the following minimum specifications:

(A) Sensitivity of 9 microvolts per W/m².

(B) Response time of 5 seconds. For purposes of this requirement, “response time” means the time for the instrument to reach 95 percent of its equilibrium response after a step change in radiant intensity.

(C) Cosine response error of no more than $\pm 1\%$ for 0–70 degree zenith angles. The cosine response error is the percentage difference between the intensity measured at a given angle and a reference value, where the reference value is the intensity predicted from the zero-degree intensity and the cosine of the incident angle.

(D) When comparing measured values for radiant energy to reference values, each measured value over the full range of measurement may not deviate from the corresponding reference value by more than $\pm 0.5\%$ of the analyzer range’s maximum value.

(iv) Check the uniformity of radiant energy intensity at least every 500 hours of emitter usage or every 6 months, whichever is sooner, and after any major modifications affecting the solar simulation. Determine uniformity by measuring radiant energy intensity as described in paragraph (f)(4)(iii) of this section at each point of a 0.5 m grid over the vehicle’s full footprint, including the edges of the footprint, at an elevation 1 m above the floor. Measured values of radiant energy intensity must be between (722 and 978) W/m² at all points.

[79 FR 23823, Apr. 28, 2014, as amended at 80 FR 9124, Feb. 19, 2015]

§ 1066.840 Highway fuel economy test procedure.

This section describes the procedure for the highway fuel economy test (HFET). This test involves emission

sampling and fuel economy measurement for certain vehicles as described in 40 CFR part 86, subpart S, and in 40 CFR part 600. See §1066.801 for further information on the driving schedules. Follow the exhaust emission measurement procedures specified in §§1066.410 through 1066.425, subject to the following exceptions and additional provisions:

(a) Perform the HFET immediately following the FTP when this is practical. If the HFET procedure starts more than 3 hours after an FTP (including evaporative emission measurements, if applicable), operate it over one UDDS to precondition the vehicle. We may approve additional preconditioning in unusual circumstances.

(b) Operate the vehicle over the HFET driving schedule for preconditioning. Allow the vehicle to idle for 15 seconds (with the vehicle in gear), then start a repeat run of the HFET driving schedule and simultaneously start sampling and recording.

(c) Turn the engine off at the end of the HFET driving schedule and stop all sampling and recording, including background. Stop any integrating devices and indicate the end of the test cycle in the recorded data.

§1066.845 AC17 air conditioning efficiency test procedure.

(a) *Overview.* This section describes a voluntary procedure for measuring the net impact of air conditioner operation on CO₂ emissions. See 40 CFR 86.1868 for provisions describing how to use these procedures to calculate credits and otherwise comply with emission standards.

(b) *Test cell.* Operate the vehicle in a test cell meeting the specifications described in §1066.835(e). You may add airflow up to a maximum of 4 miles per hour during engine idling and when the engine is off if that is needed to meet ambient temperature or humidity requirements.

(c) *Ambient conditions.* Measure and control ambient conditions as specified in §1066.835(f), except that you must control ambient temperature during emission sampling to (22.0 to 28.0) °C throughout the test and (23.5 to 26.5) °C on average. These tolerances apply to the combined SC03 and HFET drive cy-

cles during emission sampling. Note that you must set the same ambient temperature target for both the air conditioning on and off portions of emission sampling. Control ambient temperature during the preconditioning cycle and 30 minute soak to 25.0 ± 5.0 °C. For these same modes with no emission sampling, target the specified ambient humidity levels, but you do not need to meet the humidity tolerances. Note that solar heating is disabled for certain test intervals as described in this section.

(d) *Interior air temperature measurement.* Measure and record the vehicle's interior air temperature at least once every 5 seconds during the sampling period. Measure temperature at the outlet of the center-most duct on the dashboard, and approximately 30 mm behind the driver's headrest and passenger's headrest.

(e) *Air conditioning system settings.* For testing that requires the air conditioning to be operating, set the vehicle's air conditioning controls as follows:

(1) For automatic systems, set the temperature control to 72 °F (22 °C).

(2) For manual systems, select A/C mode, set the temperature to full cold and "maximum", set airflow to "recirculate" (if so equipped), and select the highest fan setting. During the first idle period of the SC03 driving schedule (between 186 and 204 seconds), reduce the fan speed setting to nominally 50% of maximum fan speed, set airflow to "fresh air" (if so equipped), and adjust the temperature setting to target a temperature of 55 °F (13 °C) at the dashboard air outlet. Maintain these settings for the remainder of the test. You may rely on prior temperature measurements to determine the temperature setting; however, if the system is unable to meet the 55 °F (13 °C) target, you may instead set airflow to "fresh air" and temperature to full cold. If the vehicle is equipped with technology that defaults to recirculated air at ambient temperatures above 75 °F (22 °C), that technology should remain enabled throughout the test; this may mean not setting the airflow to "recirculate" at the start and not setting the airflow

to “fresh air” during the first idle period of the SC03 driving schedule. Except as specified in paragraph (e)(3) of this section, use good engineering judgment to apply the settings described in this paragraph (e)(2) equally throughout the vehicle if there are separate controls for different zones (such as rear air conditioning).

(3) If the air conditioning system is designed with parameters that switch back to a default setting at key-off, perform testing in that default condition. If the air conditioning system includes any optional equipment or user controls not addressed in this paragraph (e), the manufacturer should ask us for preliminary approval to determine the appropriate settings for testing.

(f) *Test procedure.* Follow the exhaust emission measurement procedures specified in §§1066.410 through 1066.425, subject to the following exceptions and additional provisions:

(1) Prepare each test vehicle for a series of tests according to 40 CFR 86.132–00(a) through (g). If the vehicle has been tested within the last 36 hours concluding with a 12 to 36 hour soak, continue to paragraph (f)(2) of this section; otherwise perform an additional UDDS preconditioning cycle that concludes with a 12 to 36 hour soak. You may use a forced cooldown system to bring critical vehicle temperatures to within soak temperature limits. Critical temperatures include transmission oil, engine oil, engine coolant, and cabin air temperatures.

(2) Open the vehicle’s windows and operate the vehicle over a preconditioning UDDS with no solar heating and with the air conditioning off. At the end of the preconditioning drive, turn off the test vehicle and all cooling fans.

(3) Turn on solar heating within one minute after turning off the engine. Once the solar energy intensity reaches 805 W/m², let the vehicle soak for 30 ± 1 minutes. You may alternatively rely on prior measurements to start the

soak period after a defined period of warming up to the specified solar heat load. Close the vehicle’s windows at the start of the soak period; ensure that the windows are adequately closed where instrumentation and wiring pass through to the interior.

(4) Turn the air conditioning control to the “on” position before testing so the air conditioning system is active whenever the engine is running. Place the vehicle in gear 15 seconds after engine starting, which is 3 seconds before the first acceleration. At the end of the driving schedule, simultaneously switch all the sampling, recording, and integrating from SC03 to HFET, including background sampling. Indicate the end of the test cycle in the recorded data. Record the measured dynamometer roll revolutions corresponding to the SC03 driving schedule.

(5) Directly following the SC03 driving schedule, operate the vehicle over the HFET driving schedule. Turn the vehicle off at the end of the driving schedule and simultaneously stop all sampling, recording, and integrating, including background sampling. Indicate the end of the test cycle in the recorded data. Record the measured dynamometer roll revolutions corresponding to the HFET drive schedule. Turn off the solar heating.

(6) Allow the vehicle to remain on the dynamometer for (10 to 15) minutes after emission sampling has concluded. Repeat the testing described in paragraphs (f)(1) through (5) of this section and turn off the vehicle’s air conditioner and the solar heating throughout the test run. The windows may be open or closed.

(g) *Calculations.* (1) Determine the mass of CO₂ emissions for each of the two test intervals as described in §1066.605.

(2) Calculate the composite mass-weighted emissions of CO₂, $e_{CO_2-AC17comp}$, representing the average of the SC03 and HFET emissions, in grams per mile using the following equation:

$$e_{CO_2-AC17comp} = 0.5 \cdot \left(\frac{m_{SC03}}{D_{SC03}} \right) + 0.5 \cdot \left(\frac{m_{HFET}}{D_{HFET}} \right)$$

Environmental Protection Agency

§ 1066.975

Where:

m_{SC03} = mass emissions from the SC03 test interval, in grams.

D_{SC03} = measured driving distance during the SC03 test interval, in miles.

m_{HFET} = mass emissions from the HFET test interval, in grams.

D_{HFET} = measured driving distance during the HFET test interval, in miles.

[79 FR 23823, Apr. 28, 2014, as amended at 79 FR 36658, June 30, 2014; 80 FR 9124, Feb. 19, 2015]

Subpart J—Evaporative Emission Test Procedures

§ 1066.901 Applicability and general provisions.

This subpart describes how to measure evaporative and refueling emissions from test vehicles. The provisions of §§ 1066.910 through 1066.930 include general provisions for equipment and calculations related to evaporative and refueling emissions. The provisions of §§ 1066.950 through 1066.985 describe provisions that apply specifically to motor vehicles subject to standards under 40 CFR part 86, subpart S, or 40 CFR part 1037.

TEST EQUIPMENT AND CALCULATIONS FOR EVAPORATIVE AND REFUELING EMISSIONS

§ 1066.910 SHED enclosure specifications.

Enclosures for evaporative and refueling emissions must meet the specifications described in 40 CFR 86.106–96, 86.107–96(a), and 86.107–98(a).

§ 1066.915 Enclosures; auxiliary systems and equipment.

Enclosures for evaporative and refueling emissions must be equipped with fans, blowers, and measurement and data recording equipment as described in 40 CFR 86.107–98(b) through (h) and (j).

§ 1066.920 Enclosure calibrations.

Enclosures for evaporative and refueling emissions must meet the calibration specifications described in 40 CFR 86.116–94 and 86.117–96.

§ 1066.925 Enclosure calculations for evaporative and refueling emissions.

Calculate emissions for evaporative emissions as described in 40 CFR 86.143–96. Calculate emissions for refueling emissions as described in 40 CFR 86.143–96 and 86.156–98.

§ 1066.930 Equipment for point-source measurement of running losses.

For point-source measurement of running loss emissions, use equipment meeting the specifications in 40 CFR 86.107–96(i)

EVAPORATIVE AND REFUELING EMISSION TEST PROCEDURES FOR MOTOR VEHICLES

§ 1066.950 Fuel temperature profile.

Develop fuel temperature profiles for running loss testing as described in 40 CFR 86.129–94(d).

§ 1066.955 Diurnal emission test.

Test vehicles for diurnal emissions as described in 40 CFR 86.133–96.

§ 1066.960 Running loss test.

Test vehicles for running loss emissions as described in 40 CFR 86.134–96.

§ 1066.965 Hot soak test.

Test vehicles for hot soak emissions as described in 40 CFR 86.138–96.

§ 1066.970 Refueling test for liquid fuels.

Except as described in § 1066.975, test vehicles for refueling emissions as described in 40 CFR 86.150–98, 86.151–98, 86.152–98, and 86.154–98. Keep records as described in 40 CFR 86.155–98.

§ 1066.971 Vehicle and canister preconditioning for the refueling test.

Precondition vehicles for the refueling emission test as described in 40 CFR 86.153–98.

§ 1066.975 Refueling test for LPG.

For vehicles designed to operate on liquefied petroleum gas, measure refueling emissions as described in 40 CFR 86.157–98.